Institutional report - Thoracic non-oncologic

Treatment of pneumothoraces at a tertiary centre: are we following the current guidelines?

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1. Introduction

Hospital admission rates for combined primary and secondary pneumothorax are reported in the UK at between 5.8/100,000 per year for women and 16.7/100,000 per year for men. Mortality rates in the UK were 0.62/million per year for women and 1.26/million per year for men between 1991 and 1995 [1].

In an effort to improve the treatment of primary and secondary pneumothoraces, the American College of Chest Physicians (ACCP) in 2001 and the British Thoracic Society (BTS) in 1993 and 2003 published guidelines for the treatment of pneumothorax. Here, we review our experience of managing pneumothorax patients, comparing standards of management before and after the publication of the guidelines in 2003. One hundred and twenty patients were transferred to our care for management of pneumothorax between October 2001 and September 2006. One hundred and one patients underwent pleurectomy [28 by video-assisted thoracic surgery (VATS)]. There were 69 males and 32 females with a median age of 47 years (range 15–86 years). 24% (n=24) of patients had evidence of intrapleural infection at time of operation. This was more likely if the time to pleurectomy was >14 days (P=0.03). The median time of referral for patients in the pre-guideline group was 12 days [interquartile range (IQR) 9–12] while post guidelines it was 10 days (IQR 6–13). There was no statistical significance (P=0.09) between these groups in terms of time taken to refer patients. The ACCP and BTS guidelines are not being followed. Pneumothoraces should be managed by chest physicians who are aware of the current guidelines. Impact of delayed referral in the form of increased incidence of morbidity and financial burdens on hospitals needs to be recognized.

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2. Patients and methods

Patients undergoing pleurectomy were retrospectively identified from the thoracic surgical database and patients undertaking conservative management from the hospital’s patient administration system. In our thoracic surgical database preoperative data are entered prior to operation, operative data immediately following the operation and postoperative data following discharge. One hundred and twenty patients were identified between October 2001 and September 2006.

Primary pneumothorax was defined as pneumothorax occurring in an otherwise healthy lung apart from minimal blebs/bullae while secondary pneumothorax was defined as pneumothorax occurring on top of a diseased lung [e.g. chronic obstructive pulmonary disease (COPD)/bullous lung disease].

Variables collected included age, sex, referring hospital, type of pneumothorax, side affected, number of previous
pneumothoraces, number of days between admission and referral to Liverpool Heart and Chest Hospital (LHCH), smoking status, number of chest drains inserted in peripheral hospital before admission to LHCH, days in situ before pleurectomy, open/video-assisted thoracic surgery (VATS) surgery performed, evidence of intrapleural sepsis, length of stay and complications.

Conservative management was performed if the pneumothorax had resolved by time of arrival, in cases of drain malposition or in patients with high surgical risk. Indications for surgery in primary pneumothorax included an unresolving pneumothorax or persistent air leak for more than five days, recurrent pneumothorax and the presence of an intrapleural infection while indications for surgery in secondary pneumothorax included the same criteria apart from a five-day cut-off.

A VATS approach for primary pneumothorax was used if feasible while all cases of secondary pneumothorax had an open pleurectomy.

The surgical approach for all open pleurectomy cases included a muscle sparing thoracotomy and performing a subtotal pleurectomy and stapling of blebs/bullae using a GIAT 80 mm/EZ45 mm surgical stapler. The surgical approach for VATS cases was insertion of a thoracoscope using a 5.5/10.5 mm port and performing a subtotal pleurectomy and stapling of blebs/bullae using a TSG45 mm stapler. In both cases two intercostal drains; an anterior apical and a posterior basal; were inserted. The presence of intrapleural infection was identified from the culture results from pleural fluid taken at the time of pleurectomy.

Impact of late referral on the rate of intrapleural sepsis was evaluated using the $\chi^2$-test. The Mann-Whitney test was used to compare pre- and post-BTS guidelines as a national standard compliance with timeliness of referral. Significance was considered if $P$-value was <0.05. All statistical tests performed using Stats Direct (V 2.7.7).

3. Results

One hundred and twenty patients were transferred to our care for management. Nineteen of these were treated conservatively and their pneumothorax settled spontaneously without the need for surgical intervention. Suction application was a part of conservative management in all patients (17 had another large bore chest drain inserted in our hospital and two settled with the chest drain inserted in the peripheral hospital). Among the 101 patients who had a pleurectomy there were 69 males and 32 females with a median age of 47 years (range 15–86 years).

Pneumothorax was more common on the right side (61%) with only one patient presenting with bilateral pneumothorax. 78% of patients were smokers; half of those (39%) were current smokers (identified as smoking within eight weeks of admission).

