



AUDIT, RESEARCH AND GUIDELINE UPDATE

# Pleural procedures and patient safety: a national BTS audit of practice

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Received 8 November 2013

Revised 13 January 2014

Accepted 25 February 2014

Published Online First

21 March 2014

## ABSTRACT

The BTS pleural procedures audit collected data over a 2-month period in June and July 2011. In contrast with the 2010 audit, which focussed simply on chest drain insertions, data on all pleural aspirations and local anaesthetic thoracoscopy (LAT) was also collected. Ninety hospitals submitted data, covering a patient population of 33 million. Twenty-one per cent of centres ran a specialist pleural disease clinic, 71% had a nominated chest drain safety lead, and 20% had thoracic surgery on site. Additionally, one-third of centres had a physician-led LAT service.

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## AUDIT RESULTS

### Chest drain insertions

One thousand four hundred and one chest drain insertion records were entered, and 1394 fulfilled criteria for inclusion (1026 inserted for pleural fluid and 368 for pneumothorax). Eighty-one per cent drains were inserted by the seldinger technique, and of those where size was documented, 88% were of small bore (6–16 F).

**Consent:** consent was taken for 1018 (75% of patients with capacity) procedures; written in 601 (44%) and verbal in 417 (31%). The taking of consent overall, and of written consent specifically, was more frequent than in 2010, but also notable is a persistent lack of robust consent practice for drains inserted for pneumothorax, as seen previously, with written consent taken for just 25% of procedures.

**Location and timing:** 46% of drains were placed at the patient bedside and 18% in procedure rooms. Twenty-four per cent of drains for fluid were placed in the radiology department; 40% of drains for pneumothorax were inserted in the emergency department. Most drains for fluid were appropriately placed within 'routine working hours' with just 13% of procedures performed at the weekend or out of hours. Forty per cent of

drains for pneumothorax were inserted out of hours.

**Complications:** immediate and delayed complications are reported in table 1A. There were two procedure-related deaths; one due to organ puncture and the other due to an iatrogenic haemothorax secondary to intercostal artery laceration. More minor complications are seen at essentially previously reported frequencies.

**Drains for pneumothorax:** 368 drain insertions for pneumothorax were included; 148 primary spontaneous, 127 secondary, 57 iatrogenic, 27 traumatic and 8 unclassified.

The most marked deviation from BTS guidelines was a failure to attempt aspiration prior to drain insertion in some 84/148 (57%) primary spontaneous pneumothorax patients for many of whom drain insertion and admission may have been avoided.<sup>2</sup>

**Drains for pleural effusions:** of 1026 drains placed for pleural fluid, 381 (37%) were in currently undiagnosed effusions, 358 (35%) in known malignant effusions and 166 (16%) in pleural infection. Just 44% of known malignant effusion patients underwent talc pleurodesis prior to drain removal.

## PLEURAL ASPIRATION

### Diagnostic aspiration

Nine hundred and thirty-one diagnostic aspiration procedures were recorded such that this is one of the largest series reported.

**Consent:** written consent was taken for 18%, verbal consent for 43%, and there was no documented evidence that consent had been taken for 39% of procedures.

**Procedure location and timing:** 50% were performed at the patient's bedside on a medical ward, 15% in a designated procedure room, 24% in the radiology department, and 11% in other locations, such as outpatient clinics and bronchoscopy. Just 98/931 (11%) of aspirations were performed outside routine working hours.

**Number of attempts:** one aspiration attempt was made in 91% of procedures. Of the remaining 9%, the maximum number of attempts at aspiration before the procedure was abandoned was five.

**Complications:** these are summarised in table 1B. Complication rate, overall, is lower than that reported in many previously published series.

## THERAPEUTIC ASPIRATION

Three hundred and twenty-one procedures were recorded with adequate data for inclusion; 144 (45%)



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**To cite:** Hooper CE, Welham SA, Maskell NA, et al. *Thorax* 2015;**70**:189–191.

**Table 1** Summary of complication rates and use of TUS**(A) Complications of chest drain insertion**

	All drains; n=1394; (%)	Drains for pneumothorax; n=368; (%)	Drains for pleural effusion; n=1026; (%)
<b>Immediate complications</b>			
Iatrogenic haemothorax	18 (1.3)	1 (0.5)	17 (1.7)
Pain	112 (8)	45 (12.2)	67 (6.5)
Symptomatic hypotension	16 (1.9)	7 (1.9)	19 (1.9)
Organ puncture	9 (0.6)	2 (0.5)	7 (0.7)
Failure to place drain in pleural space	28 (2.0)	9 (2.4)	19 (1.9)
Iatrogenic pneumothorax	NA	NA	43 (4.2)
<b>Delayed complications</b>			
Drain fell out	128 (9.2)	26 (7.1)	102 (10)
Pain	217 (15.6)	77 (20.9)	140 (14)
Drain blocked	114 (8.2)	27 (7.3)	87 (8.5)
Pleural space infection	6 (0.4)	4 (1.1)	1 (0.1)
Skin infection	14 (1)	3 (0.8)	11 (1.1)
Surgical emphysema	59 (4.2)	46 (12.5)	13 (1.3)
Re-expansion pulmonary oedema	8 (0.6)	2 (0.5)	6 (0.6)
Death	2 (0.1)	0	2 (0.2)

