

LETTERS

Endobronchial ultrasound guided transbronchial needle aspiration of mediastinal lymph nodes for lung cancer staging: a projected cost analysis

Endobronchial ultrasound guided-transbronchial needle aspiration (EBUS-TBNA) of mediastinal lymph nodes provides a safe alternative to mediastinoscopy for staging patients with lung cancer.¹⁻⁵ Performing TBNA under real time ultrasound visualisation has been shown to significantly improve the yield of TBNA compared with conventional TBNA performed without visualisation.⁶ In addition to the clinical benefits of this procedure, EBUS-TBNA is likely to offer ongoing cost savings by avoiding the need for mediastinoscopy procedures and positron emission tomography (PET) scans in some patients.

At Leeds Teaching Hospitals NHS Trust (LTHT), conventional TBNA is used to assess large subcarinal nodes, but the Trust does not currently offer an EBUS-TBNA service. By reviewing mediastinoscopies performed as staging procedures for lung cancer in LTHT during 2006, we estimated the financial implications of establishing an EBUS-TBNA service.

METHODS

We hypothesised that patients found to have N2/N3 disease by EBUS-TBNA at initial bronchoscopy would then not require further investigation with PET imaging and mediastinoscopy. To estimate the number of EBUS-TBNA investigations that would demonstrate mediastinal malignant disease, we determined the proportion of staging mediastinoscopies positive for malignancy, and the sensitivity of EBUS-TBNA for malignancy according to published series.

The capital costs for EBUS-TBNA were determined. The UK NHS tariffs for mediastinoscopy, PET and EBUS-TBNA bronchoscopy were determined. In addition, the actual unit based costs to the hospital for providing mediastinoscopy and EBUS-TBNA (projected) were calculated for LTHT. The annual cost implications of establishing an EBUS-TBNA service were estimated for the local NHS economy as a whole, primary care trusts (purchasers of secondary care) and LTHT (local provider of secondary care).

RESULTS

Forty-seven patients underwent mediastinoscopy as a staging procedure for lung cancer in LTHT in 2006. Twenty-eight patients were shown to have malignant disease in N2 or N3 nodes, of which 27 were deemed accessible to EBUS-TBNA (all had mediastinal lymphadenopathy on initial CT scan). Mean EBUS-TBNA sensitivity for malignancy in recently

published series was 92.3%.¹⁻⁵ We therefore projected that 25 patients would have had mediastinal malignancy demonstrated by EBUS-TBNA and would therefore not have undergone CT-PET and mediastinoscopy.

Capital costs for EBUS-TBNA were £104 465 over 5 years. The national tariff for mediastinoscopy was £2157, and the actual unit based cost for the hospital was £2000. The national tariff for PET was £975; PET is provided by an independent contractor and thus is cost neutral for LTHT. The tariff cost for standard fiberoptic bronchoscopy was £575. EBUS bronchoscopy does not currently attract an additional payment above the standard tariff. The projected unit based cost to the hospital for EBUS-TBNA was £484, rising to £675 if combined with endobronchial biopsy. These costs increase to £929 and £1120, respectively, if capital costs (distributed over 5 years) were included.

We calculated that the introduction of an EBUS-TBNA service would save the local NHS economy £32 631 per year (including capital costs). Taking into account the current tariff for EBUS-TBNA and referral routes of patients to LTHT, introduction of a service would save the local primary care trusts £58 750 per annum, but would cost LTHT an additional £26 119 per annum.

DISCUSSION

Our study identifies potential cost savings for the NHS as a result of the introduction of EBUS-TBNA. The limitations of this analysis are as follows. The sensitivities quoted in published series refer to all TBNA accessible nodes. At LTHT, large subcarinal nodes are already assessed by conventional TBNA and, if malignant disease is detected, do not undergo mediastinoscopy (and thus would not feature in this analysis). The sensitivity figures quoted may therefore represent an overestimate for the purposes of this analysis. In addition, our analysis makes no allowance for a learning curve with the procedure. However, even with a reduced sensitivity of 80%, the annual local NHS saving would be £22 516.

EBUS-TBNA offers significant time reductions between referral and treatment for some patients with lung cancer. It may also reduce hospital admissions and minimise morbidity associated with mediastinal staging. This cost minimisation analysis has identified potential savings for the NHS as a whole, but the current national tariff structure acts as a disincentive for UK hospitals to establish such a service. The introduction of an additional tariff for EBUS-TBNA would encourage greater uptake of this technique.

