Severe Infectious Complications after Endoscopic Ultrasound-Guided Fine Needle Aspiration of Suspected Mediastinal Duplication Cysts: A Case Series

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Case series · Cyst infection · Duplication cyst · Endoscopic ultrasound-guided fine needle aspiration · Esophagus · Submucosal mass

Abstract

Background and Study Aims: The role of cyst cytology to diagnose mediastinal duplication cysts remains controversial. Since endoscopic ultrasound (EUS)-guided fine needle aspiration (FNA) of duplication cysts has been considered as safe so far, there are only a few case reports of infections following FNA. Case Summary: We report a case series of all patients at our institution undergoing EUS evaluation for suspected mediastinal duplication cysts (n = 5) in the last 15 years. The mediastinal lesion in 4 patients did not feature typical EUS features for duplication cysts, wherefore we did perform EUS-guided FNA in order to rule out malignancy. In 3 out of 4 patients, a duplication cyst was confirmed. The fourth lesion turned out to be a sarcoma. All 4 patients developed severe FNA-induced cyst infection causing mediastinitis and the need for surgical debridement. Despite an immediate review of the FNA by the on-site cytopathologist with establishing the diagnosis of a duplication cyst, peri-interventional broad-spectrum antibiotics could not prevent severe infections of the lesions. Conclusions: Given the potentially high rate of infectious complications, we advocate a very restrictive indication for diagnostic FNA in mediastinal masses. Yet, in unclear cases, FNA might be indispensable despite the potential adverse events in order to rule out hypoechoic, mediastinal malignancy.
quently provoke cough or stridor, cysts of the middle or lower esophagus can cause dysphagia or epigastric pain [4, 5]. According to Maier [1], bronchogenic cysts may be divided into the following 5 groups: paratracheal, carinal, hilar, paraesophageal, and miscellaneous.

Duplication cysts are usually detected incidentally upon plain radiographic studies. On computed tomography (CT), the content attenuation of the sharply marginated lesions ranges from fluid to air to soft-tissue density. CT imaging is only diagnostic for a cyst in the first case. In the cases of air or soft-tissue density, magnetic resonance imaging (MRI) may help to further ascertain the cystic nature [6]. On endoscopic ultrasound (EUS), duplication cysts classically appear as anechoic, homogeneous masses with 3–5 layered walls on EUS. Ultimately, the multilayered wall must be seen in one of those imaging techniques for diagnosis insurance, since the cyst content varies considerably.

The diagnosis of mediastinal duplication cysts and even more their differentiation from other solid thoracic tumors is crucial. The viscous and proteinaceous content may mimic a solid mass with malignant potential due to its hypoechoic echo pattern [3]. The fairly high diagnostic uncertainty after CT and MRI may be improved through EUS. But since the appearance of benign mediastinal tumors varies in EUS, also the endosonographer often encounters difficulties to distinguish them from other hypoechoic, solid neoplasms such as paratracheal, solid neoplasms as gastrinomas. Therefore, EUS-guided fine needle aspiration (FNA) might be inevitable in some cases in order to sustain an accurate diagnosis.

To date, it is controversial whether or not cyst cytology is needed to diagnose a duplication cyst and to rule out hypoechogenic malignancies of the mediastinum. Even though EUS-guided FNA of duplication cysts has been considered as safe [7], there are a few case reports of диагностically misleading results due to mediastinitis. Diehl et al. [9] even reported a case of esophageal duplication cyst misdiagnosed for a lymph node metastasis. A bronchogenic cyst was reported by Annema et al. [10].