The majority of patients (58%) had only one intercostal drain inserted prior to admission, 18% of patients had two drains inserted previously and 8% had three drains. Three patients (3%) had four drains inserted in the referring hospital. Two patients (2%) were referred with no previously inserted chest drains. There was no difference in patients having more than one drain inserted pre- and post-guidelines (29% vs. 28.5%) $P=0.9$.

Median time between admission and referral was 10 days [interquartile range (IQR) 6–14] (Fig. 1), admission and operation 14 days (IQR 10–18). 24% ($n=24$) of patients had evidence of intrapleural infection at time of operation. This was more common with secondary pneumothorax 33% ($n=16$) vs. 15% ($n=8$). Organisms grown included pneumococcus, Staphylococcus aureus, Streptococcus melleri and the fungal Candida infection (Fig. 2). This was more likely if the time to pleurectomy was >14 days ($P=0.03$).

One hundred and one patients underwent pleurectomy. There were 54 patients (53.5%) with primary pneumothorax and 47 patients (46.5%) with secondary pneumothorax. 52% of primary pneumothoraces (28/54) had their operation done by video-assisted thoracic surgery (VATS) while all the secondary pneumothorax patients had open pleurectomies.

Mean postoperative stay was 8.1 days (range 3–50 days) for open pleurectomy and 5.7 days (2–32 days) for VATS pleurectomy (Fig. 3). Median postoperative stay for patients with evidence of preoperative intrapleural infec-

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**Fig. 1.** Number of days between admission to peripheral hospital and referral to LHCH. DGH, district general hospital; LHCH, Liverpool Heart and Chest Hospital.
tion was eight days (IQR 6–14) compared to five days (IQR 4–8) for patients with no infection. This was significant \(P=0.007\). In-hospital mortality was 0%.

Seventy-seven patients (76.2%) presented after the BTS guidelines were published while 24 patients (23.8%) presented before the guidelines were published. Of those in the pre-guideline group, 13 (54%) had primary pneumothorax and 11 (46%) had secondary pneumothorax. In the post-guideline group, 41 (53%) had primary pneumothorax while 36 (47%) had secondary pneumothorax \(P=0.8\). As both the pre-guideline and post-guideline groups were comparable in terms of the proportion of primary and secondary pneumothorax patients within them, we compared time of referral pre- and post-guidelines for combined primary and secondary pneumothorax patients, we found the following results:

The median time of referral for patients in the pre-guideline group was 12 days (IQR 9–12) while after publishing the guidelines the median time for referral was 10 days (IQR 6–13). This was not statistically significant \(P=0.09\).

4. Discussion

The 2001 ACCP and the 2003 BTS guidelines for management of pneumothorax describe the management of spontaneous primary and secondary pneumothorax. It excludes the management of traumatic and iatrogenic pneumothoraces.

The timing of surgical intervention for pneumothorax has recently been challenged and remains contentious. There is no evidence-based justification for the arbitrary but widely advocated cut-off point of four days recommended by the ACCP and five days by the BTS in 2003 for referral for surgery for a persistent air leak \[4\]. Chee and colleagues \[6\] showed that 100% of primary pneumothoraces treated by tube drainage with persistent air leaks for more than seven days had resolved their air leaks by 14 days and 79% of those with secondary pneumothoraces and persistent air leaks had resolved their air leaks by 14 days with no mortality. However, considering the efficacy and relatively low levels of morbidity and recurrence associated with surgery for pneumothorax \[7\], earlier surgical intervention has been advocated for persistent air leak or failure of re-expansion, particularly in cases of secondary pneumothorax \[7\]. Several authors have recommended operative referral/intervention as early as three days for a persistent air leak. However, these studies were not controlled \[8\]. Despite the reduction in the incidence of late recurrence of pneumothorax in many of these
studies, surgical referral for a persistent air leak in a first primary pneumothorax within the first 4–5 days is not supported by the literature. However, best practice suggests that protracted chest tube drainage is not in the patient’s interest. It is therefore recommended that patients with difficult pneumothoraces should receive care from a respiratory physician and that a thoracic surgical opinion will be an early part of management [4].

It is clear from our study that time of referral of patients was greater than five days for both primary and secondary pneumothorax patients. Furthermore, the 2003 publication of BTS guidelines does not seem to have had an impact on practice. There was no significant difference in the time taken to refer patients with pneumothorax after the guidelines were established, indicating a lack of compliance with the national required standard of care.