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REFERENCES

1. Yasufuku K, Chivo M, Sekine Y, *et al*. Real-time endobronchial ultrasound-guided transbronchial needle aspiration of mediastinal and hilar lymph nodes. *Chest* 2004;**126**:122-8.
2. Rintoul RC, Skwarski KM, Murchison JT, *et al*. Endobronchial and endoscopic ultrasound-guided real-time fine-needle aspiration for mediastinal staging. *Eur Respir J* 2005;**25**:416-21.
3. Yasufuku K, Chiyo M, Koh E, *et al*. Endobronchial ultrasound guided transbronchial needle aspiration for staging of lung cancer. *Lung Cancer* 2005;**50**:347-54.
4. Yasufuku K, Nakajima T, Motoori K, *et al*. Comparison of endobronchial ultrasound, positron emission tomography, and CT for lymph node staging of lung cancer. *Chest* 2006;**130**:710-18.
5. Herth FJ, Eberhardt R, Vilmann P, *et al*. Real-time endobronchial ultrasound guided transbronchial needle aspiration for sampling mediastinal lymph nodes. *Thorax* 2006;**61**:795-8.
6. Herth F, Becker HD, Ernst A. Conventional vs endobronchial ultrasound-guided transbronchial needle aspiration—a randomized trial. *Chest* 2004;**125**:322-5.

Effect of CPAP on insulin resistance in patients with obstructive sleep apnoea and type 2 diabetes

West *et al* are to be commended for the laborious study of the impact of continuous positive airway pressure (CPAP) on insulin resistance and glycaemic control in males with obstructive sleep apnoea syndrome (OSAS) and type 2 diabetes (*Thorax* 2007;**62**:969-74). The authors did not demonstrate an improvement in insulin sensitivity and glycaemic control in obese patients after 3 months of therapeutic CPAP compared with placebo CPAP. The presentation of the apnoea-hypopnoea index (AHI) results (shown as mean (SD, 0-100% range)) suggests some patients had a relatively low AHI. It is noteworthy that the impact of the severity of OSAS on insulin resistance and a possible therapeutic approach by CPAP remains to be clarified. The effect of chronic glucose toxicity in patients with poor glycaemic control has to be considered. The HbA1c between 8.5% and 8.4% remained unchanged and accounts for mean blood glucose levels of about 190 mg/dl.

We could not demonstrate changes in insulin sensitivity in our study in 40 non-diabetic OSAS patients (AHI 43.1 (SD11.4)), in the subgroup with a body mass index (BMI) ≥ 30 kg/m²,¹ and also no early effect in nine well controlled diabetic patients with OSAS (BMI 37.3 (SD5.6) kg/m²).² These findings underline the enormous impact of obesity on insulin resistance in OSAS patients, whether or not they have diabetes.

Supplementary information for on-line repository

Table 1 : Indications for mediastinoscopies at Leeds Teaching Hospitals Trust in 2006

Indication for mediastinoscopy	Number (%)
Lymphadenopathy without suspected lung primary	45 (43)
Lymphadenopathy with suspected lung primary	40 (38)
Normal sized FDG-avid nodes with suspected lung primary	7 (7)
Mediastinal mass	2 (2)
Other *	10 (10)
Total	104 (100)

FDG = fluoro-2-deoxy-D-glucose

* Pulmonary lesion and mediastinal lymphadenopathy following Colorectal Ca (4) and osteosarcoma (1); mediastinal lymphadenopathy following Colorectal Ca (1), Thyroid Ca (1), carcinoma of sublingual gland (1), resected bronchial adenocarcinoma (1), mesothelioma being considered for resection (1).

Table 2 : Lung cancer staging

Patients with mediastinal lymphadenopathy and suspected lung primary (n=40)

T stage	N Stage	M Stage
T1 = 18 (45%)	N0 = 0 (0%)	M0 = 36 (90%)
T2 = 15 (38%)	N1 = 0 (0%)	M1 = 4 (10%)
T3 = 3 (3%)	N2 = 32 (80%)	
T4 = 4 (4%)	N3 = 8 (20%)	

Patients with normal sized FDG-avid nodes with suspected lung primary (n=7)

Pre-PET	Post-PET
T1 = 3 (43%)	T1 = 3 (43%)
T2 = 4 (57%)	T2 = 4 (57%)
N0 = 5 (71%)	N2 = 6 (86%)
N1 = 2 (29%)	N3 = 1 (14%)

FDG = fluoro-2-deoxy-D-glucose

PET = positron emission topography

Table 3 : Histology from mediastinoscopy samples (n=47)

Histology	Number (%)
No malignancy	19 (40)
Malignant	28 (60)
NSCLC	24 (51)
SCLC	3 (6)
Atypical carcinoid	1 (2)

NSCLC = Non-small cell lung cancer

SCLC = Small cell lung cancer

Table 4 : EBUS-TBNA sensitivity from recent published series

Author	No. patients	Nodal Stations	Sensitivity	Specificity
Yasufuku 2004 (1)	70	2,3,4,7,10,11	95.7%	100%
Rintoul 2005 (2)	18	2,3,4,7,10	85%	100%
Yasufuku 2005 (3)	105	Not specified	94.6%	100%
Yasufuku 2006 (4)	102	1,2,4,7,10,11	92.3%	100%
Herth 2006 (5)	502	2,3,4,7,10,11	94%	100%
Total (mean)	797		92.3%	100%

Table 5 : Unit-based mediastinoscopy cost at Leeds Teaching Hospitals Trust

Theatre costs (144min including anaesthetic and recovery time)	£1431.36
Ward costs (1 night admission)	£137.00
Medical staff	£182.00
General drugs	£40.50
Pathology tests (FBC, U&E, Clotting, G&S)	£57.35
Radiology tests (CXR)	£25.65
Other costs (speciality specific costs not separately specified)	£126.00
Total	£1,999.86