Table 1. Case overview

| Case | Age, years | Gender | Symptoms | CT diagnosis | EGD | EUS | FNA cytology | Antibiotics | Regimen | Complication | Surgery | Definitive diagnosis |
|------|------------|--------|----------|-------------|-----|-----|-------------|-------------|---------|--------------|---------|----------------------|
| 1    | 46         | f      | dysphagia| suspected bronchogenic cyst | extrinsic compression | solitary, anechoic mass, adherent to the unlayered, esophageal wall | 40×33 | not performed | na | none | cyst resection | bronchogenic duplication cyst |
| 2    | 72         | f      | none     | mediastinal mass, no further classification possible | extrinsic compression | solitary, partially echogenic mass, no wall layers, adherent to esophagus | 55×45 | foam cells | 22 G | post-procedural | infected cyst with esophageal leak | esophageal duplication cyst |
| 3    | 85         | f      | none     | unclear mass after mediastinal Hodgkin’s disease | normal | solitary, echogenic, no wall layers | 41 | foam cells | 19 G | none | infected cyst | esophageal duplication cyst |
| 4    | 71         | m      | coughing | bronchogenic cyst with wall thickening, DD carcinoma | extrinsic compression | solitary, mixed hyperechogenic mass, wall layers, not adherent to esophagus | 70×70 | acute inflammation | 22 G | procedural and post-procedural | sepsis with mediastinitis | esophageal rupture due to abscess |
| 5    | 58         | m      | none     | esophageal leiomyoma | extrinsic compression | solitary, mixed hyperechoic mass, rising from esophageal muscularis, calcifications | 80×50 | acellular mucus | 22 G | procedural | esophagectomy | esophageal duplication cyst |

f, female; m, male; CT, computed tomography; EGD, esophagogastroduodenoscopy; EUS, endoscopic ultrasound; FNA, fine needle aspiration; na, not applicable; bid, twice daily; DD, differential diagnosis; iv, intravenously; po, per os; VAC, vacuum-assisted closure.
We here report a case series of all patients at our institution undergoing EUS evaluation for suspected mediastinal duplication cysts \( (n = 5) \). In 1 out of 5 patients, we abstained from EUS-guided FNA since the EUS appearance of the lesion was judged as accurate for a duplication cyst. In the other 4 patients with suspected mediastinal duplication cysts, we did perform EUS-guided FNA in order to rule out malignancy. In 3 out of 4 patients, a duplication cyst (1 bronchogenic, 2 esophageal) was confirmed. The fourth lesion turned out to be a sarcoma. All 4 patients developed severe FNA-induced cyst infection causing mediastinitis and the need for surgical debridement. Despite an immediate review of the FNA by the on-site cytopathologist with establishing the diagnosis of a duplication cyst, peri-interventional broad-spectrum antibiotics could not prevent severe infections of the cyst.

**Patients and Methods**

All patients provided written consent for the endoscopy as well as research with their medical data. Over the last 15 years, 5 patients with suspected or finally proven mediastinal duplication cysts were evaluated at our institution. In 1 patient, the EUS features were suggestive for a duplication cyst and no FNA was performed. In the other 4 cases, despite atypical EUS appearance for duplication cysts, EUS-guided FNA was performed in order to rule out malignancy. Up to 800 EUS including approximately 150 FNA are conducted each year at our institution. The procedures were all performed by 2 experienced endoscopists and/or under their direct supervision. Patients underwent first esophagogastroduodenoscopy and then EUS followed by FNA under EUS guidance during 1 intervention. Either a 19- or a 22-gauge needle was used for the FNA. Our on-site cytopathologist immediately reviewed the cytology (rapid on-site evaluation, ROSE). If the specimen was not diagnostic after the first pass, a second FNA was performed. The procedures were all conducted under conscious sedation. The characteristics of the 5 cases are listed in Table 1. CT and EUS images of the 5 patients are shown in Figure 1. Figure 2 shows how delicate the differentiation of a layered duplication cyst wall and the wall of a neoplasia may be.

**Results and Case Presentations**

Over the last 15 years, 5 patients with suspected or proven mediastinal duplication cysts were evaluated at our institution and included in this case series. In 1 patient (case 1), EUS-guided FNA was not necessary due to classical EUS appearance of the lesion of a duplication cyst. The mediastinal lesion of the other 4 patients (cases 2–5) did not feature typical EUS features for duplication cysts, wherefore we did perform EUS-guided FNA in order to rule out malignancy. The mediastinal lesion of the other 4 patients (cases 2–5) did not feature typical EUS features for duplication cysts, wherefore we did perform EUS-guided FNA in order to rule out malignancy. In 3 out of 4 patients, a duplication cyst (1 bronchogenic, 2 esophageal) was ultimately confirmed by FNA (cases 2, 3, and 5). The fourth lesion turned out to be a sarcoma (case 4). All 4 patients developed severe FNA-induced infection causing mediastinitis and the need for surgical debridement. Despite an immediate ROSE of the FNA sample by our cytopathologist with establishing the diagnosis of a duplication cyst, peri-interventional initiation of broad-spectrum antibiotics administration could not prevent severe infections of lesions.

