## Scientific Sessions

| Time  | Room A | Room B | Room C | Room E1 | Room E2 | Room F1 | Room F2 | Room G |
|-------|--------|--------|--------|---------|---------|---------|---------|--------|
| 08:30 |        |        |        |         |         |         |         |        |
| 09:00 | CC 1216| RC 1210| CC 1217| RC 1201 | RC 1202 | RC 1204 | RC 1211 | RC 1207|
| 09:30 |        |        |        |         |         |         |         |        |
| 10:00 |        |        |        |         |         |         |         |        |
| 10:30 | SS 1310| SS 1301a Abdominal Viscera (Solid Organs) | SS 1301b GI Tract - Abdomen - pancreas/cross section imaging (2) | SS 1302 Breast Interventions (p. 206) | SS 1304 Chest Pulmonary embolism (p. 210) | SS 1311 Neuro Stroia/cerebral blood flow (p. 212) | SS 1307 Genitourinary: MR urography and function (p. 213) |
| 11:30 | SA 13 Musculoskeletal Trauma/trauma (p. 201) | SS 1310 Abdominal Viscera (Solid Organs) | SS 1301b GI Tract - Abdomen - pancreas/cross section imaging (2) | SS 1302 Breast Interventions (p. 206) | SS 1304 Chest Pulmonary embolism (p. 210) |
| 12:00 |        |        |        |         |         |         |         |        |
| 12:30 |        |        |        |         |         |         |         |        |
| 13:00 |        |        |        |         |         |         |         |        |
| 13:30 |        |        |        |         |         |         |         |        |
| 14:00 |        |        |        |         |         |         |         |        |
| 14:30 | SA 14 Musculoskeletal Osteoporosis (p. 220) | SS 1410a GI Tract - Abdomen - pancreas/cross section imaging (2) | SS 1401b Abdominal Viscera (Solid Organs) | SS 1415 Vascular Aorta (p. 223) | SS 1409a Interventional Radiology: Skeletal intervention and CT-guided biopsy (p. 223) | SS 1411 Neuro Neurourology: Intracranial and peripheral neurovascular interventions and neurocritical care (p. 214) | SS 1406 Computer Applications in Radiology (p. 215) |
| 15:00 |        |        |        |         |         |         |         |        |
| 15:30 |        |        |        |         |         |         |         |        |
| 16:00 |        |        |        |         |         |         |         |        |
| 16:30 | CC 1516| WS 1510| CC 1517| SA 15 | WS 1515 | WS 1516 | RC 1505 |        |
| 17:00 |        |        |        |         |         |         |         |        |
| 17:30 |        |        |        |         |         |         |         |        |
| Time  | Room H | Room I | Room K | Room L/M | Room N/O | Room X | Room Y |
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| 10:00 |        |        |        |          |          |        |        |
| 10:30 |        |        |        |          |          |        |        |
| 11:00 | SS 1306 Contrast Media | SS 1309 Interventional Radiology | SS 1312 Pediatric Abdomen |          |          |        |        |
| 11:30 |        |        |        |          |          |        |        |
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| 14:00 |        |        |        |          |          |        |        |
| 14:30 | SS 1406 Contrast Media | SS 1409b Interventional Radiology | SS 1403 Coronary arteries and bypass |          |          |        |        |
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| 17:00 |        |        |        |          |          |        |        |
SS 1310
Tumors/trauma

Chairpersons:
J.L. Bloem (Leiden/NL)
D. Vanel (Villejuif/FRA)

729 10:30
Functional MR imaging in multiple myeloma
H. Hwanghorst, T. Möhler, M. Essig, L. Grenacher, G. van Kaick; Heidelberg/DE

Purpose: To assess the role of functional MRI for lesion detection, characterization, and therapy monitoring of multiple myeloma.

Methods: Pharmacokinetic MRI parameters were calculated from dynamic MRI series in 18 patients with biopsy-proven monoclonal gammopathy (MGUS) and multiple myeloma (MM) and compared with normal controls (n = 7). All MRI data were compared with various histomorphological and serum markers of tumor angiogenesis.

Results: Quantitative evaluation of the MR parameters revealed a statistically significant (P < .01) increase in the mean of parameter A and k21 in MM patients as compared to normal controls. Monitoring after antiangiogenic treatment (thalidomide) revealed a significant reduction/normalization in the pharmacokinetic parameters.

Conclusion: Functional MRI may prove to be a new imaging modality to localize and to characterize patients with hematological disorders. Furthermore, antiangiogenic treatment (thalidomide) may be proven to be a rational therapeutic strategy and can be monitored by functional MR imaging.

730 10:40
Bone bruises: MR characteristics and histological correlation in the young pig
K.N. Ryu, Seoul/KR

Purpose: To correlate magnetic resonance (MR) signal characteristics of bone bruises with the histological findings.

Materials and Methods: In 14 tibiae of young pigs, bone bruises were created in the proximal tibial metaphysis. Signal intensity seen on MR images were correlated with histological findings. The following findings were evaluated: (a) changes of signal intensity on the tibiae, (b) changes of histology on the tibiae, (c) changes of (a) and (b) on follow-up examinations.

Results: We observed 3 types of injuries on T1-weighted images: focal or diffuse low signal, normal signal, and linear low signal intensities. Severe hemorrhagic areas showed low signal intensities on all sequences of MR imaging. FSE T2-weighted images showed more distinct low signal intensity than T1-weighted images. FSE STIR and FSE-FS T2-weighted images showed similar signal intensities with FSE T2-weighted images. FS T1-weighted enhanced images showed low signal intensities with variable enhancements. On histological examinations, hemorrhages and edemas were prominent at the subcortical areas of contusion sites. The areas of dense, low signal intensities in all imaging sequences showed severe hemorrhages. The areas of diffuse low signal and enhanced areas showed mixed areas of hemorrhages and edemas. Follow-up MR imaging showed evolution of processes of hemorrhages and edemas with fatty marrow changes.

Conclusions: MR imaging can depict changes in the bone marrow resulting from direct injury to the bone. MR imaging is a useful tool for evaluating the evolution of bone bruises.

731 10:50
Logistic regression analysis of peripheral nerve sheath tumors: Development of a neurogenic index using MR parameters
W.A. Simons1, F.L. Wuys1, L.H.L. De Beuckeleer1, J.E. Vandevenne1, J.L. Bloem2, A.M.A. De Schepper*: Antwerp/BE, *Lede/DK

Purpose: First, to provide a formula (neurogenic index) based on MR characteristics for predicting whether a soft tissue tumor is neurogenic or not. Secondly, to test prospectively the efficiency of this formula and thirdly to compare the performance of this formula to the performance of experienced radiologists.

Materials and methods: Retrospectively, MR images of 70 neurogenic and 70 non-neurogenic tumors were evaluated. A neurogenic index (N) was calculated using logistic regression analysis. Prospectively, MR images of a validation group of 37 soft tissue tumors were presented to three investigators for scoring this index. The same team evaluated the same validation group for differentiating neurogenic from non-neurogenic tumors based on their own experience, which was expressed in a subjective score.

Results: The neurogenic index included following parameters: compartment, distribution, fluid-fluid levels, homogeneity on T2-WI, highest SI on T1-WI, lowest SI on T2-WI and delineation on T2-WI. In the validation group, N had a sensitivity of 88.6%, a specificity of 50.0%, a PPV of 54.1% and a NPV of 84.6% for neurogenic tumors. The subjective score was slightly superior (sensitivity 93.3%, specificity 77.2%, PPV 73.7% and NPV 94.4%).

Conclusion: Defining a neurogenic index is a first attempt to develop computer-aided diagnosis and to characterize a specific group of soft tissue tumors using MR parameters only.

732 11:00
Hemangiomas of the musculoskeletal system: The importance of MRI and dynamic angiography with TC-99-labeled blood cells
M. Mastantuno, R. Massa, E. Bassetti, F. Mangano, P. Ricci, R. Passaniello; Rome/IT

Purpose: To evaluate the capability of different radiologic techniques for a correct assessment of the musculoskeletal hemangiomas.

Materials and methods: In our study 28 patients that previously performed a MRI examination for an specific painfull syndrome of the joints or a swelling of the soft tissues. In those patients where the MRI examination permitted to suspect an hemangiomaticous lesion we perform a dynamic angiography with TCt labeled blood cells and color Doppler ultrasonography. The MRI was performed with an high field MRI (1.5 T Vision Plus, Siemens) or with a dedicated equipment (0.2 T Esaote Biomedica).

Results: The MRI permits to evaluate the changes of the signal intensity in the various MRI sequences of the neoplastic lesion, to define its margins and the relationships between the lesion and the surrounding soft tissues and bones. Dynamic angioscintigraphy with TCt labeled blood cells is usefull to confirm the vascular nature of the lesion and have a clear diagnostic value especially in the late phase. Color Doppler ultrasonography has been shown to be useful in assessing the degree of intralesional, especially when the lesion has an high flow.

Discussion/conclusions: In our experience MRI and angiography are the preferred modalities for the evaluation of the musculoskeletal hemangiomas.

733 11:10
CT/MR-appearance of granulopoietic tumors in adults
C. Sroczynski, N. Hosten, S. Serke, A. Lemke, R. Felix; Berlin/DE

Purpose: While granulocytic sarcoma (chloroma) is frequently found in post mortem studies in patients with acute myelogenous leukemia (up to 25%) or myeloproliferative disorders, description of CT and MR features are scant. Extramedullary hematopoesis may also occur in patients with hematopoietic disorders, reflecting the benign variant of tumors of granulocytic precursor cells.

Materials and methods: Computed tomographies (n = 8) or magnetic resonance images (n = 10) of fourteen patients were analysed retrospectively. Eight patients had granulocytic sarcoma (GS), six patients had extramedullary hematopoesis (EH). T2w- and T1w-SE before and after gadopentetate dimeglumine were performed in all MR examinations. All tumors had been histologically proven by open biopsy (n = 5). CT guided biopsy (n = 3) or aspiration cytology (n = 6).

Results: Twenty-five of 26 manifestations were homogeneous, one tumor was associated with central necrosis. Seventeen manifestations were examined by MR. On T2-weighted spin echo images, the tumors were hyperintense (n = 14) or isointense (n = 3) with respect to surrounding muscles and demonstrated notable enhancement after intravenous gadopentetate dimeglumine. Five patients had pathologic MR pattern of the bone marrow. Asymptomatic osseous lesions were found in two cases.

Conclusions: In patients with hematopoietic disorders, hematomas, abscesses and lymphadenopathy are common causes for a soft tissue mass. Because of the typical appearance of tumors of granulocytic precursor cells biopsy may not be necessary in all cases of tumors during myelogenous leukemia. MR of the bone marrow seems adequate in patients with granulocytic sarcoma to detect asymp­

omatic osseous lesions.
Contrast-enhanced MRA in evaluating soft tissue vascular neoplasms and arterio-venous malformations

Purpose: to assess 3D CEMRA capability in depicting vascular supply of soft tissue vascular neoplasms and to establish its possible role in treatment planning.

Subjects & methods: Twelve patients with different lesions (8 AVM, 5 angiomatosus soft tissue tumors) underwent MRA. MRA was performed with a 1.5 T unit using a 3D SPGR sequence. Patients treated with embolization underwent MRA before and after the procedure.

Results: In four cases MRI established the nature of lesions (angioma) and 3D MRA demonstrated low flow lesions and lack of arterial feeders. Three angiomatosus lesions had high flow lesions and so candidate for embolization. In AVM (8) 3D CEMRA defined vascular architecture with delineation of arterial feeders and venous drainage. Post-treatment MRA showed in MAV the lack of feeder enhancement and in AVM significant enhancement.

Conclusion: Angiography has been the main method of detecting these lesions. 3D MRA is a sensitive technique in the evaluation of vascular tumors and malformations. It may identify the feeding and draining vessels for planning of embolic therapy or preoperative embolization. CEMRA results are useful complement that provided additional diagnostic information in cases of small (approx. 2 mm) osteoid osteomas.

Tissue characterization in MRI of tumors of the musculoskeletal system. An “area-to-area” comparative study of “whole-specimen” histopathology and MRI in 62 soft tissue tumors

L.H.L De Beuckeleer, E. Hauben, E. van Marck, A.M.A. De Schepper; Antwerp/BE

Aim: The aim of this study was to compare the diagnostic accuracy of MRI with that of histopathology in a “whole-specimen” setting.

Materials and methods: Sixty-two patients with soft tissue tumors were examined with MRI. All patients underwent surgical resection. The specimen was fixed in formalin and sectioned in a midaxial plane. Afterwards, a 1-cm slice of the tumor was embedded in paraffin, sliced with a microtome, stained, and the “whole-specimen” slices were examined by light microscopy. Semiquantitatively, the parameters were color, texture, necrosis, fibrosis, myxoid stroma, etc. encountered in the MR images with microscopy of a biopsy specimen. Therefore, the described features were recorded and compared.

Results: In 43 out of 62 patients, comparative studies yield more information on the MRI images with microscopy of a biopsy specimen. Therefore, the described features may reflect the true histopathologic features of the whole mass. Also, some features (necrosis, fibrosis, myxoid stromal elements...) encountered in soft tissue tumors, are not understood yet completely. We performed a comparative study between MRI and “whole-specimen” histopathology.

Conclusions: “Area-to-area” comparative MRI and histopathology may extend our insights in the histologic composition of soft tissue masses.

Abdominal Viscera (Solid Organs)

Abdomen - pancreas/cross section imaging (2)

Chairpersons:
C. Fugazzola (Varazze/IT)
S.M. Goldman (Houston, TX/US)

Comparison of spiral CT with MRI applications in pancreatic carcinoma imaging

N. Elmaz, R. Meydan, Y. Yuzer, A. Pourbagher, G. Yüce, F. Yilmaz, C. Çalışkan, İzmir/TR

Purpose: To evaluate spiral CT and MRI findings of pancreatic carcinoma. Method and material: 27 patients whose initial diagnosis was pancreatic carcinoma with clinical and sonographic findings, were examined by CT and MRI. In 18 patients, both CT and MRI studies were performed. 8 of them were evaluated only by CT and 1 of them only by MRI. In spiral CT technique, 150 ml of iodinated contrast material was injected IV by an automated injector and triphasic study was performed. MRI technique consisted of multilayer true FISP, T1W, T2W images with fat saturation followed by post-contrast images. MRCP and MRA were also included in patient examination. Tumor detection, peripancreatic vascular involvement, and resectability were evaluated. 19 patients underwent surgery, either palliative or curative, and the results were compared with radiological findings.

Results: CT and MRI findings were correlated in 14 patients. CT showed two false negative and one false positive, whereas MRI showed one false negative and one false positive result at tumor detection. The results of tumor detectability was 92.3 % for CT and 94.6 % for MRI. MRI results, with the contribution of MRA, were more successful in five patients than CT studies for the determination of resectability.

Conclusion: Since it is possible to detect the tumor (MRI), to evaluate the biliary tract (MRCP) and vascular structures (MRA) by a single modality at the same time, MR should be the first choice in pancreatic carcinoma imaging.
The characterization of cystic tumors of the pancreas: CT accuracy

C. Biasiulli1, G.M. Cartognini1, S. Accordini1, A. Guarnieri1, A.J. Megibow2, C. Procaccini1

Purpose: To evaluate the capabilities of CT to accurately characterize cystic tumors of the pancreas.

Methods and materials: Two observers retrospectively evaluated the CT exams of one hundred cystic masses of the pancreas, with pathological confirmation. The two observers, blinded about clinical information, and the final diagnosis, tried to categorize the lesions according to well-established morphologic features. Statistical analysis was performed in order to measure the agreement between each radiologist and the consensus diagnosis, and to evaluate the usefulness of certain CT findings in differentiating one type of cystic pancreatic neoplasm from another.

Results: The serous cystadenoma was better diagnosed by CT (Youden index, Y.m.i. = 0.72) than mucinous cystic tumor (Y.m.i. = 0.47) and solid pseudo-papillary tumor. Cystic variant (Y.m.i. = 0.47). The statistical analysis showed a significant agreement between the observers.

Conclusions: Being excluded from the study patients with previous history of pancreatitis, CT findings allowed to correctly characterize only 80% of cystic pancreatic masses. Among the remaining 20%, more than 10% of the wrong diagnosis could not be corrected by means of CT, given the pattern shown by the tumors. In 20-25% of cases a nonspecific diagnosis of cystic mass was made.

Isotropic imaging of pancreatic carcinoma with multislice-spiral-CT (MSCT)

U. Baum, A. Noemayr, M. Dobritz, M. Lell, T. Brunner, H. Greess, W.A. Bautz, Erlangen/DE

Purpose: Investigation of the capabilities of MSCT and its value for the staging of pancreatic carcinomas.

Methods and materials: 50 patients with suspected pancreatic carcinoma were examined with a bismuth MSCT protocol: slice collimation 4x1 mm, Pitch 3.5-4 mm. After administration of 120 ml contrast medium and 50 ml NaCl with an flow rate of 3.0 mls the examination was started with a delay of 40 s (pancreatic phase) and 80 s (portalvenous phase). The examinations were assessed in consensus of three readers experienced in abdominal radiology.

Results: MSCT allows multiphasic isotropic imaging of the upper abdomen and improves the assessment of tumor spread and lymph node metastases in arbitrary oblique planes. Interactive MPR allow an excellent demarcation of the tumor against the adjacent vessels (portal vein, superior mesenteric vein and artery, hepatic artery, coeliac trunk), the stomach, the duodenum. Small peripancreatic lymph nodes can be delineated better from pancreas and vessels.

Conclusions: MSCT is especially advantageous in defining critical relationships of the tumor to the adjacent vessels and organs. Interactive multiplanar reconstructions improve the staging of pancreatic cancer.

Dynamic contrast enhanced CT of the pancreas using multidetector-row CT: Improved detection of peak enhancement in pancreatic parenchyma and focal lesions

M. Onozawa, T. Katakai, H. Sakuma, A. Nakatsuka, K. Yamakado, K. Matsuura, K. Kakeda, TsuJP

Purpose: Previous studies demonstrated improved detectability of pancreatic lesions with dual-phase contrast-enhanced CT. However, test injection or smartprep scanning is required to obtain an optimal contrast. In this study, temporal variation in peak enhancement of the pancreas was assessed by using multidetector-row CT.

Methods and materials: Six patients with suspected pancreatic tumors underwent thin-section multi-phase CT (4-6 phases) during a single breath-hold. Eight to 16 slices were obtained for each phase. The contrast enhancement ratios (CER) of pancreatic parenchyma and lesions were calculated.

Results: The mean CERs of pancreatic parenchyma at 1-6 phases were 18.4±17.1%, 152±10.9% (mean±SD), 171±69.8 %, 169±77 %, 140.2±18.6 % and 151.5±57.7 %, respectively. The peak CERs of pancreatic parenchyma were observed at different phases (1st phase: 2 cases, 3rd phase: 2 cases, 4th phase: 1 case). The mean tumor CERs at 1-6 phases were 72.5±3.2 %, 66±33.7 %, 67±19.9 %, 70±23.3 %, 84±25.3 % and 86 %, respectively. The peak tumor CERs were observed at various phases as well.

Conclusion: The delay time between contrast injection and peak CERs of the pancreatic parenchyma and tumors was considerably variable for each subject. These results indicated that multidetector-row CT can improve detection of the pancreatic tumors and evaluation of vascularity of the lesions since multiple thin-slice images can be repeatedly acquired every 7-11 seconds.

Chronic pancreatitis versus pancreatic cancer: Usefulness of contrast-enhanced power Doppler US

M. Scialpi1, A. Rotondo1, M. Midiri1, F. Padovano1, M.R. Cazzolla1, T. Magli1, G. Angeletti1, T. Tarantino1, B. Basili1

Purpose: To evaluate the usefulness of contrast agent-enhanced Doppler US in differentiating chronic pancreatitis from pancreatic neoplasms.

Methods and materials: Twenty-one patients (8 female patients and 13 male patients; age range 39-71 years) with a pancreatic mass, diagnosed with US and/or CT and who had clinical signs of chronic pancreatitis or pancreatic cancer were examined with power Doppler US before and after intravenous infusion of the contrast agent. The presence or absence of the signal flow within the lesion was assessed. The lesions detected with US or CT were > 3.0 cm (range 1.1-3.0 cm: mean 2.5 cm). The power Doppler US results were correlated with clinical evaluation, laboratory data and surgical or FNAB findings.

Results: Lesion signal flow was not detected with nonenhanced power Doppler US in all cases. Enhanced power Doppler US depicted lesions signal flow in 7 pathologically proven pancreatic neoplasms. In 13 out of 14 patients with chronic pancreatitis no signal flow within the mass was found; in one case accurate flow evaluation of the mass was not possible due to artifact.

Conclusion: Contrast enhanced power Doppler US improves the detection of signal flow in pancreatic masses and can help in differentiating focal chronic pancreatitis from pancreatic cancer.

Mode of recurrence of periampullary cancer following Whipple’s procedure

J.K. Kim, Y.H. Ahn, P.N. Kim, H.K. Ha, M.G. Lee, Seoul/KR

Purpose: To evaluate the patterns of recurrence with emphasis on the earliest findings and their appearing time following Whipple’s procedure for different types of peripancreal cancer.

Materials and methods: 156 CTs of 46 patients with recurrent adenocarcinoma after Whipple’s procedure (common bile duct in 19, pancreas head in 16, and ampulla of Vater in 11) were retrospectively reviewed. CT was evaluated for the local recurrence in surgical bed, regional lymphadenopathy, liver metastasis, peritoneal carcinomatosis, and distant metastasis. The time of recurrence and the earliest findings were evaluated.

Results: Recurrence occurred within three months after operation in 8 (17 %) patients, three to six months in 14 (30 %), six to 12 months in 18 (39 %), 12 to 18 months in 5 (11 %), and over 18 months in one (2 %). All of thirty local recurrences, 15 (54 %) of 28 lymphadenopathies, 26 (79 %) of 33 liver metastases, 31 (51 %) of 16 peritoneal carcinomatosis, and two (27 %) of 11 distant metastases were the earliest findings of recurrence. Most of local recurrence, lymphadenopathy, liver metastasis, peritoneal carcinomatosis were observed within 12 month after operation, whereas distant metastasis usually occurred over 12 months. Forty-one (89 %) showed local recurrence or liver metastasis as the earliest finding. Adenocarcinoma of pancreatic head or common bile duct recurred earlier than that of ampulla of Vater.

Conclusion: Penapillary carcinoma has a tendency of early recurrence after Whipple’s procedure, and local recurrence and liver metastasis are the major earliest findings.

Islet cell tumors of the pancreas: Comparative study with MRI, CT and angiography

B. Op de Beeck, A. De Bondt, G. Delvaux, M. Osteaux, Brussels/BE

Purpose: To elaborate the value of MRI compared to spiral CT and angiography for detection of islet cell tumors.

Materials and methods: 15 patients with a total number of 18 islet cell tumors were evaluated with MR, CT, angiography, and intra-operative US. Findings were correlated with histopathology and endocrine activity.

Results: MRI was superior for lesion detection (16/18 lesions, 89 %) compared to CT (12, 67 %), and angiography (13, 72 %). MRI showed 2 false positive lesions, CT 1 and angiography 5. MRI detected 7 of 8 metastatic sites (liver, ADP, adrenal gland) and all positive sites. No false positive metastatic sites were noticed on MRI and CT. Angiography showed 2 false positive sites. Islet cell tumors appeared hypointense on T1-weighted MR images and hyperintense on T2-weighted images. After administration of Gadolinium, only 13 of 18 tumors were hypervascular (72 %) with a various enhancement pattern (homogeneous, ring-like or heterogeneous). Two patients underwent an additional examination after i.v. administration of Teslascan (Nycomed Amersham): enhancement in the primary endocrine pancreatic tumor and in the liver metastases was noticed.
Conclusion: MRI is the best non-invasive radiological technique to detect islet cell tumors and to evaluate metastatic disease.

745 11:40
Autoimmune pancreatitis: CT diagnosis
G.M. Carbognin, C. Biasiutti, A. Guanise, S. Ceratti, C. Procacci; Verona/IT

Purpose: To assess the possibility to distinguish by CT Autoimmune Pancreatitis (AP) from other pancreatic diseases with analogous clinical presentation.

Methods and materials: The CT images of 11 patients with proven AP, along with those of 20 patients with other pancreatic diseases, but with analogous clinical presentation, were retrospectively evaluated in a blinded fashion by two radiologist. In particular, they had to search for the typical signs recently reported in literature in order to correctly diagnose AP. Discordant cases were further analyzed in presence of a third radiologist. The final diagnosis was acquired by means of a majority or overall consensus. The sensitivity, specificity, positive and negative predictive values of CT were calculated against each of the diseases (AP, other pancreatic diseases), in order to detect a possible difference in the ability of the scan to diagnose the true patient’s status.

Results: Following the consensus evaluation, the correct diagnosis was reached in 27/31 (84.5%) cases, with 4/31 wrong diagnosis (AP diagnosed as other pancreatic disease or vice versa). Following these results, and referring to the two types of lesions (AP; other diseases), the number of true positives, false negatives, true negatives, and false positives was defined. The sensitivity and specificity of CT against AP were respectively 72.7% and 95%. The positive and negative predictive values were respectively 88.6% and 86.3%.

Conclusion: Dynamic CT enables the diagnosis of AP, even in the absence of a clinical recall. Its recognition is extremely important, since simple steroid therapy represent the correct treatment.

746 11:50
Small pancreatic cancer: Accuracy of CT and ERCP in detection and assessment
J.H. Kim, Y.H. Auh, P.N. Kim, H.K. Ha, M.G. Lee; Seoul/KR

Purpose: To evaluate the accuracy of CT and ERCP in detecting and assessing the small pancreatic cancer (< 2 cm in diameter) by comparison with surgical specimen.

Material and methods: Small pancreatic cancer in 14 patients was evaluated with CT (n = 13) including six dynamic CT and ERCP (n = 13). CT criteria were tumor identification, size, location, P-duct and CBD dilatation, lymphadenopathy. ERCP criteria were location of involvement, involved length.

Results: All patients had symptoms related with pancreatic diseases. On surgical specimen, all patients had carcinoma in head of pancreas. The average size of tumors was 1.6 cm. On CT scan, primary tumor were detected in 12 patients. Dilatation of both CBD and P-duets was seen in nine patients. There were CBD only dilatation in two and P-duets only in one. Of these 12 patients with dilatation of CBD or P-duets, nine patients (75%) had more disproportional dilatation of CBD (mean 17.3 mm) than P-duets (mean 5.4 mm). Of the ERCP (n = 10), all patients showed short segmental single narrowing (mean 16 mm) in distal CBD. Of the ERCP (n = 8), seven patients showed short segmental single narrowing (mean 14.2 mm) in pancreatic head and one patient had normal pancreatic duct.

Conclusion: CT provides enough informations for detection and assessment of the small pancreatic cancer. ERCP appears to be redundant without further gain. Considering its invasiveness, incompleteness, and operator dependency, ERCP should be need in selective cases.

10:30-12:00 Room E1

GI Tract

SS 1301b
GI tract - rectum
Chairpersons: C.J. Bartram (North Harrow/GB) J.E. Husband (Sutton/GB)

747 10:30
Multislice spiral CT with water enema in preoperative staging of rectal carcinoma: Comparison with endosonography and histopathological findings
A. Njemayr, U. Baum, M. Leil, K. Matzel, W.A. Bautz; Erlangen/DE

Purpose: Value of Multislice-Spiral-CT with water enema in preoperative staging of rectal carcinoma compared to endosonography and histopathological findings. Assessment of multiplanar reconstructions (MPR) and interactive volume rendering (VR) for staging.

Material and methods: Prospective analysis of Multislice-CT (Somatom-Plus-4-VZ, Siemens, Germany) in 28 patients with rectal tumor. Correlation with endosonography and histopathological findings. Patients were examined with a two-phase-protocol (arterial and portalvenous phase) and water enema. Reconstructed slice thickness was 1.25 and 3 mm. CT-data-analysis was done with MPR and VR on a workstation (“Virtuos”, Siemens, Germany).

Results: T-staging by Multislice-CT and endosonography (ES) was correct in 13 (6%). ES is able to distinguish T1 from T2 which is not possible in CT. 71% of the T0-T2-tumors and all T3-tumors were staged correctly by CT and ES. 29% of the T0-T2-tumors were overstaged by both methods. Lymph node metastases (without respect to the N-stage) were detected correctly in 70% (CT).

Conclusion: Accuracy of Multislice-Spiral-CT to detect tumor extension into perirectal fat is comparable to ES. MPRs were useful to distinguish lymph nodes from perirectal vessels and allowed better assessment of the floor of the pelvis. VR is suitable for 3D presentation of rectum and tumor.

748 10:40
Perirectal lymph node involvement in rectal cancer: Diagnostic value of CT with pathologic correlation
M. Chessa-Corona, G. Guist, P.C. Muzzio, P. Toppan, S. Pucciarelli, G.P. Feltrin; Padova/IT

Purpose: to evaluate the diagnostic accuracy of CT, performed with dedicated technique, in the local staging of the rectal cancer.

Material and methods: From February 1995 to June 1999, 94 patients (59 males, 35 females, mean age 58 years) examined with CT of the pelvis underwent anterior rectal resection for rectal cancer: in all patients radio logical and N staging was verified at pathological examination of excised specimens. Prone patients, after air insufflation of ampulla, during e. contrast injection; targeted analysis of regional region was performed with thin (3-5 mm) contiguous slices. For T staging, T1-T2, T3 and T4 groups were considered. For N staging, two groups of patients were considered: in the first 52 patients N+ stage was attributed to all visible lymph nodes; in the following 42 patients, only lymph nodes ≤ 5 mm were recorded as N+.

Result: pathological examination revealed 54 T2, 37 T3 and 3 T4 stages; CT examinations correctly identified 42 T2 (77.7%), 30 T3 (81%) and 2 T4 (66.6%) lesions. Regarding the N stage pathological examination in the first group (52 patients) revealed only 11 cases of lymph node involvement; CT examination detected all 11 true positive LNs but overestimated 30 more false positive cases. In the second group (42 patients) pathology revealed 21 cases of nodal involvement; CT examination identified 19 true positive, 14 true negative, 7 false positive and 2 false negative lymph nodes.

Conclusion: CT examination correctly staged 74/94 lesions (78.7%); not surprisingly most of errors were overestimation in T2 patients (10/42 = 24%) and underestimation in T3 patients (7/30 = 23%). In accordance with other reports dealing with superior accuracy of endorectal US in local staging of early disease. On the other hand the criterion we suggest for the evaluation of metastatic perirectal lymph nodes (diameter ≤ 5 mm) gave 78.6% diagnostic accuracy, 90.5% sensitivity and 87.5% negative predictive value. This can be useful in those patients in which prompt surgery, soon after radio-chemotherapy in case of nodal involvement, can be likely curative. Moreover, combining the results of endorectal US in local staging and CT in nodal involvement, a greater number of transanal curative resections can be predicted.
749 10:50
Significance of hydronephrosis in resected colorectal cancer: CT diagnosis of etiology and patterns of relapse
A.E. Dutty, J. Pitcher, C. Morris, D.C. Cunningham, J.E. Husband; London/GB

Purpose: To investigate the causes and significance of hydronephrosis in follow-up of colorectal cancer.

Methods/materials: Retrospective review of 250 CT scans, records and histology of 70 patients treated for colorectal cancer, who developed new hydronephrosis.

Results: Tumour stage was B (30%), C (60%) or D (10%), with serosal penetration in 30%. Regardless of the original site of the tumour, incidence of hydronephrosis was equal on left and right (15% bilateral). 50% of patients showed a greater than 50% rise in serum creatinine with the development of hydronephrosis, 20% of these had a normal CEA.

The cause was recurrent mass at the resection site or peritoneal mass (54%).

Conclusions: Hydronephrosis is an important early indicator of colorectal cancer recurrence, even in the absence of a mass. An unexpected rise in creatinine should be an indication for CT.

750 10:55
Endorectal coil MRI in the evaluation of rectal cancer: Comparison with endorectal ultrasound and pathologic staging
P. Torricelli, V. Spina, P. D’Alimonte, M. De Santis, R. Romagnoli, G. Luppi, M. Gavoli; Modena/IT

Purpose: To evaluate the results of endorectal coil MRI in the study of rectal cancer.

Methods and material: 25 patients with proven rectal cancer underwent endorectal coil MRI with an high field strength scanner (1.5 T). Based upon the current literature criteria the MRI staging of rectal cancer was done. In 12 out of 25 patients MRI was performed both before and after pre-operative neoadjuvant chemotherapy, in order to assess the response of the tumor to the drugs. The MRI results were compared with that of endorectal ultrasound in all cases and with pathologic evaluation in 18 patients who underwent surgery.

Results: The MRI staging agreed with pathology in 84% of cases. The rectal wall involvement was overstaged in 4 cases. The MRI accuracy in detecting perirectal metastatic lymphnodes was about 81% with a sensitivity of 86% and a specificity of 77%. MRI was not significantly better than endorectal ultrasound in assessing rectal wall involvement and it was slightly better in detecting metastatic perirectal lymphnodes. However MRI better demonstrated the results of pre-operative chemotherapy.

Conclusion: Endorectal coil MRI is a reliable, even if expensive, tool to stage rectal cancer and, moreover, to assess the results of preoperative chemotherapy.

751 11:05
Fat suppressed sequences in the identification of perivisceral fat infiltration in rectal cancer
P. D’Alessandro, A.C. Donadio, A. Del Vecchio, B. Accarino, R. Grassi, S. Cappabianca; Naples/IT

Purpose: evaluation of fat-suppressed T1w sequences in the identification of extravesical infiltration of the rectal carcinoma.

Materials and methods: 47 patients with proven rectal carcinoma underwent Magnetic Resonance Imaging (MRI) of the pelvis to evaluate T stage. MRI was performed with a 1.0 T scanner using T1w and PD-T2w images (SE technique) both in transaxial and coronal plane. In all cases T1 fat-suppressed images (using selective chemical shift) with retrograde rectal filling were obtained.

2 different groups of radiologists evaluated MRI exams and all findings were compared with histological results, obtained during the surgical treatment performed in 3 weeks after MRI.

Results: conventional MRI sequences showed perivesical infiltration in 18 patients; histological sampling showed neoplastic foci in 15. In 29 patients with no signs of fat infiltration histology showed 3 cases of metastatic spread in the fat. Fat-suppressed sequences with rectal filling showed 19 cases of nodal spread in the perivesical fat with 18 very positive at histological findings. In 28 patients with no infiltration signs, 1 showed nodal spread in perivesical fat at histology.

Discussion and conclusion: the use of fat-suppression sequences with rectal filling of contrast medium can provide a better identification of neoplastic spread in the perivesical fat.