Patients with a second attack of pneumothorax have a 40–60% chance of having a third attack and this reaches to a 75% chance of having a fourth attack if a patient suffers three previous pneumothoraces. Consequently, surgical intervention is usually warranted after two attacks of pneumothorax [9]. Unfortunately, patients with recurrent pneumothorax are not included in the 2003 BTS guidelines; and their management could be different, as these patients may need to be referred for surgical intervention from day 1 of reaching district hospitals.

Several authors suggest that VATS offers significant advantages over open thoracotomy including a shorter postoperative hospital stay, significantly less postoperative pain and better pulmonary gas exchange in the postoperative period [10]. It has been shown that delayed referral of patients with pneumothorax reduces their chances of having a VATS procedure [11]. In our study only 28 patients (27.7%) underwent a VATS pleurectomy while our elective VATS pleurectomy rate for pneumothorax is around 40%. This was mainly due to the increased incidence of preoperative intrapleural infection, with our surgeons being more inclined for an open procedure owing to the technical challenge arising from the dense organized pleura that makes it difficult to introduce the thoracoscope between the visceral and parietal surface and to achieve maximal pulmonary expansion in order to prevent residual pleural space.

Pleurial infection is a known complication of intercostal tube drainage. The rate of empyema after chest tube insertion has been estimated as 1% [11]. Other series have reported an incidence of up to 6% of chest tube related empyema in trauma cases and suggested that the administration of prophylactic antibiotics should be considered, particularly where a prolonged period of chest tube drainage might be anticipated [12]. This highlights the need for full aseptic technique in the insertion or manipulation of any chest drainage system.

Consequences of pleural infection can be dreadful. Up to 40% of empyema patients come to surgery due to failed catheter drainage and, overall, 20% of patients with empyema die [13]. The process of rapid evaluation and therapeutic intervention appears to reduce morbidity and mortality, as well as health-care costs. In view of the substantial mortality associated with pleural infection, the small number of cases seen annually in a single centre and the need for prompt effective treatment, it is appropriate to focus the care of this disorder in specialist hands. Delay of proper chest tube drainage of the pleural space is probably associated with increased morbidity and duration of hospital stay [14], and may lead to increased mortality. Misdiagnosis, inappropriate antibiotics, and inappropriate chest tube placement have been cited as important factors contributing to the progression of pleural infection [14].

5. Conclusion

Pneumothorax is not a simple pathology. Many cases will need treatment in specialized centres. The ACCP and BTS guidelines that were published in 2001 and 2003, respectively; trying to improve patient care, are not being followed and more effort is needed for better communication between physicians/general surgeons and thoracic surgeons in secondary and tertiary care centres. Impact of delayed referral in the form of increased incidence of morbidity and financial burdens on hospitals needs to be recognized.

References

eComment: Delayed surgical referral for persistent spontaneous pneumothorax: a global problem?

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We read with interest the report by Elsayed et al. regarding contemporary treatment of pneumothoraces at a tertiary UK centre [1]. The latest 2010 BTS guidelines for management of spontaneous pneumothorax recommend a formal thoracic surgical opinion should be sought for all cases with a persistent air leak or failure of the lung to re-expand after three to five days [2]. Although this recommendation (level C) is arbitrary with no strong evidence base it is intuitive and sensible. Minimizing the duration of chest tube drainage will reduce the morbidity of empyema and facilitate earlier mobilization. Earlier appropriate referral will facilitate definitive management, often surgical, including a minimally-invasive (VATS) approach and thus may be cost-effective with a shorter hospital stay.

Interestingly despite the widely available BTS guidelines, there was no significant difference in this study in the median time of referral for patients preguidelines 12 days (IQR 9–12) vs. postguidelines 10 days (IQR 6–13) (P=0.09) [2]. The lack of compliance with the required UK national standard of care suggests that more must be done to raise awareness amongst chest and general physicians in district general hospitals to expedite earlier appropriate surgical referral.

We have a similar experience at a relatively new regional cardiothoracic unit (Hospital Serdang, Kuala Lumpur). In an (unpublished) retrospective observational study of 25 consecutive patients with primary spontaneous pneumothorax who underwent surgery over an 11-month period, we observed the mean duration of chest tube drainage prior to surgery was 12.28 days. This protracted time lag between initial drain insertion and surgical referral (i.e. duration of air leak) is far from ideal, however, fortunately we did not encounter any infective complications and a VATS approach was successfully utilized in 23 cases, with open thoracotomy in the remaining two patients due to associated haemothoraces. Our experience of delayed surgical referral for spontaneous pneumothoraces is concurrent with the Liverpool experience and we agree that greater effort is required to raise awareness and improve communication between our chest physician colleagues and thoracic surgeons as earlier referral is clearly in the best interest of the patient.

References