**Case 1**

Seven months after incidental detection of a mediastinal cystic lesion on a CT scan, the 46-year-old female patient was evaluated due to progressing dysphagia and globus sensation. After initial conservative observation, the patient was transferred to our institution due to a rapidly increasing cyst size. Upon EUS evaluation, the cystic lesion measured 40 × 33 mm and was adherent to the

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*Fig. 1. Paired images of computed tomography scan and endoscopic ultrasound for all patients (cases 1–5).*
esophagus displaying a clear, but non-layered wall. The center of the lesion was anechoic with solid structures. Therefore, we established the suspected diagnosis of a mediastinal duplication cyst and abstained from EUS-guided FNA. The patient underwent uneventful surgical resection and histopathological review confirmed the diagnosis of a bronchogenic duplication cyst.

**Case 2**

CT scan was performed in a 72-year-old female patient due to persistent opacity on the chest radiograph after treatment of pneumonia. Unfortunately, the elsewhere performed CT scan did not allow further classification of the 50 × 40 mm measuring mediastinal mass. Extrinsic esophageal compression was detected upon esophagogastroduodenoscopy even though the patient did not suffer from dysphagia. EUS displayed a solitary, partially echogenic mass adherent to the esophagus without evidence of wall layers. Even though a duplication cyst was possible among several other differential diagnoses, we decided to perform EUS-guided FNA in order to rule out malignancy after procedural administration of intravenous antibiotics (tazobactam/piperacillin). The ROSE report proved the presence of foam cells. Therefore, prophylactic post-procedural antibiotics (ciprofloxacin) were then prescribed for 7 days. The definitive cytology confirmed the suspected presence of cystic lesion without dysplasia. One week later, the patient was re-admitted due to the new appearance of dysphagia and thoracic pain along with elevated inflammation markers in the blood work. The diagnosis of a superinfected esophageal duplication cyst after diagnostic FNA was made and surgical resection of the cyst was conducted. Unfortunately, leakage of the esophageal suture occurred and placement of a self-expandable metallic stent and surgical empyema evacuation had to be executed. Microbiological cultivation of empyema samples showed growth of *Bacillus cereus* and *Klebsiella pneumonia* and antimicrobial treatment was adjusted according to cumulative antibiogram. A chronic esophageal fistula developed and several self-expandable metallic stent changes and the placement of an over-the-scope clip (OTSC®, Ovesco Tübingen, Germany) were needed before the patient recovered fully. The histology of the resected specimen revealed a cyst lined by ciliated epithelium and parts of smooth muscle and cartilage confirming the diagnosis of a bronchogenic cyst.

**Case 3**

A 60-year-old female patient underwent radiologic imaging for weight loss, loss of appetite, and persistent coughing. She was diagnosed with a mediastinal mass. In order to rule out malignancy, surgical thoracoscopy and biopsy were performed under prophylactic broad-spectrum antibiotic treatment. Histopathological processing revealed Hodgkin’s disease. Furthermore, the patient developed mediastinitis due to the mediastinoscopy despite antibiotic prophylaxis. Multiple surgical debridements were needed before the infection was cured. Approximately 2 years later, a new metabolically active mediastinal lesion was found upon 18F-FDG PET/CT surveillance. Due to the lack of a layered wall and the echogenic content of the lesion, EUS-guided FNA was performed to exclude recurrent Hodgkin’s disease. Prophylactic broad-spectrum antimicrobial therapy (amoxicillin/clavulanate) was prescribed for 2 weeks. ROSE only confirmed
parts of a cystic lesion including foam cells and cell detritus without dysplasia. Unfortunately, the patient again developed infection of the newly diagnosed bronchogenic cyst and robot-assisted resection and debridement were conducted before the patient recovered fully. Histological analysis of the resected lesion featured a cyst lined with a ciliated epithelium including a florid inflammation reaction consistent with a bronchogenic cyst.