752 11:15
MRI with phased-array coil and pelvic recurrence of rectal cancer after surgery
A. Zarrella, A. De Gaspar, R. Niccolotti, R. Mollone, A. Del Maschio; Milan/IT

Purpose: Radical surgical removal of pelvic recurrent rectal cancer improves survival rates; thus correct identification and staging of relapse is important. Aim of our study was to evaluate the accuracy of MRI in suspected pelvic recurrence.

Materials and methods: From March 1995 to June 1999 30 patients with clinically suspected pelvic relapse of rectal cancer were studied with a 1.5 T MR equipment and phased-array coil.

Multplanar acquisitions T1 and T2 weighted (5-7 mm slice thickness) were acquired, the study was completed with dynamic evaluation during bolus injection of Gd-DTPA and with T1-weighted post contrast Fat-Sat sequences. The presence of lesions with characteristics of malignancy: atrophy and the relationship with pelvic structures were evaluated by two expert radiologists.

Pathologic findings (surgery or percutaneous biopsy) and follow-up were the standard of reference. Patients with relapse were considered positive.

Results: 26 patients had relapsing rectal cancer and 4 were negative for local recurrence.

MRI correctly evaluated 24 positive and 3 negative patients (1 false positive and 2 false negatives).

MRI Accuracy was 90%: Sensitivity 92% and Specificity 75%.

Among the relapsing patients 12 had proved infiltration of surrounding pelvic structures.

Conclusions: MRI is accurate in the evaluation of suspected pelvic recurrence of rectal carcinoma after surgery.

In our experience MRI is particularly useful in preoperative assessment of the infiltration of pelvic structures when surgery is planned.

753 11:25
Endorectal ultrasound in the evaluation of response to radiochemotherapy of rectal cancer
G. Nics, M. Horvath, C. Gerber, M. Hackl, M. Baur; W Kumpam; Vienna/AT

Purpose: Evaluate the usefulness of endorectal ultrasound (EUS) and define sonographic criteria to estimate response to neoadjuvant radiochemotherapy of rectal cancer, as correct T staging is difficult due to posttherapeutic changes.

Methods & materials: 20 patients underwent endoscopy, biopsy. EUS, abdominal CE-CT and ultrasound before and after radiochemotherapy. Surgical specimen were worked up histopathologically and histopathologic findings were correlated with EUS. We measured wall/tumor thickness in mm, differentiated relative posttherapeutic reduction of wall thickness in 3 groups (more than 50%, less than 50%, not change of wall thickness), and change of tumor shape (excentric to concentric, excentric to excentric, concentric to concentric).

Results: Wall/tumor thickness less than 6 mm combined with relative reduction of tumor thickness - 50%, and change of tumourshape from excentric to concentric allowed to diagnose 3 of 5 complete responses. No positive lymph-nodes were found in patients with posttherapeutic wallthickness of 7 mm or less. A sub group of non responders (4) could also be defined.

Conclusion: EUS is a useful tool to evaluate response to radiochemotherapy of rectal cancer.

754 11:35
Real-time MR-defecography
J. Tacke; G. B. Adam; A. Glowsinski; T. Schallauer; R.W. Gunther; Aachen/DE. Hamburg/DE

Purpose: To evaluate the feasibility and clinical application of MR-defecography using radial fluoroscopic sequences.

Methods and material: 10 patients with defecation disorders were examined in a 1.5 T magnet (ACS-NT. Philips). A condome filled with a mixture of water, starch and diluted gadopentetate dimeglumine (1 500) was inserted into the rectum. The defecation process was imaged by a turbo field echo sequence with radial k-space trajectories in a sagittal and coronal plane.

In order to suppress foldover artifacts, two parallel saturation slabs were placed within the FOV at a distance of 150 mm. After acquisition of a number of radial projections which were almost parallel to the REST slabs, the orientation of the slabs was changed to the perpendicular orientation and the next projections were acquired.
Results: The high temporal resolution allowed precise evaluation of the anorectal angle during resting, and contraction of the anal sphincter and during straining. Foldover artifacts and artifacts of abdominal movement during straining were reduced to a minimum, resulting in a good image quality with high temporal resolution.

Conclusion: Dynamic MR defecography using the radial fluoroscopic sequence holds great promise in replacing conventional fluoroscopic defecography.

Defecography in evaluation of enterocele
A.Z. Ginja, J.H. van Dann, M. Gosselink, W.R. Schouten; Rotterdam/NL

Purpose: Enterocele is a peritoneal sac containing intestine and in women lying between posterior vaginal wall and anterior rectal wall and may be difficult to clearly define on clinical examination. The purpose of this study was to define the role of defecography in diagnosis of the pelvic floor abnormalities more commonly found in association with enterocele.

Materials and methods: 49 of the patients (age 30-83) undergoing defecography for various anorectal symptoms, rectal evacuation difficulties were found to have an enterocele. 31 with grade 3 or 4 (called group A) enterocele and 18 with grade 1 or 2 enterocele (called group B). 31 control patients undergoing defecography for various anorectal symptoms were selected matched for age with group A but without an enterocele. The defecography parameters measured in all 60 patients were: anorectal angle in resting and during straining, perineal descent, presence + size of rectocele, presence and grade of enterocele, internal intussusception or external rectal prolapse.

Results: There was no difference regarding age or symptomatology between enterocele and control group. 10 (32 %) of the 31 patients in group A and 12 (66) of the 18 patients in group B had had a previous hysterectomy whereas only 1 (0.03 %) out of 31 patients in control group had had a previous hysterectomy. Almost half the patients in group A and B had had previous pelvic trauma during childhood. Intussusception and rectal prolapse was found in 91 % in group A and 78 % in group B but only 42 % in control group. Pelvic floor descent was increased significantly in 74 % in enterocele group A compared to 26 % in control group. Rectocele was found more commonly in group B (39 %).

The anorectal angle values did differ significantly between the groups.

Conclusion: Defecography plays a vital role in objective demonstration of enterocele and associated pelvic floor abnormalities. Rectal intussusception and prolapse and an increased pelvic floor descent are often associated with an enterocele.

Post-surgical MRI evaluation of anal atresia
L.H. Bog, P.R. Ros; Zaragoza/ES, Boston, MA/US

Purpose: The aim is to take into consideration the possibilities of MRI in the evaluation of patients with anal atresia that have undergone surgical treatment.

Material and methods: Twelve patients that have undergone a sagittal posterior anorectoplasty were evaluated, after a variable interval after surgery, by means of MRI using a 0.5 T unit and a minimum basic protocol, which includes axial proton density and T2 weighted images and coronal T1 weighted planes.

Results: MRI shows clearly the anatomical references of this kind of pathology, evaluating precisely the neorectum and its location with regards to the remnant of the sphincter complex, being this of great value in those cases with post-surgical incontinence. The outline of the levator ani muscles is clearly shown in those cases where it is present. Those added congenital malformations (sacral atresia, neurogenic bladder) are depicted clearly.

Conclusion: MRI is an useful technique in the post-surgical evaluation of those patients with anal atresia, in that it helps in evaluating the anatomical structure present, such as the sphincter complex, the levator ani muscles, and the neorectum. It also shows the associated congenital anomalies.

Breast
SS 1302
Interventions
Chairpersons:
E. Azavedo (Stockholm/SE)
R. C. Otto (Baden/CH)

10:30-12:00

10:30
Robotic system for automatic biopsy/therapy of breast lesions in high-field MR-scanners: Initial results
W. A. Kaiser*, H. Fischer*, J. Vagner*, Jena/DE, Karlsruhe/DE

Purpose: By MR-Mammography a significant progress was achieved in diagnosing small breast cancers. However, biopsy and therapy had to take place later. A robotic system shall be presented, which approaches a focus in the breast image-guided under a high magnetic field (1.5 T).

Materials and methods: The system works in direct vicinity of the isocenter of the magnet (Philips Gyroscan ACSII, Siemens Vision) and consists of several components (trocar, coaxial sleeve, biopsy needle, laser/kryo-applicator, control and driving unit). It contains a rack, a driving unit along the three axes of space, and a gripping unit for charging the roboter with instruments of biopsy removal. Movement along the x-, y- and z-axis takes place by means of ultrasound motors. To measure the actual position of the manipulator laser sensors and optical rotation code transducers are used.

Results: First 1.5 T-in-vivo experiments in pig liver yielded successful biopsies of all 8 tiny (2×3 mm) capsules included. Targets were hit with a precision of less than 2 mm.

Conclusions: After future experiments in human breasts, this robotic system could allow a combined imaging/biopsy/therapy-examination of breast lesions, e.g. using laser- cryotherapy, within a high field MR-scanner.

10:40
MR-guided breast interventions: Results according to BI-RADS classification
M. Muller-Schimpfle, K.C. Siegmund, N. Fersis, P. Ruck, U. Kranick, C.D. Clausen, Tubingen/DE

Purpose: To evaluate the usefulness of MR-guided marking and microbiopsy interventions of lesions exclusively detected by MR imaging.

Methods and materials: MR imaging was performed at 1.0 T (n = 55) and at 0.2 T (n = 8; Magnetom Expert/Open, Siemens Medical Systems, Erlangen, Germany). Lesion localizations were carried out with an MR-compatible metal coil (Cook, Mönchengladbach, Germany; n = 18) or a hook wire (Somatex, Berlin, Germany, BARD, Karlsruhe, Germany, n = 19). Needle guidance was achieved by a self-designed perforated plate. Microbiopses (n = 15) were performed either with MR-non-compatible 14 G high-speed biopsy systems or with semi-automar MR-compatible 18 G and 14 G sets after exact placement of an MR-compatible 13 G coaxial needle. The coaxial needle was guided by a commercially available plate adjustable in all directions. BI-RADS categories were classified by two radiologists on diagnostic pre-interventional MRI examinations of the breast.

Results: In 63 interventions, malignant histology was found in 0/6 BI-RADS 3, 13/ 49 BI-RADS 4, and 6/8 BI-RADS 5 lesions. The positive biopsy rate was independent of the lesion size. Five of eight examined cases had an overexpression of c-erbB2. Only the high-speed biopsy system provided a high quality of microbiopsies for histopathologic workup.

Conclusion: MR-detected lesions classified as BI-RADS categories 3-5 show similar positive biopsy rates like mammographically detected BI-RADS 3-5 lesions. This finding is independent of lesion size.

11:55
Post-surgical MRI evaluation of anal atresia
L.H. Bog, P.R. Ros; Zaragoza/ES, Boston, MA/US

Purpose: The aim is to take into consideration the possibilities of MRI in the evaluation of patients with anal atresia that have undergone surgical treatment.

Material and methods: Twelve patients that have undergone a sagittal posterior anorectoplasty were evaluated, after a variable interval after surgery, by means of MRI using a 0.5 T unit and a minimum basic protocol, which includes axial proton density and T2 weighted images and coronal T1 weighted planes.

Results: MRI shows clearly the anatomical references of this kind of pathology, evaluating precisely the neorectum and its location with regards to the remnant of the sphincter complex, being this of great value in those cases with post-surgical incontinence. The outline of the levator ani muscles is clearly shown in those cases where it is present. Those added congenital malformations (sacral atresia, neurogenic bladder) are depicted clearly.

Conclusion: MRI is an useful technique in the post-surgical evaluation of those patients with anal atresia, in that it helps in evaluating the anatomical structure present, such as the sphincter complex, the levator ani muscles, and the neorectum. It also shows the associated congenital anomalies.

10:50
Determination of the optimum number of specimens to obtain at directional, vacuum-assisted breast biopsy
F. Lomoachitz, T.I. Heibich, M. Rudas, A. Stadler, K.F. Linnau, G. Pfarl, G. Wolf, Vienna/AT

Purpose: To determine the optimum number of specimens to obtain at 14-g and 11-g directional, vacuum-assisted breast biopsy (DVABB).
Materials and methods: In a prospective randomized study 60 mammographic lesions (40 masses, 20 calcifications, BI-RAD III/IV; 58 female patients; age range: 31-78 y) were biopsied with 14-g and 11-g DVABB. Stereotactic biopsies were performed in prone position using a standardized protocol. 20 specimens per lesion were obtained and separated in chronological order followed by corresponding histopathological work-up. The histopathological analysis of each specimen was compared to the result of subsequent surgical excision.

Results: Complete agreement with the histopathological findings was found in the first specimen in 22 (37 %) of all 60 lesions. Obtaining two, three, four, five and six specimens (one clockwise rotation) yielded a diagnosis in 30 (50 %), 38 (63 %), 50 (83 %), 54 (90 %) and 58 (97 %) of the 60 lesions. All 40 masses were diagnosed correctly obtaining five specimens. In 18 of 20 lesions evident as calcifications obtaining six specimens resulted in the correct diagnosis. In 2 of the 20 calcifications twelve specimens were necessary to get the right diagnosis. There was no difference in the results comparing 14-g and 11-g DVABB.

Conclusion: 14-g and 11-g DVABB achieved a 100 % diagnostic yield with five specimens in masses. However, additional specimens are necessary to yield the correct diagnosis in some calcifications.

760 11:00
Role of stereotactic vacuum-assisted breast biopsy in an interdisciplinary breast care center

K.C. Siegmund, C.T. Remy, N. Fersis, P. Ruck, U. Krainick, C.D. Claussen, M. Müller-Schimpfle; Tubingen/DE

Purpose: Implementation of the stereotactic vacuum-assisted breast biopsy to establish specific indications for a better standardization and optimization of biopsy procedures.

Materials and methods: In 18 patients with 26 mammographically detected suspicious breast lesions (24 BI-RADS 4, 2 BI-RADS 5) an 11 G-vacuum-assisted biopsy was performed. Most of the lesions consisted of microcalcifications (23/26). Their size differed from 3 to 35 mm (mean 18 mm). After the procedure every patient was asked if she would still prefer to undergo this procedure rather than an open excisional biopsy.

Results: From each lesion 8 to 48 cores (mean 23) were taken in a mean time of 65 minutes. A complete/partial removal of the lesion was achieved in 11/15 cases (total = 26). One third of the BI-RADS 4 lesions (8/24) and both BI-RADS 5 lesions proved to be malignant. An intense bleeding occurred in 8 cases. In one case it led to the termination of the procedure. Other complications than bleeding did not occur. Only 2 patients would not undergo this procedure again because of neck pain.

Conclusion: The vacuum-assisted breast biopsy is a safe and well tolerated procedure to avoid open surgical biopsy in cases of BI-RADS 4 microcalcifications with typically low positive breast biopsy rates and in lesions with low probability of complete surgical removal.

761 11:05
Digital stereotactic biopsy: A newly developed holder for vacuum biopsy (Mammotome) at the Mammomat 3000

U. Aichinger, R. Schultz-Wendland, W.A. Bautz; Erlangen/DE

Purpose: Vacuum core biopsy is normally performed on a special stereotactic table. Now there is a special holder available which allows stereotactic guided vacuum core biopsy at a mammographic unit.

Methods: Since Feb. 1999, we performed vacuum core biopsy in 37 patients with suspect, only mammographically detected lesions. The biopsy was performed using a Mammotome 3000 (Siemens) in conjunction with a digital camera (OPDIMA, Siemens) and a newly developed holder for the vacuum biopsy system (Mammotome, Ethicon). Correct sampling was documented by immediate mammographic views.

Results: All 37 solid lesions and microcalcifications were detected and biopsied: the material was representative in all cases. There were no major side effects such as pain, major bleeding or infection. The follow-up mammograms after three and six months showed no visible scarring.

Discussion: The newly developed holder for the vacuum core biopsy system (Mammotome) allows, in conjunction with the digital stereotactic unit, a safe, rapid and minimal invasive procedure in the workup of microcalcifications, as well as mammographically detected soft tissue lesions. Because of the possibility of completed removal of visible lesions, false negative results are rare.

762 11:10
US-guided breast biopsy with Mammotome of non-palpable nodules

L. Bell, F. D’Ernco, N. Poerio; Castelfranca/IT

Purpose: to test the utility and accuracy of Mammotome system to assess small breast lesions and particularly to identify malignancies.

Methods and materials: from April to August ’99 we performed 24 biopsy in 23 women affected by breast lesions identified at US examination: mean age was 56 years, right side was affected in 10 cases, left side in 13 cases while one case was bilateral.

Results: Nodules were present in 20 patients (diameter from 6 to 15 mm), while in 4 cases we detected parenchymal distortion. Four faint nodules showed microcalcifications at mammograms.

Conclusions: Mammotome 14 gauge was used and local anesthesia was previously performed. From 22 specimens were collected in each case.

763 11:15
US-guided large-core breast biopsy

P. Crystall, S. Strano, S. Shchannsky, M. Koretz; Beer-Sheva/IL

Objective: Large needle automated biopsy of breast commonly performed. either with stereotactic X-ray or ultrasound guidance. In this study we evaluated our experience of US-guided large-core needle breast biopsy (US-LCNBB) and compared results with vacuum-assisted stereotactic breast biopsy (VASSB).

Materials and methods: In the last 17 months 99 solid nonpalpable breast masses were biopsied under sonographic guidance in 98 women [median age 53.1 years; range, 28-74 years]. A 14-gauge core biopsy needle was used. A median of four core biopsy specimens was obtained per lesion.

Results: US-LCNBB was diagnostic in 93 cases. Lesions included: 22 cancers (21 of them invasive ductal carcinoma and 1 case of DCIS), 42 fibroadenomas, 12 fibrous nodules. 9 cases of fibrocystic changes, 2 mammary duct ectasia, 2 sclerosing papillary lesion, 1 intraductal hyperplasia, 1 tubular adenoma, 1 chronic inflammation and 1 old hematoma. In six patients, insufficient materials was obtained, and repeat stereotactic or open biopsies were done in 4 of them.

Conclusions: These figures are comparable with those of stereotactic biopsy in our hospital. Advantages of US-LCNBB include: cost-effectiveness, short procedure time, no ionizing radiation, accessibility to all areas of the breast and axilla and real time visualization of needle position.

764 11:25
Needle localization of non-palpable breast lesions using full-field digital mammography

S.D. Grebe, U. Bick, F. Diekmann, K.-J. Winzer, J.U. Blohmer, B. Hamm; Berlin/DE

Purpose: To investigate the potential of full-field digital mammography for needle localization of non-palpable breast lesions.

Subjects and methods: Since June 1999, all needle localization procedures in our department have been performed using a novel full-field digital mammography unit (Senograph 2000 D, General Electrics). The initial prelocalization as well as the final postlocalization CC and ML views were obtained with standard exposure setting. All other images during the localization procedure were obtained with a 50 % reduced dose. The number of images as well as the procedure time was recorded and compared to film-based localizations.

Results: Up to now, more than 50 needle localizations have successfully been performed with the new digital technique. Image quality was sufficient in all cases and at least equivalent to prior screen-film mammograms. Half-dose images were adequate for control of the needle position during the procedure. With the digital technique, images are available for review already 20 s after exposure, reducing the total procedure time compared to the film-based technique by at least 10 - 15 minutes.
Conclusions: Full-field digital mammography is ideally suited for needle localization procedures and offers potential for reduction in both procedure time and radiation dose.

765 11:30
Pros and cons of the advanced breast biopsy instrumentation: A two years experience

L.F. Fingerig, G. Di Tolla, G. Patelli, R. Lanocata, T. De Simone, A.V. Marchiano, B. Damascelli, Milano/IT

Purpose: to assess the safety and reliability of the ABBI system as an adequate biopict tool, comparable to the widespread wire-localization surgical approach.

Methods and materials: since June 1997, 195 patients underwent 200 ABBI biopsies for suspected or indeterminate breast lesions. In most cases the 20 mm cannulas were used, not aiming at radical lumpectomy, but only at the best possible sampling. All the biopsies succeeded in removing the targeted lesion. The shortest distance was always chosen and the biopsy was only prevented in very thin breasts (compression 25 mm, 12 cases). Only 5 patients were rejected as the parenchymal distortions were no longer visible at digital mammography.

Results: 88 lesions were malignant, 112 benign. The variety of histologies present in the lesions was correctly assessed, even in cases of multiple associated pathologies. Every time the lesion was seen on digital mammograms, it could be targeted and removed. There were 9 electrocautery and 1 motor failures (specimen removed by scissors), 3 hematomas evacuated by percutaneous aspiration within 24 hours.

Conclusion: the ABBI system did not show any implicit error in targeting or removing the lesions. It was highly reliable and completely safe for the patients.

766 11:40
Extended minimal invasive breast biopsy (MIBB) with and without subsequent radiofrequency ablation. Feasibility of complete tumor treatment tested in animal model using highly malignant VX2 tumors

T. Boehm, T. Azhani, A. Malich, I. Hilger, M. Fleck, W.A. Kaiser, Jena/DE

Purpose: To investigate if complete histologic excision of small tumors using the a vacuum assisted biopsy technique is possible. To evaluate the frequency of the local recurrences despite achievement of histologic free margins in the biopsy specimens. To evaluate the efficiency of combined vacuum assisted tumor excision and RF ablation for prevention of local recurrences.

Method/materials: 12 VX2-tumors were implanted into the spine muscle (M. erector spinae) of 6 rabbits under ultrasound guidance. Tumor growth was monitored by B-mode ultrasound in a 3-day interval. Minimal invasive tumor excision was performed using MIBB directed, vacuum assisted biopsy device (Advanced Breast Care Technologies, Norfolk, USA) when tumor sizes reached 10 mm. 4 rounds of directed vacuum assisted biopsy in 22.5° angle interval were performed. In 6 tumors subsequent RF ablation (8 min, 36 W) was performed using a cooled RF needle ablation system (CC-1 Cosman Coagulator, Radiomics Inc., Burlington, USA). Impedance was measured during ablation. Lesion development was monitored using B-mode-US. Follow up B-mode ultrasound was performed in a 3-4 day interval up to 3 weeks after MIBB excision/RF ablation. Histologic analysis was performed.

Results: The time between implantation and excision varied between 14 and 25 days (17±2±5). Correct centered positioning of the biopsy needle took between 12 and 35 min (20±4). Histologic tumor free margins in the outer round of core biopsy specimens were found in 8/12 (66 %) cases. Maximum lesion sizes during RF ablation was between 18 and 25 mm (19±2 mm). Local recurrences after MIBB occurred in 5/6 cases (83 %). Local recurrences after combined MIBB/RF-ablation occurred in 1/6 cases (17 %). Two cases with histologic positive margins in core biopsy specimens were in the MIBB and two in the MIBB/RF-ablation group.

Conclusions:
1. Minimal invasive resection of highly malignant tumors using a extended vacuum assisted biopsy technique is possible.
2. In rare cases complete excision using a vacuum assisted biopsy technique without local recurrence is possible.
3. Combined MIBB and RF ablation reduces local recurrences considerably.
4. MIBB combined with rapid section histologic technique can be used for margin definition in combination with RF ablation of small breast tumors since no imaging technique gives reliable informations about tumor margins.
5. The technique of the time consuming needle positioning procedure should be improved. Correct centered positioning of the biopsy device is crucial for achievement of tumor free margins.
ResuHs: 122 patients were eligible lor comparative analysis with 30
P.

Concluslon: Contrast enhanced MR demonstrated a CT-comparable moderate
and disease without knowledge 01 the DSA results.

Material and methods: Fourteen anesthetized juvenile pigs received experimen­
vein. They underwent gadolinium-enhanced 3D MR angiography and contrast­
angiography images were reviewed independently and in random order by three
obscervers. To evaluate the accuracy 01 each modality the lung casts were com­
over contrast-enhanced CT is the combined visualization of pulmonary arteries and
lung perfusion.

Comparison of three-dimensional MR-angiography with contrast-enhanced
CT of peripheral pulmonary embolism in a porclne model
P. Reitner1, H. Coxson1, Y. Nakano1, L. Heyneman1, S. Ward2, E.M. Baile1, N.L. Muller1, J.R. Mayo1, *GrazAT, -Vancouver/CA
Purpose: The purpose of this study was to compare gadolinium-enhanced three­
dimensional (3D) MR angiography with contrast-enhanced CT for the evaluation of peripheral pulmonary embolism using a methacrylate cast of the porcine pulmo­
vascular tree. They underwent gadolinium-enhanced 3D MR angiography and contrast­
hanced CT after imaging the animals were killed and the pulmonary arterial tree was cast using clear methacrylate, allowing visualization of the emboli. CT and MR angiography images were reviewed independently and in random order by three
observers. To evaluate the accuracy of each modality the lung casts were com­
pared to the results of the imaging studies.

Results: Eighty-four emboli were included in the statistical analysis. No significant
difference of sensitivities and positive predictive values (p = 0.18 and p > 0.64) between gadolinium-enhanced 3D MR angiography and contrast-enhanced CT was evident. The overall sensitivity and positive predictive value for gadolinium­
enhanced 3D MRA was 82 % and 94 %, that of spiral CT were 76 % and 92 %.

Conclusion: The main advantage of gadolinium-enhanced 3D MR angiography over contrast-enhanced CT is the combined visualization of pulmonary arteries and
lung perfusion.

Factors contributing to observer disagreement in the ESTIPEP study
C.M. Schaefer-Prokop, M. Prokop, J. Hahne, C.J. Herold; Vienna/AT
Purpose: To evaluate the reasons for observer disagreement of CTA examinations for the diagnosis of pulmonary embolism.

Methods: A total of 758 CTA examinations from the ESTIPEP multi-center study on CT angiography for pulmonary embolism were read independently by two
radiologists with a high level of expertise in the field. Cases were rated to be
positive, negative, indeterminate or non-diagnostic. In all cases of observer
disagreement, a third reader was consulted. We compared the group of studies with concordant CT diagnoses (group A) to that with discrepant diagnoses between
the two readers (group B). For these two groups, we evaluated the qualita­
tive assessment of image quality related to vascular opacification, image noise, motion artifacts and streak artifacts.

Results: In 142 of 758 examinations (18 %), cases were rated discrepancy. There was no significant difference regarding the use of scan parameters between groups A and B: a 3 mm collimation was used in 77 % of cases in either group. However, the number of patients in whom low contrast volumes (< 100 ml) was injected was significantly higher in group B (48 % versus 36 % in group A). In group B, vascular opacification was considered insufficient in 22 % of patients (versus 7 % in group A). There were moderate differences with respect to the presence of degenerative calcifications (18 % in group B vs. 11 % in group A), streak artifacts (14 % in group B vs. 8 % in group A) and image noise (12 % in group B vs. 5 % in group A). For the total number of patients, agreement of individual readers with the consensus diagnosis varied from 86 % to 99.3 %, while in the group with discrepant readings (B) individual reader agreement with the final

Conclusion: In CTA examinations for acute pulmonary embolism, insufficient
vascular opacification contributes more to disagreement between radiologists than differences in their evaluation of image artifacts. Even in an experienced group of radiologists the individual perfor­
ance of the readers plays a major role.

Diagnostic strategies for pulmonary embolism: The Dutch consensus
M. Oudemans-van Weenen, E.J.R. van Beek, W.L. van Putten; Rotterdam/NI
Purpose: the diagnosis of pulmonary embolism is a continuing challenge. We
assessed the cost-effectiveness of strategies, including some of the newer
diagnostic tests.

Methods and materials: based on literature data, we derived assumptions and calculated the mortality, adequacy of therapeutic decisions and overall costs of 41 strategies by using a decision analytic model. The strategies included a variety of diagnostic tests, such as angiography, spiral computed tomography, lung
scintigraphy, ultrasonography of leg veins and plasma D-dimer.

Results: strategies which included pulmonary angiography were significantly better in terms of mortality. Strategies which did not perform angiography as a final test had higher mortality, but some were cheaper. The strategy which uses perfusion-ventilation scintigraphy, ultrasonography and angiography had similar mortality, however, at significantly higher costs. Other strategies were either too expensive or resulted in unacceptable mortality.

Conclusion: the optimal diagnostic strategy should include pulmonary angiogra­
y. The use of lung scintigraphy and ultrasonography reduces the number of patients requiring angiography by 40-50 % and is cost-effective. A strategy which uses perfusion scintigraphy and spiral CT prior to angiography yields similar outcome, but at increased costs.

Equipment availability and diagnostic strategies for suspected pulmonary embolism in Austria
N. Schöpflin, C. Thalinger, A. Schibany, J. Hahne1, A. Ba-Salaham, C.J. Herold; Vienna/AT, -Siebersdorf/AT
Purpose: To investigate equipment availability and current diagnostic strategies for suspected pulmonary embolism (PE) in Austrian hospitals.

Material and methods: A questionnaire was sent to the medical directors of all
Austrian hospitals with emergency and/or surgical and/or orthopedic and/or medi­
cal departments. The questionnaire contained questions regarding the available
equipment suited for the imaging diagnosis of PE, the first line and second line
imaging tests for patients with suspected PE, and additional lower extremity venous imaging and laboratory tests complementing the diagnostic armamen­
tarium.

Results: The return rate of questionnaires was 81 % (127 of 157) hospitals. 97 % of hospitals were equipped with sonography, 59 % with pulmonary angiography; 54 % with helical CT; 19 % with ventilation/perfusion scanning; and 4 % with perfusion scanning alone. Helical CT was the first line imaging study in suspected PE in 56 % of hospitals, followed by echocardiography and ventilation/perfusion scanning. Lower extremity venous imaging (47 %), and interestingly, VQ scan­ning (43 %) served as second line imaging tests. D-dimer tests were included in the diagnostic strategy in 74 % of hospitals.

Conclusion: Helical CT is already the most commonly used primary method in patients with suspected PE. Ventilation/perfusion scanning is available only in a minority of hospitals to investigate patients with suspected PE.

Prospective spiral CT of asymptomatic pulmonary embolism (PE) in patients with lower limbs deep venous thrombosis (DVT)
B. Gheyte, D. Szapiro, V. Willms, R.F. Donnelinger; Liege/BE
Purpose: To assess with spiral CT the incidence and extent of asymptomatic PE in patients with symptomatic DVT of lower limbs.

Methods & materials: 565 consecutive patients were prospectively evaluated for suspected DVT by US (n = 546) or phlebography (n = 19). Eighty-five patients presented evidence of DVT and 54 patients without clinical suspicion of PE (23 male, 31 female; mean age: 59.7 years, range 21-88) underwent combined CT venography (CTV) and spiral CT angiography (SCTA) of pulmonary arteries within 6 hours. Level of DVT was classified as follow: calf = 1, knee = 2, thigh = 3, pelvis = 4 and abdomen = 5. Severity of PE was classified using a modified Miller index.
Results: 37 patients (60.5 %) had PE (acute n = 24, mixed: acute and chronic n = 11, and chronic n = 2). Mean DVT score for both limbs was 3.18 (range 1-9) and mean Miller index was 3.74 (range 0-16). A significant correlation (r = 0.40, p < 0.01) was found between the score of extent of DVT of both lower limbs and the Miller index.

Conclusion: Systematic SCTA of pulmonary arteries may have a clinical and therapeutic impact in patients with extensive DVT.

775 11:40

Clinical validity of normal pulmonary angiogram in patients with suspected pulmonary embolism. A meta-analysis

E.J.R. van Beek, E.M.J. Brouwers-Kruyster, M. Oudkerk; Sheffield/GB, Rotterdam/NL

Purpose: To assess the clinical validity of withholding anticoagulants in patients with clinically suspected pulmonary embolism and normal findings at pulmonary angiography.

Materials and methods: A literature search was performed using Medline and Current Contents databases English. German and French language articles, which described patients with suspected pulmonary embolism who were followed-up after a normal pulmonary angiogram. Articles were evaluated using pre-defined criteria for strength of design. Articles of good or excellent design were included into a meta-analysis. A minimum of 3 months follow-up was required for inclusion.

Results: A total of 8 studies met the criteria, and these included a total of 1050 patients. Follow-up was incomplete in 51 of these patients. Recurrent thromboembolic events were described in 18 patients (1.8%; 95% CI: 1.0 - 2.7%), and these were fatal in 3 patients (0.3%; 95% CI: 0.02 - 0.7%). In a worst case scenario, where all patients lost to follow-up had died from recurrent pulmonary embolism, the recurrence and fatality rates would have been 6.3% and 5.1%, respectively.

Conclusion: It is safe to withhold anticoagulant therapy in patients with suspected pulmonary embolism and a normal pulmonary angiogram. Pulmonary angiography should still be considered as the reference method for excluding pulmonary embolism.

776 11:50

Pulmonary embolism: Comprehensive diagnosis using electron-beam computed tomography for detection of emboli and assessment of pulmonary perfusion

U.J. Schtapf, R. Brüning, H. Konschitzky, C.R. Becker, A. Knez, J. Weber, P. Herzog, A. Huber, R. Haberl, M.F. Reiser; Munich/DE

Purpose: To comprehensively assess thoracic anatomy and pulmonary microcirculation in pulmonary embolism (PE) via combined CT angiography of the pulmonary arteries (CTPA) and functional CT blood flow imaging.

Method/materials: 22 patients with suspected acute PE were prospectively evaluated. First, contrast-enhanced (100 cc, 4 cc/s, 16 s delay) thin slice electron-beam (EBCT) CTPA was performed. Next, a dynamic multislice blood flow study was performed with 45 cc of contrast material in a 7.6-cm lung volume in each patient with ECG-gating. Pulmonary blood flow was calculated and perfusion parameters were visualized on color-coded maps. Color-coded maps and CTPA images were independently evaluated segment by segment by two radiologists for perfusion deficits and presence of clots, respectively. The results were compared.

Results: Mean pulmonary blood flow was 0.63 ml/min/ml in occluded versus 2.27 ml/min/ml in non-occluded segments (p = 0.002). There was good correlation between volume and functional scans with agreement in 78% of segments. Sensitivity and specificity of perfusion maps for the presence of segmental PE compared with CTPA were 76.3% and 83.1%, respectively, with a positive and negative predictive value of 79.7% and 84.4%. False negative findings were mainly caused by partial occlusion of vessels. In 8 patients other significant pathology than PE was diagnosed.

Conclusions: Combined angiographic and dynamic CT imaging allows directly visualizing emboli and evaluating their effect on pulmonary microcirculation. Thus, a comprehensive and non-invasive diagnosis of thoracic structure and function is feasible using a single modality, without missing other pathology in suspected PE.

10:30–12:00 Room F2

Neuro

SS 1311 Stroke/cerebral blood flow

Chairpersons: E. Schindler (Vienna/AT), A. Thron (Aachen/DE)

777 10:30

MRI in hyperacute stroke

S. Kozling, F. Vohtel, J. Dietrich, J. Mlaede, J. Berrouschot, H.D. Wolf, H. Barthel, Leipzig/DE

Purpose: To report our first MRI experiences in patients with acute stroke.

Methods and materials: Thirty patients were studied by 1.5 Tesla MRI (diffusion (DWI), susceptibility, perfusion (PWI); EPI; MRA) within six hours after onset of symptoms. Before MRI, all patients have got CT. In 22 patients °Tc-EDC-SPECT was performed. MRI was prospectively reviewed for identification and characterization of lesions as well as for patterns of DWI/PWI changes in infarctions. MRI results were correlated with control imaging (CT and/or DWI) obtained within the first week.

