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MRI in assessment of lung cancer

We congratulate Fischer *et al* for their significant and well-written article, published in this issue of *Thorax*.¹ The report covers important topics in the imaging of lung cancer staging. The authors report that positron emission tomography (PET)-CT improves discrimination in metastatic disease. They also demonstrated that patients with enlarged lymph nodes on CT require confirmation independent of PET findings, and that a positive PET-CT finding requires confirmation before making a decision about surgery. We would, however, like to discuss and highlight an alternative technique with benefits for lung cancer staging.

Recent advancements in MRI systems (such as improved pulse sequences, utilisation of contrast media and new techniques such as diffusion) have made MRI an increasingly important tool for lung cancer staging. Reports have indicated the ability of MRI to reveal mediastinal tumour invasion and to help identify hilar and mediastinal nodal metastases.^{2–4} A series of 115 consecutive non-small cell lung carcinoma patients prospectively underwent CT, MRI and ¹⁸F-fluorodeoxyglucose (FDG)-PET, as well as surgical and pathological examinations. The study reported that the quantitative sensitivity (90.1%) and accuracy (92.2%) of MRI were significantly higher than the quantitative and qualitative sensitivities (76.7% and 74.4%) and accuracies (83.5% and 82.6%) of co-registered FDG-PET/CT on a per patient basis ($p < 0.05$).⁴

The cost of imaging studies is an important consideration. The nature and complexity of the imaging system and the requirement for continuous production of radiopharmaceutical products makes PET/CT intrinsically more expensive than other imaging methods. The characteristics of MRI make it a safer modality than PET/CT. Unlike the ionising radiation used in CT, the powerful magnetic field and radiofrequency energy of MRI have not been shown to cause cancer or fetal abnormalities. It is important to note that although x-rays are known to cause cancer, the exact risk of developing cancer from CT scans or repeated CT examinations is unknown.⁵ We hope that this short comment may encourage investigators to use and study MRI as a new method that offers considerable benefits for lung cancer staging.

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Risk disclosure prior to bronchoscopy

We read with interest the article by Uzbek *et al*¹ demonstrating increased patient anxiety upon receiving detailed information regarding complications of bronchoscopy, in addition to the letter by Echavarría *et al*² documenting the consenting practices of 33 respiratory physicians in the north east of England. A wide variation in practice is identified. The General Medical Council guidance for doctors relating to consent³ indicates that a physician 'must tell patients if an investigation... might result in a serious adverse outcome, even if the likelihood is very small'. An adverse outcome is defined as one 'resulting in death, permanent or long term physical disability or disfigurement, medium or long term pain, or admission to hospital'. The guidance also indicates that less serious side-effects or complications should be communicated if they occur frequently.

In reviewing the Uzbek paper and their local practice, Echavarría *et al*² feel that the appropriate balance between the disclosure of relevant risks and patient anxiety is one in which a high risk disclosure is advisable. However, it can be argued that this balance can only be struck in the knowledge of local and even personal bronchoscopic practice and performance, and that it is unethical to advise patients of risks that are neither serious nor common.

Many hospitals now utilise computer software to record and analyse bronchoscopic findings and outcomes. These software packages frequently allow the recording of relevant complications or side-effects with free text areas for the documentation of less frequently encountered, but clinically relevant, events. In a review of 1261 fibre-optic bronchoscopies, recorded on InfoFlex5 software (CIMS, Hertfordshire, UK) at Sheffield Teaching Hospitals NHS Foundation Trust over a 24-month period (1 December 2007 to 1 December 2009) 86.5% of patients did not encounter complications of sufficient severity for a record to be created. Data were unavailable for 4.2% of patients; 9.4% had documented bleeding and 2% were noted to have undergone desaturation requiring premature termination of the procedure or considered to be clinically relevant or unexpected. This latter group included those developing pneumothorax following trans-bronchial biopsy. No deaths were encountered in the patient cohort despite approximately 10% of the patient group undergoing interventional bronchoscopic procedures including laser therapy or stenting.

The quality of statistical output from any database is dependent on the quality of data entry and the consistency between clinicians in identifying and recording relevant complications. For instance, two clinicians may differ in their assessment of a 'clinically relevant' desaturation or bleeding event, and may therefore enter different datasets for a similar clinical experience, thus confounding analysis. However, for major complications, such as intraprocedural death or large volume haemorrhage, this is less likely to occur.

Our data would suggest that, in an appropriately selected patient group, administered to by experienced medical staff with appropriate training and expertise, major risks for bronchoscopy are infrequent and rarely life-threatening. On this basis the more limited information disclosure outlined by Uzbek *et al*,¹ with resultant lower levels of anxiety for patients may be more appropriate.

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Author’s response: ‘risk disclosure prior to bronchoscopy’—Bianchi *et al*

We are grateful to Dr Bianchi and colleagues for their interest in our study.¹ They argue that ‘knowledge of local and even personal bronchoscopic practice and performance’ is necessary to determine the level of risk to the patient from the procedure and hence the degree of information that must be provided.² This is certainly true if there is reason to believe that the risks in an institution or for an individual differ significantly from the norm—in either direction.

A database, such as that used in the Sheffield Teaching Hospitals, for recording complications following bronchoscopy is a valuable resource for auditing outcomes and quality assurance. However, one must be cautious when interpreting the absence of a serious complication in any given series. Hanley and Lippman-Hand, in a now-classic paper, described the ‘rule of three’ for such series: if none of *n* patients showed the event of interest, we can be 95% confident that the chance of this event is at most 3/*n*.³ For example, the Sheffield data showing no death with 1261 fiberoptic bronchoscopies translate into a 95% confidence limit ranging from zero to an upper limit of 1 death in 420 procedures (Clinicians may find the other implication of using CI—that occurrence of an uncommon complication is not of itself an evidence of poor performance—more comforting). The absence of an uncommon complication in a personal or an institutional series will not of itself help the clinician strike the difficult balance between providing too much and too little risk information.