**Case 4**
A 71-year-old male patient was diagnosed with a mediastinal mass due to new productive coughing. On the initial CT scan, a bronchogenic cyst was suspected, but due to abnormal thickening of the wall, endobronchial ultrasound-guided FNA was performed to rule out bronchogenic carcinoma. Cytopathological analysis revealed a mitotic active neoplasia, but immunohistochemical staining failed to further differentiate the tumor, wherefore additional diagnostics were indicated. After detection of a 7 × 7 cm solitary, mixed echogenic lesion without classical wall layers (see also Fig. 2) and no adherence to the esophagus, we performed EUS-guided FNA after procedural administration of intravenous broad-spectrum antibiotics (tazobactam/piperacillin). ROSE was only able to diagnose acute, abscess-forming inflammation. The patient developed fever (38.8°C) shortly after the intervention, wherefore continuous broad-spectrum antibiotic treatment for 7 days was initiated (amoxicillin/clavulanate). Upon suspected superinfection, the mass was removed surgically and a retrocardiac vacuum-assisted closure system was placed. Histopathological analysis of the surgical specimen revealed a sarcoma of follicular dendritic cells. No tumor metastasis or recurrence was noted in the follow-up.

**Case 5**
In the search for malignancy due to generalized erythromelalgia, an intramural esophageal lesion was detected in a 58-year-old male patient on CT imaging. Due to the progression in size of the suspected leiomyoma, EUS was performed and revealed a hypoechogenic, submucosal lesion lacking a layered wall (see also Fig. 2). To rule out a radiographically suspected leiomyoma or gastrointestinal stromal tumor, EUS-guided FNA was performed and broad-spectrum antibiotics (tazobactam/piperacillin) was administered during the procedure and once post-procedural. ROSE revealed cylinders of acellular mucus suggesting a mucin-producing lesion. Five days later, superinfection of the lesion was noted and pus drained into the esophageal lumen. Cultivation of blood cultures showed growth of pansensitive *Streptococcus anginosus* and *S. mitis/oralis*. Continued antimicrobial treatment consisting of tazobactam/piperacillin was not able to contain the diffuse spreading of the infection. After rupture of the abscess into the esophageal wall, total esophagectomy with creation of a cervical esophagostomy became necessary to control the infection. Apart from extensive inflammation reaction, the removed surgical specimen featured a ciliated epithelium-lined cyst including a smooth muscle wall and calcifications consistent with an esophageal duplication cyst.

**Discussion**
Classic transsectional imaging modalities such as CT and MRI have limited accuracy to diagnose foregut and bronchogenic duplication cysts. For instance, CT imaging was reported to misclassify such mediastinal cysts for other soft tissue lesions in up to 43% due to the cyst attenuation variation ranging from water to soft tissue [11]. The authors concluded that MRI might improve the diagnostic accuracy by showing a clearly increased signal intensity within the cysts on T2-weighted images [11]. Eloubeidi et al. [12] elaborated in their study that CT and MRI failed to diagnose duplication cysts in up to 30%.

The European Society of Gastrointestinal Endoscopy state in their guideline paper published in *Endoscopy* [13] that EUS-guided FNA of cystic lesion in the mediastinum bears the potential risk of life-threatening mediastinitis and therefore refuse the FNA of simple mediastinal cysts. However, the guidelines state that EUS-guided FNA plays a role to rule out malignancy in atypical or complex cysts. In such cases, antibiotic prophylaxis should be given. Due to the fact that duplication cysts may contain high amounts of protein or calcium that are echogenic on EUS, instead of being hypoechogenic like classic cystic lesion, even the diagnostic uncertainty of EUS may be significant. Therefore, in order to provide a definitive diagnosis of a newly detected mediastinal mass, FNA has to be considered to exclude a hypoechogenic malignancy. Yet, the extension of the diagnostic pathway by EUS-guided FNA transforms the classical EUS into a complication-prone procedure. The American Society for Gastrointestinal Endoscopy indeed acknowledges the infection risk caused by EUS-guided FNA of cysts in general and recommends prophylactic and short post-procedural antibiotic treatment. Yet, the authors do not provide any recommendation on whether or not FNA shall be performed in the further evaluation process of complex or atypical medias-
tinal cysts [14]. Interestingly, EUS-guided FNA of pancreatic cysts seems safer and less prone to cause cyst infection than in the mediastinum [15].

Eloubeidi et al. [12] suggested searching for detached ciliary tufts in the cyst fluid upon cytological review in order to diagnose a duplication cyst. In their study, EUS and EUS-guided FNA was shown to correctly diagnose those 30% of mediastinal masses priorly misdiagnosed by CT and MRI [12]. Ultimately, plain EUS struggles with the same limitations as other modern imaging modalities in order to establish an accurate assessment in the presence of semi-liquid cyst filling.