Results: All intracerebral hemorrhages (n = 7) could be diagnosed by MRI. In 4 cases of TIA, there was no acute lesion on MRI (on SPECT: no perfusion deficiency (n = 2), limited deficiency (n = 2)). 2 of 3 malignant middle cerebral artery (MCA) infarctions were diagnosed correctly by MRI (1 by SPECT). With exception of 1 lesion in the medulla oblongata (on acute MRI outside the region), all other acute ischemic lesions (15 partial MCA infarctions) were correctly seen (by SPECT: 1 no deficiency, 1 malignant MCA infarction, 13 partial deficiencies). There were 5 patterns of DWI/PWI changes in acute ischemic lesions.

Conclusion: We believe that MRI will develop to the method of choice in imaging of hyperacute stroke.

778 10:40

Initial MRI in stroke?

C.M. Fitzek1, S. Fitzek1, H.C. Hopf1, P. Stoeter2; 1 Jena/DE, 2 Mainz/DE

Introduction: To show the capability and results of MRI examinations of peracute brainstem and hemorrhagic stroke patients in clinical emergency situations. The hypothesis, that CT scan is faster and more accurate under this conditions is to be disproved.

Methods: 30 patients with clinical signs of peracute brainstem and hemorrhagic stroke were examined. CT scan was performed between half an hour and 8 hours, MRI between one and 24 hours after clinical onset of symptoms. CT scan was done without contrast medium. MRI was done with EPI-T2W and EPI-DW imaging without contrast medium using the following parameters: 1.5 T Magnetom Vision TR 4000 ms, TE 103 ms, b = 1150 s/mm², 250 ms each slice. Total scanning time of both methods were compared.

Results: The scanning time of the emergency MRI was equal to the CT scanning time by the use of EPI facilities: 9 min in scanning room, 5 min in magnet or CT gantry including scout scan. Even in agitated and moving patients without sedation imaging was successful because of the short scanning time. Every clinical brainstem and hemorrhagic infarction greater than 2 mm was detected in emergency MRI. Differentiation from old and recent infarctions was possible in addition.

Conclusion: MRI with EPI-T2W and EPI-DW imaging is a powerful diagnostic tool in investigating acute brainstem and hemorrhagic infarction. Even peracute and very ill patients can be imaged as fast and as secure as by CT but with much higher diagnostic confidence.

779 10:50

Value of MRI for the detection of ischemic lesions in patients with TIA and RIND: A comparison of FSE T2 with fast FLAIR imaging

J. Sikorska, J. Walecki; Warsaw/PL

Purpose: To evaluate fast spin-echo T2 and fast FLAIR sequences in the detection of ischemic lesions in patients with transient ischemic attacks (TIA) and reversible ischemic neurological deficits (RIND).

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Material and methods: 79 patients, mostly men (64 %), age range: 37-60 years, underwent clinical and MR studies at 1.5 T. Sequences: T2, first echo (TR 4162 ms, TE 16 ms, NSA 1), second echo (TR 4152 ms, TE 80 ms, NSA 1) and 16 echo fast FLAIR (TI 1800 ms, TR 13716 ms, TE 112 ms, NSA 2) with FOV 23 cm, matrix 256x256, slice thickness 5 mm were obtained. First MR examinations were performed in 79 patients from 4 to 24 hours after onset of clinical symptoms. Follow up examinations (one or two studies, according to findings on the first test) were obtained during 7 days after onset in 53 (67 %) patients with TIA, and within 4 weeks in 26 (33 %) patients with RIND. MR images were compared for lesion location, size and conspicuity in relation to clinical findings. Statistical analysis was performed using Fisher's exact test.

Results: No lesions were detected on the first FSE and FLAIR examinations in 27 (34 %) patients. TIA, 52 (66 %) patients with TIA and RIND had clinically comparative acute ischemic lesions detectable within 24 hours on FLAIR. Lesion detection was negative on the first echo FSE sequence in 22 (28 %) patients as compared to FLAIR. The sensitivity of lesion detection on the PD-w images was 57.7 %, specificity 100 % (p < 0.0001). Lesion detection on the second echo T2-w images was negative in 17 (22 %) patients. The sensitivity of lesion detection was 67.3 %, specificity 100 % (p < 0.0001) as compared to FLAIR. Additionally, in 24 (30 %) patients in FLAIR images it was possible to identify other asymptomatic and more numerous lesions like old lacunar infarcts and foci of gliosis as compared to FSE. Follow up FLAIR examinations performed within 1 week after onset of symptoms revealed more diminshed, slightly hyperintens lesions whereas PD and T2-w images presented no previous abnormalities in 17 (21.5 %) TIA's patients without present clinical symptoms. In 22 (27 %) patients with RIND, ischemic foci were detected on FLAIR within 4 weeks after onset while clinical studies and FSE T2 images revealed no comparative abnormalities. Most lesions were observed in main artery territories or watershed zones of the brain hemispheres involving the cortex. Some lesions appeared in basal ganglia or deep white matter most likely due to border zone infarcts. 80 % of these foci became invisible on follow up MR studies. In 1 patient with chronic signs of brain stem stroke, asymmetrical hyperintensity of central pons was noted only on the first FLAIR examination. In 4 patients FLAIR images allowed to detect early deoxyhemoglobin foci in the areas of ischemia.

Conclusions: Our results indicate that the fast FLAIR sequence is more sensitive than FSE T2 imaging for detection of acute reversible ischemic lesions, specially those involving peripheral and central gray matter, even in patients with full remission of clinical symptoms. Using FLAIR with clinical correlation may suggest the etiology of symptomatic and asymptomatic ischemic lesions, especially when dedicated methods as DWI and PWI can be performed. FLAIR as integration of other MR sequences may help in early treatment and optimising medical decision for patients with TIA and RIND representing a high risk group of stroke population.

Acknowledgement: This work was supported partially by CMKP grant 501-2.2-23-08/99.

780 10:55

Diffusion-weighted MR imaging in the evaluation of periventricular ischemic disease
N. Yuhtlen, C. Calli, A. Yesildag, E. Adali; Izmir/TR
Purpose: To determine the extent and types of ischemia in the periventricular white matter in elderly with isotropic diffusion-weighted and ADC map images.
Methods and materials: 65 patients, age ranging from 52 to 82 (female = 27, male = 38) with periventricular ischemia on conventional MRI, were included in the study. All patients were examined with T1W (TR/TE: 650/14 ms), T2W (TR/TE: 3800/90 ms) axial images followed by dark fluid (TR/TE/TI: 9000/110/1500 ms) and isotropic diffusion-weighted images (b = 0, 500, 1000 s/mm²; ADC map).
Results: Periventricular ischemic changes were seen as confluent and patchy hyperintense areas on T2W and dark fluid images in all patients. Diffusion-weighted images revealed acute ischemic focal lesions in 14 patients. These acute infarctions were markedly hyperintense on diffusion-weighted and hypointense on ADC map images. However, leukoaraiotic areas showed mild and diffuse periventricular hyperintensities both on diffusion-weighted and ADC map images. On the other hand, 36 of the 68 patients had multiple subcortical deep chronic infarctions, which were hypointense on T1W images.
Conclusion: Diffusion-weighted and ADC map images are necessary for the detection and differentiation of acute and chronic periventricular ischemic lesions.
Transcranial color-coded Doppler in the assessment of cerebral microcircle

G. Caruso, A. Martino, T.V. Bartolotta, L. Manfre, R. Urso, R. Martino, R. Lagalla; Palermo/IT

Purpose: The aim of the work was to evaluate the intracranial relative cerebral blood flow in patients affected by epiaortic or intracranial vascular disease, by using transcranial color-coded study Doppler (TCCD) after echo-amplifier contrast media administration.

Materials and methods: 21 patients (45 - 73 aged), affected by severe (> 75%) - group B) or moderate (< 50% - group C) internal carotid or vertebro-basilar stenosis. Height healthy volunteers (40-60 aged, group A) underwent similar TCCD study as a control group. All the patients were investigated using a temporal window, before and after fast bolus-injection (2 ml/s) of contrast media 300 mg/ml. An independent workstation and dedicated software (AT1) was used for the evaluation of tissutal echoes changes, and time/intensity curves were generated.

Results: In healthy patients (group A), all the time/intensity curves were similar, confirming a regular intracranial microcircle. In group B and C symptomatic patients, time/intensity curves showed statistically significant changes, according with microcircle impairment.

Conclusions: Time/intensity curve is strictly related to contrast media concentration into intracranial microcircle. According to our results, not all B-C class patients showed significant reduction of intracranial microcircle blood flow. On the other hand, significant microcircle impairment was found in healthy volunteers.

Results: The baseline percent stenosis was reduced from 87.5 ±10.2% to 6.8 ±19.6% (n = 24, stenosis measured by angiography). Complications included four transient ischaemic attacks. In one patient it was not possible to pass the calcified stenosis of the ICA (95 %) and no PTA/stent placement was performed. Twelve patients (50%) developed bradycardia during stent placement due to stimulation of the carotid sinus. Ten of these patients were successfully managed with i.v. Atropine. Two patients developed additional hypotension and required Dopamine infusion and intravenous fluids. There were no other complications like myocardial infarction or respiratory failure. All patients recovered without limitations.

Conclusion: Our results indicate that carotid artery stenting in patients with concomitant cardio-pulmonary disease is feasible and safe. During the procedure the team should be prepared to treat PTA-induced cardiac bradycardia.

Comparison of gadolinium-enhanced T1-weighted excretory MR urography and static fluid T2-weighted MR urography

P. Jung, G. Jakse, R.W. Günther; Aachen/DE

Purpose: Cerebral Blood Flow (CBF) is a parameter of multifactorial relationship. For clinical purposes it is of special interest to know CBF for early recognition of cerebral ischemia.

Methods: After i.v. injection of nonionic contrast agent 6 levels above the Reid's Baseline (DH) are performed using EBT-Multi Slice Mode. Images are taken at each 2 s for 20 times. A control measurement of the ascending aorta is done for getting the Blood Pool Curve. Evaluation of CBF is possible on PC using a software written in C++. The computer-supported determination of CBF allows:
1. measuring CBF-values in ml/100 g/min
2. visualizing regional CBF-patterns
3. histogram analysis of CBF-values.

Patients: We studied 39 patients (mean age 59±16 years), 21 patients without neurological symptoms (NO) and 18 patients with neurological symptoms (N).

Results: The mean global CBF of NO Patients was evaluated as 57±12 ml/100 g/min. Within the N-Patients the mean global CBF was with 44±16 ml/100 g/min significantly lower (p = 0.01). Additionally we found with increasing age decreasing CBF-values.

Conclusion: If available, using this fast multislice imaging technology it is possible to measure CBF-values in ml/100 g/min globally in 6-8 adjacent CT-levels simultaneously.

Reversible imaging findings in hypertensive encephalopathy

G. Sparacia, M. Galia, R. Miraglia, N. Nicastro, G. Brancatelli, R. Lagalla; Palermo/IT

Purpose: The hypertensive encephalopathy is a syndrome characterized by intracranial abnormalities due to subacutely elevated systemic blood pressure. In this study we present the imaging findings of reversible cerebral abnormalities in the hypertensive encephalopathy thought to result from derangements in vascular cerebral autoregulatory mechanism.

Methods and material: We reviewed CT and MR exams of eight patients with hypertensive encephalopathy related to one of the following diseases: n = 3 patients with preeclampsia-eclampsia syndrome; n = 1 patient with cyclosporine neurotoxicity; n = 4 patients with chronic renal disease due to systemic lupus erythematosus (SLE) in two cases, to Wegener’s granulomatosis in one case, and to idiopathic renal disease in one case. All patients were examined at the onset of neurologic deficits and underwent to CT or MRI follow-up within 7-20 days after the onset of neurologic deficits and after the hypertension was corrected.

Results: CT and MR findings were characterized by the presence of conical-subcortical and deep cerebral lesions related to edema. Six of the eight patients presented bilateral lesions, in 3 (50 %) cases in the occipital lobes, in 1 (17 %) case in the cerebellum, and in 2 (33 %) cases in the frontal lobes. In 4 (67 %) of the six patients the lesions were symmetric. Only two of the eight patients presented a single lesion. In 4 (50 %) of the eight patients (2 patients with preeclampsia-eclampsia syndrome, 2 patient with SLE) the findings on the imaging studies resolved on follow-up examinations performed after the hypertension was corrected, while in the other 4 patients the lesions did not show regression.

Conclusion: In the hypertensive encephalopathy, the rapid reversal of cerebral edema with treatment suggests edema caused by vascular autoregulation failure. These lesions should be properly and promptly recognized at MR or CT since they are reversible if appropriate therapy is timely instituted.

Comparison of gadolinium-enhanced T1-weighted excretory MR urography and static fluid T2-weighted MR urography

C.A. Nolte-Emden, J. Tacke, G. Staatz, A. Bucker, P. Haage, G.B. Adam, P. Jung, G. Jakse, R.W. Günther; Aachen/DE

Purpose: To investigate the clinical value of different MR Urography (MRU) techniques.

Methods: In 170 urologic patients, MRU was obtained with T2-weighted HASTE/RARE sequences (= T2-MRU) followed by gadolinium-enhanced T1-weighted 3D-gradient-echo sequences in combination with low-dose furosemide (= T1-MRU). In 30 patients, T2-MRU was also combined with a prior diuretic injection.

Results: The combination of low-dose furosemide (5-10 mg) and gadolinium in T1-MRU proved to be the superior technique for imaging the nondilated urinary tract. Leakages and urinary fistulas could be diagnosed only with T1-weighted MRU. In T2-MRU, parapelvic cysts could simulate a marked obstruction of the renal pelvis and, furthermore, the superposition of extrarenal fluid collections frequently degraded the visibility of the urinary tract on T2-weighted projection images. T1-MRU was superior or equal to T2-MRU in ureterohydronephroses grade I and II. On T1-MR urograms, filling defects were visualized more accurately than on T2-weighted urograms, which often only displayed a stop in the ureteral course. T2-weighted MR urograms were superior in grade III and IV ureterohydronephroses. T2-MRU was able to visualize the severely dilated collecting system even if the renal function was quiescent. The combination of both techniques allowed to make the correct diagnoses in almost all patients.

Conclusion: T1- and T2-weighted techniques in MRU have their own diagnostic priorities. They complement one another to cover almost all indications in urinary tract imaging and to avoid invasive diagnostic procedures.
786 10:40
Gd-DTPA enhanced MR urography: Comparison with X-ray urography
C. Catalano, M. Ciccanello, P. Pavone, A. Laghi, V. Panebianco, F. Pediconi, R. Passariello, Rome/IT
Purpose: To evaluate the value of Gd-DTPA enhanced MR Urography (MRU) after i.v. administration of low dose furosemide in the assessment of urologic patients
Material and methods: 57 patients with different urologic pathologies were examined with MRU using a breath-hold 3D T1 weighted sequence after i.v. administration of 0.1 mmol/kg of Gd-DTPA. In all patient, immediately prior to the start of the MR examination, a standard dose of 1 ml of furosemide was injected. MR urograms and excretory urograms were reviewed by two blinded radiologists.
Results: MRU was considered diagnostic in 54 patients, in 3 cases images were not diagnostic due to inadequate breath-holding. A rapid filling (mean 5 minutes after contrast administration) of the collecting system was obtained in all patients after the low dose furosemide injection, without any signal loss due to T2* effects. MRU provided correct results in 94 % of the cases. Excretory urography appeared superior in delineation caliceal fornices and small intrarenal stones; MAU was considered superior in the assessment of the ureters.
Conclusion: MAU after low dose furosemide allows accurate depiction of the collecting system and appears superior to excretory urography in the evaluation of the ureters, reducing the number of ascending pyelography.

789 10:50
MR-urography in the study of patients with orthotopic urinary neobladder
D. Buccigardi, F. Monetti, A. Grasso, M. Calabrese, L. Dogliotti, C.E. Neumaier, Genoa/IT
Purpose: To investigate the role of MR-urography (MRU) in the follow-up of patients who underwent total cystectomy and orthotopic bladder reconstruction
Methods and materials: We studied 14 males (48-62 years old) who underwent cystectomy and orthotopic bladder reconstruction. They had disease free follow-up of 2-19 months (mean 12). We used a 1.5 scanner with TSE T2 weighted single slice sequences (thickness = 30-60 mm) and TSE-T2 weighted multislice sequences (thickness = 1 mm). In both cases TR/TE was 3000/600 ms. We obtained coronal and oblique coronal MIP reconstructions. To achieve distension of excretory system and cancel Signals of intestinal loops, patients received orally 600 ml of water plus 300 ml of contrast medium (LUMIREM® Guerbet). Overall examination time was 20 min.
Results: Renal pelvis and calices were visible in 13/14 cases; both ureters were visualised in 9. The orthotopic neobladders were always recognized. The images obtained demonstrated well the morphology of the neobladder and were adequate to verify the evolutive adaptation of the bowel loops to their new function as reservoirs.
Conclusion: We propose MRU with oral hydration as a simple, non invasive method to evaluate the urinary system in patients with orthotopic neobladder.

790 11:00
MR-urography for the evaluation of patients with urinary diversion or neobladder after cystectomy
G. Verswijvel, H. van Poppe, R.H. Ogyn, Leuven/BE
Purpose: To study whether the upper urinary tract and continence/incontinence urinary diversions in patients surgically treated for bladder cancer can be evaluated with MR-urography (MRU).
Material and methods: Thirteen patients with different types of diversion techniques after cystectomy for bladder cancer were studied. MR (1.5 T) was performed including (a) T1- and T2-weighted imaging, (b) three-dimensional (3D) contrast-enhanced MR-angiography and (c) high-resolution 3D contrast-enhanced MRU. Prior to gadolinium injection (Gd-DTPA 0.2 mmol/kg body weight, injection rate 2 ml/s), 0.1 mg/kg body weight, furosemide was administered intravenously. The MRU images were obtained as T1-weighted 3D acquisitions.
Results: The collecting system was adequately seen, irrespective of the renal function. In two patients recurrent cancer was found in (renal pelvis and ureter). Appropriate evaluation of the urinary diversions was achieved (i.e. Bricker's ileal conduit, Boari cystoplasty, Haulm-Mann-, Mainz-neobladder).
Conclusion: MR-urography is a good alternative to IVU and retrograde contrast studies to evaluate the collecting system and urinary diversions. MR-urography is suited to evaluate 'late' complications, related to the initial pathology (i.e. urethral malignancy), or related to the operative procedure. An important prerequisite is a good understanding of the surgical procedure.

791 11:10
Virtual endoscopy of the upper urinary tract based on gadolinium-enhanced three-dimensional MR urography data sets
C.A. Nolte-Ernsting, A. Grambach, G. Staatz, C. Sussiek, M.W. Kibinger, G.B. Adam, R.W. Günther, Aachen/DE
Purpose: To investigate the feasibility of reconstructing a virtual endoscopy from MR urography (MRU) data sets.
Methods: The gadolinium-enhanced excretory MR urograms obtained from 35 patients (5 normal; 30 pathologic) were used to reconstruct a virtual ureterorenoscopy (MRURS) based on a threshold image segmentation. MR urograms were acquired with T1-weighted 3D gradient-echo sequences after iv injection of gadolinium-DTPA in combination with low-dose furosemide.
Results: The excretory MR urograms provided a complete visualization of the urinary tract with a strong endoluminal contrast-enhancement. The reconstruction of an MRURS was possible in all 35 patients, even when the collecting system was nontubular. The best anatomic accuracy was obtained from MRU sequences with a very small voxel size (eq. 1x1x1 mm³). Breath-hold data acquisition proved superior to respiratory gating for motion artifact suppression. Inside the renal pelvis, the calices were assessed by turning the virtual endoscope in all directions. From the endovesical view, the ureteral orifices, the trigone, and the urethra could also be visualized. All filling defects diagnosed by MRU could be evaluated endoscopically using MRURS. With the assessment of the surface structure alone, the differentiation between a calculus and a tumor was difficult.
Conclusion: A virtual ureterorenoscopy can be successfully reconstructed using the data of high-resolution 3D MRU sequences.

792 11:20
MRI of intrarenal endocytic activity: Application to two models of glomerulopathy and hydrenephrosis
O. Hägerl, N. Grenier, C. Delalande, C. Demmienne, B. Fougouery, H. Triffaud, C. Ohayon, C. Combe, Bordeaux/FR, Paris/FR
Purpose: To evaluate the role of MR imaging in conjunction with USPIO in identifying and differentiating glomerular versus interstitial intrarenal macrophagic infiltration in rats.
Materials and methods: Two experimental models of nephropathies were developed: a model of nephrotic nephritis induced by intravenous injection of sheep anti- rat glomerular basal membrane serum (anti-GBM GN, n = 44) and a model of obstructive nephropathy (n = 6). Imaging sessions were performed on a spectrometer operating at 4.7 T using FLASH sequences. Signal intensity was measured in each kidney compartment before and 24 h after intravenous injection of 90 μmol of USPIO. MR findings were compared with histological data and urine proteins.
Results: In the anti-GBM GN model, 24 hours after injection of USPIO, a significant signal drop (p < 0.05) was present only in the cortex where glomerular lesions were located. In the hydrenephrosis model, the signal drop (p < 0.05) was located in all kidney compartments in response to diffuse interstitial lesions. The drop in signal intensity was due to capture of iron either by macrophages or mesangial cells gaining endocytic activity. It was correlated to the degree of proteinuria.
Conclusion: MR imaging, 24 h after injection of USPIO, can evidence endocytic activity and can localize precisely this activity in the different kidney compartments.

793 11:30
Effects of extracorporeal shock wave lithotripsy on renal function: Value of resistive index in correlation with scintigraphy, magnetic resonance perfusion imaging and plasma big-endothelin
L. Palfvein-Freittner, F. Frauscher, G. Helweg, A. Schuster, M.F.H. Schocke, G. Höfle, D. Kendler, G. Janetschek, G. Bartsch, D. zur Nedden, Innsbruck/AT
Purpose: The goal of this study was to evaluate changes of resistive index (RI) after extracorporeal shock wave lithotripsy (ESWL) in correlation with plasma big endothelin (ET-1) levels, perfusion scintigraphy and magnetic resonance (MR) perfusion imaging.
Methods: In 21 normotensive patients, divided in 3 age groups, the RI was measured before 1, 3, 6 and 24 hours after ESWL. The RI was correlated with the findings on plasma Big ET-1, renal scintigraphy and MR perfusion imaging, which were also performed before and after ESWL.
Results: The RI increased significantly in all patients from 0.64 ± 0.05 to 0.72 ± 0.06 after ESWL (p < 0.001). The untreated kidneys showed a less significant increase. The RI increased through 24 hours only in the patients elderly than 60 yrs
(age group III). Elevated Big ET-1 levels and significant changes on renal blood flow, determined by scintigraphy and MR perfusion imaging, were only found in age group III after treatment.

Conclusions: ESWL obviously causes considerable renal parenchymal damage, resulting in disturbances of renal perfusion particularly in the patients older than 60 yrs. The RI correlated well with the findings on big ET-1, scintigraphy and MR perfusion imaging and therefore seems to be a valuable tool in assessing post ESWL changes.

794 11:40
FLASHSTAR in the evaluation of changes in RBF after extracorporeal shock wave lithotripsy
M.F.H. Schodde, C. Wolf, L. Pallwein-Prettnier, F. Frauscher, C. Kremsner, H. Volgger, G. Janetschek, P. Lukas; Innsbruck/AT

Purpose: FLASHSTAR is a completely noninvasive method for measuring renal blood flow (RBF). Using FLASHSTAR it is possible to determine RBF without an external contrast agent. Our purpose was to evaluate the utility of FLASHSTAR to assess changes in RBF after ESWL.

Methods: Using a whole body 1.5 Tesla MR scanner (Siemens, Erlangen, Germany) FLASHSTAR was performed in 12 patients (3 female, 9 male, mean age 45±7 years) before and 12 hours after ESWL. The slice thickness of the parasagittal planes was 6 mm with a field of view of 220 mm and a matrix of 128×128 pixels. Each kidney was covered by 9 slices. RBF maps were created by subtraction of two sets of data acquired alternately with and without 180° inversion applied to spins in the proximal arteries. Four regions of interest (ROI) were evaluated in each kidney.

Results: In the treated kidneys we found a decrease in RBF ranging from 14.8 to 17.8%, in the contralateral kidneys a decrease in RBF ranging from 10.7 to 12.7%.

Conclusions: We detected changes in RBF in both kidneys after ESWL which is in line with the facts known in literature. FLASHSTAR appears to be a sensitive tool for the noninvasive determination of RBF and changes in RBF after treatment.

795 11:50
Pharmacokinetics of a highly concentrated MR contrast agent (1 M Gadobutrol) in patients with chronically impaired renal function
B. Tombach1, C. Bremer1, R. Schaefer1, P. Reimer1, W. Ebert2, V. Geens1, F. Matzkes1, W.L. Heindel3, Münster/DE, Berlin/DE

Purpose: To investigate the pharmacokinetics of 1-molar gadobutrol in patients with severely impaired renal function and during routine hemodialysis.

Methods: 9 patients with a creatinine clearance < 30 ml/min (group A) and 11 patients requiring chronic hemodialysis (group B) were closely monitored within 5 days following the iv bolus injection of 1-molar gadobutrol (0.1 or 0.3 mmol/kg bw).

To calculate pharmacokinetic parameters sampling was performed up to 120 h (group A) respectively within 3 consecutive hemodialysis sessions (1, 48, 96 h).

Results: For patients with severely impaired renal function mean elimination half-life of gadobutrol increased to 20.4 h, but renal elimination was still the main pathway. The mean eliminated fraction of gadobutrol within a 3 h hemodialysis session was 68.2%, and following 3 hemodialysis sessions the total eliminated amount of gadobutrol increased to 98%.

Conclusion: Half-life of gadobutrol is prolonged in patients with impaired renal function, but elimination via the kidneys is still the predominant route. Gadobutrol is effectively removable by hemodialysis and can therefore safely be applied to patients on dialysis.

10:30-12:00  Room H

Contrast Media

SS 1306
MR contrast agents/experimental studies

Chairpersons:
O. Clément (Paris/F), E.J. Rummeny (Münster/DE)

796 10:30
SPION-enhanced MRI of atherosclerotic plaques: Characterization of accumulating plaques with histology and immunohistology
S.A. Schmitz, R. Gust, S. Winterhalter, S. Wagner, S. Coupland, M. Kresse, W. Semmler, K.-J. Wolf, Berlin/DE

Purpose: The study examined the potential of MRIs enhanced by superparamagnetic iron oxide (SPION) for assessing the inflammatory activity of atherosclerotic plaques. We used MRI as well as histological and immunohistological techniques to characterize plaques with high SPION accumulation.

Methods and materials: Aortas of Watanabe hyperlipidemic hereditary rabbits were studied using water-excitation 3D gradient echo MRI (TR/TE/FA: 41 ms/11 ms/15°) without contrast medium (controls, n = 5) or before and 48 h after 200 μmol Fe/kg DDM43134 experimental SPION (n = 5). In vivo MRI was compared to ex vivo histology and anti-macrophage immunohistology. The extension of findings was quantified and expressed as aortic wall area (%).

Results: In vivo MRI demonstrated more extensive areas of signal loss in the aortic wall following SPION (10±5%) than in controls (0.5±0.4%), p < 0.009. SPION iron was detected in endothelial cells (50±11%), or in subendothelial phagocytes, typically macrophages, with either 1-19 (20±7%) or > 20 (9±5%) iron-positive cells per 100x view. SPION tends to accumulate in areas of high cellularity or subendothelial plaque instability.

Conclusion: Aortic wall areas with a high SPION accumulation have features of high plaque inflammatory activity: numerous macrophages, high cellularity or subendothelial plaque instability. The experiments confirm the value of SPION-enhanced MRI as a method for assessing active atherosclerosis.

797 10:40
MRI characterization of breast tumor microvessels using USPIO particles with correlations to histopathology
K. Turetschek1, S. Huber1, T.H. Helbich1, E. Floyd1, T.P.L. Roberts2, D.M. Shames2, K.S. Tarlo2, M.F. Wendland1, R.C. Brasch1, San Francisco, CA/US, Vienna/AT, Groton, CT/US, Wayne, PA/US

Purpose: The aim of the study was to define the potential of an ultrasmall superparamagnetic iron oxide particle (USPIO), with a mean diameter of < 20 nm, for the quantitative characterization of tumor microvasculature with correlation to histopathology.

Methods & materials: NC100150 injection, an USPIO already under evaluation in clinical trials, and albumin-(Gd-DTPA) 30 were compared in MR examinations on sequential days in the same 20 ENU-induced mammary tumors in rats. Dynamic contrast-enhanced MR imaging was performed using a T1-weighted 3D-SPGR sequence. Kinetic analysis yielded MRI estimates of microvascular permeability (kPS) and fractional plasma volume (FPV) for each contrast medium. Correlation analyses were performed comparing these estimated MR-derived parameters to the histologic microvascular density (MVD) and to the histologic tumor grades.

Results: Using each contrast medium, a strong and significant (p < 0.05) correlation was observed between MRI-derived estimates of microvascular permeability (kPS), histologic tumor grade, and the histologic microvascular density, a surrogate of angiogenesis. Correlations between FPV and tumor grade or MVD were not statistically significant.

Conclusion: Results show that a macromolecular particulate MRI contrast agent can be applied advantageously to the characterization of tumor microvessels. The MRI tumor characteristics, specifically permeability defined with the USPIO particles, correlated strongly with established histopathological characteristics.


798 10:50
MRI assay of breast cancer microvascular permeability with VEGF-inhibition: Correlations with accumulation of cytotoxic therapeutics
H.E. Daldrop-Link1, O. Meink9, A. Wolfe1, D. Whaler1, S. Oei1, R.C. Brasch2
'MDAnderson, 'San Francisco, CA/US

Purpose: To correlate in vivo estimates of tumor microvascular permeabilities based on dynamic magnetic resonance imaging (MRI) with tumor concentrations of cisplatin and 5-fluorouracil (5-FU).

Methods: Eighteen human MDA-MB-435 breast carcinomas were implanted in homogenous athymic rats. Nine animals received vascular endothelial growth factor (VEGF) antibody 24 hours before MRI, another group of nine rats served as untreated controls. 3D-SPGR MRI was enhanced with albumin-(Gd-DTPA) 30, injected nearly simultaneously with 5-FU and cisplatin. The tumoral endothelial transfer coefficient, KPS, was estimated by fitting dynamic MRI data to a two-compartment kinetic model. KPS data were correlated with postmortem tumor concentrations of cisplatin and 5-FU.

Results: A highly significant positive correlation ($r^2 = 0.781; p = 0.0001$) was observed between MRI-assayed tumor microvascular permeability based on a macromolecular contrast agent and the tumor accumulation of cisplatin. However, no correlation ($r^2 = 0.001; p = 0.8977$) was observed between MRI-assayed permeability and tumor accumulation of the relatively small 5-FU molecule.

Conclusion: MRI enhanced with macromolecular contrast medium can detect a decline in breast cancer microvascular permeability following VEGF antibody treatment. The measured decline in permeability resulted in a smaller accumulation of cisplatin, a large protein bound cytotoxine, but did not influence the tumor concentration of small molecular 5-FU.

799 11:00
A new labeling method for high resolution MR imaging tracking of human hematopoietic stem cells (HSCs)
M. Löwen1, N. Carlsson1, C.H. Tung1, X.W. Tang1, D. Scadden1, R. Weissleder1
'Charlestown, MA/US, 'Cambridge, MA/US

Purpose: To develop a method for MR imaging of human hematopoietic stem cells (HSCs) in vivo.

Methods and materials: HSCs were isolated from human bone marrow and labeled intracellularly using a cross linked iron oxide particles derivatized with a HIV-Tat binding assay. Colony formation assay, phenotypic analyses and in vivo injection into immunodeficient NOD/SCID mouse were used to study the cellular uptake, toxicity, biodistribution and recovery of the labeled cells. High resolution MR imaging was performed using a T1 1 T system.

Results: Human CD34+ cells could be labeled with up to 10¹⁴ particles/cell corresponding to 20 pg of superparamagnetic iron/cell. There was no apparent impairment of HSCs viability, proliferation and differentiation. Twenty-four hour after injection, CLIO-Tat labeled HSCs homed to bone marrow (4 % of injected cells/g tissue) in a way similar as non labeled cells. CLIO-Tat labeled HSCs could be visualized at a single cell level by high resolution MRI.

Conclusion: Small numbers of CLIO-Tat labeled HSCs are detectable by high resolution MRI imaging. This new technique could have applications in monitoring stem cell transplantation and gene therapy applications.

800 11:10
Heat shock protein (HSP) 90 but not HSP 70 mRNA expression is upregulated in human endothelial cells after stimulation with ionic and nonionic contrast media
H. Altko1, M. Hoppke1, K. J. Klose1
'Würzburg/DE, 'Wetlitz/DE

Purpose: To evaluate alterations in gene expression after contrast media stimulation of human endothelial cells.

Method and materials: Human umbilical endothelial cells were cultured under standard conditions and stimulated with contrast media (1:100 and 1:500 of Iotrolan, Ioxitalam, Iomeprol) for 30 min. After stimulation RNA was isolated using a spin column kit. For further analysis differential display (RAT-PCR) and Northern blot analysis was carried out. As a control the cells were stressed by a heat shock (42 °C for 30 min).

Results: Differential display indicates upregulation of HSP 90 after cell stimulation. Northern blot analysis of the mRNA expression of HSP90, HSP70, c-fos and c-jun confirmed the upregulation of HSP90 after stimulation with Ioxitalam and Iomeprol but not Iotrolan; the expression of the other genes was not altered except for an expected massiv upregulation of ISP70 after heat shock.

Conclusions: This is to our knowledge the first report of alterations in gene expression after contrast media stimulation of endothelial cells. Further studies in this field might improve our understanding of the pathophysiology of contrast media toxicity.

801 11:20
Optical (near-infrared) detection of tumors using cyanine dyes as contrast agents
A. Becker, K. Licha, B. Riefke, H. Rinneberg, W. Semmler
'Berlin/DE

Purpose: Near-infrared (NIR) imaging has emerged as a new, promising diagnostic modality. The method is based on differences in the absorption of NIR light (700-900 nm) between normal and tumor tissue. However, intrinsic tumor contrast is low and hinders reliable detection especially of small cancerous lesions. NIR dyes with absorption in the near-infrared region can principally be employed as contrast agents improving sensitivity and specificity of the method.

Methods and materials: 10 hydrophilic cyanine dye derivatives were synthesized and characterized with respect to their photophysical and physicochemical properties. After injection into tumor-bearing nude mice, the fluorescence distribution was monitored by fluorescence imaging.

Results: By structural modifications of indocyanine green a variety of novel cyanine dyes with different degrees of hydrophilicity and molecular weight were generated. The dyes exhibited high molar extinction and efficient fluorescence emission in the near-infrared range. After injection into tumor-bearing nude mice, the dyes caused an elevated tumor fluorescence intensity permitting localization of tumors from 4 to 24 h after application.