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Factors that predict failure in home management of an acute exacerbation of COPD

There is increasing interest in managing patients with non-severe acute exacerbation of chronic obstructive pulmonary disease (AECOPD) in the community. Hospital at Home and COPD Outreach programmes facilitate discharge of patients that would otherwise require hospital admission and have been shown to reduce hospital stay,¹ readmission² and healthcare costs without compromising patient care and satisfaction.³ Despite the human and health-related benefits associated with home services, ~30% of patients relapse within 8 weeks, requiring hospital readmission.²

In an effort to better understand the factors that predict relapse in these patients, we prospectively studied consecutive admissions with AECOPD discharged to a COPD Outreach programme. Patients with an AECOPD who met specific criteria⁴ were enrolled within 24 h of presentation to hospital. At presentation demographics, number of hospitalisations in the previous year, oxygen use, vaccination status (pneumococcal and influenza) and smoking history were assessed. Breathlessness and quality of life scores were recorded and oxygen saturations and spirometry were measured. Rehospitalisation data were collected at day 14, 6 weeks and 3 months following discharge. Readmission for AECOPD was defined as hospitalisation for >24 h and was assessed using hospital records.

Patient variables were analysed for their association with readmission by day 14, 6 weeks and 3 months using χ^2 or the Fischer exact test. Multivariate analyses to

evaluate for independent risk factors were performed using logistic regression with readmission as the categorical dependent variable. Admissions for reasons other than COPD were not included in the analyses.

In total, 349 admissions with AECOPD were enrolled in the study. There were 46 readmissions (13%) for AECOPD to hospital by day 14, 81 (23%) by 6 weeks and 106 (30%) by 3 months. The study had approximately equal numbers of males (49%) and females (51%), with a mean age of 69.2 years. Median FEV₁ (forced expiratory volume in 1 s) % predicted was 46.43%.

Univariate analysis is shown in table 1. We found no association between readmission and age, gender, spirometry, quality of life score or length of index admission.

Multivariate analysis identified that hospitalisation in the previous year (p=0.03, OR 2.26, CI 1.1 to 4.8) and a Borg score ≥ 3 (p=0.04, OR 2.15, CI 1.0 to 4.6) predicted readmission by day 14 in 75% of cases. Long-term oxygen therapy (p=0.001, OR 3.28, CI 1.6 to 6.5), pack-year history ≥ 50 (p=0.008, OR 3.13, CI 1.4 to 7.3) and Borg score ≥ 3 (p=0.001, OR 3.31, CI 1.6 to 6.8) predicted 6 week admission in 68.9%.

Our study identifies independent risk factors that are easy to assess, reproducible and can be carried out as early as arrival to hospital, allowing these patients to be identified early in their admission. A significant factor associated with early readmission was the level of dyspnoea reported by patients at the time of enrolment. This reflects the importance of the subjective symptom of breathlessness as a factor that drives patients to seek medical attention.

This is the first study to identify specifically the factors that are associated with rehospitalisation in exacerbations managed out of hospital. This management strategy will become increasingly important in reducing the costs associated with AECOPD

Table 1 Univariate analyses of association between independent variables and readmission

Variable	Day 14	Week 6	Month 3
Admissions in previous year	p=0.02 (OR 2.3, CI 1.1 to 4.7)	p=0.014 (OR 2.0, CI 1.2 to 3.5)	p=0.027 (OR 1.8, CI 1.0 to 3.0)
Long-term oxygen therapy	p<0.05 (OR 1.95, CI 0.9 to 3.8)	p<0.001 (OR 3.84, CI 2.2 to 6.7)	p<0.001 (OR 3.5, CI 1.9 to 6.3)
Portable oxygen	p=0.51 (OR 1.33, CI 0.6 to 2.9)	p=0.02 (OR 2.76, CI 1.5 to 5.1)	p<0.001 (OR 3.28, CI 1.7 to 6.3)
Home nebuliser	p=0.43 (OR 1.38, CI 0.6 to 3.1)	p=0.36 (OR 1.3, CI 0.71 to 2.5)	p=0.24 (OR 1.4, CI 0.8 to 2.7)
Oxygen saturation <92% on room air	p=0.28 (OR 1.51, CI 0.7 to 3.3)	p=0.005 (OR 2.17, CI 1.4 to 3.3)	p=0.02 (OR 1.7, CI 1.2 to 2.4)
Pack-year history ≥ 50	p=0.78 (OR 1.07, CI 0.35 to 3.3)	p=0.03 (OR 3.25, CI 1.5 to 6.9)	p=0.01 (OR 2.86, CI 1.3 to 6.2)
Borg scale ≥ 3	p=0.026 (OR 2.47, CI 1.2 to 5.1)	p<0.001 (OR 3.23, CI 1.7 to 6.0)	p<0.001 (OR 3.23, CI 1.7 to 6.1)
MMRC scale ≥ 3	p=0.02 (OR 2.56, CI 1.1 to 5.7)	p=0.01 (OR 2.0, CI 1.1 to 3.6)	p=0.01 (OR 2.0, CI 1.1 to 3.4)
Vaccination status (pneumococcal and influenza)	p=0.65 (OR 1.2, CI 0.58 to 2.4)	p=0.8 (OR 1.1, CI 0.61 to 1.9)	p=0.83 (OR 0.94, CI 0.55 to 1.6)

Pack-year history, number of packets of cigarettes smoked per day \times total number of years smoking; Borg scale refers to level of dyspnoea at enrolment; MMRC (modified Medical Research Council) scale ≥ 3 refers to level of dyspnoea at enrolment.