Once the diagnosis of a symptomatic mediastinal duplication cyst is established, surgery remains the treatment of choice. To date it is still controversial whether or not asymptomatic cysts should be resected. Supporters of that paradigm advocate that asymptomatic cysts will either become symptomatic in the future in approximately 70% [16], or regular follow-up imaging is warranted indefinitely in order to prevent malignant transformation [17, 18]. Furthermore, definitive diagnosis might only be established upon histopathological review of surgical specimen. Even though Cioffi et al. [19] presented a series of 26 patients who underwent surgical resection of a bronchogenic or esophageal duplication cyst without detection of postoperative morbidity, the risk of postsurgical morbidity and mortality cannot be neglected.

Although Fazel et al. [7] reported no infectious complications in 22 patients undergoing EUS-guided FNA of mediastinal cysts, we have treated 4 patients for life-threatening, infectious complications after diagnostic EUS-guided FNA of unclear mediastinal masses since the introduction of EUS-guided FNA at our institution 15 years ago. Three of the lesions turned out to be duplication cysts, whilst 1 was a mediastinal sarcoma of follicular dendritic cells. All 3 of the duplication cysts did not display classic cystic features in the EUS, wherefore further diagnostic information was sought by FNA to exclude a solid, malignant process. In retrospect, especially the echogenic content led to the false diagnosis and consecutively to the conduction of an FNA. The post-procedural infections occurred despite the administration of pre- and/or post-procedural antibiotics and the use of a smaller 22-gauge needle in 3 cases. This complication rate of 100% (4 out of 4 FNA of suspected mediastinal duplication cysts ever performed at our institution) stands in sheer contrast to the lack of complication (0 out of a few hundred) reported for EUS-guided FNA of mediastinal lymph nodes [20]. One could hypothesize that the protein-rich content of a duplication cyst is an excellent nutrient medium for bacteria originating from the human oropharyngeal tract.

We conclude that in order to accurately diagnose a duplication cyst upon imaging only, it is crucial to clearly identify a layered cyst wall in at least one imaging modality before performing EUS. Furthermore, we believe that severe infection after EUS-guided FNA in mediastinal cysts is more frequent than thought so far. Even procedural and/or post-procedural administration of antibiotics did not allow infection prevention in our study. Possibly, the inorganic mucoid cyst content renders the bacteria inaccessible to antimicrobial agents. Despite the limited study design of our retrospective case series lacking a uniform administration of antibiotic prophylaxis, we aim to sensitize other colleagues for our observed risk of severe complications when dealing with mediastinal duplication cysts. A prospective study design would be very desirable, but given the rare incidence of the entity, reaching sufficient power might be challenging.

Conclusion

Given the potentially high rate of infectious complications, we advocate a very restrictive indication for diagnostic FNA in mediastinal masses if a duplication cyst is suspected. Yet, in unclear cases, FNA might be indispensable despite the potential adverse events in order to rule out hypoechoic, mediastinal malignancy.

Statement of Ethics

All patients provided written consent for the interventions as well as publication of their anonymized medical data.

Disclosure Statement

The authors hereby state no conflicts of interest. None of the authors received any funding for the current case series.

Author Contributions

P.V.V.: performance of endoscopies, writing manuscript. C.G.: performance of endoscopies, editing manuscript. P.B.: performance of endoscopies, editing manuscript.
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References