Conclusion: We have demonstrated that hydrophilic cyanine dyes which accumulate in experimental tumors are suitable NIR contrast agents by enhancing absorption contrast and by providing a dye-specific fluorescence contrast above low autofluorescence background.

802 11:30
Liver lesion characterization using ultrasound superparamagnetic iron oxide particles (USPIO) for magnetic resonance imaging (MRI) in experimentally induced rat liver tumors
O.G. Schueller1, C. Poeckler-Schoeniger1, J. Koepe1, W. Schreiber1, P. Bansbach1, M. Georg1, 'Mannheim/DE, 'Mainz/DE, 'Heidelberg/DE

Purpose: Specificity of tumor characterization in diagnostic imaging of liver lesions is still not sufficient. The aim of this animal study was to evaluate the potential of USPIO-particles (AMI 227, Sinerem®) as contrast agent for MRI in the differentiation of liver lesions.

Method/materials: Liver tumors were induced in rats by oral application of Nitrosomorpholine. Until now 40 tumors are histologically proved (26 hepatocellular carcinomas (HCC), 8 angiosarcomas (AS), 3 adenomas (AD), 1 fibrosarcoma (FS)).

Results: Liver tissue showed a marked signal loss after injection of USPIO-particles in both T1- and T2-weighted images. The HCs showed a moderate increase in signal intensity in T1-w sequences and a moderate increase of T/L ratio in T2-w sequences. In both T1 and T2 sequences a significant enhancement of HCCs (0.48 resp. 0.50) was observed in the T2-w sequences. The ADs showed a significant enhancement in all sequences and a moderate increase of T/L, on postcontrast images. The FS showed an enhancement (24 % resp. 22 %) only in the T1-w sequences. Nevertheless the T/L showed the greatest increase in the T2-w sequences. The CAF showed a negative enhancement in the T2-w sequences, the HZ showed a negative enhancement in the T2-w SE sequence and a positive enhancement in the T1-w SE sequence.

Conclusions: USPIO-particles are an efficacious contrast agent for MRI of the liver. Besides the simplified identification of the liver lesions in contrast enhanced images, the possibility of liver lesion differentiation is improved.
New gadolinium based compounds for contrast enhanced MRA

**Methods and materials:** Within the European Biomedi2 MACE Program (Contract BMH4-CT 960051) two MR contrast media (X, Y) were developed and tested at the University of Monas (BE), Turn (IT), and Basel (CH). X and Y were compared with intravascular P717 and extracellular GdODTA as references (Guerbet, France) in 12 rats (n = 3 per group). 3D-MR images were acquired before and every 10 min for 2 h after i.v. contrast injection. Imaging parameters were: TR/TE = 5 ms/2.2 ms; FOV = 70x200 mm; slice thickness 0.9 mm. Signal intensities (SI) were measured in the left ventricle, the aorta, and surrounding noise. Postcontrast -precontrast signal to noise ratios (JSNR) were calculated and plotted over time.

**Results:** All tested contrast media provided strong initial vascular signal enhancement, JSNR for X, Y, P717, and GdODTA were 13.4 ± 3.2, 24.0 ± 2.3, 22.6 ± 1.2, and 25.8 ± 1.3, respectively. Two hours after administration, X, Y, and P717 still provided strong vascular enhancement (JSNR = 2.5 ± 0.1, 12.5 ± 0.2, and 10.3 ± 1.1 whereas SI in the GdODTA group was almost baseline (JSNR = 0.2 ± 0.6).

**Conclusion:** Preliminary results suggest that these new Gadolinium based MR contrast media can provide strong and persistent vascular enhancement and thus might be useful for specific applications such as MR Angiography of the coronary arteries.

**Influence of MRI contrast media on the contractility of the arterial vessel wall**

**Purpose:** We sought to assess the influence of Gadolinium containing MR contrast agents on the contractility of the arterial vessel wall.

**Methods and material:** Bilateral segments of rabbit carotid arteries were mounted in flow chambers, where they were perfused and embedded in aerated (95 % O2, 5 % CO2) Krebs solution. The flow volume was kept at a constant rate. Therefore, changes in pressure of the circulating Krebs solution indicated alteration of vessel wall contractility. Viability of the artery was tested by 124 mmol KCI. 3x10^-3 mol phenylephrin and then increased by 4x10^-3 mol phenylephrin. After a wash out phase Gadopentate (n = 10) or Gadoteridol (n = 10) were added to the perfusate of one carotid artery in concentrations of 0.1, 0.3, and 0.6 mmol/l. The contralateral artery served as a control. To assess potential relaxing effects of the MR contrast media vessels were brought into a contracted status with 3x10^-3 mol phenylephrin and then decreased by 4x10^-3 mol phenylephrin and again visualized. Gadopentate and Gadoteridol did not induce any significant pressure changes.

**Discussion:** Gadopentate and Gadoteridol in doses of up to 0.6 mmol/l did not alter vascular contractility. An impact of MR contrast agents on the blood pressure, as has been shown in clinical trials, probably is due to changes of the arterial contractility.

**Material and methods:** Closed circuit flow model of tubings at 37°C, pulsatile flow (1200 ml/min). Erythrocytes were diluted with 0.9 % saline to a hematocrit of about 40 %. Stent (Palmar TM) stent-graft (Passager TM) was placed in the tubing, stenosis was achieved by constricting the stent with a thread. Control experiments contained no implant but the same degree of stenosis. Initially every other, thereafter every ten minutes up to 60 minutes samples were drawn. Hemolytic (LDH, GOT) and hematologic parameters (hematocrite, erythrocytes) were evaluated.

**Results:** Compared to the control (n = 10) a larger increase of GOT/LDH during the time was evaluated in the stent group (n = 8). Significant after 50 minutes (stent: LDH 103±34 U/L vs. 51±44 U/L without stent, p = 0.007). There were no significant differences between different degrees of stenosis (25 %, 50 %, 70 %). Experiments with stent-graft (25 % stenosis) revealed a significantly higher degree of hemolysis within the first 20 minutes (compared to stent).

**Conclusion:** Our results indicate a hemolytic effect of the implants, probably due to mechanical stress and shear forces induced by turbulences in the stent (irrespective of the stenosis). In vivo protective agents (serum albumine) are effective, but passage time is longer, therefore a hemolytic effect in vivo seems probable.

**Influence of MRI contrast media on the contractility of the arterial vessel wall**

**Purpose:** To evaluate efficacy of local drug delivery with “channeled balloon” catheters in New Zealand white rabbits to prevent restenosis after balloon angioplasty.

**Methods and material:** Thirtyfour rabbits were fed a cholesterol diet and received balloon denudation of both common iliac arteries. 4 weeks later, local application of r-hirudin (n = 8), L-arginine (n = 7) or molsidomine (n = 8) was performed on one common iliac artery. As control, saline was injected on the contralateral artery. In 8 zero controls saline was injected on one side and nothing was applied on the other. The “channeled balloon” catheter allows simultaneous balloon dilatation (8 atm) of the stenosis and local application of drugs (4 atm). Six weeks after local drug delivery the animals were killed and the vessels were examined histologically.

**Results:** Application of L-arginine resulted in a significant reduction of neointimal area (NA) (-41 %), molsidomine decreased NA by 25 %, r-hirudin decreased NA by 38 %. However, infusion of saline significant increased NA compared to balloon dilatation only (+38 %).

**Conclusion:** Local drug delivery with the “channeled balloon” is feasible in preventing restenosis in rabbits. Reduction of neointima area was significant for the NO-donors l-arginine, molsidomine and hirudin. However, saline infusion causes significant trauma resulting in additional neointima proliferation.

**Comparison of bare and polymer-coated iliac stents:** Experimental results K. Schuermann1, J. Lahann1, A. Mahnken1, P. Haage2, D. Vorwerk2, D. Klee2, R.W. Gunther2, A. Aachen/DE, A. Angiolisti/DE, Aachen/DE, A. Angiolisti/DE, Aachen/DE, Aachen/DE, Aachen/DE.

**Purpose:** To evaluate a new coating of metal stents with the polymer poly-2-hydroxy-methenyl-para-xylene that allows covalent bonding of drugs.

**Methods and material:** Biocompatibility and stability of the novel coating was confirmed in vitro before the in-vivo evaluation. Memotherm (n = 36), Palmaz (n = 24) and 2A stents (n = 12) were coated and implanted face-to-face to bare stents (n = 72) of the same type into the iliac arteries of 36 sheep. Sheep were divided into 3 groups of 12 animals. In group 1 (healthy arteries) and 2 (arteries pretreated with Fogarty manoeuvre) Palmaz and Memotherm stents were placed, in group 3 (healthy arteries) Memotherm and 2A stents. Patency was monitored with angiography and intravascular ultrasound (IVUS) for 1 or 6 months. Specimens were analyzed histologically.

**Results:** IVUS showed similar patency of coated and bare stents. No enhanced inflammatory response to coated stents was observed. Neointimal formation was similar in bare and coated Palmaz and 2A stents, and mildly increased in coated Memotherm stents only in group 2 after 6 months and group 3 after 1 month follow-up.

**Conclusion:** Results are promising. Performance of coated and bare stents was almost similar. Bonding of an anticogulant drug to a polymer-coated stent is warranted.

**Comparison of bare and polymer-coated iliac stents:** Experimental results K. Schuermann1, J. Lahann1, A. Mahnken1, P. Haage2, D. Vorwerk2, D. Klee2, R.W. Gunther2, A. Aachen/DE, A. Angiolisti/DE, Aachen/DE, A. Angiolisti/DE, Aachen/DE, Aachen/DE.
**808 11:00**  
Negative pressure effectiveness study of different thrombectomy devices in vitro  
J.T. Deichman, S.A. Beyer-Enke, R. Adamus, R.W.R. Loose. Nuremberg/DE  
**Purpose:** Comparison of suction and negative pressure in vitro of two different hydrodynamic thrombectomy devices and PAT-device.  
**Materials & methods:** Measurements were done with silicone tubes of different diameters (2.3 mm, 3 mm, 4 mm). As hydrodynamic thrombectomy devices 6 F and 7 F Hydrolyser, double lumen (Cordis, Roden, NL) and 8 F S.E.T. catheter, triple lumen (HP-Medica, Augsburg, D) were used and compared to conventional 8 F PAT-device (Angiomed, Karslruhe, D). All hydrodynamic thrombectomy devices were tested with different Flow to establish Venturi-effect: different distance device-tip/thrombus-equivalent with and without guidewires.  
**Results:** Effectiveness to establish negative pressure in vitro varies for different types of devices. Max. negative pressure was measured with PAT-device (-400 mbar). S.E.T.-catheter shows the max. negative pressure for hydrodynamic thrombectomy devices (-200 mbar). The use of guidewires increases the negative pressure (-300 mbar). Hydrolyser device shows the lowest negative pressure (-100 mbar).  
**Conclusion:** Effectiveness to establish different negative pressure in vitro varies in different thrombectomy devices. Hydrodynamic devices can be used for different peripheral arterial vessels. The use of guidewires does increase the negative pressure. For pulmonary arteries the authors recommend the use of the PAT-device instead of hydrodynamic thrombectomy devices.

**809 11:10**  
Targets for a new endovascular device to treat femoropopliteal arterial disease: Focusing the development of new technology  
G.S.R. Muragin, M.G.M. Humink. Rotterdam/NL  
**Purpose:** To determine criteria that would make a new endovascular device cost-effective compared to bypass surgery and percutaneous transluminal angioplasty in the treatment of femoropopliteal arterial disease.  
**Materials and methods:** A decision model was developed to compare established therapies and treatment with a new hypothetical endovascular device. Cost-effectiveness from the perspective of the health care system was considered. Outcome measures were lifetime costs and quality adjusted life years. Using net health benefit calculations and threshold analysis, we determined combinations of costs and payer rates that would make the new device cost-effective compared to established therapies. In subgroup and sensitivity analyses we explored the effect of gender, age, indication, lesion type, procedural risk and society's willingness to pay for incremental gain in health.  
**Results:** A device that costs US$ 3000 would be cost-effective compared to bypass surgery and percutaneous transluminal angioplasty in the treatment of femoropopliteal arterial disease.  
**Conclusions:** The target combinations of costs and payer rates found in this study are probably attainable and further development of such devices seems warranted.

**810 11:20**  
A new stent prototype (work in progress)  
E.P. Strecker: Karslruhe/DE  
**Purpose:** To introduce a new stent design.  
**Material and methods:** This stent consists of two nitinol wires partially connected to each other. After delivery through a catheter a tube-like helical stent forms within the artery. Bare metal and covered stent designs were tested experimentally in flow models, regarding mechanical properties, introduction and delivery technique. The bare stent was also implanted into iliac arteries and carotid arteries of six dogs. After 3 weeks angiographic follow-up stents were explanted for microscopic examination.  
**Results:** Stents with expanded diameters of 5 to 10 mm can be introduced through a 4 Fr catheter with 0.038 inch luminal diameter. Covered stents expanded diameter of up to 30 mm need a 10 Fr sheath. Initial technical success rate was ~90%. Bare stents explanted after 3 weeks were patent and revealed minor intimal hyperplasia in the areas of the stent strut connection points.  
**Conclusions:** This new stent design has a small introduction diameter which is independent of the expanded diameter. The stent can be introduced through tortuous arteries and thus is a new option for treatment of intracranial arteries. The covered stent design also is suited for treatment of aneurysms.

**811 11:25**  
First clinical experience with a new rotational thrombectomy device (Rotarex)  
K.A. Hauserger, J. Tauss, K. Tissenhausen, H.R. Portugaller. Graz/AT  
**Purpose:** To evaluate the technical performance and the reopening capacity of a new thrombectomy catheter (Rotarex) in acute and subacute femoropopliteal arterial occlusions.  
**Patients:** 13 patients with acute and subacute occlusions (history of 4 weeks or shorter) of the femoropopliteal artery have been treated. Six patients had severe claudication, 3 rest pain and 4 a gangrene. Median length of the occlusion was 10.5 cm.  
**Methods:** After successful guidewire recanalization of the occlusion the Rotarex catheter was introduced via a 4F sheath and over a 0.020 guidewire. The catheter was activated by an external motordrive which is connected with the catheter via a magnetic clutch. When the catheter is activated the rotating catheter tip which is covered by a protectioncambor rotates with 20,000 rpm. This creates a significant suction. Solid particles which are aspirated into to rotationcambor are fragmented.  
**Results:** Reopening of the occluded vascular segment was successful in 12/13 patients. In 1 patient early recocclusion occurred despite a good initial result. In 12/13 patients the lumen of the reopened vessel was near the nominal vascular lumen after Rotarex thrombektomie alone. However, residual plaques necessitated an additional PTA and 1x insertion of a Hemobahn stent-graft. Peripheral embolism occurred 2x, in one patient aspiration was successful, in the other the embolus did not cause flow limitation and was therefore not treated. 2x recocclusion after 4 weeks was observed, both patients had a poor run-off. In one a bilateral recocclusion 4 months after bilateral Rotarex thrombektomie was observed. PTA was successful on both sides.  
**Conclusion:** The Rotarex catheter is easy to handle and has a high reopening capacity. In our hands this device was more effective than pure hydrodynamic devices. The first results are promising. Further studies are necessary.

**812 11:30**  
Endovascular treatment of experimental aortic aneurysms: MRI monitoring of histologic organization in the excluded aneurysm sac  
M.B. Pitton, R.P. Schmenger, C. Düber, A. Neufang, M.A. Kondering, M. Thelen. Mainz/DE  
**Purpose:** To correlate MRI and histology and to monitor histologic organization after endovascular treatment of aneurysms.  
**Material and methods:** In 24 dogs autologous aortic aneurysms were created at the sheath of reclus absimus muscle. Endovascular treatment was performed with polyester covered nitinol stents. Follow-up was 1 and 6 weeks and 6 months. MRI was performed using a 1.5 T system with TSE sequences (TR 4000 ms, TE 96 ms) and SE sequences (TR 784 ms, TE 12 ms). Histology was related to MRI images. Signal intensities (SI) were related to reference tissue (tight connective tissue), and were color coded for quantitative analysis. Histologic organization was defined in 4 categories: I: detritus, II: III: increasing fibre proliferation, IV: tight connective tissue.  
**Results:** According to histologic categories (I-IV) relative SI of T2w images was reduced from 4.58 in detritus (I) to 3.28 (II), 2.26 (III) and 1.74 in tight connective tissue (IV). Relative SI of T1w images was reduced from 1.81 (I) to 1.73 (II), 1.42 (III) and 1.11 (IV). There was no change of SI after gadolinium in detritus. SI increased with increasing organization categories from 1.13 (II) to 1.68 (I).  
**Conclusion:** Histologic organization can be monitored by MRI. Organization can be semiquantitatively computed by color coded MRI.
Material & methods: We treated 12 ovine abdominal and thoracic aortas with the nitinol e-PTFE stentgrafts. After 4 weeks and 3 months, implants were retrieved but showing no complete coverage of the stentgraft after 4 and 12 weeks. Localized loss of cell nuclei in the elastic layer beneath the stent was seen indicating cellular necrosis due to pressure against the aortic wall. In the clinical pilot study the primary success rate was 87%. Four leaks were detected. We had 3 major and 3 minor complications. No death occurred.

Conclusions: Histopathological examinations in the ovine aorta showed no evidence of media disruption that could lead to progressive dilatation of the stented aortic necks. In the clinical pilot study the endovascular treatment of AAAs was an effective and safe approach of treatment. Nevertheless further studies are necessary to determine the biohistological response to stentgraft treatment, especially in diseased aortic tissue for further establishment of this promising interventional technique.

814 withdrawn by author

815 11:45
Trials of a new reflective coating for ultrasound guided needles, catheters and guide wires
W.R. Lees. B. Slater. A.R. Gillams: London/GB

Purpose: Poor visualisation of needles because of acoustic coupling dependence is the major problem in ultrasound guided abdominal procedures. We evaluated a new polymer coating (‘Echocoat, SPS Biopolymers) which traps microbubbles increasing the scattering cross section.

Methods and materials: We examined needles of varying lengths and diameters in artificial biopsy phantoms, ex-vivo tissue phantoms and with 3D in a water tank (ATL, Bothell, Acuson, Mountain View and Siemens, Issaquah). 3D acquisitions were obtained at varying angles. in/out of plane, in fundamental, tissue harmonic and pulse inversion modes. Relative echogenicity, artefact and visual appearance of coated and uncoated needles was compared.

Results: The shaft of the uncoated needles was only visible beyond a 70° angle from the insonating beam and even with optimal in-plane orientation only the proximal needle was seen. With coated needles the entire barrel was seen with no variation in echogenicity ≤ 10° from the beam. The coated needle absorbed acoustic energy eliminating reverberation artefact. Visualisation was slightly improved in pulse inversion. The principal advantage was angle independence with the entire needle visualised in all conditions, modes and in different tissues.

Conclusions: The polymer coating increased the scattering cross-section and was almost completely angle independent in/out of plane. No special electronics or harmonic mode is necessary.

10:30-12:00 Room K

Pediatric

SS 1312 Abdomen

Chairpersons:
M. Fujioka (TochiguiJP)
P. Toma (Genova/IT)

816 10:30
One year experience with US-guided reduction of intussusception
P. Crystal, B. Farber, N. Shabsin, V. Tsoldikov, Y. Barki. Beer-Sheva/IL

Objective: Intussusception is the most common abdominal emergency in early childhood. Standard methods for therapeutic management of intussusception includes hydrostatic barium enema and pneumatic reduction, both performed under fluoroscopic control and involve ionizing radiation. Recently, ultrasound-guided reduction replaced the conventional approach in our hospital.

Material and methods: From September 1998 to September 1999 US-guided hydrostatic reduction was performed in 37 consecutive cases. The enema consisted of mixture of the saline and water-soluble contrast medium (12:1 ratio) and was given at a hydrostatic pressure of 100-160 cm water. We used established sonographic criteria of reduction: disappearance of the target, visualization of the fluid reflux, fluid filling of the small bowel. Single abdominal radiography was done after reduction in doubtful cases.

Results: In 33 cases (89%) reduction was successful. No complications occurred. For patients underwent surgery (1 resection and 3 manual reduction).

Conclusion: Primary advantages of US-guided reduction are the lack of radiation exposure and improved of the reduction rate. We recommend this method as optimal for the nonoperative management of childhood intussusception

817 10:40
MR-angiography (MRA) in the assessment of portal hypertension in children M. Ottobre, G.L. Bava, E. Biscaldi, P. Toma*, Genova/IT

Purpose: US and Doppler are essentials to study portal hypertension after venous thrombosis. Angiography allows planning the surgical shunt or the liver transplantation. We present the MRA findings relating to Doppler and angiographic features.

Materials and method: 9 patients (mean age 8) with portal hypertension after portal vein thrombosis, underwent US, duplex-color Doppler (7-4 Mhz) and MRA (1.5 T, body coil: contrast enhanced 3D-TOF and 3D-PC sequences) to plane surgery (15 patients) and to follow-up (3 renal shunts and 1 splenectomy). In 3 patients anesthesia was needed. In 4 cases we compared MRA with conventional portography.

Results: US is the main tool to detect splenomegaly, ascites, ovarian thickening, collateral vessels. Doppler demonstrates the portal and splenic blood flow speed and direction. MRA evaluates porto-systemic shunts and the presence of flow in non-collaborative children 3D-PC technique increased the quality reducing image artifacts. In collaborative patients contrast enhanced 3D-TOF in breath-hold are time reduc­

Doppler and MRA demonstrate an excellent correlation highlighting the diagnostic gain in non-invasive assessment. MRA was confirmed by conventional angiogra­

phy in all but one case; in another MRA gave more informations.

Conclusions: Doppler confirms its diagnostic value; MRA is an useful tool in non-invasive assessment and follow-up.

818 10:50
Incidence of ceftaxone-associated pseudolithiasis of gallbladder
F. Papadopoulou, H. Nalbandidou, O. Lekidou, M. Badouraki, M. Panteleli, S. Karyda, S. Efremidis, Thessalonik/GR

Objective: to assess the incidence of ceftaxone-associated pseudolithiasis in relation to form of administration and the age of patients.

Material and methods: We included 76 children with serious infections receiving ceftaxone either once daily (Group 1: 32 children, mean age 3.4 years) or divided in two equal daily doses (Group 2: 44 children, mean age 4.3 years).

Results: Ten children in Group 1 (31.2%) and 11 in Group 2 (25.0%) developed pseudolithiasis. The difference in incidence between the two Groups was not significant (p = 0.05). No difference was also found in age, sex, type of infection, dose and duration of treatment (p = 0.05). The only significant difference found was the age of patients: mean age of children with lithiasis 5 years versus 1.3 years of children without (p = 0.004) in Group 1 and 7.5 versus 3.1 respectively in Group 2 (p = 0.003). More over in both groups the difference in incidence of pseudolithiasis between children ≤ 2 years and children > 2 was found significant (p = 0.03 in Group 1 and p = 0.004 in Group 2).

Conclusion: The incidence of ceftaxone-associated pseudolithiasis is unaffected by the form of administration. The only factor that seems to affect this complication is the age of the patient.

819 11:00
Idiopathic perforation of the extrahepatic bile duct in infancy
H. R. Foroutan: Shiraz/IR

Spontaneous perforation of the bile duct (IPBD) in neonates and infants is uncommon but could easily be diagnosed if clinically suspected. The presence of bile in the peritoneal cavity associated with obstructive jaundice is pathog­nomonic of this situation. This could be simply proven by paracentesis. HIDA scan would be helpful in suspected cases. In the last ten years four patients (2-19 months) with ascitis, jaundice and clay color stool have been treated successfully in this center. Isotope scanning easily showed bile leak to the peritoneum. The sites of perforation were at the junction of cystic duct and common bile duct. Intraoperative cholangiography showed patent common bile duct. For two patients drainage without suturing was performed, for another one the site of perforation...
was repaired. T-tube was inserted for the last one which was removed after performing cholangiography ten days after operation. All of these patients were asymptomatic 4-6 months after operation.

820 11:05
The posterior rectal shelf: Is it significant?
B. Rampersad, A.J. Howes, N.A. Barnes, G.A. Lamont, H.M.L. Carty; Liverpool/GB

Constipation although very common in children is usually functional. However, we would like to present a group of 11 patients (five male, six female), with a possible structural cause of obstruction, as demonstrated by a posterior rectal shelf on contrast enema.

All were symptomatic before age one year, with constipation, (10 patients), recurrent abdominal pain (one patient), rectal bleeding (three patients), and bilious vomiting (one patient). Contrast enema performed in all cases demonstrated a narrowing at the ano-rectal level with a posterior shelf and elongated anal canal.

A normally placed anus was confirmed clinically in all patients and with sphincter mapping in two patients. Eight patients underwent rectal biopsies (five normal, three hypoganglionosis). Anorectal manometry in two patients showed a positive recto-anal inhibitory reflex but poor squeeze pressures.

These patients improved without intervention, three required laxatives and three additionally required suppositories and enemas. Abdominal pain persists in one patient, although constipation is less prominent. One patient with significant bleeding had a normal laparotomy and at 17 years still had bleeding and constipation.

In conclusion, patients presenting with constipation in infancy a small number will have a posterior rectal shelf. Symptom severity varies and although some improve without treatment the majority will require prolonged management of their symptoms.

821 11:15
Imaging of patients with Wilms’ tumor
V. Bešlagić, N. Kapdve, S. Dzidarević, F. Krakonja, D. Vrcoc, E. Sadagc, F. Dalagija, M. Sakić, Sarajevo/BA

Purpose: To assess diagnostic imaging methods in preoperative evaluation and postoperative follow up of patients with Wilms’ tumor, admitted at the University Clinical Hospital Sarajevo between January 1997 and October 1999.

Material and methods: We surveyed 11 children with Wilms’ tumor, age ranging from 3 months to 7.5 years. Imaging methods included intravenous urography (IVU), barium enema, conventional ultrasound (US), color Doppler ultrasound (color Doppler US), computed tomography (CT), magnetic resonance imaging (MRI).

Results: Wilms’ tumor was unilateral in 10 patients, bilateral in one patient. Preoperative evaluation included US in 11 patients (100%), color Doppler US in 2 patients (18%), IVU in 10 patients (90%), barium enema in 1 patient (9%). CT in 8 patients (72%). Radiologic follow up methods were conventional US in 11 patients (100%), CT in 2 patients (18%), MRI in 1 patient (9%). Minimal size of tumor measured by US and CT was 50×30 mm, maximal size was 140×120 mm. IVU and US were sufficient for the primary diagnosis of tumor, while CT and MRI were better in staging of tumor.

Conclusion: Infantile nephroblastoma is the most common primary renal tumor of childhood. Imaging plays a significant role in management of Wilms’ tumor. Synthesis of traditional and new imaging methods is indispensable for an optimal multimodality imaging approach to diagnosis and treatment of Wilms’ tumor.

822 11:25
Ganglieneuromas in children: MRI- and CAT-characteristics
A.J. Schierer, T. Nehues, V. Engelbrecht, U. Moedder; Düsseldorf/DE

Purpose: The aim of this study was to demonstrate typical appearances of ganglieneuromas in computer assisted tomography (CAT) and magnetic resonance imaging (MRI).

Material and methods: Retrospective analysis of imaging diagnosis in 9 children (age: 3 to 15 years) with the histological diagnosis of ganglieneuroma.

Results: The tomographs showed large (max. 11.7 cm in diameter) round resp. oval tumors with sharp delineation. The sites of the tumors were the retroperitoneum (5x), the mediastinum (3x) and the adrenal gland (1x). CAT and MRI were capable of demonstrating critical intraspinal tumor involvement, which occurred in 4 cases. Comparing CAT and MRI, MRI was more accurate in defining the intraspinal involvement. The ganglieneuromas were of heterogeneous appearance in the native CAT scan and showed little or moderate enhancement after administration of contrast media. In five patients tumor calcifications with a disseminated sprinkled pattern were seen in CAT. In MRI T1w scans the tumors were homogeneous and muscleisointense, after gadolinium application a homogeneous, marked enhancement was evident. In T2w the tumors were hyperintense.

Conclusion: This retrospective study suggests that ganglieneuromas are generally at the time of diagnosis large tumors which can be well detected by CAT and MRI. The specific appearance of ganglieneuromas in CAT resp. MRI is helpful to differentiate ganglieneuromas from other tumors in childhood.

823 11:35
Videofluoroscopy of the esophagus in children after esophageal surgery
M. Hoermann, P. Pokieiser, K.F. Linnau, W. Pumberger, S. Kreuzer, V.M. Metz; Vienna/AT

Purpose: After esophageal surgery difficulties in swallowing, regurgitation and pulmonary infections are common. Follow up is usually performed with X-ray, endoscopy and manometry. Aim of this study was to present the efficacy of videofluoroscopy of the deglutition in children after esophageal surgery.

Methods & materials: 20 children (11, 9 months) underwent videofluoroscopies after esophageal surgery. The age was ranging from 2 days to 14 years (mean 29 months).

The time of visibility of radiologic findings was determined and the radiologic findings were compared to clinical charts, clinical presentation, endoscopy results and manometry.

Results: In 12 patients we found motility disorders, in 8 patients stenosis, in 3 patients fistulas, in 1 patient anastomotic leakage, in 1 patient a brachyoesophagus, in 2 patients aspiration and in 1 patient reflux. Mean visibility time was, for stenosis 1.04 s, for fistulas 0.68 s, for aspiration 1.08 s and for anastomotic leakage 0.44 s. Follow up revealed no further complications.

Conclusion: In children structural and morphological changes are common. Videofluoroscopy seems to be an accurate technique to detect postoperative complications after esophageal surgery.

824 11:40
Unenhanced CT scans of the paediatric abdomen: Radiation exposure versus diagnostic benefit
C.G. Taylur, S. Bose, A.K.P. Lim, K. McHugh; London/GB

Purpose: It is a commonly held belief that non contrast scans of the paediatric abdomen are useful in the initial assessment of abdominal lesions to detect calcification. This study aims to investigate whether this practice provides significant diagnostic benefit.

Methods and materials: 70 consecutive cases were reviewed retrospectively by a Consultant Paediatric Radiologist and a Radiology Fellow. Pre and post i.v. contrast scans of the abdomen and/or pelvis were analysed separately at least a week apart. No clinical history was given. Results were recorded on data sheets. Each anatomical area was recorded as normal/abnormal/not sure. Presence or absence of calcification within an abnormality was noted. A diagnosis was made including a degree of certainty 95%±75%±50%.

Results: A correct diagnosis was made from 67% of non contrast scans vs. 79% of enhanced scans. Diagnostic certainty of 95% was recorded in 36% of non contrast studies vs. 56% of enhanced scans. The number of “not sure” recorded per anatomical area was 40% less in contrast enhanced scans. 20 out of 70 cases had a calcified abnormality. The calcification was missed in 28% of the contrast enhanced scans, however this did not significantly affect the diagnosis given.

Conclusion: Unenhanced CT scans of the paediatric abdomen considerably increase the radiation burden and do not provide significant diagnostic benefit.

825 11:50
Spiral CT in younger children: Can the radiation exposure be reduced?
D. Wurrmanns, H. Lenzen, S. Diederich, P. Lange, K. Ludwig, C. Hagedorn, W.L. Hendei; Munster/DE

Purpose: The influence of scanning parameters on image quality in spiral body CT was assessed in order to determine a protocol for reduced radiation exposure in younger children.

Material and methods: 47 spiral CT studies (29 abdominal and 18 thoracic) of children (age 0 to 10 years, mean 2.4 years) were retrospectively reviewed by 3 board certified radiologists. Over time, scanning parameters were changed from collimation 10 mm (20 cases), pitch 1 to collimation 5 mm (27 cases), pitch 2, reconstruction interval was 5 mm or less, scan time was 1 s. Simultaneously, tube current was reduced from originally 100 - 225 mA (21 cases) to a low-dose protocol with tube current of 25 or 50 mA (26 cases), depending on children’s age.
exposure can be reached without significant loss of image quality. To our experience, 5 mm collimation (p = 0.02) in detail visibility was found for abdominal CT. Multivariate ANOVA revealed no influence of low-dose protocol (p = 0.40) but significant influence of collimation (p = 0.04) on detail visibility.

**Conclusion:** In spiral CT of younger children a notable reduction of radiation exposure can be reached without significant loss of image quality. To our experience, a tube current of 50 mA with 5 mm collimation, pitch 2 and reconstruction interval of 5 mm or less seems appropriate for both thoracic and abdominal studies.

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**826 11:55**

**Influence of iopamidol and other components of a nonionic contrast medium on fetal colon fibroblasts. An in vitro investigation.**

S. Puig, P. Paukovits, W. Rehbandt, S. Kühle, M. Hörmann, C. Bieglmayer; Vienna/AT

**Purpose:** Nonionic contrast media, such as Gastromiro® (Gerot, Vienna), are widely used for investigation of the colon in preterm infants. The purpose of this study was to evaluate the viability of fetal colon fibroblasts after incubation with iopamidol and the other components of Gastromiro®.

**Material and methods:** Colon fibroblasts of a 13-week and a 22-week-old fetus as well as of a 7-years-old child were obtained from the American Type Culture Collection (ATCC). The cells were grown to confluence according to the ATCC standard protocols. The different components of Gastromiro® were diluted with culture medium (1:2, 1:3, 1:5).

**Results:** Measurements of viability were performed using MTT stain (Promega, USA), 51-chrome release (Du Pont NEN, USA) and plating efficiency test. After 24 hours, the viability of cells was reduced by 25% - 100% after incubating with iopamidol, depending on the concentration. In the plating efficiency test a significant colony formation was only observed after preincubation with iopamidol in concentrations 1:3 and 1:5.

**Conclusion:** Our preliminary findings suggest that iopamidol in low concentration has a rather small influence on the viability of colon fibroblasts, while high concentrations have toxic effects. The other components of Gastromiro® had no significant influence on the viability. Therefore iopamidol should only be used in low concentrations.

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**14:00-15:30 Room B**

**Musculoskeletal SS 1410**

**Osteoporosis**

Chairpersons: H. Imhof (Vienna/AT); K Verstraete (Gent/BE)

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**832 14:00**

**Van Buchem disease: Genetic and radioclinical features**

F.M.H. Vantehoenderen, W. Balemans, W. van Huffel, G.J. Tan, F. Dikkers, A.M.A. De Schepper, Antwerp/BE; ‘Emmeloord/NL; ‘Groningen/NL

**Purpose:** To present a comprehensive overview of the genetic and radioclinical features of Van Buchem disease (Hyperostosis Corticalis Generalisata).

**Methods and materials:** To identify the defective gene of this rare autosomal recessive disease, a genetic linkage study was done on 11 Van Buchem patients and their family, who live in a small Dutch village, which is a small ethnic isolate. 14 and 69. Clinical features and imaging studies (plain films and CT-scans) of 11 patients and of 10 carriers of the defective gene were reviewed.

