Scintigraphic detection of carcinoid tumors with a cost effectiveness analysis
Dimitroulopoulos D, Xynopoulos D, Tsamakidis K, Paraskevas E, Zisimopoulos A, Andriotis E, Fotopoulou E, Kontis M, Paraskevas I, Apostolikas N

Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of somatostatin receptor scintigraphy (SRS) for the diagnosis of gastroenteropancreatic carcinoid tumours. Details of the diagnostic procedure were reported.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with histological or cytological confirmation of an operated (present or past) abdominal carcinoid, or for patients with suspected tumours, a history of carcinoid syndrome-related signs and symptoms with an additional elevation of urinary 5-HIAA (not defined).

Setting
The setting was a hospital. The economic study was carried out in Greece.

Dates to which data relate
The effectiveness and resource use data were gathered from April 1997 to October 2003. The price year was not explicitly stated, although some costs were estimated in 2000.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was carried out prospectively on the same sample of patients as that used in the clinical study.

Study sample
A sample of 31 patients (18 males and 13 females; age range: 27 - 73 years) was enrolled in the study. Seven patients were under investigation for suspected carcinoids in different sites (caecum, appendix, small intestine, pancreas) and 24 had histologically or cytologically confirmed tumours (in 10 of them the primary lesion was excised). Power calculations do not appear to have been performed.

Study design
This was a diagnostic study that was carried out at the "Agios Savvas" Cancer Hospital (Section of Nuclear Medicine) in Athens. All patients underwent both diagnostic procedures. The patients were not followed after a diagnosis was made. No patient was lost to follow-up. No blinded assessment of the outcome was undertaken.

**Analysis of effectiveness**

All of the patients included in the initial study sample were accounted for in the analysis of effectiveness. The primary outcome measure was the rate of detection of primary and metastatic sites, globally and in each group of patients. False-negative results and sensitivity values were also assessed.

**Effectiveness results**

SRS visualised the primary tumour or metastatic sites in 22 (71.0%) out of 31 patients. More specifically, 16 of the 24 (66.7%) who had histologically-cytologically confirmed carcinoid tumours and 6 of the 7 (85.7%) who were under investigation for highly suspected carcinoid.

Conventional imaging was positive in 19 (61.3%) patients. More specifically, 4 of the 7 (57.1%) with suspected carcinoids and 15 of the 24 (62.5%) with known tumours.

Thus, SRS provided additional detection sites when compared with conventional imaging methods, even if the global detection rates were quite similar (71.0% versus 61.3%).

The detection of primary sites was 33.3% higher with SRS than with conventional methods (71.4% versus 38.1%; p=0.039). The primary lesions were detected by SRS in 15 (71.4%) of the 21 patients. Octreoscan scintigraphy failed to detect primary tumours in 6 patients (28.6%), 4 with known lesions (stomach, duodenum, appendix, caecum) and 2 under investigation (appendix, small intestine). The 6 lesions (<1 cm) that were not visualised after injection of 111-In-pentetreotide were detected by endoscopy (3) or surgery (3) and diagnosed by histology. Only one of the 6 lesions was visualised by conventional imaging methods.

The positive detection rates in metastatic sites were similar for SRS and conventional imaging methods, 48.4% and 51.6% respectively, (p>0.05).

In the 19 patients with metastatic disease, SRS detected metastatic lesions in 15 cases (78.9%). However, it failed to visualise metastatic sites in 4 patients (21.1%), all in the liver, which were subsequently detected by ultrasonography and CT scans.

Conventional imaging visualised metastases in 16 (84.2%) patients with a detection rate 5.3% higher than that for SRS.

In the case of primary sites, the rate of false-negative results was 28.57% for both known and suspected carcinoids with SRS. With conventional imaging methods, the rate was 71.42% for known carcinoids and 42.85% for suspected carcinoids.

In the case of metastatic sites, the rate of false-negative results was 16.66% for known carcinoids and 0% for suspected carcinoids with SRS. With conventional imaging methods, the rate was 4.16% for known carcinoids and 28.6% for suspected carcinoids.

When diagnostic strategies were combined, the sensitivity was:

- 88.75% for chest X-ray/upper abdominal CT scan/SRS,
- 88.75% for chest CT scan/upper abdominal CT scan/SRS,
- 82% for chest X-ray/upper abdominal ultrasonography/SRS, and
- 82% for chest CT scan/upper abdominal ultrasonography/SRS.
Clinical conclusions
The effectiveness analysis showed that SRS was a very sensitive method for the detection of primary and metastatic gastroenteropancreatic carcinoids, but was less sensitive than ultrasound and CT in the detection of liver metastases. High detection rates were observed when diagnostic tools were combined.

Measure of benefits used in the economic analysis
The health outcomes were left disaggregated and no summary benefit measure was used in the economic evaluation. In effect, a cost-consequences analysis was carried out.