1. Maier HC: Bronchiogenic cysts of the mediastinum. Ann Surg 1948;127:476–502.
2. Geller A, Wang KK, DiMagno EP: Diagnosis of foregut duplication cysts by endoscopic ultrasonography. Gastroenterology 1995;109:838–842.
3. Bhatia V, Tajika M, Rastogi A: Upper gastrointestinal submucosal lesions – clinical and endosonographic evaluation and management. Trop Gastroenterol 2010;31:5–29.
4. Neo EL, Watson DJ, Bessell JR: Acute ruptured esophageal duplication cyst. Dis Esophagus 2004;17:109–111.
5. Bowton DL, Katz PO: Esophageal cyst as a cause of chronic cough. Chest 1984;86:150–152.
6. Cardinale L, Ardissone F, Cataldi A, Gned D, Prato A, Solitto F, Fava C: Bronchogenic cysts in the adult: diagnostic criteria derived from the correct use of standard radiography and computed tomography. Radiol Med 2008;113:385–394.
7. Fazel A, Moezardalan K, Varadaraju S, Dragani P, Eloubeidi MA: The utility and the safety of EUS-guided FNA in the evaluation of duplication cysts. Gastrointest Endosc 2005;62:575–580.
8. Wildi SM, Hoda RS, Fickling W, Schmulewitz N, Varadarajulu S, Roberts SS, Ferguson B, Hoffman BJ, Hawes RH, Wallace MB: Diagnosis of benign cysts of the mediastinum: the role and risks of EUS and FNA. Gastrointest Endosc 2003;58:362–368.
9. Diehl DL, Cheruvattath R, Facktor MA, Go BD: Infection after endoscopic ultrasonography-guided aspiration of mediastinal cysts. Interact Cardiovasc Thorac Surg 2010;10:338–340.
10. Annema JT, Veselic M, Versteegh MI, Rabe KF: Mediastinitis caused by EUS-FNA of a bronchogenic cyst. Endoscopy 2003;35:791–793.
11. McAdams HP, Kirejczyk WM, Rosado-de-Christenson ML, Matsumoto S: Bronchogenic cyst: imaging features with clinical and histopathologic correlation. Radiology 2000;217:441–446.
12. Eloubeidi MA, Cohn M, Cerfolio RJ, Chhieng DC, Jhala N, Jhala D, Eltoum IA: Endoscopic ultrasound-guided fine-needle aspiration in the diagnosis of foregut duplication cysts: the value of demonstrating detached ciliary tufts in cyst fluid. Cancer 2004;102:253–258.
13. Polkowski M, Larghi A, Weynand B, Boussiere C, Giovannini M, Pujol B, Dumonceau JM, European Society of Gastrointestinal E: Learning, techniques, and complications of endoscopic ultrasound (EUS)-guided sampling in gastroenterology: European Society of Gastrointestinal Endoscopy (ESGE) technical guideline. Endoscopy 2012;44:190–206.
14. ASGE Standards of Practice Committee, Earley DS, Acosta RD, Chandrasekharra V, Chathadi KV, Decker GA, Evans JA, Fanelli RD, Fisher DA, Fonkalsrud L, Hwang JH, Jue TL, Khashab MA, Lightdale JR, Muthusamy VR, Pasha SF, Saltzman JR, Sharaf RN, Shergill AK, Cash BD: Adverse events associated with EUS and EUS with FNA. Gastrointest Endosc 2013;77:839–843.
15. Lee LS, Saltzman JR, Bounds BC, Poneros JM, Brugge WR, Thompson CC: EUS-guided fine needle aspiration of pancreatic cysts: a retrospective analysis of complications and their predictors. Clin Gastroenterol Hepatol 2005;3:231–236.
16. St-Georges R, Deslauriers J, Duranceau A, Vaillancourt R, Deschamps C, Beauchamp G, Page A, Brisson J: Clinical spectrum of bronchogenic cysts of the mediastinum and lung in the adult. Ann Thorac Surg 1991;52:6–13.
17. Miralles Lozano F, Gonzalez-Martinez B, Luna More S, Valencia Rodriguez A: Carcinoma arising in a calcified bronchogenic cyst. Respiration 1981;42:135–137.
18. Faigel DO, Burke A, Ginsberg GG, Stotland BR, Kadish SL, Kochman ML: The role of endoscopic ultrasound in the evaluation and management of foregut duplications. Gastrointest Endosc 1997;45:99–103.
19. Cioffi U, Bonavina L, De Simone M, Santambrogio L, Pavoni G, Testori A, Perachia A: Presentation and surgical management of bronchogenic and esophageal duplication cysts in adults. Chest 1998;113:1492–1496.
20. Fritsch-Ravens A, Srimat PV, Bobrowski C, Pforte A, Topalsid T, Krause C, Jaekle S, Thonke F, Soehendra N: Mediastinal lymphadenopathy in patients with or without previous malignancy: EUS-FNA-based differential cytodiagnosis in 153 patients. Am J Gastroenterol 2000;95:2278–2284.