**Results and Conclusions:**

1. The gene defect was mapped on Chromosome 17q12-q21
2. The most common clinical features, present in all patients were a widened and thickened chin, a high forehead and facial nerve paralysis. Sensorineural hearing loss was seen in 4 patients
3. Radiological manifestations included endosteal sclerosis of the neurocranium with loss of diploë, foraminal stenosis of the cranial nerves, osteosclerosis of mandible, endosteal diaphyseal hyperostosis of tubular bones, ribs and clavicles, with narrowing of the medullary cavity, and modeling defects of the diaphysis.
4. Radioclinical abnormalities become more prominent in older patients, which suggests that the van Buchem gene is very actively involved in bone metabolism.
5. No obvious radiological stigmata of the disease were seen in carriers.

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**833 14:10**

**Short-TE projection reconstruction MR microscopy of trabecular bone explants**

R. Toftfani, M.A. Cozy, P. Szomolanyi, V. Jellus, R.S. Pozzi-Mucelli, F. Vitturi, Trieste/IT; Bratislava/SK

**Purpose:** To develop new Magnetic Resonance Microscopy (MRM) techniques that have a potential role in the characterization of trabecular bone architecture as well as assess the impact of MRI image acquisition and analysis on the quantitative evaluation of trabecular bone microstructure.

**Methods and materials:** Cartilage-bone cylindrical plugs with a diameter of 4 mm were excised from different regions of four disarticulated femoral heads of patients operated for femoral neck fractures. Short-TE projection reconstruction (PR) MR microimages were acquired at 7.05 T on a Bruker NMR spectrometer equipped with a standard microimaging accessory. PR microimages (TR = 1500 ms, TE = 3.2 ms) were obtained with a very short echo time (3.2 ms) by using the partial echo acquisition technique. The voxel resolution was 50x50x150 mm and the image matrix was 128x128x32.

**Results:** Short-TE projection reconstruction MRM allowed quantification and visualization of trabecular bone architecture. The use of a short echo time minimized the phase dispersion due to the high changes in susceptibility at the bone-marrow interface.

**Conclusions:** Short-TE PR MRM may be very useful in the study of osteoporosis as non-destructive technique with the ability to provide three-dimensional information of the bone architecture.

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**834 14:20**

**Differences of bone status between children suffering from atopic and non-atopic asthma. Is there a new manifestation of atopy on bone?**

A. Malich, W.F. Baum, T. Azhan, W.A. Kaiser; Jena/DE; Halte/DE

**Purpose:** Growth retardation on asthmatic children was first described 50 years ago. To test the reason of this retardation in children, non or very less topically treated with steroids, this study was done.

**Methods/materials:** 160 asthmatic children (111 extrinsic, 12 intrinsic, 37 mixed type), mean age 9.6 y were included. Asthma severity grade (ASG), height, using single photon absorptiometry bone mineral content (BMC), bone width (BW) and bone mineral index (BMI) have been determined. Bone age has been investigated. T-testing, standard deviation score (SDS) and variance analysis were used.

**Results:** 8.3 % (girls) and 6.6 % (boys) were small per age. 8.3 % of the girls showed retarded BMC and BW: (boys: 16.7 ±4.0 %). BMI was retarded in 16.7 % (girls) and 16 % (boys). Mean bone age was negative in both sexes (boys: -0.86 y; girls: -0.57 y). Children suffering from extrinsic asthma were significantly more involved in those retardations. All bone parameters showed significant correlations to body height. none showed any dependence to ASG.

**Conclusions:** Topic steroid application and ASG do not play a central role in retardation of bone parameters on atopic asthmatic children. An association of these symptoms to atopy was observed. PGE 2 and a changed activity of estrogens in atopics may play a greater role in pathophysiology of atopic asthma and bone.

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**835 14:30**

**The dependence of ultrasound variables measured in a fixed size ROI on calcaneal area**

J. Damlakis, K. Perisinakis, N. Gourtsoyannis; frolikan/GR

**Purpose:** The objectives of the study were (a) to investigate the dependence of broadband ultrasound attenuation (BUA) and speed of sound (SOS) measured in a fixed size circular region of interest (ROI) on calcaneal area and (b) to examine whether the normalization of ultrasonic variables for the area of the calcaneus provides better discrimination of clinical studies.
Methods and materials: Ultrasound variables were measured in 169 healthy postmenopausal women (mean age 66.5 years, range 42–87 years) and 39 women with vertebral fractures (mean age 72.9 years, range 51–86 years). An imaging device (UBIS 3000) was used for ultrasound measurements.

Result: Significant relationship was found between both ultrasonic variables and calcaneal area (r² = 0.06, p < 0.001 for BUA, r² = 0.12, p < 0.0001 for SOS).

Normalization of ultrasound variables (BUA and SOS) was based on the regression equations of the relationships between BUA, SOS, and calcaneal area. Significant difference was found between the areas under the ROC curve for BUA and SOS (p = 0.003) as well as for SOS and SOS (p = 0.003).

Conclusion: Normalized ultrasound variables for calcaneal area improve the discrimination of clinical studies.

836 14:40
Relationship of cervical and thoracic and lumbar bone mineral density by quantitative CT
D. Waishaupt1, M. Schweitzer2, M.N. Ducicco3, P.E. Whiteley4; Zuchern CH, 1Philadelphia, PA/US

Purpose: To compare vertebral bone mineral density (BMD) in the cervical, thoracic, and lumbar spine in healthy volunteers using quantitative CT (QCT).

Material and methods: QCT of the vertebral bodies of C-2, C-5, T-12, and L-4 was performed on 50 healthy volunteers (25 females, 25 males; mean age: 31.7 years). Trabecular BMD analysis was performed at each level.

Results: Counterintuitively, mean BMD (mg/cm²) was significantly lower in men at C-5 (BMD women/men 341.6/300.6 mg/cm²) and C-2 (297.2/269.6), and lowest at T-12 (185.2/180.1). The difference in BMD of C-2 was statistically significant from that of C-5, T-12 and L-4 (p < 0.0001) for both genders. Also the BMD of C-5 differed significantly from that of T-12 and L-4 (p < 0.0001). BMD of C-5 showed significant gender differences (p = 0.002) and BMD of C-2 showed a nearly significant gender difference (p = 0.07). Correlation coefficient showed a strong correlation between the BMD of T-12 and L-4 for both genders (r = 0.6709).

Conclusion: Trabecular BMD of C-2 and C-5 is independent and significantly denser than BMD of T-12 and L-4 in both men and women. In addition gender differences in BMD of C-5 and C-2 exist possibly explaining the higher prevalence of non-osteoporotic cervical fractures in men.

837 14:50
Comparisons of quantitative bone mineral measurements and semiquantitative assessment of radiographs in the classification of bone loss
C.B. Henk1, S. Grampp2, Y. Lu1, C. Krestan3, H.K. Genant4, H. Imhof5; Vienna/AT, 1San Francisco, CA/US

Purpose: To compare the appearance of vertebral bodies on radiographs with various methods of noninvasive assessment of bone mineral status.

Material and methods: A total of 77 postmenopausal women were examined with: quantitative computed tomography (QCT, GE 9600, lumbar spine); 2) dual X-ray absorptiometry (DXA, Hologic QDR 2000, lumbar spine, proximal femur, distal radius); 3) peripheral QCT (pQCT, Stratec XCT 960, distal radius); 4) radiographic absorptiometry (RA, Chugai = phalanges, Compumed = metacarpals). Lateral spinal radiographs were semiquantitatively graded into 5 levels (0: normal; 1: mild; 2: moderate; 3: severe osteoporosis). A Student’s t-test was used for comparing the different measurements for reflecting inter-group differences.

Results: The steepest slopes for the comparison of mean values between all groups was found for QCT spine followed by DXA spine. DXA radius pQCT, RA metacarpals. RA phalanges, DXA femur. This was also reflected by the ability of QCT to distinguish between all groups and at the other side of the spectrum DXA of the femur, which could only distinguish between groups 0 and 4. The other methods could distinguish at least groups 0 and 1 from group 3 and 4.

Conclusion: The radiological appearance of the spine has a significant relationship to the bone mineral content at various axial as well as appendicular sites. The semiquantitative grading of the vertebrae can be instrumental in estimating the general skeletal status.

838 15:00
Lumbar and femoral BMD predict clinical vertebral fractures and femoral neck fractures significantly better than heel ultrasound parameters
A. Hoeiseth; Oslo/NO

The purpose was to compare the associations of previous fractures in females with lumbar and femoral BMD parameters and with calcaneal ultrasound parameters (SOS, T1 and OSI).

321 females, mean age 68 years (sd 8 years); consecutively referred for evaluation of osteoporosis, had both types of measurement performed. For the pooled material all parameters were standardised (Z-scores). For each parameter the association with fractures was assessed as the mean deviation of group means from the pooled mean. Statistical significance was expressed as the probability for the mean group Z-scores of being below zero (t-test).

All parameters were negatively correlated to the number of fractures and to age. Non-significant negative associations were found between the ultrasound and BMD parameters and forearm and miscellaneous peripheral fractures. For the femoral neck fracture group only the mean femoral BMD was significantly below the pooled mean (Z-score = -0.71, p = 0.01), for vertebral fractures only lumbar BMD was significantly below (Z-score = -0.41, p = 0.05).

The ultrasound parameters seem comparable to BMD in the assessment of risk of peripheral fractures, but inferior for vertebral and femoral neck fracture risk assessment. For these fractures site specific measurements seem to be required; the ultrasound measurements underestimate the risk of these fractures. Further assessment of the ultrasound measurements may be needed before they can be advocated as the only means of osteoporosis estimation.

839 15:10
Cut-off levels for quantitative ultrasound of the calcaneus in the distinction of healthy and osteoporotic individuals
C. Krestan1, S. Grampp2, C.B. Henk3, K. Linna4, H. Resch5, F.M. Kamberger6, H. Imhof7; Vienna/AT

Purpose: To calculate cut-off levels for quantitative ultrasound (QUS) in the distinction of normal and osteoporotic individuals identified by dual X-ray absorptiometry (DXA).

Material and methods: In 1357 patients (856 women, 54.8 years old 15, 501 men, 50.7 years old 15) bone mineral density measurements of the lumbar spine (posterior-anterior, L1-L4) and the femoral neck (QDR 4500, Hologic Inc., Waltham, MA, USA) as well as QUS of the stiffness of the calcaneus (Achilles, Lunar Corp., Madison, WI, USA) were performed.

Individuals with a T-score > -2.5 (osteoporotic) at the spine and femur were identified and the highest QUS T-scores (3 SD from the mean) within both groups of osteoporotic patients were identified.

Results: Females with osteoporotic DXA values at the spine showed a maximum QUS T-score of -1.0 (male -0.2); females who were osteoporotic at the femur showed a maximum QUS T-score of -0.6 (male 0.0). Therefore, all individuals above these values were not osteoporotic.

Conclusion: Clearly defined cut-off values qualify QUS as a screening tool for the presence of osteoporosis at the spine and femur. The application of QUS will help to avoid unnecessary DXA exams and therefore decrease costs and radiation exposure.

840 15:20
Dual X-ray absorptiometry (DXA) and peripheral quantitative CT (pQCT) in female hemodialyzed patients
C.V. Albanese1, S. Mazzaferr1, V. Ruschioni2, M. Pasqualli2, R. Passanello3; Rome/IT

Purpose: Aim of this study was to evaluate bone status by dual energy X-ray absorptiometry (DXA) and peripheral quantitative computed tomography (pQCT) in order to evaluate bone mineralization in female hemodialyzed patients (HD).

Material and methods: We studied 34 HD female 15 were in premenopausal (mean age 38±5 years) and 19 were in postmenopausal (mean age 58±8). Bone mineral density (BMD) was measured by DXA at lumbar spine (L2-L4) and femoral neck (Neck) and by pQCT at forearm in all patients. The patients were considerate osteopenic (T score between -1.0 and -2.5 SD) or osteoporotic (T score < -2.5 SD) according to WHO.

Results: We found a significant reduction of BMD in postmenopausal patients in comparison to premenopausal patients at all sites examined by DXA (L2-L4: 0.790±0.18 vs. 0.990±0.14, p < 0.001; Neck: 0.640±0.15 vs. 0.790±0.19, p < 0.001). The osteoporosis was found in a 40% of postmenopausal patients (T score < -2.5 SD). In premenopausal patients we found a 30% of osteopenia. No differences in BMD was found at forearm.

Conclusion: HD postmenopausal women showed an additional factor risk in bone loss decreasing the bone mass compared to premenopausal HD patients and we consider that it is important to evaluate BMD by DXA at axial and appendicular sites to improve the management of the female HD patients.
SS 1401a
GI tract - stomach/duodenum/cross section imaging
Chairpersons:
J. Bovenie (Lège/BE)
N. Gourtsoyiannis (Irkut/EGR)

Eary gastric carcinoma: CT and MR features
M. Düx, L. Grenacher, A. Lubienski, A. Schipp, G.W. Kaufmann; Heidelberg/DE

Purpose: To assess typical imaging features of early gastric carcinoma using Computed Tomography (CT) and Magnetic Resonance Imaging (MRI).

Methods and materials: For staging reasons 112 patients with gastric carcinoma were preoperatively examined by Hydro-CT. In addition, 65 specimens of gastric carcinoma were submitted to MRI prior to histologic work-up. In case of early gastric carcinoma the imaging studies were retrospectively assessed for the visibility, size, location, contrast enhancement and growth pattern of the tumors compared to the histologic findings.

Results: 9 of 18 (50%) and 10 of 13 (77%) early gastric carcinomas were visible on the CT/MR-scans, retrospectively. Ulcerous tumors of 1.5 cm in diameter or less may be missed by CT- and MR-imaging. Ulcerous lesions > 1.5 cm in diameter, flat and polypoid early gastric carcinomas of any size are reliably detected by CT and MRI. On CT-images, early gastric carcinoma typically shows a marked contrast enhancement, however distinction from a T2-carcinoma is impossible. MRI shows a layered pattern of the gastric wall that allows to distinguish early from advanced gastric carcinoma.

Conclusion: Depending on the size and growth pattern early gastric carcinoma may be missed by CT- and MR-imaging. MRI is superior to CT in staging early gastric carcinoma provided that in the near future endoscopically applicable receiver coils will be suited to reliably show a layered pattern of the gastric wall.

Exophytic adenocarcinoma of the stomach: US and CT features with emphasis on differentiation from malignant stromal tumor
D.H. Lee, Y.T. Ko, T.S. Seo; Seoul/KR

Purpose: Exophytic adenocarcinoma of the stomach (EAS) is a tumor that has a large extramural portion. Exophytic growth of gastric carcinoma is very rare, and such tumor may be confused with malignant stromal tumor (MST). The purpose of this study is to assess the US and CT findings of EAS, and to determine their value in distinguishing between EAS and MST.

Methods & materials: Fourteen patients with EAS and 15 patients with MST were included in this study. US and spiral or dynamic CT findings were assessed and compared retrospectively.

Results: The location of tumor was gastric antrum in eight cases of 14 EAS, but gastric body or fundus in all of 15 MST (p = 0.0007). US and CT showed an exogastric mass with a variable degree of internal necrosis in all of EAS and MST. On CT images, thickening of the gastric wall adjacent to the mass appeared in ten of 14 EAS (71.4%), but it was not seen in all of 15 MST (p = 0.000). Lymph node enlargement was seen in seven of 14 EAS and in three of 15 MST (p = 0.05). Discrepancy US and CT findings of necrosis appeared in EAS (p = 0.0077), but they were not seen in MST (p > 0.05).

Conclusion: Antral location, thickening of the gastric wall adjacent to an exogastric mass, and discordant images between US and CT are typical of EAS, and allow distinction between EAS and MST.

Preoperative evaluation of gastric cancer: Value of CT during gastric arteriography (CTGA)
H.S. Kim, J.C. Choi, J.A. Choi, C.M. Park, I.H. Cha; Taejon/KR, Seoul/KR

Purpose: The purpose of this study was to evaluate the utility of dual-phase spiral CT during gastric arteriography (CTGA) in the preoperative staging of gastric cancer.

Materials and methods: We performed CTGA in 21 patients with pathologically proven gastric cancers. CTGA findings were prospectively analyzed and correlated with surgical and pathologic findings. Dual phase scans were performed at 10 seconds (early) and 60-100 seconds (delayed) after injection of 120 ml of contrast medium at an injection rate of 6 ml/s through a preset 5 F catheter positioned in the celiac trunk. Spiral CT scans were assessed for enhancing pattern of the normal gastric wall, tumor detectability, and accuracy of tumor staging.

Results: Normal gastric mucosa was clearly visible as two or three layers in all patients on early phase scan and in eight patients on delayed phase scan. The primary tumors were correctly detected with CTGA in seven (88%) of the eight early gastric cancers and in all 13 (100%) advanced gastric cancers. The accuracy of CTGA for T staging was 50% and 77% in early and advanced gastric cancer, respectively. The overall accuracy for tumor detection and T staging was 95 and 67%, respectively. The accuracy of CTGA for the degree of serosal invasion and regional lymph node metastasis was 77% and 70%, respectively.

Conclusion: CTGA technique improved tumor detection rate and accuracy of tumor staging, especially in early gastric cancer, and could be very useful in the preoperative staging of gastric cancer.

Preoperative staging of gastric cancer: A comparison of helical hydro-CT and endoscopic ultrasound
C.R. Habermann, C. Dieckmann, R. Riecken, F. Weiss, J. Sievers, P. Steiner, E. Bucheler; Hamburg/DE

Purpose: To evaluate the accuracy of Hydro-CT of the stomach in patients with gastric cancer for preoperative staging and to attach its value in comparison to endoscopic ultrasound.

Materials and methods: 45 patients with primary malignant gastric tumors were preoperatively evaluated with helical CT after oral application of water and with endoscopic ultrasound. Each tumor was staged according to the TNM classification and compared with postoperative pathological findings.

Results: The accuracy for T staging with Hydro-CT was 81%, for N staging 69% and for M staging 97%. The results for endoscopic ultrasound were 90%, 75% and 47%. The correct T classification was most difficult for CT in differentiating T2 and T3. If N1 and N2 were considered as a single group, N-stage accuracy increased for Hydro-CT, reaching 71%. Most false positive staging of lymph nodes were caused by enlarged nodes due to inflammation. Three CT's were impossible to evaluate caused by insufficient extension of the stomach.

Conclusion: Helical CT focused on the stomach is an alternative to endoscopic ultrasound and provides useful information to the surgeon.

TN-staging of gastric carcinoma: Accuracy of endosonography, hydro-CT and MRI compared with histologic staging
M. Düx, L. Grenacher, A. Lubienski, C. Kuntz, G.W. Kaufmann; Heidelberg/DE

Purpose: To assess the potential of Endosonography (EUS), Hydro-CT (HCT) and Magnetic Resonance Imaging (MRI) for the preoperative TN-staging of gastric carcinoma.

Methods and materials: 36 patients with gastric carcinoma were preoperatively examined by EUS and HCT and Magnetic Resonance Imaging (MRI) for the preoperative TN-staging of gastric carcinoma.

Results: The location of tumor was gastric antrum in eight cases of 14 EAS, but gastric body or fundus in all of 15 MST (p = 0.0007). US and CT showed an exogastric mass with a variable degree of internal necrosis in all of EAS and MST. On CT images, thickening of the gastric wall adjacent to the mass appeared in ten of 14 EAS (71.4%), but it was not seen in all of 15 MST (p = 0.000). Lymph node enlargement was seen in seven of 14 EAS and in three of 15 MST (p = 0.05). Discrepancy US and CT findings of necrosis appeared in EAS (p = 0.0077), but they were not seen in MST (p > 0.05).

Conclusion: Antral location, thickening of the gastric wall adjacent to an exogastric mass, and discordant images between US and CT are typical of EAS, and allow distinction between EAS and MST.

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H.S. Kim, J.C. Choi, J.A. Choi, C.M. Park, I.H. Cha; Taejon/KR, Seoul/KR

Purpose: The purpose of this study was to evaluate the utility of dual-phase spiral CT during gastric arteriography (CTGA) in the preoperative staging of gastric cancer.

Materials and methods: We performed CTGA in 21 patients with pathologically proven gastric cancers. CTGA findings were prospectively analyzed and correlated with surgical and pathologic findings. Dual phase scans were performed at 10 seconds (early) and 60-100 seconds (delayed) after injection of 120 ml of contrast medium at an injection rate of 6 ml/s through a preset 5 F catheter positioned in the celiac trunk. Spiral CT scans were assessed for enhancing pattern of the normal gastric wall, tumor detectability, and accuracy of tumor staging.

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Conclusion: CTGA technique improved tumor detection rate and accuracy of tumor staging, especially in early gastric cancer, and could be very useful in the preoperative staging of gastric cancer.

Efficacy of MRI in determining tumor size and local expansion of gastric carcinoma
L.M. Portnoi, L.B. Denisova, V.O. Neledova, G.A. Shashuk, V.A. Isakov, I.A. Kazantseva, S.E. Dubrova; Moscow/RU

The aim: To evaluate the accuracy of MRI in determining tumor size and local expansion of gastric carcinoma.
Materials and methods: 24 gastric cancer patients, who’s diagnosis was confirmed by conventional radiology, endoscopy, CT and histology were included into the study. Final diagnosis was provided by macro- and microscopic study of surgically removed stomach. Patients drank 600-800 ml of water just before MRI examination. MRI examinations were performed on a 0.5 T GE Sigma contour. Axial, sagittal and coronal T1-SE (TR/TE = 60/460 ms), T2 FSE (TR/TE = 3500/96 ms) images were obtained. Slice thickness was 8-10 mm, matrix was 256 x 192.

Results: MRI correctly diagnosed 28 gastric cancer limited by gastric wall and revealed 3 tumors spread into perigastric space. The sizes of the tumors were correctly defined by MRI in 2/3 of proximal cancers in cardia. 6/6 in the body and antrum of the gastric diseases. which diagnosis was confirmed by conventional radiography, endoscopy, CT and histology were included into the study. Patients drink 600-800 ml of water just before MRI examination. MRI examinations were performed on 0.5 T GE Sigma contour. Axial, sagittal and coronal T1-SE (TR/TE = 60/460 ms), T2 FSE (TR/TE = 3500/96 ms) images were obtained. Slice thickness was 8-10 mm, matrix was 256 x 192.

Results: MRI correctly diagnosed 34 gastric cancers, 2 gastric ulcers, 1 gastric lipoma. MRI showed 2 false-negative results of gastric cancer, and no false-positive results were found in a group of healthy controls. T2-weighted images were optimal for diagnosis of gastric cancer, in which it usually revealed irregular thickness of gastric wall with irregular contour. Sensitivity of MRI was 94.8 % (95 % confidence interval (CI): 82.6 - 99.9), specificity - 100 %, (95 % CI: 78.2 - 100), positive predictive value - 100 % (95 % CI: 90.5 - 100), negative predictive value 88.2 % (95 % CI: 63.5 - 98.5). accuracy - 96.2 % (95 % CI: 87.2 - 99.5).

Conclusion: MRI is highly accurate in diagnosing infiltrating stomach diseases in comparison to a combination of different diagnostic techniques.

Accuracy of MRI diagnosis of diseases of the stomach

L.M. Portnoi, L.B. Denisova, V.O. Neledova, G.A. Stashuk, V.A. Isakov, I.A. Kazantseva, S.E. Dubrova: Moscow/RU

Aim: To evaluate the accuracy of MRI in diagnosis of different stomach diseases.

Materials and methods: Fifteen healthy subjects and 30 patients with gastric diseases, which diagnosis was confirmed by conventional radiography, endoscopy, CT and histology were included into the study. Patients drank 600-800 ml of water just before MRI examination. MRI examinations were performed on 0.5 T GE Sigma contour. Axial, sagittal and coronal T1-SE (TR/TE = 60/460 ms), T2 FSE (TR/TE = 3500/96 ms) images were obtained. Slice thickness was 8-10 mm, matrix was 256 x 192.

Results: MRI correctly diagnosed 34 gastric cancers, 2 gastric ulcers, 1 gastric lipoma. MRI showed 2 false-negative results of gastric cancer, and no false-positive results were found in a group of healthy controls. T2-weighted images were optimal for diagnosis of gastric cancer, in which it usually revealed irregular thickness of gastric wall with irregular contour. Sensitivity of MRI was 94.8 % (95 % confidence interval (CI): 82.6 - 99.9), specificity - 100 %, (95 % CI: 78.2 - 100), positive predictive value - 100 % (95 % CI: 90.5 - 100), negative predictive value 88.2 % (95 % CI: 63.5 - 98.5), accuracy - 96.2 % (95 % CI: 87.2 - 99.5).

Conclusion: MRI is highly accurate in diagnosing infiltrating stomach diseases in comparison to a combination of different diagnostic techniques.
14:00-15:30
Abdominal Viscera (Solid Organs)

SS 1401b
Abdomen - ultrasound

Chairpersons:
M. Claudon (Vandoeuvre-lès-Nancy/FR)
H. Ozer (Izmir/TR)

852 14:00
Impact of intraoperative ultrasound of the liver in the age of magnetic resonance tomography and helical computed tomography

R.W. Proesch, J. Zacherl, P. Pokieser, K.F. Linnau, M. Hörmann, F. Langle, R. Steininger, Vienna/AT

Introduction: Intraoperative Ultrasound (IOUS) proved to be a valuable tool in liver surgery. Aim of the study was to evaluate IOUS in the background of modern imaging techniques as Magnetic Resonance Tomography (MRT) and triphasic Helical Computed Tomography (HCT) in patients with liver tumors.

Patients and methods: Hundred four patients underwent IOUS. Of them 62 preoperatively had HCT, 26 MRT, 24 conventional computed tomography (CCT) and 8 patients had computed tomography with arterial perfusion (CTAP), 37 patients suffered from a primary liver malignancy, 41 had metastatic lesions mainly originating from the colon and rectum. In 12 patients we found benign tumors, 14 patients had another disease. 76 patients underwent the operation in order to treat (resection, chemotherapy or ethanol instillation) a liver tumor, in 28 cases a suspicious lesion was found during operation for another reason.

Results: Overall we detected 42 preoperative unknown lesions with a mean diameter of 12.6 mm by IOUS in 26 % of cases. 16 lesions were malignant (in 12.5 % of patients). In patients in which treatment of the liver tumor was planned (n = 76) additional topoatomic information was gathered by IOUS. The IOUS result led the surgeon to change the operative strategy in 38.6 % (in 26.3 % against resection, in 10.5 % in favour of resection). The rate of lesions firstly detected by IOUS (NLR) was very high when only CCT (40 %) or HCT (34.1 %) was used for preoperative staging. NLR after staging with MRT, HCT + MRT or CTAP was 16.7 %.

Conclusion: The modern imaging technologies HCT and MRT improved staging of liver tumors. Even after modern preoperative staging IOUS offers additional information in an important proportion of patients and remains an unrenounceable tool in liver surgery.

853 14:10
The benefits of tissue harmonic imaging in the evaluation of abdominopelvic lesions

C. Yuzel, H. Ozdemir, E. Asik, Y. Oner, S. Isik; Ankara/Tr

Purpose: To compare tissue harmonic imaging and conventional sonography and determine if tissue harmonic imaging improves image quality and helps in lesion characterisation.

Materials and methods: This study was carried out between June-September 1999. During this period 90 various abdominal or pelvic lesions detected in 71 randomly selected patients were evaluated with both conventional ultrasonography and tissue harmonic imaging. Images were obtained by an ATL HDI 5000 ultrasonography device and its C5-2 probe which is capable of scanning between 2.5 MHz. Both conventional and harmonic images were stored on the hard disk and all the images were separately interpreted concerning image quality and lesion characterisation by three radiologists who had at least four years experience in ultrasonography.

Results: According to different interpreters tissue harmonic imaging improved overall image quality in 67 (74 %), 73 (81 %) and 76 (84 %) of the lesions respectively. Also it helped lesion characterisation in 28 (31 %), 28 (31 %) and 36 (40 %) of the lesions.

Conclusion: Tissue harmonic imaging improves overall image quality and helps lesion characterisation. In our experience the most useful aspects of tissue harmonic imaging were easier differentiation of solid versus cystic structures and accentuation of acoustic shadows behind stones.

854 14:20
Tissue harmonic imaging and conventional imaging in abdominal examinations

C. Kessler, M. Jenett, M. Hohmann, M. Koberle, D. Hahn, Würzburg/DE

Purpose: Tissue Harmonic Imaging (THI) is an optional system feature that improves the image quality in patients who are difficult to image by increasing the contrast resolution and decreasing the image artifacts. Aim of this study was to obtain a higher diagnostic confidence by THI.

Methods and materials: 150 patients as well as 50 patients who were difficult to image by conventional ultrasound (CU) because of e.g. obesity, hypertrophic muscles or noise artifacts were investigated with both CU and THI. The patients were examined in a standardized manner and the images were digitally archived. The images were reviewed independently by three readers, experienced in ultrasound and the images were graded according to an individual score.

Results: THI increased the differentiation of solid and liquid structures e.g. complicated cysts, little ascites. Pathological findings within liquid structures were easier to verify by THI than by CU. Lesions of liver and kidney as well as lymph nodes could be imaged with higher specificity by THI. In 93 % of the patients the image quality was better by THI than by CU and it was easier to obtain a definite diagnosis.

Conclusions: THI is a feature which results in a higher diagnostic confidence than CU and eliminates the need for other methods of examination involving CT and MRI.

855 14:30
Does tissue harmonic imaging improve sonoographic image quality and detection of pathologic findings?

S.I. Filimonow, J. Petersen, M. Bollow, C. Enzweiler, T. Wiese, B. Hamm; Berlin/DE

Purpose: To compare fundamental gray-scale sonography with Tissue Harmonic Imaging (THI).

Methods and materials: Using Sonoline Elegra (Siemens) and transducers of 3.5 MHz and 7.5 MHz 44 patients (27 with and 17 without pathology) were examined. The resulting 88 sono graphic images (44 with and without THI respectively) were reviewed by 5 experienced blinded observers (single images as well as matched pairs). Overall image quality was rated (score 1-5). Diagnostic confidence was assessed (score 1-5), and it was recorded whether or not the readers preferred the THI image to the corresponding fundamental image. The results were assessed by means of McNemar- and Mann-Whitney-Test. A ROC-Analyse was performed.

Results: The image quality of THI-Images was significantly higher than that of fundamental images (p < .01). The confidence in detection or exclusion of pathology was increased significantly (p < .01) by using THI. In 87 % of the cases THI images were preferred to fundamental sono graphic images.

Conclusion: Tissue Harmonic Imaging is superior to fundamental sonography in terms of image quality and detectability of pathologic findings.

856 14:40
Project graph technique for time management in abdominal ultrasound examinations

U.K.M. Teichgräber, T. Benter, L. Klühns, R.J. Schröder, B. Dörken, R. Felix; Berlin/DE

Purpose: The time required for ultrasound examinations is considered too short by insurance companies. To find out the minimal examination time to perform an ultrasound exam a project graph technique was applied.

Methods and materials: Time measurements of abdominal ultrasound exams were performed by two independent observers. The different jobs for the performance of an ultrasound examination were determined and the critical pathway method applied. The total slack of abdominal ultrasound examinations was determined, the minimal time to perform each job was measured and the critical pathway was calculated.

Results: There were 14 different jobs identified to complete one abdominal ultrasound exam. The project graph displayed the shortest possible time of 24 minutes to perform an ultrasound examination. The pure ultrasound exam ("hands on the ultrasound probe") was 6 minutes. The jobs of the physician were completely on the critical pathway. As consequence the physician had no slack related to an total time of 24 minutes for an ultrasound examination, in contrast there is a total slack of 7.5 minutes for the nurse.
Conclusion: The applied project graph technique is an effective instrument for the purpose of quality management for hospitals as well as private practices. The workflow and actions which are necessary to be done to perform an treatment or examination can be analyzed. Human resource management and cost planning should be performed based on project graphs.

857 14:50

Three-dimensional ultrasonography in the evaluation of the hepatobiliary system
S. Catt, D.A.B. O'Dwyer, S. Fanfani, A. Fanfani, F. Frosini; PratoIT

Purpose: To determine the applications of 3DUS in diagnosing hepatobiliary pathologies.

Methods: In two years we examined 200 patients presenting with hepatobiliary diseases using a Kretztechnik 5300 US system.

Results: 3DUS accurately estimates gallbladder volume used to diagnose cystic duct syndrome or spasm of Oddi's sphincter. Reslicing 3D volumes to visualise diseases using a Kretztechnik 5300 US system. Should be performed based on project graphs.

Conclusions: 3D volumetry allows precise quantitative and qualitative demonstration of gallbladder dysfunction. 3DUS is an important adjunct in ultrasonography because the coronal plane adds diagnostic information to: (1) ultrasound beam attenuation by gallstones, assisting in prediction of gallstone composition; (2) location and number of gallstones within the biliary tract, especially within the cystic duct and prepyloric section of the common bile duct; (3) visualisation of neoplasms, especially papillary carcinomas. 3DUS angiography is expected to improve diagnosis of liver masses. It may be enhanced by use of contrast media and second harmonic imaging. 3DUS improves the diagnostic accuracy of bi-plane ultrasound reducing the need for invasive and expensive diagnostic procedures.

860 15:20

Contrast enhanced ultrasound: Value of a new diagnostic technique - flash echo imaging - in the diagnosis of hepatic hemangioma
L. Panetti, G. Mareasca, M. Salcuni, C. Martinoli, A.M. Da Geta
ciI'; S. Marrazzo', V. Summaria'; 'CastronovisIT, 'RomeIT, 'ChietiIT, 'GenoaIT

The aim of the study was to evaluate the diagnostic possibilities of contrast enhanced ultrasound in liver hemangiomatosis using the new technique named Flash Echo Imaging (FEI), which was a new development of the techniques used to evaluate the contrast enhancement agents.

Material and methods: 15 patients with hepatic lesions suspected for hemangiomatosis were studied using the FEI technique, now available in the software of the Toshiba PowerVision 6000 equipment, during bolus injection of ultrasound contrast agent Levovist (Schering AG Berlin, 300 mg/mL). The diagnosis of hemangiomatosis was confirmed in all patients by TC or MR.

Results: The FEI technique allowed to evaluate the dynamic distribution of contrast agent in the lesions as well as in the normal liver parenchyma, showing a significant delay in the hemangiomatosis perfusion compared with the normal parenchyma. Furthermore a significant persistence of contrast agent in the blood pool of the hemangiomomas was observed in most of the cases. Some lesions showed in the latest phase of the study a small arteriolar afference. According to the vascular nature of the hemangiomas, which blood flow is very low, and its TC and MRI typical patterns after contrast enhancement these findings seem to be diagnostic and specific of hepatic hemangioma lesions.

861 14:00

Multi-row helical CT angiography: Display of aortic dissections
T.R. Fleeter, D. Boll, D. Pless, G. Schmid, J. Goerich, H.-J. Brambs; UlmDE

Purpose: To introduce a fast and simple scanning method for the detailed display of aortic dissections and the involvement of peripheral arteries.

