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Noninterventional statistical comparison of BTS and CHEST guidelines for size and severity in primary pneumothorax

To the Editor:

Primary spontaneous pneumothorax (PSP) occurs in apparently healthy young people with an incidence of 12.5 cases per 100 000 per year [1]. Attempts to develop standardised care guidelines for this condition have been severely hampered by a lack of high-quality clinical research into this condition. The American College of Chest Physicians (CHEST) concluded in 2001 that "insufficient data exist…to develop an evidence-based document" and so produced a consensus statement based on expert opinion [2]. Similarly, the British Thoracic Society (BTS) 2010 guidelines are based predominantly on nonanalytical studies and expert opinion [3]. In both documents, the size of the presenting PSP is used to determine initial treatment. A "small" PSP without respiratory compromise is thought not to require intervention, while a "large" PSP has typically been treated either by aspiration or intrapleural drainage. Implicit in these definitions is the belief that large pneumothoraces will not respond well to conservative management. Remarkably, no consensus regarding the definition of PSP severity exists, with CHEST and the BTS each using different arbitrary measurements of the presentation chest radiograph. When these measurements were compared directly to one another, they showed poor correlation [4]. This lack of a clinically useful radiological biomarker for pneumothoraces requiring intervention hinders the development of evidence-based care of this condition. We wished to determine whether the BTS definition of large pneumothorax (>2 cm at the hilum) or CHEST definition (>3 cm from apex to cupola) better predicts the requirement for intercostal chest drain (ICD) insertion.

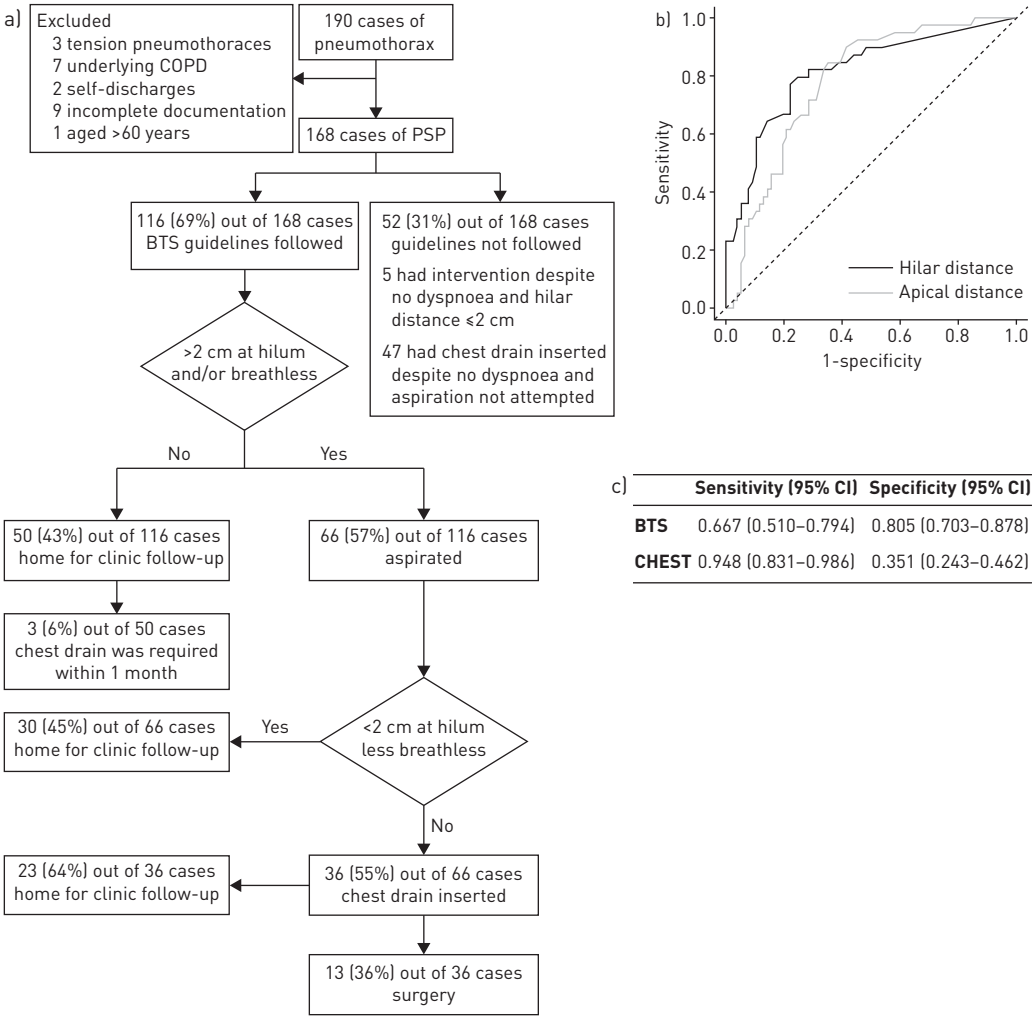
A pilot study of 42 cases estimated the area under the receiver operator curve (ROC) to be between 0.92 and 0.95 for hilar and apical measurements. From this, we calculated that for an 80% power to detect a 0.03 difference with 5% two-sided significance, 115 cases were required. Patients from 13 UK National Health Service hospitals were recruited prospectively from February 2012 to May 2013. The study was approved by the research and development departments of all participating hospitals. Inclusion criteria were diagnosis of PSP, and age between 16 and 60 years. Cases of tension pneumothorax and those >50 years with a smoking history of >5 pack-years were excluded. Case notes and presentation radiographs were reviewed by the research team, who were all senior or middle-grade, UK-trained respiratory and emergency physicians trained to follow BTS guidelines. Verification of adherence to BTS guidelines was performed by the lead authors, and was based on reviewing case notes and chest radiographs. Measurements of the interpleural distances were recorded at the level of the ipsilateral hilum, and between the apex of the lung and the cupola. Current BTS guidelines state that in noncompromised patients with a