FBC = full blood count; U&E = urea and electrolytes; G&S = group and save; CXR = chest X-ray

Table 6 : Unit based standard bronchoscopy cost at Leeds Teaching Hospitals Trust

30 minute procedure including biopsy, brushing and washings for histology/cytology

Pay costs (2 x band 5 nurses, 1 x band 2 health care assistant, 1 x SpR and 1 consultant)	£75.84
Biopsy forceps	£22.32
Endobronchial brush	£12.33
Traps, cleaning brushes, suction liners	£7.20
General consumables (gloves, drapes, estimated drugs)	£30.00
Sterilisation	£16.00
Maintenance charge and capital costs	£4.82
Pathology costs (biopsy, brush, wash)	£98.79
Contribution to LTHT overheads and indirect costs	£67.40
Total	£334.70

SpR = specialist registrar (training grade doctor); LTHT = Leeds Teaching Hospitals Trust

Table 7 : Projected unit-based cost for EBUS-TBNA (sampling mediastinal nodes and endobronchial lesion) at Leeds Teaching Hospitals Trust

Assumes 45min procedure including biopsy, brush and wash for endobronchial lesion and TBNA for mediastinal node

Pay costs (2 x band 5 nurses, 1 x band 2 health care assistant, 1 x SpR and 1 consultant)	£113.00
Other consumables from standard bronchoscopy	£76.67
Sterilisation (2 scopes)	£32.00
EBUS-TBNA needle	£150.00
Maintenance contract for EBUS scope and processor (assuming 47 procedures per year)	£103.00
Pathology costs (now including mediastinal node biopsy)	£132.65
Contribution to LTHT overheads and indirect costs	£67.40
Total	£674.72

SpR = specialist registrar (training grade doctor); LTHT = Leeds Teaching Hospitals Trust

Table 8 : Projected unit-based cost for EBUS-TBNA (sampling mediastinal nodes alone) at Leeds Teaching Hospitals Trust

Assumes 30min procedure involving only TBNA for mediastinal node *

Pay costs (2 x band 5 nurses, 1 x band 2 health care assistant, 1 x SpR and 1 consultant)	£75.84
Other consumables from standard bronchoscopy	£38.12
Sterilisation	£16.00
EBUS-TBNA needle	£150.00
Maintenance contract for EBUS scope and processor (assuming 47 procedures per year)	£103.00
Pathology costs (now only mediastinal node biopsy)	£33.86
Contribution to LTHT overheads and indirect costs	£67.40
Total	£484.22

SpR = specialist registrar (training grade doctor); LTHT = Leeds Teaching Hospitals Trust

* Proposed investigation for patients with peripheral endobronchial lesion deemed inaccessible to bronchoscopy, or patients referred from District General Hospital where endobronchial sampling likely to have already taken place.

Table 10 : Overall cost implications per annum not including capital costs (positive figure = costs saved, negative figure = cost incurred)

	Cost saving from avoided mediastinoscopies (n=25)	Cost saving from avoided PET scans (n=25)	Cost of additional EBUS-TBNA procedures* (n=13)	Cost of new EBUS-TBNA procedures**(n=34)	Total
NHS	+£50,000	+£24,375	-£4,420	-£16,456	+£53,499
PCT	+£53,925	+£24,375	£0	-£19,550	+£58,750
LTHT	-£3,925	£0	-£4,420	+£3,094	-£5,251

PET = positron emission tomography; PCT = primary care trust; LTHT = Leeds Teaching Hospitals Trust

* Additional cost of sampling mediastinal nodes in patients already undergoing standard bronchoscopy at LTHT for endobronchial sampling

** Additional cost of performing EBUS bronchoscopy to sample mediastinal nodes alone without endobronchial sampling – patients with peripheral endobronchial lesions or patients referred from District General Hospitals following endobronchial sampling.

Table 11 : Overall cost implications per annum including capital costs (positive figure = costs saved, negative figure = cost incurred)

	Cost saving from avoided mediastinoscopies (n=25)	Cost saving from avoided PET scans (n=25)	Cost of additional EBUS-TBNA procedures* (n=13)	Cost of new EBUS-TBNA procedures**(n=34)	Total
NHS	+£50,000	+£24,375	-£10,192	-£31,552	+£32,631
PCT	+£53,925	+£24,375	£0	-£19,550	+£58,750
LTHT	-£3,925	£0	-£10,192	-£12,002	-£26,119

PET = positron emission tomography; PCT = primary care trust; LTHT = Leeds Teaching Hospitals Trust

* Additional cost of sampling mediastinal nodes in patients already undergoing standard bronchoscopy at LTHT for endobronchial sampling

** Additional cost of performing EBUS bronchoscopy to sample mediastinal nodes alone without endobronchial sampling – patients with peripheral endobronchial lesions or patients referred from District General Hospitals following endobronchial sampling.