Method and materials: Multi-Row-Helical CT was performed in patients with aortic dissections. All dissections were primary diagnosed by using dual-row-helical CT (Picker Twin RTS, USA) The follow-up studies were performed with a four-row-helical CT (Picker MX8000, USA). Slice thickness was 2.5 mm, pitch was 0.875

859 15:10

Hepatic vascular transit time analysed using bolus injections of ultrasound contrast: Work in progress on the potential utility in detection of occult liver metastases in colon cancer
C.J. Harvey, M.J.K. Blomley, D.O. Cosgrove, R.J. Eckersley, R. Heckemann, J. Butler-Barnes; LondonGB

Purpose: Previous studies have shown that early enhancement (rise time ~10% above baseline; controls greater than 24 s) and an early enhancement index EEl (ratio of intensity at 30 s to peak intensity; controls less than 36%) of the intensity of the hepatic Doppler signal after Levovist (SHU 508A, Schering AG, Germany) is a sensitive marker for liver metastases. The aim of this study was to see whether these indices can be used to stage liver involvement in colorectal cancer.

Methods: 31 patients with proven colon cancer (22 male; age range 56-78 years, mean 66 y) were studied preoperatively. 2 g bolus injections of Levovist were given with a 10 ml saline flush. Using an HDI 5000 ultrasound system (ATL Inc, Bothell, WA) spectral Doppler intensevity recordings were obtained from each visualised hepatic vein (121 curves were analysed). Time intensity profiles were calculated for 180 s after injection and an exponential smoothing algorithm applied. The rise time and EEl were calculated by 2 independent readers. Data for the most abnormal hepatic vein trace (ie earliest rise) were compared with dual phase helical liver CT data obtained at the same attendance.

Results: CT showed overt metastases (n = 13), 'clear' livers (n = 13) and indeterminate lesions (~ 1 cm) (n = 5). The mean rise time for patients with overt metastases was earlier at 16.5 s versus 29.5 s for 'clear' livers (P = 0.004, 2 tailed unpaired t-test). The mean EEl for overt metastases was higher at 68% compared to 27% for 'clear' livers (P = 0.003, 2 tailed unpaired t-test). All but one of the overt metastases group showed an early rise time (~ < 24 s). The 'clear' liver and indeterminate lesion groups were subdivided on the basis of rise time into early (~ > 24 s, n = 8) and late (~ > 30 s, n = 10). Data from follow-up CT is awaited to see if these indices prove a predictor for the development of metastatic disease. Good agreement was obtained by 2 blinded readers for rise time (R2 > 0.9).

Conclusion: This simple functional test is a marker of overt liver metastases. Further work is in progress to assess accuracy in the detection of occult metastases.
and 1.25, rotation time 0.75 s for the four-row-CT compared to 5 mm slice thickness and pitch 1.5, rotation time 1.0 s for the dual-row CT for the coverage of the whole aorta and related supraaortic and pelvic arteries. Reconstruction increment was 50% of the slice-width for both systems. Injection rate for intravenous contrast was 2.5 ml/s for overall 140 ml. Initial scan delay was 25 to 35 s. Images were compared according to contrast-enhancement, display of false and true volume, artifacts and perfusion of involved abdominal organs.

Results: The maximum volume coverage during the arterial contrast enhancement was 1440 mm for the four-row CT whereas the dual-row was limited to 850 mm. Therefore it was possible to display the whole aorta with all supraaortic and pelvic vessel as well as femoral peripheral vessels. The connection of the mesenteric and coeliac artery to the false and true volume could be visualized in all cases. There was an increased homogenous contrast enhancement of up to 25% for the four-row helical CT. Due to the delayed third phase the perfusion of the false volume could be identified in all cases.

Conclusion: Multi-Row helical CT offers a more enhanced and detailed display method for the detection of aortic dissection combined with a large volume coverage.

862 14.05
Interactive curved unfolding reconstructions of the aortic arch in CT-angiography of thoracic aortic aneurysms. Role in delivery of endovascular stent grafts
C. Engels, S. Rankin, J.F. Reidy; LondonGB

Purpose: To demonstrate the effectiveness of interactive curved unfolding reformats (ICUR) in CT-Angiography (CTA) of the aortic arch for planning and follow-up of stent graft delivery in thoracic aortic aneurysms.

Patients and methods: 14 patients (8 male, 5 female, mean age 69 years) with complex thoracic aortic disease (7 atherosclerotic, 3 traumatic transections, 1 type B dissection, 1 aorto-oesophageal fistula and 2 pseudoaneuysms) had CTA of the thoracic aorta for possible treatment with transulimal stent graft insertion. 11 patients had CT-follow-up after treatment (mean 85 days). 3 were considered unsuitable and excluded. Axial handycopes were compared with sagital and oblique reformats (MPR) and ICUR for diameters of the aneurysmal necks and the aortic aneurysms, as well as for proximal neck and required stent graft length.

Results: Measurements and documentation of graft position and leak morphology were more reliable with ICUR than MPR. 6 patients had leaks; one, only seen in ICUR, required interventional treatment. 4 supra-aortic arteries were covered (3 left subclavians, 1 CCA) as planned. One patient received a carotid-carotid bypass before intervention.

Conclusion: CUR appear superior to conventional MPR in CT-Angiography before and after endovascular treatment of complex thoracic aortic disease and are recommended for routine.

863 14.15
Detection and treatment of endoleaks following endograft repair of aortic aneurysms
V. Napoli, C. Vignali, M. Ferrari, R. Cioni, P. Petruzzi, S.G. Sardella, M. Di Giuilio, E. Neri, C. Bartolozzi; Pisa/IT

Purpose: To compare sensitivity and specificity of Doppler ultrasound study (DUS) and spiral CT scans in the diagnosis of endoleaks after stent-graft repair of abdominal aortic aneurysm.

Methods: Thirty-three patients with abdominal aortic aneurysm were treated by endovascular graft-stenting. One-hundred eleven DUS and 79 spiral CT were compared within a 6 months follow-up. Videotaped DUS were retrospectively reassessed for imaging of aneurysm sac and stent-graft with B mode, both conventional and power DUS of pergraft endoleaks, velocimetric analysis of different types and sites of endoleaks and M mode pulsatile wall motion of aneurysmal sac in case of leakage.

Results: CT showed 5 endoleaks: 4 combined types I and II, 1 type I. Sensitivity, specificity, positive and negative predictive values of DUS compared with CT were respectively 80%, 100%, 100%, 98%, with 1 false negative. Velocimetric analysis demonstrated retrograde high velocity flow outside aneurysmal sac in three cases of combined endoleak and antegrade low velocity flow inside the aneurysmal sac in the type I. Both DUS and CT studies showed the site of endoleak. Angiographic treatment (one embolization and one aortoplasty) was performed in 2 patients.

Conclusion: DUS studies had lower sensitivity than CT in detecting endoleaks. Velocimetric studies were helpful to depict type I and II and to select patients for angiography in combined endoleak.

864 14.25
Aortic arch length measurements for endovascular repair of abdominal aortic aneurysms
M. Tillich, G.D. Rubin, K. Petz, B. Hill, D.S. Paik, S. Napel, C.K. Zarin; Stanford, CA/US

Purpose: To determine the accuracy of helical CT, projection arteriography, and intravascular ultrasound withdrawal (IWL) length measurements for predicting appropriate aortoiliac stent-graft length.

Materials and methods: Helical CT data from 33 patients were analyzed both before and after endovascular repair of abdominal aortic aneurysms. The length of the median luminal centerline (ML) and the shortest path that remains one common iliac artery radius away from the vessel wall (SL) were calculated from the lower renal artery to the common iliac artery bifurcation. Conventional angiographic measurements were calculated from CT data as the length of the 3-D ML projected onto four standard viewing planes (PML). These predeployment lengths as well as IWL, available in 24 patients, were compared to the aortoiliac length following stent-graft deployment.

Results: The mean absolute error of SL, ML, the maximum PML, and IWL were -2.0±0.5 mm (p < 0.05), 9.8±7mm (p < 0.001), -5.2±8mm (p < 0.001), and -14.1±9mm (p < 0.001), respectively. The percentage of patients with predeployment prediction within seven millimeters of the postdeployment result was 94% (31/33), 52% (17/33), 55% (18/33), and 17% (4/24) for the SL, ML, maximum PML, and IWL, respectively.

Conclusions: The shortest aortoiliac luminal path length that maintains one radius distance from the vessel wall predicts stent-graft length most accurately.

865 14.35
Iliac arterial dissections after endovascular treatment of abdominal aortic aneurysms: Correlation with iliac curvature and arterial diameter
M. Tillich, D.S. Paik, S. Napel, G.D. Rubin; Stanford, CA/US

Purpose: To evaluate the role of iliac curvature and iliac diameter in patients with iliac dissections after endovascular repair of abdominal aortic aneurysms.

Materials and methods: Postdeployment helical CT data from 42 patients were analyzed and divided into a group with iliac dissections, and a control group without dissections. Quantitative analysis of the iliac curvature and the iliac arterial diameter was performed on predeployment helical CT scans, in all patients. The curvature (K), defined as the inverse of the radius of curvature, was calculated for every millimeter along the median luminal centerline of the iliac arteries. Iliac curvature was quantified as the sum of the curvature values for all points with curvature ≥ 0.03. The location of the greatest curvature and the minimum arterial diameter were evaluated and correlated to the presence of the dissection.

Results: Eighteen dissections were detected in 15 patients. Iliac curvature was significantly larger in the group with iliac dissections than in the non dissected contralateral site (3.55±2.08 versus 2.61±2.1, p < 0.05), and in the control group (2.0±0.9 p < 0.05). There was no correlation between iliac diameter and the presence of dissection.

Conclusion: Quantification of iliac curvature may enable prediction of iliac arterial dissection following endovascular device insertion.

866 14.45
Presurgical evaluation of abdominal aortic aneurysms: Role of spiral CT angiography
O.F. Podezhnokova, V.M. Tcheremisin, A.A. Erofeev; St. Petersburg/RU

Purpose: The aim of the work was to determine the possibilities of spiral CT angiography (SCA) in complex presurgical radiodiagnosis of abdominal aortic aneurysms (AAA).

Materials and methods: 42 patients with AAA were studied. Ultrasound, transfemoral angiography, SCA were performed in all patients. CT data were computed to 3D imaging and maximum intensity projection (MIP).

Results: SCA allows to diagnose AAA, to assess their size, extent and diameter and to clarify the relationships to the aortic branches, thus influencing the choice of the surgical approach. The status of the aorta proximal to the aneurysm was evaluated for preoperative selection. Distal portions of the aorta and of other large vessels located below the aneurysm were evaluated with the aim to determine the possibility of their potency after surgery. Calcinosis was detected, the degree of narrowing of the lumen of the aorta and of its branches was measured. The presence of the accessory renal arteries was confirmed in several cases. Thrombotic masses were revealed and evaluated.

Conclusions: SCA meets all the diagnostic requirements before surgical treatment of patients with AAA. It allows to reduce the cost and awareness of the examination and to determine the status of the adjacent structures.
Methode and materials: Following a test bolus injection of 16 ml of iodinated contrast medium injection parameters for CT angiography (CTA) to obtain uniform opacification of the aorta and iliac arteries within and between patients.

Methods and materials: Following a test bolus injection of 16 ml of iodinated contrast medium injection protocol (120 ml; 4 ml/s) was applied, using a delay time determined from the peak of the time-attenuation curve. In the other 16 patients (group 2) a mathematical technique, based on Fourier deconvolution was used to compute optimized biphasic IV contrast medium injection protocols. Attenuation uniformity was quantified in each patient as the plateau deviation of the 30 time-contiguous attenuation values from the mean enhancement during the scanning period. Intereindividual variation was expressed as the within-group variance of mean enhancement.

Results: Group 2 patients received individual doses ranging from 71 - 160 ml (mean: 115 ml) with calculated biphasic protocols indicating a mean initial flow rate of 7 ml/s (range: 5-10) for the first 4-6 seconds, followed by a mean maintenance flow rate of 3 ml/s (range: 2.5-5) for the remaining 24-26 seconds. Significantly greater uniformity of enhancement was achieved with group 2 versus group 1 with a plateau deviation of aortic enhancement of 19 versus 38 HU, respectively (p < .001). Intereindividual variance was not significantly smaller in patients of group 1 compared to group 2.

Conclusion: A tailored biphasic injection protocol (high initial flow, low maintaining flow rate) and individual dosing of contrast medium leads to a more uniform enhancement.

868 15:00
Comparative analysis of helical CT angiography versus MR angiography in the pre-operative assessment of abdominal aortic aneurysms with surgical correlation

B. Lucay, J. Thornton, J. Varghese, P. Haslam, F. McGrath, M. J. Lee, Dublin/IE

Purpose: To compare helical CT angiography with MR angiography in the preoperative assessment of patients with abdominal aortic aneurysms (AAA).

Methods and materials: 30 patients (M:F 20:10, age range 56-80 years, mean 66 years) had pre-operative helical CT (120 ml of 300 mg% iopamidol at 2.5 ml/s, 20 s delay, 8 mm slice thickness, pitch 1.5) and MR angiography (1.5 T GE unit, TR/TE: 10.3/1.945, FOV 48 cm, matrix 256x128, 1 NEX and 28x3 mm slices in 32 seconds, dynamic injection of 0.3-0.5 ml/mo/kg gadobutrol). AAA were judged to be infra renal (-1 cm from renal artery), juxta renal (-1 cm from renal artery) or supra renal by two observers in consensus. The superior aneurysm neck and juxta renal were compared with surgical findings (20 patients).

Results: No significant difference was noted in the mean aneurysm diameter (P < 0.01) between MRA (6.02 cm) and CT (6.10 cm) and the mean superior neck length (P < 0.003) between CT (18.13 cm) and MR (17.86 cm). CT accurately predicted iliac involvement in 18 of the 20 patients while MRA accurately predicted iliac involvement in 19 of 20 patients. One AAA which was judged to be infra renal on CT and MRA, proved to be juxta renal at surgery and one AAA which was called juxta renal by imaging was proven to be supra renal at surgery.

Conclusion: Use of MRA and helical CT are equally accurate in the preoperative assessment of AAA.

869 15:10
Fat fast saturation with contrast-enhanced three-dimensional MR angiography

P.R. Hilfiker, J.R. Herfkens, S.G. Hess, M.T. Alley, D. Fleischmann, N.J. Pelc, Stanford, CA/US

Purpose: To evaluate a partial fat saturation technique designed for fast three-dimensional (3D) contrast enhanced magnetic resonance angiography (MRA) and to compare it to non-fat saturation and conventional fat saturation imaging.

Material and methods: Abdominal 3D MRA was performed in 35 patients in the equilibrium phase without fat saturation, with conventional fat saturation and with a fast fat saturation technique. Signal-to-noise (SNR) and contrast-to-noise (CNR) of major abdominal vessels were compared for the three techniques. Vessel conspicuity, edge blurring, motion artifacts and overall image quality were evaluated qualitatively.

Results: SNR of non-fat saturation and fast saturation images were not significantly different. Both fat saturation techniques had a significantly higher CNR between vessels and retropertitoneal fat. Motion artifacts were significantly increased with use of conventional fat saturation, but not with use of fast saturation. Vessel visualization was significantly better with both fat saturation techniques, but apparent blurring of vessel margins was increased. Overall impression with either fat saturation technique was rated as superior to the non-fat saturation acquisition.

Conclusion: Use of fat saturation with 3D MRA increases the contrast between vessels and perivascular tissue. The partial fat saturation technique allows to obtain water specific images within a breathhold which reduces motion artifacts.

870 15:20
Safety and efficacy of standard and triple-dose gadodiamide injection-enhanced MR angiography of the abdomen: A phase III double-blind multicenter trial

S.A. Thurnheer, A. Capelastegui, R.F. Dondelinger, C. Gervas, P. Kato, F.H. Del Olmo, C.N. Ludman, V.M. Sanjuan, R.P. Spielmann, T.J. Vogl, J.P. Pruvo; 1. Vienna/AT, 2.Galdacano/ES, 3.Liege/BE, 4. San Sebastian/ES, 5. Helsinki/FI, 6. Madrid/ES, 7. Nottingham/GB, 8. Valencia/ES, 9. Halle/DE, 10. Berlin/DE, 11. Life/FR

Purpose: To evaluate the efficacy and safety of gadodiamide-enhanced MR angiography at two different dose levels in the assessment of arterial stenoses in the abdomen. Intravenous digital subtraction angiography (DSA) served as a standard of reference.

Methods and materials: In a randomized double-blind multi-center trial, a total of 105 patients with a haemodynamically significant arterial stenosis or occlusion in the abdominal aorta, its major side branches or iliac arteries were randomized to MR angiography using a standard (0.1 mmol/kg) or triple-dose (0.3 mmol/kg) gadodiamide injection ( Omniscan, Nycomed Oslo, Norway).

Results: Both the on-site and independent reader found the highest agreement between DSA and MR angiography for stenoses between 70 and 99 % using a triple-dose regimen. Since the confidence intervals for the mean differences for both dose groups was within the predefined equivalence range of ±10%, MR angiography was considered equivalent to DSA with respect to the assessment of the degree of stenosis (0.3 mmol/kg). The contrast index (CI) proximal to the main stenosis was significantly higher for the triple-dose group (8.37±15.00 and 9.55±15.38 for the 0.1 and the 0.3 mmol/kg group, respectively). The image quality and the confidence in diagnosis increased significantly when using a triple-dose of contrast medium. The overall frequency of adverse events after MR angiography was very low (1.83 %), but was not related to the administration of contrast medium.

Conclusion: The results indicate that triple-dose MR angiography is superior to the standard dose examination for the assessment of arterial stenoses in the abdomen. Regardless of the dose used, gadodiamide injection has shown to be safe contrast medium.

14:00–15:30
Interventional Radiology

SS 1409a
Skeletal intervention and CT-guided biopsy

Chairpersons:
S. Feuerbach (Regensburg/DE)
J.H. Gothin (Gotthenburg/SE)

871 14:00
CT-guided obturator nerve block for treatment of hip pain

B. Amaya, D. Pickuth, M. Okonsiewski, R.P. Spielmann, S.H. Heywang-Köbrunner; Halle/DE

Purpose: The obturator nerve block is a time-consuming procedure if performed without guidance. So far the procedure has not been widely used for treatment of chronic hip pain. We describe a simple and fast procedure for an obturator nerve block under CT-guidance.
Patients and methods: 34 chronically ill patients with osteoarthritis underwent 38 CT-guided obturator nerve blocks. 16 ml lidocaine 1% mixed with 2 ml lipomed 300 were injected into the obturator canal. The patients were followed up to 9 months after the intervention.

Results: In 68% pain relief was achieved. Little pain relief (1 week) was encountered in 6%, complete pain relief 2-4 weeks in 35% and 3 weeks-more than 9 months in 27%. The procedure took 15 minutes in average.

Conclusion: The reasons for a midterm or even long-term effect based on a single injection of local anaesthetic are not exactly known. The CT-guided block of the obturator nerve is a fast, easy and safe procedure that appears useful for midterm (months) and sometimes even long-term treatment of hip pain.

872 14:10
CT-guided, percutaneous radiofrequency thermoacoagulation of the cervical zygapophysial joint by cervical pain syndrome
A. Gevargis, D.H.W. Grönnemeyer, M. Matysek, Bochum/DE
Purpose: The purpose of the study is to evaluate CT-guided percutaneous radiofrequency thermoacoagulation for the treatment of nonradicular cervical pain, due to zygapophysial joint arthropathy, when CT-guided percutaneous injections of steroids and local anesthesia were of only temporary success (43 of 186 patients).

Material and methods: Patients are placed on the CT table in prone position. The 23-gauge insulated canula (Leibinger-Germany) is advanced vertically lateral to the zygapophysial joint under CT-guidance, to lesion the capsule and lateral branch of the posterior primary ramus leaving the spinal nerve. Then we replace the canule on the posterior border of the joint with bone contact to lesion the medial branch of the posterior primary ramus. Coagulation duration is 90 seconds with 60℃ temperature. The treatments are without any heavy sedation or general anesthesia. There were no cases of postoperative complications such as infection or anesthesia dolorosa.

Results: 78% of the 43 patients obtained excellent and good results pain relief and were able to resume their activities of daily living. 22% obtained only a fair or poor result for a period of over 6 months due to an visual analog scale.

Conclusion: The CT-guided percutaneous radiofrequency neurotomy is an efficient, precise, careful and safe method to treat the nonradicular chronic cervical pain syndrome.

873 14:20
CT-guided minimal invasive therapy of disc disease and vertebrostenosis
W. Köps, A. Abdelrahims, D. Tscholakoff, Vienna/AT
Introduction: The growing number of patients with disc disease and/or vertebrostenosis without immediate indication to surgery causes an increasing need for prophylaxis and rehabilitation, especially methods for pain reduction. In this case minimal invasive therapy, above all the periradicular therapy (PRT) as well as the epidural sacral infiltration (ESI) have been developed for an important complement of the conservative pain therapy. Aim of this study was to evaluate the effectiveness of CT-guided therapy combined with concurrent physiotherapy and magnetic field therapy.

Methods and materials: We carried out CT-guided PRT and/or ESI on patients with radicular symptoms and CT-or MR-proven thoracic or lumbar disc herniation, and on patients with claudicatio spinalis with CT-or MR-proven lumbar vertebrostenosis. The patients referred from neurosurgery had either no primary need for surgery or had a history of multiple disk operations with chronic pain. The CT-guided interventions were performed in prone position using a 22 Gauge fine needle. During the PRT and ESI a solution of 2:1:0.5 parts of local anesthetic (Carbostesin 0.5%), cortisol (Celestan blphase) and contrast agent was applied according to Fairbank et al. The evaluation of technical success occurred by review of the CT examinations.

Results: We performed 25 CT-guided interventions (11 ESI, 14 PRT) on 13 patients (9 women; 4 men). 6 patients showed a significant pain reduction according to the Visual Analog Scale and an improvement of daily life activities after the Oswestry-Score. In 5 patients only small improvement was noted (1 of them needed surgery). In 2 patients an increase in pain and a degradation of the Oswestry-Score was observed (1 of them needed surgery). On CT the position of the needle tip and the spread of the medical solution could be localized precisely, reducing the necessary dose of local anesthetic and cortisol significantly. There were no complications in any case.

Conclusion: CT-guided minimal invasive therapy of disc disease and vertebrostenosis combined with concurrent physiotherapy and magnetic field therapy is an effective and standardized procedure to treat patients in an atraumatic way without any complications.

874 14:30
CT-guided periganglionic steroid treatment and pain relief in patients affected by sciatalgia
L. Manfà, F. Bencivinna, A. Caronia, C. Duranti, G. Manasia, S. Caruso, M. Giardina, R. Lagalla, Palermo/IT
Purposes: The purpose of this was to evaluate the results of periganglionic injection on steroid around the vertebral forominal fat tissue in patients affected by severe back pain and sciatalgia.

Material & methods: 68 patients affected by left and/or right sided sciatalgia related to several abnormalities (i.e. disc emation, spondylosis, post-operative epidural scar), who previously underwent CT and/or MR study of the lumbar spine, underwent periganglionic injection of 2 cc (80 mg) of Depomedrol® using a 20 G Chiba needle, with no administration of sedative, anesthetic or contrast media agents.

Results: Back pain and sciatalgia before and 3 months after the treatment were graded according to the Oswestry low back pain disability questionnaire.

Conclusion: CT-guided periganglionic steroid treatment seems to be a minimal invasive solution to solve peripheral radicular pain in patients affected by foraminal stenos, disc emiation or epidural scar.

875 14:35
CT-guided, minimal-invasive osteosynthesis of the calcaneus: Feasability of a new technique and initial results
H.M.A. Häuser, E. Mayr, K. Bohndorf, A. Rüter, Augsburg/DE
Purpose: To evaluate feasibility and preliminary technique as well as clinical results of intraoperative CT-guided osteosynthesis of complicated calcaneus fractures.

Method/material: 12 patients underwent CT-guided surgery of the calcaneus in a regular operating-room using a mobile CT. The operating-team consisted of one surgeon, radiologist, nurse and technician. Planning and control during the intervention was undertaken by repetitive CT examination (5 mm scans, 10 mAs, 120 kV). As surgical technique only minimally-invasive method with fixateur externe (distraction and fracture-reposition), percutaneous k-wires and screws (fragment adaption and fixation) was used. All patients were followed clinically for 1-12 month (5.5 months).

Results: All calcanei were successfully reconstructed, the patients could be mobilised after one day; no delayed fracture healing occurred. Scans per intervention: 58-185 (mean 112) with overall 1245-3765 mAs (mean 2638 mAs). Mean time for CT-installation in the operating-room 20 min, mean duration of intervention 114 min (76-155 min).

Conclusion: CT-guided minimally-invasive surgery of intraarticular calcaneal fractures seems to be a promising modality. The combined approach of surgery and radiology was of special value.

876 14:40
First experience in 35 patients with laser guided punctures under CT fluoroscopy control
M. Qitreb, J.H.W. Hout, Almelo/NL
Purpose: This study was performed to evaluate a new device for CT-guided punctures. The primary goal was to develop a practical working method with knowledge of potential sources of error. The secondary goal was to assess efficacy in patients.

Materials and methods: A spiral CT scanner (Elsiact) equipped with CT-fluoroscopy and a laser guide was used. Two observers performed 50 punctures of point-like targets in a silicon phantom at different depths and angles and under conditions simulating patient motion and respiratory data. The device was then used in 35 patients for different interventions.

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Results: After laser-guided introduction of the needle, CT-fluoroscopy was used to advance the needle tip to the target. In the phantom, all punctures ended within 2 mm from the target, indifferent of the angle of introduction. Cranio-caudal angulations could only be used after manual correction of the device. In patients, all operators obtained good results. CT-fluoroscopy enabled better controlled interventions, but corrections after needle introduction were not possible. The main sources of error seemed due to patient motion, needle bowing and positioning the needle tip behind the target.

Conclusion: When a standard working method with knowledge of error sources is used, laser guidance and CT-fluoroscopy are useful tools for interventions.

877 14:50
CT fluoroscopic versus conventional CT guided percutaneous puncture: A phantom study
R. Kuckith, J. Kirchner, U. Lauffer, F. Donnerstag, D. Liermann; Bochum/DE
Purpose: Computed tomography fluoroscopy (CTF) has been increasingly used in interventional procedure. We performed a phantom study to check the handling and usefulness of CTF in comparison to conventional CT guided puncture.

Material and methods: The punctures were performed on a CT guidance system (Somatom Plus 4 Power, Siemens Corp., Forchheim, Germany) allowing real-time CT (120 kV, 50 mA, slice thickness 8 mm, TI 0.75 s) with up to 8 frames per second on a matrix of 256x256. Image reconstruction is based on a partial scan, i.e. 240°, with a 0.5 s acquisition time. By means of a foam phantom, 2 experienced and 2 unexperienced colleagues punctured in CTF and in conventional technique using varying angles in single and double angulation.

Results: There was a low significant difference in the number of trials between CTF and conventional guided puncture for inexperienced puncturers but not for experienced puncturers. The time of examination was shortened by CTF, but the applied dose was increased with the exception of unexperienced puncturers under difficult conditions.

Conclusion: CTF decreases the time of intervention, but increases the applied dose.

878 15:00
CT guided core-needle biopsy for diagnosis of malignant lymphoma
R. Agid, M. Levi-Skleir, A.I. Bloom, S. Lieberman, Y. Sherman, D. Ben-Yehuda, A. Pollack, E. Libson; Jerusalem/IL

We performed a retrospective study in order to estimate the accuracy of CT guided core needle biopsies for the diagnosis and subsequent treatment of malignant Lymphoma.

Materials and methods: Between 1989 and 1999, 267 CT guided core needle biopsies were performed in 241 patients (120 women and 121 men) with either primary or recurrent malignant lymphoma. Patients age ranged from 4 to 88 years. 156 (58.4 %) nodal biopsies and 111 (41.5 %) extranodal biopsies were performed using either Turner 18 G or 20 G needles.

Results: An accurate histological diagnosis was made in 199 (82.5 %) patients, 17 (7.05 %) of whom required a second biopsy. The remaining 42 (17.4 %) patients had non diagnostic CT biopsies. 37 (15.3 %) of them were diagnosed by a surgical biopsy, 4 (1.6 %) by bone marrow biopsy and 1 (0.4 %) by paracentesis. 179 patients had non Hodgkin's lymphoma and 62 patients had Hodgkin's disease. Of the 37 surgical biopsy patients: 31 had a single CT biopsy prior to surgery, 3 had two, and 4 had three.

In total 23 (9.54 %) patients underwent repeated CT biopsy which was diagnostic in 17 (73.9 %) and non diagnostic in 7 (30.4 %).

Conclusion: The majority of CT guided core biopsies are diagnostic in lymphoproliferative disorders. The results of this study suggest that one repeated CT guided biopsy is recommended before the patient is referred to surgical biopsy.

879 15:10
Navigation system (Navi Ball) for CT-guided punctures
J.M.A. Meyers, T. Schmitz-Rode, G.A. Krombach, J.G. Pfeffer, R.W. Günther; Aachen/DE

Purpose: A new navigation system (Navi Ball) for CT-guided punctures was tested clinically.

Methods and materials: The device consists of a transparent hemisphere with an angulation scale. The hemisphere is fluid filled and contains a bubble indicating the angulation. The system works as a circular spirit level. This allows adjustment of the needle according to the angulation of the planned puncture path as measured on the CT-scans. The system is fixed to the needle and leveled. The system was tested in 20 patients under CT-guidance. The needle deviation was measured in two rectangular planes.

Results: The guidance system allowed rapid and simple performance of the puncture. First-time needle placement in a double angulated approach led to a mean deviation of ±3.6° for each plane.

Conclusion: The guidance system is easy to use by a single operator. Excellent accuracy of first-time needle placement was achieved.

880 15:20
CT-guided Tru-Cut biopsy of the pancreas
B. Op de Beeck, J. De Mey, M. Osteaux; Brussels/BE

Purpose: To evaluate the sensitivity and specificity of CT-guided Tru-Cut biopsy of the pancreas and their complication rate.

Material and methods: 25 patients with pancreatic masses at the level of the head (11), neck (4), body (7) and tail (3) underwent CT-guided Tru-Cut biopsy. Mean diameter of the masses was 4.3 cm (1.0 - 8.5 cm). The approach was transgastric (7), transduodenal (2), transhepatic (3), transsplenic (1) or directly without passage through an abdominal organ (13). Biopsies were performed with a 16- (1), 18- (16) or 20-gauge (8) needle.

Results: No severe punction-induced complications were noticed. 3 small (12 %) and 2 moderate hematomas (8 %) were seen on the post-puncture CT-images. All hematomas resolved spontaneously. 2 patients died respectively 4 and 6 days after biopsy but autopsy showed no relationship. Biopsy was conclusive in 24 patients (sensitivity 96 %). In this group, all malignant (18) and all benign (6) lesions were correctly diagnosed (specificity 100 %). Only one apudoma of 1.0 cm was missed in a patient with known MEN1.

Conclusion: CT-Guided Tru-Cut biopsy is a highly accurate technique to characterize pancreatic masses. After biopsy, small hematomas are not infrequently seen. Special attention should be focused on perigastric varices secondary to obliteration of the portal, mesenteric or splenic vein.

Neuro

SS 1411
Intracranial tumors: Advanced diagnosis
Chairpersons:
H.G. Becker (Hannover/DE)
D.A. Rüfenacht (Geneva/CH)

881 14:00
MRI of cerebral gliomas: Value of diffusion- and perfusion-weighted Imaging
M. Hartmann, S. Heiland, O. Jansen, K. Sartor; Heidelberg/DE

Purpose: To assess the usefulness of diffusion- (DWI) and perfusion-weighted (PWI) echoplanar MRI in the diagnosis and grading of cerebral gliomas.

Methods: 32 patients (21 men and 11 women, age 25 to 65 years) with histologically proved supratentorial glioma (12 low-grade, 8 anaplastic gliomas and 12 glioblastomas) were examined using a 1.5 T superconducting imager. We evaluated the enhancement pattern, apparent diffusion coefficient (ADC) and the maximum regional cerebral blood volume (rCBV) of each tumor.

Results: The ADCs of the low-grade gliomas were significantly higher than that of the anaplastic gliomas ( 0.002) and glioblastomas ( p < .0001). The maximum rCBV in the low-grade group (0.8±0.22) was significantly lower than that of the anaplastic gliomas (4.1±2.2) and that of the GBM (4.6±2.1) ( p = .0002). The difference of the ADCs and of the rCBV ratios of the anaplastic gliomas and GBM were not statistically significant. Two gliomas which were diagnosed as low-grade gliomas due to conventional contrast enhanced MRI had regions of high rCBV corresponding with the histological diagnosis of anaplastic glioma.

Conclusion: DWI and PWI depict areas of high cellularity and of high vascularity, corresponding to the regions of the most cellular proliferation and hypervascularisation. These informations are not obtained with conventional MRI and they offer parameters for assessing glioma grade and regions of focal activity.
882 14:05
Quantitative assessment of perfusion and blood-brain-barrier permeability in brain tumors by MRI
M.J.P. van Cach, E.P.A. Vonken, J. van der Grond, C.J.G. Bakker, M.A. Viergever; Utrecht/NL

Purpose: To report initial clinical experience with a method that allows quantification of the perfusion of CNS-tumors, irrespective of the presence or absence of the Blood-Brain-Barrier (BBB).

Methods and materials: Perfusion is thought to be an important diagnostic indicator for tumors, e.g. for differentiation between necrosis and recurrent tumor. The perfusion can be quantified by the monitoring of the first passage of injected contrast material through brain necrosis and brain-feeding arteries (i.e. arterial input function). By a numerical method we separated the contributions of active perfusion (i.e. transport of oxygen and nutrients) and extravasation of contrast agent, yielding quantitative perfusion maps and an extravasation-image. This method was applied in screening protocols of patients with different grades of enhancing and non-enhancing tumors.

Results: All resulting perfusion maps were in agreement with the findings of conventional MRI and histological grading when available. Correction for the extravasation is essential for Cerebral Blood Volume (CBV) maps and at least theoretically better for Cerebral Blood Flow (CBF) maps. In all patients, the perfusion scan provided additional information like identification of the feeding arteries, hyper-perfused regions and the condition of the newly formed vasculature.

Conclusion: Quantitative perfusion MRI of CNS-tumors is feasible and yields additional information.