PSP of >2 cm at the level of the hilum, pleural aspiration should be attempted prior to the insertion of an ICD. We therefore reasoned that when BTS guidance was followed, the subsequent requirement for ICD within 1 month of initial presentation was likely to reflect clinical compromise or failure of more conservative management (no intervention or aspiration alone) and was therefore a valid end-point for testing the definition of large or "severe" pneumothorax.

In this series, 116 patients of 168 PSP cases (69%) were treated according to the BTS guidelines and so were included in subsequent analysis (fig. 1a). We acknowledge that the exclusion of patients not treated according to BTS guidelines may have introduced bias. The nature of nonadherence was ICD insertion without attempting aspiration in 90% of cases and inappropriate aspiration attempts in 10% of cases (hilar distance ⩽2 cm, no breathlessness). There were no statistically significant differences between the demographics of those treated according to the BTS guidelines and those who were not (not shown). 50 (43%) of the included 116 patients required no instrumentation of the thorax and were discharged for follow-up; three had recurrences and ultimately fulfilled the BTS guidance for ICD insertion within 1 month of their initial presentation. Their mean interpleural distance at the hilum was 0.3 cm and their average apical–cupola distance was 2.8 cm. The remaining 66 cases underwent pleural aspiration, 62 (94%) because of an interpleural distance at the hilum of >2 cm (mean 2.9 cm) and four (6%) because of breathlessness despite having a hilar size of <2 cm; their mean apical–cupola distance was 7.0 cm. 30 (45%) of the 66 patients who underwent aspiration remained ICD-free 1 month after presentation. In this series, no pneumothorax >5.4 cm in depth at the level of the hilum avoided subsequent ICD insertion. Of the 36 cases that went on to undergo insertion of an ICD, 13 (36%) eventually went on to require surgery for persistent air leak or recurrence.

Logistic regression was performed including the variables hospital, age, interpleural distance at the hilum, interpleural distance at the apex and the hilar–apical interaction. In this model, hilar distance was significantly associated with ICD insertion ($p<0.001$) but apex distance and the interaction were not. The estimated correlation between hilar and apical interpleural distances was 0.700 (95% CI 0.592–0.782). We used the R library pROC to fit ROC curves, estimate ROC c-statistics (and confidence intervals) and to test differences between the c-statistics of ROC curves (R Group, Vienna, Austria). We used Wilson score intervals to generate confidence intervals for estimated sensitivity and specificities of the two guidelines. The ROC c-statistic for hilar distance was 0.815 (95% CI 0.729–0.899), while that of apical distance was 0.778 (95% CI 0.693–0.864); these are not significantly different (fig. 1b and c). An interpleural distance of >2 cm at the level of the hilum was found to have high specificity (0.805, 95% CI 0.703–0.878) for predicting the eventual requirement of ICD but was only moderately sensitive (0.667, 95% 0.510–0.794). By contrast, a distance of >3 cm at the apex proved to be highly sensitive (0.948, 95% CI 0.831–0.986) but was relatively nonspecific (0.351, 95% CI 0.243–0.462). Using McNemar's test, the differences in sensitivities and specificities reached statistical significance ($p=0.001$ and $p<0.001$, respectively). This suggests that strict adherence to the BTS guidelines will probably lead to more reliable identification of those patients for whom an ICD is unnecessary and, hence, will lead to insertion of fewer inappropriate ICDs; however, it suggests that a third of patients treated by observation or aspiration will eventually return for insertion of an ICD within the month following presentation. In contrast, the CHEST definition identifies most patients who would eventually require an ICD if BTS guidance were to be followed but the low specificity of this measure makes it poorly suited to identify those patients who did not require an ICD. Using the CHEST definition, 65% of patients whose pneumothorax could have been treated conservatively or by aspiration would unnecessarily be admitted for an ICD. This would impose unnecessary costs on the health budget, as ICD insertion currently leads to hospital admission for a mean of 5 days [5, 6]. Moreover, ICD insertion is associated with more pain [7]. Conversely, the BTS definition of large PSP would lead to relative underintervention, with a third of patients re-presenting for drainage. If PSP carried a significant mortality, then the CHEST guidance would be safer, but since this is not the case, we conclude that the BTS guidelines are preferable. The inclusion of all 168 PSP patients in the analysis appeared to improve the performance of the BTS (hilar) measure in predicting drain insertion (not shown). But since the majority of excluded patients had received a chest drain prior to attempted aspiration, they have been excluded from the final analysis as being uninformative.