Direct costs
The perspective adopted in the study was unclear. The economic evaluation included the costs of the diagnostic procedures. Personnel costs were calculated as the cost of a working hour for each person (physician, technician, nurse, or assistant personnel). The cost of materials covered radiographs, injection systems, contrast liquids and kit material. Equipment cost was calculated in working hours. Housing and overhead costs were based on the number of square metres required to investigate a patient, including the cost of furniture, cleaning, telephone and the services of various overhead departments. While the unit costs were reported, the quantities of resources used were unclear (a single procedure was assumed for each diagnostic tool). Resource use was estimated on the basis of a sample of patients included in the clinical study. The costs were estimated from a database of health care cost elements in Greece and from actual prices of Octreoscan and contrast materials. Discounting was not relevant because of the short timeframe of the analysis. The price year was not reported, although some costs (i.e. equipment costs) were assessed in 2000.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
Euros (Euro).

Sensitivity analysis
Sensitivity analyses were not performed.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The cost analysis was restricted to four combinations of diagnostic procedures which were the most sensitive among all considered in the clinical study.

The estimated costs were:

Euro 1,294.93 for chest X-ray/upper abdominal CT scan/SRS,

Euro 1,362.75 for chest CT scan/upper abdominal CT scan/SRS,

Euro 1,183.93 for chest X-ray/upper abdominal ultrasonography/SRS, and
Euro 1,251.75 for chest CT-scan/upper abdominal ultrasonography/SRS.

**Synthesis of costs and benefits**
A synthesis of the costs and benefits was not relevant since a cost-consequences analysis was performed.

**Authors' conclusions**
Somatostatin receptor scintigraphy (SRS) provided more relevant information than conventional imaging for the diagnostic management of gastroenteropancreatic carcinoid tumours. Thus, the optimal strategy was a combination of SRS and conventional imaging modalities such as chest X-ray/upper abdominal computed tomography (CT) scan or chest CT scan/upper abdominal CT scan.

**CRD COMMENTARY - Selection of comparators**
The selection of the comparators was appropriate as a series of combined diagnostic tools, which reflected actual patterns of care in the authors' institution, was considered. Magnetic resonance, another potentially useful diagnostic approach, was not considered because it was not commonly used. You should decide whether they are valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness analysis was based on a diagnostic study. This was appropriate for the study question since the same group of patients underwent all diagnostic assessments. Thus, no external comparison group was needed, which limits the potential impact of selection bias. However, the sequence of tests was not described. Further, it was unclear whether some assessment bias could have affected the results of the analysis because details on the investigators evaluating the results of the interventions (i.e. number, blinding and expertise) were not reported. A relatively small sample of patients was enrolled in the study, but no statistical justification for the sample size was provided. The evidence came from a single centre, which might limit how representative the patient sample was. These issues might reduce the internal validity of the study.

**Validity of estimate of measure of benefit**
No summary benefit measure was used in the analysis because a cost-consequences analysis was conducted. Please refer to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

**Validity of estimate of costs**
The cost analysis was restricted to those health services strictly related to the use of the diagnostic procedures. The costs associated with the subsequent treatment of patients were not considered. A detailed breakdown of the cost items was provided, but the unit costs were presented only as macro-categories. Similarly, limited information on resource consumption was provided. This limits the possibility of replicating the analysis in other settings. The source of the data was reported, but few details were provided. Thus, it was unclear whether the costs reflected charges, reimbursement rates, or actual prices. The price year was not reported, which makes reflation exercises in other time periods difficult. The cost estimates were specific to the study setting and were not varied in the sensitivity analysis.

**Other issues**
The authors stated that their findings were consistent with those observed in published studies. The issue of the generalisability of the study results to other settings was not explicitly addressed, and all estimates were specific to the study context. This limits the external validity of the study. The study referred to patients with known or suspected gastroenteropancreatic carcinoid tumours and this was reflected in the authors’ conclusions.

**Implications of the study**
The study results support the addition of SRS to conventional imaging techniques for the diagnosis of gastroenteropancreatic carcinoid tumours.

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Bibliographic details
Dimitroulopoulos D, Xynopoulos D, Tsamakidis K, Paraskevas E, Zisimopoulos A, Andriotis E, Fotopoulou E, Kontis M, Paraskevas I, Apostolikas N. Scintigraphic detection of carcinoid tumors with a cost effectiveness analysis. World Journal of Gastroenterology 2004; 10(24): 3628-3633

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15534919

Other publications of related interest
Kwekkeboom DJ, Lamberts SW, Habbema JD, et al. Cost-effectiveness analysis of somatostatin receptor scintigraphy. Journal of Nuclear Medicine 1996;37:886-92.

Scherubl H, Bader M, Fett U, et al. Somatostatin-receptor imaging of neuroendocrine gastroenteropancreatic tumours. Gastroenterology 1993;105:1705-9.

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Subject indexing assigned by NLM

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Adult; Aged; Carcinoid Tumor /economics /radionuclide imaging; Cost-Benefit Analysis; Female; Gastrointestinal Neoplasms /economics /radionuclide imaging; Humans; Indium Radioisotopes; Male; Middle Aged; Octreotide /analogs & derivatives; Pancreatic Neoplasms /economics /radionuclide imaging; Pentetic Acid /analogs & derivatives; Radionuclide Imaging /economics /methods; Radiopharmaceuticals; Receptors, Somatostatin; Sensitivity and Specificity

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