883 14:15
Quantification of endothelial permeability, leakage space and blood volume in brain tumors using combined T1 and T2* contrast-enhanced dynamic MR imaging
X.P. Zhu1, K. Li2, I.D. Kamaly-Asl3, D.R. Checkley4, J.J.L. Tessler1, J. Waterton1, A. Jackson1;1Manchester/GB, 2Macclesfield/GB

This study describes a method for imaging brain tumors which combines T1 weighted (T1W) and T2*weighted (T2*W) dynamic contrast enhanced acquisitions. Several technical improvements have been made to produce high quality 3D mapping of endothelial permeability surface area product (k) and leakage space (vi), based on T1W data. Tumor blood volume maps are obtained from T2* weighted images with a complete removal of residual relaxivity effects. The method was employed in 15 patients with brain tumors (5 glioma, 5 meningoima, 5 acoustic schwannoma). Mean values of vi were significantly greater in acoustic schwannomas (53% (9%) than in meningiomas (34% (7%) or gliomas (22% (4%). Mean values of vi in meningoima were significantly greater than gliomas. Mean values of rCBV correlated closely with k. There is also positive correlation between k and vi for pixels with low k values. This relationship was weaker in areas of high k. Highest mean ratio of k to vi, (kep) were seen in 2 patients with glioblastoma, 1 patient with transitional meningoima, 1 patient with angioblastic meningoima. Pixel by pixel comparison showed strong correlation between rCBV and k in eleven of fifteen patients. However, decoupling between pixel-wise rCBV and k was found in four patients who had lesions with moderate k and vi elevation but no increase of rCBV. Results from this study suggest that in assessing the angiogenic activities in brain tumors it is useful to simultaneously monitor changes in tumor blood volume, vessel permeability and leakage space of tumor neovascularature.

884 14:25
Ultrafast 3D quantitative mapping of blood volume and endothelial permeability in brain tumors
K. Li1, X.P. Zhu1, J. Waterton1, A. Jackson1;1Manchester/GB, 2Macclesfield/GB

We present a new method to allow simultaneous mapping of endothelial permeability and blood volume in intra-cranial lesions. The technique was based on a tumour leakage profile during the first pass of contrast bolus, calculated from the time dependent plasma-contrast concentration function (PCCF), in 3D T1 weighted dynamic studies. We described the theoretical basis of the model and implementation of the technique. This new method has been applied to eleven patients with known intra-cranial neoplasms, including 7 gliomas, 4 meningiomas and 1 pituitary adenoma. Diagnoses were histologically confirmed in 9 patients. The performance of the method has been evaluated by comparing results to those obtained from more conventional methods in patients with primary brain neoplasms. Tofts multi-compartment model was used to obtain endothelial permeability maps, surface area product (k) and leakage space vi [6] from T1W dynamic contrast enhancing image data sets. A standard y variate model was used to calculate perfusion parametric maps from T2*WI data. Both maps generated from the new and conventional methods were color rendered to improve the visibility of tumour regions with different permeabilities. Percentage of voxels, rejected from perfusion and permeability mapping, are compared for all tumours. In addition, histograms endothelial permeability values measured from the entire tumour volumes were also compared. Results show that the new permeability maps are visually comparable to those calculated using a conventional multi-compartment model. Quantitative new maps are free from over estimation due to first pass effects. The new blood volume maps, which segment out the contamination of contrast leakage, agree closely with maps derived from susceptibility studies. It is concluded that the new permeability maps are visually compatible with k maps derived from traditional multi-compartment models. However, they have less fitting errors in areas of minimal enhancement and are free from artificial demonstration of high permeability due to large vessels. New tumour blood volume maps separate true perfusion from the contamination of contrast leakage and are comparable to T2*CBV maps obtained after the elimination of T1 relaxivity effect in tumours with disrupted blood brain barrier. The new method is extremely fast, robust and computationally simple. The new method has greater potential in clinical applications than conventional techniques, especially where longitudinal assessment of therapeutic response is required.

885 14:35
Usefulness of diffusion weighted MR with echo-planar technique in the distinction between radiation necrosis and recurrence of brain tumors
A. Luna1, J. Petrella1, L.C. Da Cruz1, J. Provenzale1;1Madrid/ES, 2Dunham, NC-US

Purpose: to describe the role of diffusion weighted sequence in the study of radiation necrosis versus recurrent brain tumors, and in grading the recurrences.

Material and methods: 15 consecutive patients with previous treated brain tumors (14 gliomas and 1 ependymoma) were evaluated using a 1.5 T magnet. All the patients had received radiation therapy. The results of the stereotatic biopsy (9 high grade recurrences, 1 low grade recurrence and 5 treatment related changes) were compared to the apparent diffusion coefficient (ADC) ratio of the lesion and the contralateral white matter. The ADC values were calculated placing ROIs in the areas of suspect (enhancing areas) avoiding cystic or necrotic areas.

Results: there was a clear overlapping in the ADC ratios of the radiation necrosis group and the high grade recurrence group. There was no statistical significative difference (p = 0.63). The radiation necrosis group showed a more homogeneus results than the recurrences but a distinetion was not possible. One limitation of our study was the presence the EPI artifact in the air-bone interfaces and in the areas around the Ommaya reservoir used for lidone-131 labeled antitiascon monoclonal antibodies B1C6 (11 patients).

Conclusions: diffusion-weighted MR with EPI is not able to distinguish radiation necrosis of recurrent tumors.

886 14:45
In vivo NMR 1H spectroscopy for classifying human brain tumors
Y.A. Zozulya, V.A. Rogozhin, Z.Z. Rozhko, O.Y. Chuvashova; Kiev/UA

Purpose: Twenty-six patients with intracranial tumors and five healthy volunteers were examined by magnetic resonance imaging (MRI) and in vivo NMR 1H spectroscopy (MRS) with 1.5 T Magnetom Vision Plus System (SIEMENS). Two patients had metastatic brain tumors, such as adenocarcinoma and small cell carcinoma, eleven of them were diagnosed with glioma-type tumors, twelve - with astrocytoma type tumors and one - meningeoma. The in vivo MRS method was used for more correct diagnosis and for tumor-grade differentiation.

Methods and materials: Localized single-voxel 'H spectra were recorded at number of regions of the tumors: necrosis, centre and peripheral regions, to the control - at sites and at the contralateral hemisphere. All spectra were calculated qualitatively.

Results: Three resonance signals were presented in the spectra. N-acetyl aspartic acid (NAA), choline-containing compounds (Cho) and creatine (Cr). The solid region of all tumors exhibits reducion of NAA, strong contribution from Cho, Ins, Gln, minimal presence of Cr, enhanced broad mobile lipid resonances and accumulation of Lac. For considered classes of tumors the following mean ratios are obtained: 0.63 - NAA/Cr < 1, 1.89 - Cho/Cr < 1 for astrocytoma, 3.73 - NAA/Cr < 1 and 13.65 - Cho/Cr < 1 for glioma and glioblastoma, in particular in active growth region of astrocytoma Cho/Cr'1 and of glioblastoma NAA/Cho < 1, and Cho/Cr', in necrosis and peripheral regions NAA/Cho < 1, Cho/Cr'.

Conclusion: 'H MRS is very useful for a) Characteristics of a brain mass as a neoplasm, b) identification of inactive neoplasms or neoplasms in remission, c) Evaluation of the efficacy of tumor treatment.
Fifteen children with neurofibromatosis type 1 were studied (male: female). Proton spectroscopy was performed using the STEAM technique (TR 25000 ms, TE 20 ms). Spectra were obtained from typical neurofibromatosis bright objects and brain glioma. Magnetic resonance imaging in neurofibromatosis type 1 has demonstrated abnormalities not previously recognised on either computed tomography or pathological studies. The abnormalities appear as regions of T2 prolongation in characteristic sites in the brain. These "neurofibromatosis bright objects" are thought to be a benign, self-limiting phenomenon not seen with typical bright objects and 5/15 had atypical bright objects or brain glioma. Proton spectroscopy showed no new abnormalities in the three major peaks, however there were increased levels of lipid peaks in keeping with myelin breakdown. Atypical bright objects, thought to be gliomas, showed the classic spectroscopic appearance of tumours i.e reduced N-acetyl and increased choline peaks.

Results: Fifteen children with neurofibromatosis type 1 were studied (male: female 9:6) with a median age of 11.2 years. 14/15 children had typical neurofibromatosis bright objects and 5/15 had atypical bright objects or brain glioma. Proton spectroscopy showed no major abnormalities in the three major peaks, however there were increased levels of lipid peaks in keeping with myelin breakdown. Atypical bright objects, thought to be gliomas, showed the classic spectroscopic appearance of tumours i.e reduced N-acetyl and increased choline peaks.

Conclusions: We have shown that magnetic resonance proton spectroscopy can be performed as part of the routine imaging protocol in children with neurofibromatosis type 1. Our early experience shows that both of these methods are useful in distinguishing between neurofibromatosis bright objects and presumed brain glioma.

**889** 15:10

**Does 11C-Seastambini in brain tumours reflect blood brain barrier damage only?**

A. Slauderherz, B. Fazeny, C. Marosi, C. Nasel, S. Puig, M. Miller, T. Leitha; Vienna AT

**11C-seastambini (MIBI) has been successfully applied in recurrent glioblastoma. The aim of this study was to evaluate the incremental diagnostic information of MIBI as tumour-avoid radiopharmaceutical in comparison to 11C-pertechnetate (11Ct) as sole indicator for the integrity of the blood-brain barrier (BBB).**

25 patients with confirmed recurrent brain tumours were included. MIBI SPEET was performed 10 min p.i. of 555 MBq MIBI i.v. with a triple-headed gamma camera equipped with LE-URH-PAR collimators over 360° (3’/step) and stored in a 128° matrix. Identical acquisition parameters were used for 11Ct SPEET, which was acquired 3 hr. p.i. of 740 MBq 11Ct. Normalized tumor uptake (NU) was calculated from attenuation corrected transaxial slices. Additionally tumour/pexus-, tumour/ nasopharynx- and tumour/parotis-ratios were assessed in both studies. No statistically significant differences were found for the mean NU of tumour tissue with MIBI (0.26±0.10) and 11Ct (0.39±0.33) and for the tumour/nasopharynx- and tumour/parotis-ratios, only the tumour/pexus-ratio was significantly higher for 11Ct than for MIBI (p < 0.05).

In conclusion, our data indicate that MIBI scintigraphy in brain tumours at 10 min p.i. reveals no additional visual information over the conventional 11C-pertechnetate brain scan and tracer retention primarily reflects BBB damage.

**890** 15:20

**MR imaging of metastatic disease to the brain with Gadobenate dimeglumine (Gd-BOPTA)**

A. La Noce1, C. Colosimo1, J. Ruscella1, I. Saliero1, M.A. Kirchin1, G. Pirovano2, A. Spinazzi2; 1Milan/IT, 2Barcelona/ES

**Purpose: To evaluate the safety and efficacy of incremental doses of gadobenate dimeglumine for the MR detection of metastatic lesions in the brain.**

**Methods and materials:** A randomized, double-blind, parallel-group study of two incremental dose regimens of gadobenate dimeglumine (regimen 1: 0.05 + 0.05 + 0.1 mmol/kg; regimen 2: 0.1 + 0.1 + 0.1 mmol/kg) was performed in 150 patients with 1 to 8 proven intraxial metastatic lesions to the brain. Efficacy was assessed in terms of lesion-to-brain (L/B) ratio, percent enhancement, number and size of lesions detected, diagnostic confidence and lesion conspicuity. Safety was assessed in terms of AEs, vital signs, ECGs and laboratory parameters.

**Results:** Cumulative dosing in both regimens produced dose-related increases in L/B-ratio and percent enhancement. The first doses of the two regimens led to the detection of additional lesions in 22-29% (regimen 1) and 31-33% (regimen 2) of patients. At the same time diagnostic confidence was increased and lesion conspicuity improved over unenhanced MR. Cumulative dosing in both regimens led to significant improvements in all qualitative parameters. No safety concerns were apparent up to a dose of 0.3 mmol/kg.

**Conclusions:** Gadobenate dimeglumine-enhanced MRI is safe and beneficial for the detection of brain metastases. Overall, regimen 2 appears to provide better results in terms of lesion detection, diagnostic confidence and lesion conspicuity.

**14:00-15:30** Room G

Computer Applications

**SS 1405**

Intranet/PACS/Teleradiology

Chairpersons:

M. Langer (Freiburg/DE)

H. Nishitani (Tokushima/JP)

**981** 14:00

Development of an Intranet-based DICOM server

G. Sprea, A. Caronia, S. Di Benedetto, M. Midini, R. Lagalla; Palermo IT

**Purpose:** To develop an Intranet-based DICOM gateway for image distribution within and outside the radiology department.
Methods and materials: The system is based on a workstation (IBM-compatible) running Windows 95/98 or NT operating system with a world-wide web server software and a DICOM agent software that receives images from DICOM compliant sources (CT, US, MRT, NM). This workstation constitutes the DICOM gateway and the world-wide web server which can be remotely accessed with a client-server world-wide web browser enhanced with a DICOM plug-in enabling the browser to access DICOM images.

Results: Once medical images are sent to the server from any DICOM compliant source, they are stored in full 16 bit uncompressed DICOM format with no loss of information or windowing capabilities and can be easily viewed remotely by using low cost PCs and shareware software. The system serves multiple users simultaneously within and outside our department via world-wide web. Security is provided through user logins and passwords as well as campus firewalls.

Conclusion: The system provides easily and inexpensive distribution of medical images within and outside the radiology department thanks to the DICOM standardization and the world-wide web technology.

892 14:10
Intranet technology in wide area PACS
C. Saccavini, R. Stramare, S. Puggina, C. Dus, G.P. Feltrin; Padova/IT

Purpose: Our aim has been to utilize Hospital Network and World Wide Web technology to create an immediate and effective reports communication system: physicians can follow in real time the radiological reporting courses and access to patients previous reports and images.

Materials and methods: We have published our RIS/PACS database to the computer hospital network (network structured currently managed in Ethernet 10 with TCP/IP) using a common browser (Microsoft Explorer or Netscape Navigator) physicians can access to our Intranet site. An easy graphic interface drives them in patients reports visualizing. We compress images by jpeg algorithm in order to allow the trasmission on the low-band hospital network.

Results: Actually more than 60 clinical departments access to our Intranet site. We have monitored and logged all our site requests: 120 daily accesses have been verified, almost all for an immediate report consultation. It's useful to consult previous reports in our Intranet site rather than consult voluminous clinical folder.

Conclusions: Thanks to world wide web diffusion, this system is easily accessible also to inexperienced computer users. Intranet technology low cost are, on the other hand, not secondary aspects. Security and privacy respect are assured by Intranet technology and smart-cards use.

893 14:20
Intranet based communication of assignments into radiological department and enterprise wide distribution of radiological images and reports.

(Experiences from the RIS-PACS-project at university hospital of Jena)
M. Herzau, T. Azhan, M. Spech, W.A. Kaiser, Jena/DE

Purpose: Implementation of a RIS-PACS-system independent from a modality manufacture company in a heterogeneous background of modalities, workstation, HIS and other departmental applications. Test of an Intranet based solution for communication of assignments, and the enterprise wide distribution of radiological images and reports.

Methods and materials: Draft and Implementation of a PACS-System, which carry out these requirements:
- independent from a modality manufacture company
- apply to the DICOM-standards and HL7
- integration of RIS as the master-system.

The interface between HIS and RIS was developed as a bi-directional HL7-based communication. For communication with departmental applications we tested an alternative intranet based communication.

Results: We accomplished an integrated solution, which is flexible useful for every clinical department. The requirements for hard- and software are low-cost and platform independent. Management of authorization and patients administration is fully regulated by HIS. Radiological images are linked to corresponding radiological reports. Several states of reports are supported. Further improvement of workflow depends on departmental applications.

Conclusion: The use of modern Web-technologies means a conscious argument with a dynamical process. Solutions in a heterogeneous background are possible and very flexible, if all components are up to date. There is the demand to improve this trend.

894 14:30
PACS-image distribution: Policies, technical solutions, applications and results
G. Gelt; Graz/AT

Purpose: Digital modalities, networks and PACS provide the technical possibility to distribute radiological images immediately to all parts of the hospital. It was our purpose to explore these possibilities in a way, that creates a consensual cooperation of radiologists and clinicians to improve the quality of patient care.

Methods and materials: The Graz University Hospital runs a large PACS, linked to a RIS. To implement image distribution the following modules have been implemented:
1. Establish a procedure for consensus finding between radiologists and clinicians. This ranges from a request form in normal cases (image distribution together with radiological report) to the setup of a small working group to establish individual distribution policies.
2. Development of DICOM compatible software for image distribution and image viewing, where the RIS is responsible for implementing the filters for the distribution policies.

Our PACS is Siemens-Siemet, the RIS was developed in house and is called AURA and we have connected modalities from multiple vendors.

Results: Today there are approximately 200 PCs to run the image viewing software (PACS-View) and the Department of Radiology has distribution agreements with 28 clinical departments. The services are very well accepted for simple image viewing as well as for secondary image processing, e.g. for stereotactic surgery, surgical navigation, 3D models in maxillofacial surgery etc.

Conclusion: Image distribution in digital form is a logical (and inevitable) step in the development of radiology. Radiologists should take a lead to develop this as a service to clinicians in a consensual way to serve the interest of patient care.

895 14:40
Enterprising radiology: Regional PACS - why and how
F.E. Lindhardt; Viborg/DK

Purpose: Joining of the radiology departments at the 5 hospitals of Viborg County into one organization and one virtual department. Reasons are 1) a political demand: more streamlined health services; 2) economical: better exploitation of doctors' time and fewer nightduties (doctors and staff), and 3) a common wish from the radiology departments to improve quality, service delivery and efficiency when digitalization and rationalization took place.

Methods: Viborg Sygehus started with PACS in the early nineties. The four other departments got PACS in 1998, all have the same shared PACS-RIS-HIS. A radioclon connects the hospitals. There are 2 ISDN lines to university hospitals and one LAN to a doctor's workstation at home. 2/3 of all examinations can be softcopyread at institutions where they are not performed, without harming patient treatment locally. Patients can be examined near home, specialists read the images independently of time and place. Departments with 24 h duty have been reduced from 3 to 1; expertise can be delivered by teleradiology.

Working groups create standards on examinations, postprocessing, image quality and folder concepts. Which is essential when images are transmitted elsewhere for reading or consultation.

Education of staff focused on visions and goals for the county's radiological service and on creating awareness when working in one, new organization. Technology training as well.

Results: A skilled staff aware of the needs when working in one organization, which is prepared to fulfill the visions and goals of regional health programmes.

Necessary technical solutions for a regional PACS have been established.

896 14:50
A user driven architecture for teleradiology and PACS
U. Engellmann', A. Schroeter', M. Schwab', U. Eisenmann', M. Vetter', K. Lorenz', J. Quiles', H.P. Meinzer', Heidelberg/DE, Santiago de Compostela/ES

Purpose: Users requirements have been taken into account to develop the CHILI teleradiology and PACS system architecture. Most important requirements are vendor-independent communication, integration with PACS systems, data privacy and extensibility.
Methods and materials: The CHILI communication protocol for data transmission and teleconferencing is based on a strong data security concept based on German and European requirements and law. Many additional vendor independent communication methods have been integrated (such as DICOM, E-Mail, rcp, ftp, WWW). CD-ROM to be able to exchange images nearly with everybody who has access to a computer and a network. More than fifteen software components can be configured according to the users needs in their specific application scenarios. The system is extendable by powerful image postprocessing functions or interfaces to other information systems by means of a Plug-in mechanism. Plugins are under development in several groups for advanced image analysis and visualisation purposes.

Results: CHILI is in use in more than 50 installations for different clinical application scenarios and research. It can easily be adopted to different applications without major difficulties in transporting the data to the graphic workstations (intranet, email and Hospital Information System (HIS)). After the acquisition, data (DICOM-3) is sent to the archive (1.5 Tbyte RAID, five 150 CDR juke-boxes). Currently, all data is stored on the RAID for fast accessibility. Windows NT based workstations are used to query the archive and the HIS, and to use tools like a wordprocessor and a digital anatomical atlas. Studies can also be sent to a graphic workstation for three dimensional rendering and processing. Results can be stored locally or as a new study on the archive.

Conclusions: With the digital archive, studies are available last and viewing is more flexible compared to film-viewing (e.g. window/level adjustment). The digital department has an improved efficiency (faster diagnosis) and a possible cost reduction (less film-printing).

897 15:00

Implementation and impact of the digital radiology department
P.M.A. van Ooster, A.H.H. Bongaarts, M. Oudkerk: Rotterdam/NL

Purpose: Showing the implementation of our digital radiology network and its impact on diagnosis.

Methods: The digital network consists of the radiology network (archiver and workstations), Sienet (Siemens, scanners and consoles), and external resources (inter/intranet, email and Hospital Information System (HIS)). After the acquisition, data (DICOM-3) is sent to the archive (1.5 Tbyte RAID, five 150 CDR juke-boxes). Currently, all data is stored on the RAID for fast accessibility. Windows NT based workstations are used to query the archive and the HIS, and to use tools like a wordprocessor and a digital anatomical atlas. Studies can also be sent to a graphic workstation for three dimensional rendering and processing. Results can be stored locally or as a new study on the archive.

Results: Radiologists can perform complete diagnosis from the desktop and construct reports including relevant images using either e-mail or print-out. Three-dimensional processing for clinical and research applications can be performed without major difficulties in transporting the data to the graphic workstations.

Conclusions: With the digital archive, studies are available last and viewing is more flexible compared to film-viewing (e.g. window/level adjustment). The digital department has an improved efficiency (faster diagnosis) and a possible cost reduction (less film-printing).

898 15:10

Functional integration of HADS using DICOM and HL7
S.G. Kostomanolakis, N. Stathakia, F. Logothetidis, M. Tsiknakis; Iraklion GR

Purpose: This study investigates the use of the DICOM and HL7 standards to functionally integrate Heterogeneous Autonomous Decentralized Information Systems (HADS) in healthcare organizations.

Materials & methods: In the context of HYGEIANet, the integrated health-telematics network of Crete, an open architecture based on standards has been designed to integrate HADS in a healthcare facility. This architecture has been used to functionally integrate a healthcare record system, a DICOM image archive, an X-ray Film Digitization Console, and an HL7 acceptor agents.

X-ray orders placed within the healthcare record system, trigger HL7 messages which are intercepted by an HL7 acceptor software agent. The HL7 acceptor processes the HL7 message and the examination order appears in the X-ray Film Digitization Console. Once the X-ray examination is completed, the digitised X-rays are forwarded to the DICOM image archive and a HL7 notification message is sent to update the healthcare record system.

Results: A computing configuration consisting of HADS communicating via the DICOM and HL7 standards has been successfully employed to achieve functional integration in a healthcare facility.

Conclusions: The use of standards promotes interoperability of applications and enables process automation in healthcare organizations.

899 15:20

Teleradiology assessment by German radiologists: Follow-up 1997 to 1999
M. Walz, C. Brill, R. Bolte, K.J. Lehmann, M. Georgi; Mannheim/DE

The aims of the study, which has been started in spring '97 and followed up in summer '99, are the analysis of the teleradiology infrastructure, the present usage and future requirements as well as the opinion to legal, economical, social and political aspects.

199 (of 4400 sent) questionnaires in 1997 and 144 (of 1500 sent) in 1999 could be evaluated. 82 radiologists took part at both investigations enabling matched pair analysis. 50 % of answers came from hospitals and private offices each. Teleradiology information status has improved from 48 % of well informed radiologists in 1997 to 65 % in 1999 (in hospitals 76 %, in private offices 51 %). The main advantages in '99 opinion are quite similar to 1997, interfaces to other health care structures, optimized quality of patient management and improved work procedures leading. Hope for reduction of costs has slightly decreased. Risks are mainly seen in separation of coupled work of radiological examination and reporting and unsolved questions of liability, privacy and data security. Technical equipment especially regarding network and DICOM has significantly increased as well as internet or ISDN communication and company remote service. Personal need is primarily recognized in on-duty-service from home, emergency consultation and electronic image and report service but the highest usage is found in emergency consultation, manufacturer support and central teleradiology services. Generally high demand for standardization of communication protocols is reported.
advantageous for one patient. The sign-test result of $p = 0.07$ indicated a tendency obtaining more accurate results after Gd-BOPTA, for which mainly the late scans accounted.

**Conclusion:** There is no difference between both contrast media concerning the “dynamic scan”. The longer “diagnostic imaging window” of Gd-BOPTA seems to be an advantage especially in late liver-to-lesion contrast and is therefore improving the global diagnostic impact even at half dose of Gd-DTPA.

**902 14:20**

**Efficacy and safety of a new oral negative contrast agent (Magnelux) for MR imaging of the abdomen**

**W.A. Wolgemuth, K.H. Buehne, K. Bohndorf, Augsburg/DE**

**Purpose:** Like in CT, in abdominal MRI there is a need for a cheap and reliable oral contrast medium. In a preclinical study the efficacy and safety of a newly developed negative oral contrast agent (Magnelux) was studied.

**Materials & methods:** In a phase I study, 43 consented healthy volunteers were blindly randomised in 4 different dose groups (600 ml 30 %, 1000 ml 30 %, 600 ml 40 %, 1000 ml 40 %) of a clay suspension. 5 sequences of the abdomen (T1w tra, T2w tra + sag, T1w fatsat tra + sag) were acquired before and 1 hour after administration. ROI’s were measured in stomach, duodenum, jejunum, coecum, noise and reference standard. Artifacts were evaluated and a safety profile as well as adverse event (AE) monitoring were performed.

**Results:** In T2w images, delineation of stomach/liver, jejunum/bladder, jejunum/ovaries and jejunum/uterus was significantly improved ($p < 0.01$), visualisation of the pancreatic borders was not improved significantly. No major AE occurred, minor AE were nausea/vomiting in 28 % and obstipation/diarrhoea in 21 % with a higher incidence in the higher dosage group.

**Conclusion:** Clay suspension, which is generally recognised as save from the FDA (GRAS-status) as human food ingredient, proved to be an effective and safe contrast agent for abdominal MRI.

**903 14:30**

**An open phase III trial of ferristene (USAN) by enteroclysis with i.v. administration of gadolinium for MRI of the small bowel**

**P. Boraschi, R. Gigoni, F. Cartei, P.P. Rondine, G. Bracconi; Pisa/IT**

**Purpose:** To evaluate the efficacy and safety of ferristene by enteroclysis combined with intravenous gadolinium for MRI of the small bowel. Methods and materials: Twenty-three patients with suspected disease of the small bowel were submitted to MRI at 0.5 T (Signa Contour; GE). Imaging protocol included two phases: the first one without administration of any contrast agent and the second one where the small bowel was filled by enteroclysis with 900 ml of a luminal iron oxide contrast medium (Abdossan, Nycomed Amersham, Oslo, Norway) and 0.1 mmol/kg of Gd-DTPA were intravenously administrated. Axial T1w, proton-density and T2w SE images, sagittal and coronal T1w SE and STIR sequences were subsequently obtained. Three investigators blindly evaluated images to determine small bowel distribution of ferristene, artefacts, delineation of bowel lesion/wall and the diagnostic value of ferristene combined with gadolinium. Pre and post-contrast signal intensity measurements of bowel lesion/wall, bowel lumen and background noise were also calculated.

**Results:** No significant difference between the 3 investigator’s evaluation of the improvement of the diagnostic information was found (percentage of improvement of 90 % with 95 % confidence limits of 68 % and 99 %). A statistically significant difference between 1st and 3rd investigator was found for grading of quality of delineation of bowel lesion/wall. Signal intensity measurements showed a significant increase of the bowel lesion/wall for the SE T1w images. No serious adverse event was reported in our series.

**Conclusion:** The combined administration of ferristene by enteroclysis and intravenous gadolinium appears to be a safe and efficient tool for MRI of the small bowel.

**904 14:40**

**Multivariant discriminative analysis of MRI characteristics before and after Mn-DPDP in focal liver cirrhosis. Report from the German multicenter trial**

**T. Helmeberger, J. Laubenberger, E.J. Rummery, G. Jung, K. Siemens, B. Lundby, H. Fagertun, K. Meurer, M.F. Reiser; Munich/DE, Freiburg/DE, Cologne/DE, Rostock/DE, Oslo/NO, Keller/NO**

**Purpose:** Comparison of the diagnostic impact of the imaging characteristics in focal hepatic disease pre and post Mn-DPDP administration by multivariant discriminative analysis (MDA).

**Material and methods:** 151 patients with focal liver disease were studied in a multicenter trial. At 1.0/1.5 T breath-hold T1- and T2-WI pre and post Mn-DPDP (0.005 mmol/kg bw) i.v. administration was applied. Qualitative (presence of necrosis, margin, rim enhancement post contrast) and quantitative parameters (contrast-to-noise (CNR) and contrast-to-marker (fluid-filled tube) ratios (CMR) in T1- and T2-WI, based on signal intensity measurements of liver lesions, and marker) were used for MDA and compared to the gold standard (HCC in 23 %, metastasis in 25 %, cyst in 13 %, FNH in 10 %, hemangiom in 11 %, and other or no lesion in 18 % of the patients, histology in 49 %, follow-up in 51 %).

**Results:** In T1-WI, the lesion delineation improved post Mn-DPDP (68 % pre vs. 79 % post) but not detection of necrosis (16 % pre vs. 18 % post). Post Mn-DPDP, rim enhancement of metastasis (34 %) was significantly superior to that of other lesions (14 %, $p < 0.002$). The CNR for metastasis, cyst, and FNH increased significantly ($p < 0.03$) post Mn-DPDP, with no significant changes in HCC and hemangiom. Using CNR/CMR in T1/T2WI together with the presence of necrosis as efficacy parameters for lesion differentiation, MDA generally produced the highest values of sensitivity, specificity, and accuracy between 65-93 %, 44-83 %, and 65-86 %, respectively. However only in FNH a significant difference between using pre and post contrast parameters for MDA (accuracy 52 % pre vs. 65 % post) was seen. Using CMR instead of CNR gave only slightly but not significantly higher values in MDA. Overall, T2-WI was not affected by Mn-DPDP.

**Conclusion:** The diagnostic impact of Mn-DPDP could not be established definitively in this very heterogeneous study population. Therefore, further investigation is still necessary. Nevertheless, MDA using qualitative and quantitative parameters could prove its usefulness in lesion discrimination.

**905 14:50**

**MnDPDP-enhanced MRI in the diagnosis of hepatocellular carcinoma: Detection and correlation with dual-phase spiral CT**

**F. Donati, R. Lencioni, D. Cions, L. Crocetti, G. Granai, A. Cicerelli, M. Cosottini, V. Zampa, B. Bartolozzi, C. Zampa, C. Bartolozzi; Florence/IT**

**Purpose:** To determine the appearances and detection rates of hepatocellular carcinoma (HCC) in cirrhosis at MnDPDP-enhanced MRI and correlate the results obtained with those at dual-phase spiral CT.

**Subjects and methods:** Fifty patients with liver cirrhosis and US examination showing at least one focal hepatic lesion were enrolled in a phase III study. All patients underwent unenhanced and MnDPDP-enhanced MRI at 1.5 T, and dual-phase spiral CT. Twenty-four patients also underwent Lipiodol spiral CT. MR examination protocol included SE T1w and MP·GAE T1w acquired before and 60·120 minutes after the administration of 0.5 μmol/kg (0.5 ml/kg) MnDPDP at the rate of 2.5 ml/min, and fast SE T2wi obtained solely before contrast injection. Imaging tests were read blindly and prospectively at separate sessions by 3 radiologists. Findings at MRI matched lesion-by-lesion with findings at dual-phase spiral CT. Proof of the total tumor burden was provided by findings at US, spiral CT, Lipiodol spiral CT, and histopathology. The distribution of the quantitative variables was expressed as the mean and standard deviation. The distribution of the qualitative variables was expressed as the frequency of the various modalities under observation. Statistical analysis was performed by the two-tailed non-parametric SIGN test at a level of significance fixed at $p = 0.05$.

**Results:** Eighty tumors 0.8-19 cm in diameter (mean±standard deviation, 3.2±2.4 cm) have been identified. Dual phase spiral CT detected 64 of 80 lesions (80 %); pre-contrast MRI, 38 of 80 lesions (48 %); MnDPDP-enhanced MRI, 65 of 80 lesions (81 %); and MRI (pre-post-contrast), 69 of 80 lesions (86 %). The statistical analysis of the quantitative data obtained in this study produced the following main results: - no significant difference between procedures was found as the presence of lesion in concerned: - no modification have been observed between procedures as concerns the diagnosis regarding the main lesion; - as concerns the grading of the quality of delineation of the main lesion, the evaluation of MRI (GRE T1) is significantly more positive than that of spiral CT; - as concerns the level of the conspicuity of the main lesion, the evaluation of MRI (GRE T1) is significantly more positive than that of spiral CT.

**Conclusion:** MnDPDP-enhanced MRI of the liver is superior to unenhanced MRI for HCC detection. MRI with use of MnDPDP allows more confidence in the final diagnosis, greater quality of delineation of the lesion, and higher level of the conspicuity as compared with spiral CT.
906 15:00
MRI in liver transplantation: Prospective evaluation in pre-transplant candidates using iron oxide-enhanced imaging compared to clinical and histopathologic findings
R.M. Hammerstingl1, W.V. Schwarz1, J. Schwenkenbecher1, O. Soeliner1, R. Lobeck2, W.O. Bechtel3, T.J. Vogl4, "Frankfurt am Main/DE, Berlin/DE
Purpose: To evaluate prospectively the diagnostic potential of iron oxide-enhanced MRI in the preoperative evaluation of patients concerned for liver transplantation.
Methods and materials: 78 patients concerned for liver transplantation were prospectively investigated using a 1.5 T Magnetom (Siemens, 63 SP; Philips, ACS-NT). The sequence protocol included proton-density, T2-weighted SE/TSE-sequences, T1-weighted SE/GRE-sequences using unenhanced and iron oxide-enhanced studies (Endorem: 15 μmol/kg bw). Within one month patients underwent liver transplantation. Specimen were histopathologically evaluated and findings correlated with MRI.
Results: Histopathology revealed benign (hemangiomata (n = 2), regenerating nodules (n = 15), and malignant liver lesions (HCC (n = 27)). In 37 cases no focal lesions were detected. Cirrhotic liver parenchyma was delineated in 76 patients. A sensitivity of 91.9% and a specificity of 86.7% were calculated using iron oxide-enhanced MRI compared with histopathologic findings. Three false negative cases were reported missing a trabecular HCC in cirrhosis. Six false positive diagnosis were assessed. Small HCC-nodules were diagnosed in portal cirrhosis with fibrotic changes referring regenerating nodules histopathologically. A statistically significant improved detection rate was documented using iron-oxide enhanced MRI compared to unenhanced MRI and previous CT examinations (p < 0.05).
Conclusion: Iron oxide-enhanced MRI is an effective imaging tool in the preoperative evaluation of patients concerned for liver transplantation.