Our data suggest that below a hilar distance of 2 cm, patients with PSP are less likely to require ICD insertion as defined by failed aspiration (enlarging pneumothorax or clinical compromise) than if the apical 3-cm cut-off is employed. Only a much-needed randomised controlled trial will provide definitive proof for or against the requirement for drainage in PSPs >2 cm at the hilum. There is currently much interest in the use of ambulatory management of PSP [8] but it remains unproven if ambulatory drains in patients with large PSP are as effective as conventional underwater seal ICD. Encouragingly, a recent observational study suggested that outpatient management of PSP is safe and leads to healthcare cost savings [9].



c)

	Sensitivity (95% CI)	Specificity (95% CI)
BTS	0.667 (0.510–0.794)	0.805 (0.703–0.878)
CHEST	0.948 (0.831–0.986)	0.351 (0.243–0.462)

FIGURE 1 Prospective analysis of pneumothorax management. a) Patient flow diagram representing patient selection and outcome rates. All patients received chest radiographs at presentation and were treated according to local protocols and clinical need. Inclusion criteria were primary spontaneous pneumothorax (PSP) and age 16–60 years. Across the East of England, UK, 168 consecutive patients presenting with PSP in 13 National Health Service hospitals were recruited over a period of 15 months (February 2012 to May 2013). b) Receiver operator curve for patients in whom British Thoracic Society (BTS) guidelines were followed, relating hilar distance to eventual requirement for an intercostal chest drain (ICD), or apical distance to eventual ICD. The dashed line is the "line of no discrimination". c) Sensitivity and specificity of BTS (>2 cm at the hilum) and American College of Chest Physicians (CHEST) (>3 cm at the apex) definitions of a large PSP in predicting the eventual need for an ICD when BTS guidance was followed. COPD: chronic obstructive pulmonary disease.

In conclusion, in this multicentre, prospective audit of patients treated according to the BTS guidelines, BTS guidance is associated with the insertion of fewer chest drains in patients who would otherwise not have suffered an enlarging pneumothorax or clinical compromise, whereas CHEST guidance would encourage the insertion of chest drains in more patients who would otherwise not have suffered an enlarging pneumothorax or clinical compromise. A randomised controlled trial is required to determine whether this would have ultimately affected outcome.

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Hilar rather than apical interpleural distance more accurately predicts need for intercostal chest drain insertion http://ow.ly/JvKFY

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Lung cancer screening feasibility in Australia

To the Editor:

The National Lung Screening Trial (NLST) reported a 20% relative reduction in lung cancer-specific mortality using low-dose computed tomography (LDCT) screening [1]. US Preventative Services Task Force modelling [2] illustrates the potentially large benefits of screening, yet nationwide population-based screening has not been adopted. Controversial issues include high false positivity, and uncertain cost-effectiveness and relative applicability to different settings and countries [3–6]. The Queensland Lung Cancer Screening Study (QLCSS) is the first study to assess NLST screening protocol feasibility in Australia.

QLCSS applied the NLST protocol with two modifications: age eligibility was changed from 55–74 years to 60–74 years; and minimum lung function (forced expiratory volume in 1 s ⩾50% predicted) was required. Smoking (⩾30 pack-years, current or quit within the past 15 years) and general health requirements were identical [1, 7].

Volunteers received a baseline and two annual incidence scans (T_0, T_1 and T_2, respectively). Baseline scans were considered positive if one or more nodules ⩾4 mm diameter were detected; incidence scans were considered positive if one or more new nodules of any size was detected, or a previously identified nodule