907 15:10
Lymph node metastases from urologic and gynecologic cancers: Evaluation with Sinerem®-enhanced intravenous MR-lymphography
M. Taupitz1, B. Hamm1, J.O. Barentsz1, P. Vock1, B. Harnim1, J.O. Barentsz1, P. Vock1, C. Roy1, M.F. Beltin1, L. M. Liypill1, B. Harnim1, J.O. Barentsz1, P. Vock1, C. Roy1, M.F. Beltin1, "Berlin/DE, "Nijmegen/NL, "Bern/CH, "Paris/FR, "Tübingen/DE, "Münster/DE
Purpose: This study was designed to evaluate the accuracy of lymph node staging in urologic and gynecologic tumours by Sinerem®-enhanced MR imaging (MRI). The results were correlated with histopathologic findings.
Methods/materials: MRI was performed prior to and 24 to 36 hours after i.v. injection of USPIO (Sinerem®) at a dose of 2.6 mg Fe/kg in 50 patients (cancer of bladder: 21, prostate: 25; kidney: 10, ovary: 1, vulva: 1, prostate + kidney: 1) from 5 centers. All patients underwent surgery including lymphadenectomy within 10 days of the MRI examination. Imaging was performed at 1.5 T using a body phased-array coil (axial T1 SE, T2w FSE and T2w GRE sequences). MRI covered the pelvic or abdominal region, depending on the localization of the primary tumor. Size and changes in the signal intensity of individuallymph nodes were evaluated on pre- and post-Sinerem images. Imaging data were correlated with histopathology. In a total of 64 lymph nodes, a direct correlation between MRI appearance and histopathologic findings could be performed.
Results: On-site evaluation yielded the following results: Of the 64 individually correlated lymph nodes, 17 were metastatic and 47 nonmetastatic on histopathologic regarding individual lymph node evaluation on MRI, the results were as follows (pre-Sinerem/post-Sinerem): TN: 40/44 nodes, TP: 13/14 nodes. FN: 4/3 nodes, FP: 7/3 nodes. Two of the 3 false-negative nodes on postcontrast images were found to be partially invaded on histopathology and showed a signal decrease on at least one T2-weighted sequence due to the uptake of iron oxide particles (positive Perls staining). The third node was found to be totally invaded but was also Perls-positive. Sensitivity and specificity of Sinerem-enhanced MRI versus plain MRI (size criterion) were 82% and 94% versus 76% and 85%, respectively.
Conclusions: Sinerem-enhanced MRI was found to be superior to plain MRI based on lymph node size in demonstrating lymph node metastases in patients with urologic and gynecologic tumors.

908 15:20
New blood pool MRI-contrast agent (NC100150) for diagnosis of pulmonary embolism
P. Stierle1, C. Weber, J. Weiger, J. Sievers, V. Hoffmann, E. Bucheler
Hamburg/DE
Purpose: Evaluation of a new ultrasmall superparamagnetic iron oxide MR-contrast agent NC100150 in patients with thromboembolic disease.
Method and materials: 13 of 69 patients with signs of pulmonary embolism (PE) entered the double-blind, randomized, multi-center phase 2 study. Following pulmonary angiogra (PA) (n = 4) or Spiral CT (SCT) (n = 9) breathhold pulmonary 3-D GRE MRA and non-breathhold MR-venography (MRV) of the lower extremities were performed. MRV were correlated with phlebography (n = 2) or US (n = 6). Administration of doses between 0.75 and 6 mg Fe/kg bw of NC100150 (30 mg Fe/ml) were induced 10 min prior to MRI. Images were analysed with regard to vessel visualisation, thrombus localisation and vessel to lung contrast (C/N).
Results: Even the lowest dose enabled visualisation of all segmental arteries. Visibility and C/N of subsegm. arteries increased significantly with higher concentrations. MRA correctly diagnosed PE in all patients. No significant difference between SCT and MRA was observed with regard to vessel visualisation. Subsegmental thrombi detected by PA in two patients were correctly identified by MRA. 6 patients had DVT. MRV correctly diagnosed all of them.
Conclusion: Single injection of NC100150 facilitates high accuracy MR-diagnosis of both PE and DVT.
Results: The placement of the endoprosthesis succeeded in all cases, but in 8/76 patients a type 2 endoleak manifested immediately after the procedure. The mortality rate in the following 30 days was 0. During the follow up period (mean, 12 months), type 2 endoleak was confirmed in the 8 patients, with no further dilation or reduction of the aneurysmal sac. A type 1 endoleak was demonstrated in further 6 patients, 4 of whom had a straight endoprosthesis placement. All of them underwent a new intervention: 5/6 had surgery, and 1/6 received a new endovascular repair.

Conclusion: In our experience, type 2 endoleak is an early postoperative complication of endovascular abdominal aortic aneurysm, and it does not resolve spontaneously, even when sustained by small collateral. Treatment is generally not needed, but only a watchful monitoring. Type 1 endoleak is more common in the straight endoprosthesis placement and requires surgical repair.

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Endoluminal treatment of abdominal aortic aneurysm: Mid-term results

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Purpose: To report our preliminary results with the stent-grafts in the treatment of abdominal aortic aneurysm.

Materials and methods: Between Feb. 98 and Sept. 99, 33 patients (32 males and 1 female, mean age 68, 68 % ASA 3-4) were treated for abdominal aortic aneurysm by implantation of endograft. 24 Aneurin, 6 Talent, 2 Vanguard. 1 Stenway endoprostheses were used (31 bifurcated, 2 straight). We performed Doppler ultrasound (DUS) at discharge and DUS plus spiral CT controls at 3-6-12-18 months. Follow-up period ranged from 7 days to 20 months.

Results: All procedures but 2 (surgical conversions: 6 %) were successful. One patient (3 %) required surgical conversion after 14 days, for right iliac branch occlusion and buckling. All conversions occurred in the early period of our experience. DUS and spiral CT controls revealed 5 endoleaks (15 %): 2 resolved spontaneously on follow-up, 2 treated successfully (1 angioplasty, 1 embolization); only one endoleak (3 %) still persists at 6 months follow-up. A stenosis of the left iliac branch occurred in one patient after 3 months and was successfully treated by angioplasty. No other major complications occurred. The primary success rate was 76 %, with a secondary success rate of 85 %; no intraoperative deaths occurred. One patient died for heart failure within 14 days to the surgery conversion (perioperative mortality rate: 3 %).

Conclusion: Our preliminary experience supports the effectiveness of the endovascular stent-graft repair of the abdominal aortic aneurysm in selected patients and suggests the importance of an accurate follow-up to reveal early- and mid-term endoleaks.

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Abdominal aortic aneurysms treated with endoluminal bifurcated endograft: One year experience

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Purpose: To evaluate the one year results of endovascular grafting for abdominal aortic aneurysms (AAA).

Methods and materials: From September 98 to September 99, 25 patients (mean age 68 years) were submitted to AAA repair with endoluminal bifurcated endograft (24 Vanguard II and 1 Talent). The mean diameter of the AAA was 5 cm and neck diameter and length was 2.5 and 4.1 respectively. In 23 patients the AAA involved the common iliac arteries. All patients were selected with Angio-CT and Digital Subtraction Angiography.

Results: No intraoperative complications and conversion to open surgery occurred. Complications during the follow-up were: 2 minor endoleaks (not treated but followed-up); 2 controlateral limbs obstructions (one treated with fenobulnysis and stenting); 1 obstruction of the right renal artery; 1 inguinal hematoma. Procedure time ranged between 90 to 150 minutes.

Conclusions: Based on initial results and limited follow-up period endoluminal repair of AAA with bifurcated endograft may be feasible alternative to conventional surgery especially for patients at high surgical risk.

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Infrarenal aortic aneurysms treated with endoluminal stent-grafts: Results at 24 months

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Purpose: To evaluate technical and clinical efficacy of endoluminal aorto-iliac endoprosthesis to exclude infrarenal abdominal aortic aneurysms (AAA).

Materials and methods: From April 1997 to September 1999, 27 patients (26 males, 1 female) with atherosclerotic AAA were treated with 26 aortolnic bifurcated and 1 straight aorto-aortic endoprosthesis. Average age was 71 years. Preoperative angiography and (sprint) CT were performed in all. The proximal neck had a mean length of 26 mm, mean diameter 22 mm. The mean diameter of the aneurysm was 47 mm, mean length 65 mm. In 5 iliac arteries were aneurysmatic. Bifurcated device was implanted in 26 patients, straight in 1. Postinterventional follow-up included CT after 5 days, 3, 6 and 12 months, and angiography when required.

Results: Implantation was successful in 25 patients; two cases required surgical conversion. Mean surgical was 122 min; mean fluoroscopic time was 17 min. In one patient, already operated on for type A aortic dissection, extending to the level of renal arteries. CT control after 7 days showed contrast medium in periprosthetic thrombus, it was significantly reduced at 1 month and maintained unchanged at 1 year follow-up. After 18 months the patient died because of aneurysm rupture. Another endoleak seen immediately after implantation showed progressive reduction at 3 and 6 months control. In all other cases aneurysm exclusion was obtained. In three patients distal limb recanalization and angioplasty was necessary at the end of the implantation for thrombosis (at 1, 5 and 30 days respectively) due to residual iliac stenosis; in all cases patency was restored, but in one pelvic haemorragia from dissected external iliac artery required open surgery. At follow-up a significant reduction of aneurysm diameter was observed in 10 patients (average follow-up 16.3 m); stent grafts did not migrate nor shorten.

Conclusions: Aortolnic covered endoprosthesis appears to be a safe treatment if performed by trained interventional radiologist. Surgical conversion rate is below 7.5 % (2/27), high primary patency (92 %), assisted patency (24/24) and high AAA exclusion (92 %) are obtained. Reduction of diameter is observed in more than 1/3 of cases, in small-medium sized aneurysms that represent, another indication to endoluminal treatment together with high risk patients.

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Endovascular treatment of aortic aneurysms: Intra-extra-luminal pressure translation in endoleaks and thrombosed areas

M.B. Pitton, C. Duber, R.P. Schmenger, A. Neufang, M. Thelen; Mainz/DE

Purpose: To investigate pressure translation in the aneurysm sac after endovascular aneurysm treatment.

Materials and methods: In 36 dogs different types of aortic aneurysms were created with lumbar arteries patent or ligated. Endovascular treatment was performed with covered nitinol stents. At follow up (1 and 6 weeks and 6 months) a laparotomy was performed. A tip-catheter was inserted in the excluded aneurysm. Pressure and dp/dtmax was recorded simultaneously with a intraluminal reference catheter.

Results: Pressure translation was measured at increasing blood pressure from 34 to 399 mmHg systolic (dp/dtmax: 217-2454 mmHg). In thrombosed areas pressure was reduced by factor 0.47 systolic, and dp/dt max by factor 0.09. In endoleaks pressure translation was significantly increased (0.88 systolic, and 0.91 for dp/dtmax). Pressure translation was linear at increasing blood pressure. Increasing follow up was accompanied by stronger reduction of pressure translation in thrombosed areas. systolic: 0.66 vs 0.39. p = 0.05 (1 week vs. 6 months), and dp/dtmax 0.12 vs. 0.04. p = 0.05.

Conclusion: Endovascular stent grafts significantly reduce systolic peak pressure in the excluded aneurysm sac. In particular, dp/dt max is considerably reduced. Collateral flow prevents effective pressure relief of the excluded aneurysm. Large aortic side branches should be occluded prior to stent therapy.

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Transrenal stent fixation of stent grafts: Radiologic and histologic findings

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Purpose: To investigate the effects of transrenal fixation of stent grafts.

Materials and methods: Experimental aortic aneurysms were created in mongrel dogs. Endovascular treatment was performed using polyester covered nitinol stents with bare struts at the proximal end. Bare struts were fixed to cover the ostia of 9 renal arteries, 21 lumbar arteries, and 4 testicular arteries. No anticoagulation after stent grafting. Follow-up was 1 and 6 weeks and 6 months. Treatment results were documented by angiography, CT, and IVUS and were related to histology.

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Thrombotic complications in patients suffering from aneurysms of the aorta treated with bifurcated stents

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Purpose: Determination of time related occurrences for thrombotic complications in patients suffering from abdominal or thoracic aneurysms of the aorta after endovascular stent placement.

Materials and methods: 82 patients with abdominal or thoracic aneurysms (73 and 9 cases respectively), were excised between 7/95 and 12/98. All went through endovascular surgery and implantation of aortic stents. The examined 75 men and 7 women, with a mean age of 67.7 years where analyzed by the means of contrast enhanced 3 phased Spiral-CT which was accomplished within an average of 12.1 months after stent placement.

Results: We diagnosed the occurrence of thrombotic complications in 19 subjects (23.2 %) Within this group 16 subjects (19.5 %) showed intraluminal aortic stent thrombotic residuals, whereas in 5 cases (6.1 %) at least one additional distal iliacal stent was involved. In the remaining three patients (3.7 %) a complete occlusion in one of the iliacal stents by thrombosis was detected. First thrombotic complications occurred in the earliest case 1 week after surgery in the latest case 20 months after endovascular intervention. In the mean average the first thrombotic manifestation was shown 7.5 months after endovascular surgery. In 3 cases (3.7 %) a lysis of the initial thrombotic clot was diagnosed.

Conclusion: It was shown that the complication by thrombotic clots occurred in every fifth patient after endovascular intervention of abdominal and thoracic aneurysms. Furthermore we evaluated either a complete lysis of the thrombotic clot or a progredient manifestation of the thrombosis.

Stent-graft repair of type A aortic dissection with entry tear in descending thoracic aorta

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Matsusaka/JP

Purpose: Type A aortic dissection with entry tear in the descending thoracic aorta is one of the challenging subsets among type A dissection. Our purpose is to evaluate the efficacy of stent-graft repair of such aortic dissection.

Methods & materials: We treated six patients with type A aortic dissection with entry tear in the descending thoracic aorta. Five patients had acute dissection (interval between diagnosis and stent-grafting: 6 days) and one patient had chronic dissection (interval: 3 years). Coexisting problems including hypertension, pericardial effusion, aortic regurgitation, chronic renal failure, disseminated intravascular coagulopathy, and cerebral bleeding were observed in five of six patients. Custom-made stent-grafts, which were fabricated with expanded polytetrafluoroethylene and Z-stents, were deployed through 20 Fr delivery systems.

Results: Closure of entry tear was obtained in all patients. Complete thrombosis and shrinkage of false lumen was observed at ascending aorta in all patients. Thrombus of false lumen at descending thoracic aorta was complete in five patients, while it was partial in one patient. No procedure-related complications except for leukocytosis and pleural effusion were observed. All patients are doing well during follow-up (mean, 13 months) without any late complications.

Conclusion: Stent-graft repair of type A aortic dissection with entry tear in the descending thoracic aorta is a feasible and effective method and may be an alternative to conventional surgical intervention in selected patients.

The effectiveness of MR coronary angiography in the diagnosis of coronary artery diseases

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Purpose: Evaluation of the role of MR coronary angiography in the diagnosis of coronary artery diseases compared with X-ray angiography.

Materials and methods: In this prospective study, 40 patients were examined with MR and X-ray coronary angiography. T2 prepared, fat suppressed, segmented K-space TFE 3D axial and 2D oblique images were obtained using a 1.5 scanner with ECG and respiratory triggering with navigator echoes. The evaluation of the images were done, blinded to the results of X-ray angiography, with MPR and MIP.

Results: Main coronary arteries were demonstrated. Decreases in lumen signal intensity and diameter were determined as stenosis, whereas luminal discontinuity was regarded as obstruction. The significance of MR angiography in demonstration of coronary artery diseases was evaluated in terms of specificity and sensitivity, compared with X-ray angiography results and a high correlation was observed.

Conclusion: MR coronary angiography may be an effective, alternative non-invasive diagnostic modality in demonstration of proximal coronary artery diseases.

Intravenous angiography using electron beam computed tomography: A viable alternative to conventional coronary angiography

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Purpose: Non-invasive detection of coronary stenoses with Electron Beam Computed Tomography (EBCT) after intravenous injection of contrast medium has recently emerged. We sought to determine the diagnostic accuracy of EBCT angiography in the clinical setting using conventional coronary angiography as the gold standard.

Materials and methods: 37 patients (30 men) were investigated. After intravenous injection of 150 cc of contrast medium, 40-60 consecutive transaxial tomograms, covering the proximal and mid part of the coronary arteries, were obtained with ECG triggering at end diastole during breathhold. 3D reconstruction of the proximal and mid parts of the arteries were compared to the conventional angiograms.

Results: Of the 259 proximal and middle coronary segments, 211 (81 %) were analyzed by EBCT. Of the left anterior descending artery (LAD) segments 95 % were assessable. Right coronary (RCA) and circumflex artery (LCX) segments were assessable in 66 % and 76 % respectively. Overall sensitivity and specificity to detect a ≥50 % diameter stenosis was 77 % and 94 % respectively. This was 82 % and 92 % for the LAD, 60 % and 97 % for the RCA and 83 % and 89 % for the LCX.

Conclusion: Intravenous EBCT coronary angiography appears to be a break-through technique. However, the technique is not yet robust enough to reliably visualize and assess RCA and LCX anatomy. Imaging of the left main and LAD is robust and accurate.

Navigator-echo-based respiratory gating for 3D-MR coronary angiography: Reduction of scan time using a slice-interpolation technique

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Purpose: The aim of the study was to compare a conventional respiratory-gated 3D-MR angiographic technique (MRCA) with a respiratory-gated 3D-MR angiographic technique that includes a slice-interpolation technique (SI-MRCA). The value of
both MRCA techniques was compared for the visualization of coronary arteries and for the diagnostic accuracy in identifying hemodynamically significant coronary artery stenoses.

**Methods and materials:** Forty patients with proximal coronary artery stenosis were examined on a 1.5 Tesla scanner, i.e. twenty patients with each sequence. A grading system was used to evaluate the image quality. Detection of coronary artery stenoses was compared with conventional coronary angiography by two blinded readers.

**Results:** Using a slice-interpolation technique the average scan time of the entire heart can be reduced. However, a higher number of coronary artery segments are visualized with sufficient image quality. For the assessment of stenoses sensitivity was 71 % and specificity was 53 % for conventional MRCA, respectively 72 % and 60 % for SI-MRCA.

**Conclusion:** The application of partial k-space reading reduces the scan time, improves specificity for the assessment of coronary artery stenoses and increases the number of completely identified coronary artery segments.

**921 14:30**

Correlation of 3D MR coronary angiography with selective coronary angiography: Impact of the novel motion adapted gating technique

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**Purpose:** The impact of a novel respiratory motion compensation technique (Motion Adapted Gating, MAG) for visualization of coronary arteries (CA) was verified by correlation with selective coronary angiography (SCA).

**Methods & materials:** 15 subjects (11 patients/4 healthy volunteers), age 52 ± 20 yrs were investigated. A 1.5 T Philips Gyroscan ACS-NT with PowerTrack 6000 gradient system was used. ECG-triggered, respiratory motion gated 3D TFE sequences were acquired. The real-time algorithm utilized the novel concept of k-space weighting in combination with automatic analysis of respiratory motion. The three main CA and left main (LM) were evaluated. Qualitative analysis was performed by three blinded investigators. Visibility was graded on a 5-point-scale (0 = not visualized, 1 = insufficient, 2 = sufficient, 3 = good, 4 = excellent). Segments graded 2-4 were defined as adequately visualized.

**Results:** 62/68 assessable CA segments in patient, 22/32 in volunteer group were adequately visualized. Visibility of CA was classified as excellent for proximal RCA (avg. 3.6 ± 0.5), good for LM, proximal/middle LAD, proximal LCX and middle RCA. Visibility of CA in patient and volunteer group was not significantly different (p < 0.05). Evaluation of CA stenoses (luminal narrowing > 50 %) was best in LM, proximal LAD, LCX and RCA (6/6 correctly detected) still of good quality in middle LAD and RCA (8/10 correctly detected) but of less diagnostic accuracy in the distal segments. A grading system was applied for the evaluation of CA segments.

**Conclusion:** MRI with MAG demonstrates to be a promising new noninvasive technique for noninvasive imaging of CA with high patient comfort.

**922 14:40**

Contrast-enhanced magnetic resonance coronary angiography: Diagnostic value of 2- and 3-dimensional image reconstruction techniques for detection of coronary stenoses

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**Purpose:** Contrast-enhanced magnetic resonance (MR) coronary angiography allows visualization of coronary arteries. Postprocessing may be performed by various 2- and 3-dimensional techniques. We compared 3 techniques of image reconstruction in respect to their accuracy to detect coronary stenoses.

**Methods & materials:** MRI imaging was performed in 61 patients on a 1.5 T scanner using an contrast-enhanced 3D gradient-echo breath-hold technique (TR/TE 4.2/1.6). In two studies, the imaging volume was positioned in oblique planes along the course of right and left circumflex and along left main and left anterior descending coronary arteries, respectively. During each measurement 20 ml Gadolinium-DTPA (Magnevist, Schering) were applied. Original source images, cine-loop image displays and maximum intensity projections (MIP) were independently evaluated. Results were compared to conventional coronary angiography.

**Results:** 427 coronary artery segments were assessed. In the evaluable segments, source images showed highest accuracy; joint evaluation yielded 85.3 % sensitivity and 89.3 % specificity.

**Conclusion:** Evaluation of unprocessed source images showed highest accuracy in detecting coronary artery stenoses by contrast-enhanced MR coronary angiography. MIP postprocessing is compromised by a higher number of unrecognizable images due to overlap of coronary arteries with adjacent cardiac structures using the presented technique with oblique imaging planes.

**923 14:50**

Improvement of magnetic resonance imaging of the coronary arteries with a clinically available intravascular contrast agent

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**Purpose:** To investigate the effect of a presently clinically approved MR contrast agent with a partial intravascular behavior, based on super paramagnetic iron oxide particles, on a specific magnetic resonance coronary angiography (MRCA) technique.

**Methods and materials:** Five patients (3 males) were investigated before and after intravenous administration of AMI-25 (Endorem, Guerbet) at a dose of 15 mmol Fe/kg per kg body weight, diluted in 100 ml of isotonic glucose, during 30 minutes. T1 measurements were performed with a series of inversion recovery gradient echo images with varying inversion times. MRCA was performed with a three-dimensional gradient echo sequence (TR/TE = 2.6/1.3 ms) with retrospective respiratory gating. Matrix size was 128x256, field of view was 240x320 and slab thickness of 120 mm.

**Results:** T1 relaxation time of blood was reduced from 1562±130 ms to 642±244 ms (p < 0.01), while for myocardium there was no significant change (T1-pre: 1058±30 ms, T1-post: 1001±138 ms, p = 0.46). Post contrast the signal-to-noise ratio (SNR) of blood in the aortic root improved with 90.5 %, the SNR in the right atrium improved with 44.1 %. The blood versus myocardium contrast-to-noise ratio improved with 60.8 %.

**Conclusion:** SNR and CNR for MRCA can be improved importantly with a clinically approved intravenous contrast agent.

**924 15:00**

Assessment of morphology and patency of arterial and venous coronary artery bypass graft by ECG-triggered multislice computed tomography

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**Purpose:** To investigate and compare the value of the recent generation of ECG-gated multislice computed tomography scanners in the follow up of patients with internal mammary artery (IMA) and venous coronary artery bypass grafts (CABG), controlled by arteriography. Patency and morphology of the graft and the anastomoses were evaluated.

**Methods:** 20 Patients with 53 bypass grafts (18 IMA/35 venous grafts) were examined pre/6 months post CABG surgery. A phase contrast FLASH 20 sequence (pxl 0.98x0.98, venc 75 cm/s) was applied for flow measurements.

**Results:** The determined patency rate of CABG with Multislice-CT was 82.8 %. The bypasses rated as occluded were controlled by arteriography. All as occluded described grafts with Multislice-CT were also seen occluded in arteriography. Therefore sensitivity and specificity was 100 %. All proximal venous graft anastomoses were correctly visualized. The distal anastomoses could only be determined in 24 %. This is due to the complexity of the grafts, mostly jump grafts and the small diameter of the distal coronary arteries.

**Conclusion:** These data suggest that subsecond ECG-gated Multislice CT is a highly accurate approach to non-invasively assess not only saphenous vein and arterial graft patency but also demonstrate morphological changes of the graft and related proximal anastomoses. This is due to the high data resolution in combination with the elimination of motion artifacts by ECG-gating. Screening of patients with CABG utilizing this method seems reasonable.
**Results:** Graft flow IMAs was found to be patent in 46/47 patients (CT 46/47). Anastomosis to LAD was visualized in 27/47 patients. There was no relevant flow and no contrast enhancement in the distal part of the LIMA graft in one patient. Cardiac catheterisation confirmed the graft occlusion in this patient. IMA flow measurements were diagnostic in 97% (pre/post CABG surgery) of our patients. Evaluation of flow measurements revealed a volume range of 27-105 ml/min (mean 65±24 ml/min; 41±15 ml/min). Native/graft, p < 0.03.

**Conclusions:** MR examination can cover information about graft function and patency. Evaluation of the anastomosis to LAD is actually not sufficiently possible.

**926 15:20**

**MR angiography of sequential venous coronary artery bypass grafts with targeted breath-hold volume scans**

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**Purpose:** To assess possibilities of a recently introduced breath-hold MR technique using targeted volume scans (VCATS) to evaluate sequential venous bypass grafts.

**Methods and materials:** Sixteen patients with 21 grafts and 52 distal anasto- moses were studied with the VCATS protocol on a 1.5 T scanner with a phased array body coil. Grafts were first localized with a single breath-hold volume scan acquired with a multishot EPI sequence (TR = 5.55, TE = 1.4 ms). Then, targeted volume scans were made with a 3D breath-hold turboFlash sequence with a resolution of 1.9±1.25±1.5 mm in about 30 minutes. Results were compared to selective coronary angiography.

**Results:** In one patient the study was not completed due time constrains. Therefore the status of 50 graft segments could be evaluated. All graft segments could be localised on the single breath-hold localizer scan. On angiography 30 segments were patent, the remaining 20 were occluded. Sensitivity and specificity for the detection of patent segments were 93 % and 95 %. Stenial wires induced local artefacts in 10 of the proximal graft segments, but patency of these segments could be evaluated outside the artifact.

**Conclusion:** The single breath-hold EPI localiser scan is adequate for graft localisation. VCATS showed a high sensitivity and specificity for the establishment of venous graft patency.

**943 16:10**

**Meta-analysis of dose-relevant scan parameters in chest CT: How did spiral CT change patient exposure?**

C. Küpper, M. Prokop, C.J. Herold; Vienna/AT

**Purpose:** To assess dose-relevant scan parameters in publications on chest CT in order to determine how often patient exposure can be estimated from published data and how spiral CT influenced radiation exposure to the patient.

**Materials and Methods:** Data were sampled from two major journals (Radiology and European Radiology). All CT studies of the chest from the years 1993 to 1998 were included. The following dose-relevant parameters were collected: scanner type, kVp, mAs, spiral technique, slice collimation, and pitch factor.

**Results:** We included a total of 215 studies on chest CT. The proportion of studies that mentioned all dose-relevant factors was 51% in spiral CT and 32% in conventional CT. Spiral CT accounted for 14% of studies in the years 1993-1995 and 50% in 1998. In spiral CT, the number of studies that used a pitch < 1 increased from 17% to 80%, respectively. The median mAs (normalized to 120 kVp) was higher with conventional CT (median 323 mAs, range: 140-986 mAs) than with spiral CT (median 210 mAs, range: 30-520 mAs).

**Conclusion:** Since 1993 the use of spiral CT continually increases. Pitch-factors < 1 and lower mAs settings contribute to dose savings as compared to conventional CT. However, wide variations in mAs call for studies to further minimize patient exposure.

**944 16:15**

**Thoracic high-resolution CT: Influence of 0.5 second gantry rotation and ECG-gating on image quality**

M. Montaudon, B. Blacher, V. Latrabe, F. Laurent; Pessac/FR

**Purpose:** To determine if ECG-gating and shorter acquisition time of 0.5 second rotation improve the image quality of thoracic high-resolution computed tomography (CT) scans.

**Materials and Methods:** In 25 patients referred for HR thoracic CT, high-resolution millimeter slices (120 kVp, 200 mA) were performed with 1-second, 0.5-second and 0.5-second + ECG-gating scanning time at 5 selected levels. At each location, degradation due to motion and image quality were graded independently on a four-point scale by three blinded radiologists. Statistically significant differences were determined with a Mann-Whitney U test.

**Results:** Parenchymal image quality was better on 0.5-second ECG-gated scans than on 0.5-second scans (p < 0.05) and on 0.5-second scans than on 1-second scans (p < 0.001). Using half-second acquisition time, motion artifacts were less prominent and improvement of image quality was significant at all studied levels. Despite an expected signal-noise ratio decrease, half-second scans improved image quality by reducing noise-related artifacts. This effect was raised by ECG-gating.

**Conclusion:** ECG-gating and 0.5-second gantry rotation high-resolution scans are associated with improved clarity and diminished motion artifacts on pulmonary images when compared with 1-second conventional high-resolution scans.

**945 16:25**

**Single-slice spiral CT of the thorax: Comparison of standard versus high-resolution single-volume acquisition protocol**

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**Purpose:** To validate a high-resolution single-volume acquisition protocol (P 1) in comparison to a standard acquisition protocol (P 2).

**Methods/materials:** In 30 adult patients single-slice spiral-CT of the thorax was performed on 2 different occasions utilizing different CT-protocols (slice thickness - SD): 1. 3 mm SD, pitch 3, single breathhold, continuous volume-acquisition mode.
3D CT bronchography: Preliminary results in assessment of airway disease
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Purpose: To propose a new 3D technique providing a CT bronchography for the assessment of chronic airway disease.

Material and methods: Volumetric helical CT data sets from 10 patients referred for suspicion of bronchiectasis were used for the 3D reconstruction of the bronchial tree. Collimation varied between 1 and 3 mm and a pitch of 1.5, 0.6 mm reconstruction interval. The cross-sectional areas of the bronchi were automatically segmented on axial images using a procedure based on the mathematical morphology theory and a morphologic marking exploiting the connection concept, together with a contour extraction by using a conditional watershed. Then a specific 3D propagation procedure exploiting the oriented, multivalued and evolutive 3D graph was applied to describe the 3D topology. The reconstructed bronchial tree was visualized by using a semi-transparent volume rendering technique. The results were compared to the axial CT images for the assessment of bronchial walls and lumens.

Results: In all cases the procedure provided a robust 3D reconstruction up to 6-7° order divisions. It proved to be stable with respect to bronchial stenosis, irregularities, dilatation, and mucoid impaction.

Conclusion: CT bronchography may provide a 3D visualization of the bronchial tree for an accurate assessment of complex bronchial abnormalities.

Changes in lung parenchyma after acute respiratory distress syndrome (ARDS): Assessment with high-resolution computed tomography (HRCT)
I.-M. Nobauer-Huhmann, K. Eibenberger, H. Steltzer, K. Strasser, C.J. Herold; Vienna/AT

Purpose: To evaluate the nature, extent and distribution of parenchymal lung changes after acute ARDS, and to determine the influence of the disease and the effect of therapeutic procedures on these changes.

Methods and materials: HRCT, clinical examination and lung function tests were carried out in 15 patients, 6 to 10 months after ARDS. Nature and extent of parenchymal changes were compared with the severity of ARDS and with clinical and therapeutic data.

Results: Lung parenchymal changes similar to those found in the presence of pulmonary fibrosis were observed in 13 of 15 patients (87 %). A significant correlation was observed between the extent of lung parenchymal changes and the severity of ARDS (P < 0.01), the time patients had received mechanical ventilation with a peak inspiratory pressure greater than 30 mmHg (P < 0.05), and the time the patients had received mechanical ventilation with more than 70 % oxygen (p < 0.01). The parenchymal changes were significantly more frequent and more pronounced in the ventral than in the dorsal compartments (p < 0.01). Conclusion: ARDS may be followed by fibrotic changes in lung parenchyma. The characteristic distribution of these changes indicates that they may be caused by the ventilation regimen and the oxygen therapy rather than by ARDS itself.

Mobile computerized tomography in the detection and management of pulmonary nodules and loculated empyema in ARDS
B. Sharma, M. Farrugia, S. Vijayanathan, B. Ayers; London/GB

The importance of sequential mobile computerized tomography (CT) for the detection and management of pulmonary nodules and pneumothorax formation in ARDS is demonstrated.

Materials and methods: Serial chest CT was performed with a mobile scanner (Phillips tomoscan M) in ICU patients with ARDS. Scanning was performed during intermittent suspended respiration (120 kV, 90 mA, 10 mm collimation and table feed).

Results: CT determined the presence and site of pneumomediastinum and pneumothoraces more effectively than chest radiography. In one patient, nine pneumomediastina were demonstrated which were subsequently all drained successfully. Serial CT also demonstrated the changing nature of air collections and eventual development of parenchymal fibrosis.

Conclusions: Serial CT is an important factor in the assessment and successful management of patients with severe ARDS. The availability of mobile CT enhances the practicability of performing serial scans.
Materials and methods: 116 emergency CT-scans were requested within 22 days. Prior to the examination, urgency, purpose of the examination, postulated diagnosis, management and treatment plan were noted. Provided with the results of the examination the referring physicians were again questioned about the definite diagnosis, management and treatment.

Results: 22 % of the CT's were ordered "at once" (within 10 min), 78 % with moderate urgency (within 30 min). 66 % of all CT-requests had the objective to exclude serious disease, 21 % to confirm a suspected diagnosis and 13 % to extract a diagnosis from differential diagnosis. 73 % of the CT's led to an increase in the ER-physicians diagnostic confidence. Following the receipt of examination results the ER-physicians changed 60 % of their diagnoses, 65 % of their management plans, 36 % of their therapy plans and 24 % of the specialties consulted.

Conclusion: The significant influence of CT-examinations upon the referring ER-physicians by affecting their diagnostic certainty, the overall patient management and therapeutic planning is shown in this study.

This excellent diagnostic method should be performed as early as possible.

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Imaging of tracheomalacia and tracheal stenoses using electron-beam-ctomography EBCT
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Purpose: To evaluate EBCT in the diagnosis and treatment planning of tracheal disorders.

Methods and material: 22 examinations on 18 patients with suspected or known tracheal stenoses and/or tracheomalacia were performed. EBCT was used to scan the tracheobronchial tree with 3 mm collimator and 20 mAs table feed in deep inspiration and expiration (5-8 seconds scan time). Additional dynamic studies with 3 mm collimation and 9 images/second (60 mAs) were performed during forced inspiration and expiration. In case of suspected vessel malformation iv contrast was applied (8 examinations). Cross area of the trachea was calculated for all slices, minimal intensity projections and virtual endoscopic images were used. All diagnoses were confirmed with flexible bronchoscopy and/or operation.

Results: The short scan times allowed reproducible examinations in deep inspiration and expiration even with compromised lung function. Tracheomalacia was detected at deep expiration and using dynamic studies, the differences between inspiration and expiration scans provided detailed information of the extent of the disease.

Conclusion: EBCT allows functional imaging of the tracheobronchial tree with low patient dose. It provides reliable information about the extent of the disease for treatment planning.