**(B) Complications of pleural aspiration**

	All aspirations; n=1162; (%)	Diagnostic aspiration; n=931; (%)	Therapeutic aspiration; n=231; (%)
Pain	112 (5.0)	33 (3.5)	25 (7.8)
Symptomatic hypotension	7 (0.6)	4 (0.4)	3 (0.9)
Organ puncture	3 (0.3)	3 (0.3)	0 (0)
Dry tap/failed procedure	43 (3.7)	38 (4.1)	5 (2.2)
Iatrogenic pneumothorax	15 (1.3)	14 (1.5)	1 (0.4)
Haemothorax	13 (1.1)	13 (1.4)	0 (0)
Chest wall haematoma	12 (1.0)	12 (1.3)	0 (0)

**(C) Ultrasound guidance for procedures for pleural fluid**

Procedure	Real-time bedside TUS (%)	TUS in radiology department (%)	Remote 'X-marks the spot' TUS (%)	No evidence of TUS guidance (%)
Chest drain insertion (n=994)	467 (47)	220 (22)	164 (17)	143 (14)
Diagnostic aspiration (n=930)	438 (47)	205 (22)	101 (11)	186 (20)
Therapeutic aspiration (n=318)	226 (71)	12 (4)	44 (14)	36 (11)
All procedures (n=2242)	1131 (50)	437 (20)	309 (14)	365 (16)

TUS, thoracic ultrasound.

undiagnosed effusions, 120 (37%) known malignant effusions, 57 (18%) known benign effusions.

**Consent:** written consent was taken from 25% of patients, verbal consent from 57%, 3% of patients lacked capacity to consent, and there was no documented evidence of consent in 15% of cases.

**Procedure location and timing:** 49% were performed at the patient's bedside on a medical ward, 38% in a designated procedure room and the remaining 13% in other locations, such as radiology, accident and emergency and day-case units. Nine per cent of procedures were performed outside routine working hours.

**Aspiration site:** the anatomical position of aspiration was documented for 149 patients and was within the triangle of safety for 86 (58%) and inferior or posterior to this site for 63 (42%).

**Number of attempts and volume aspirated:** a single attempt at aspiration was made in 92% of cases. Of the remaining 8%, the maximum number of documented attempts was six. As recommended in the 2010 BTS guidelines, for the avoidance of

re-expansion pulmonary oedema and syncope,  $\leq 1.5$  L was aspirated in 287/306 (94%) procedures where volume was documented.<sup>2</sup>

**Complications:** these are summarised in table 1B. In common with diagnostic aspirations, reported complication rates were low.

**Ongoing clinical plan:** most large pleural effusions reaccumulate following therapeutic aspiration, and in order to avoid multiple therapeutic procedures, a more definitive plan should be made at the time of first aspiration. Data was entered for 312 patients. No future clinical plan had been documented for 148 (47%); chest drain insertion was planned for 50 (16%); LAT for 25 (8%); video-assisted thoracoscopy for 14 (5%); indwelling pleural catheter placement for 18 (6%); and a further therapeutic aspiration for 25 (18%).

**THORACIC ULTRASOUND**

Availability and training in bedside thoracic ultrasound (TUS) has increased since the 2010 audit;<sup>1</sup> 75 (83%) hospitals have

access to bedside TUS; 79 (88%) respiratory departments have access to at least one ultrasound machine (compared to 76% in 2010).

Sixty-five per cent departments have at least one consultant, and 47% at least one specialist trainee with Royal College of Radiologists (RCR) level 1 competence in TUS (47% and 43%, respectively, in 2010).

Acquisition of RCR level 2 competence, allowing training of colleagues to level 1 within departments remains uncommon; 24% departments in this series have one or more consultants, and 5% one or more specialist trainees with level 2 competence.

*Ultrasound guidance for procedures:* this is summarised in table 1C.

Ultrasound guidance has been demonstrated to improve the safety and success rate of simple pleural aspiration and chest drain insertion, and BTS guidelines now strongly recommend the use of real-time ultrasound guidance for all pleural procedures performed for fluid.<sup>2</sup> Appropriate ultrasound guidance for chest drain insertion has substantially increased from 52% of procedures in 2010 to 69% in the 2011 dataset. The remote 'X-marks the spot' technique has been shown to have little advantage over an unguided procedure, but its use is seen to continue for all simple pleural procedures. Combining chest drain and pleural aspiration data, 70% of procedures were performed with appropriate ultrasound guidance.

#### LOCAL ANAESTHETIC THORACOSCOPY

One hundred and thirty-five procedures were performed in 25 hospitals. The median age of patients was 74 years (IQR 65–81). Ninety-one per cent were carried out primarily to obtain a tissue diagnosis, while 9% were performed with primarily therapeutic intent to drain fluid and deliver a talc pouddrage. Median length of inpatient stay was 2 days (IQR 1–4).

*Procedure location:* 82 (64%) were performed in a bronchoscopy suite, 22 (17%) in operating theatres and 25 (19%) in a dedicated procedure room.

*Consent:* written consent was taken for 132 (98%) of procedures.

*Imaging:* 132 (98%) had a CT scan performed before their LAT; 118 (87%) of port placements were done with real-time ultrasound guidance, 13 (10%) without ultrasound guidance, and 4 (3%) with remote X-marks the spot.

*Complications:* failure to place port 2 (1.5%), intercostal vessel laceration 1 (0.7%), surgical emphysema 11 (8.1%), and pleural space infection 1 (0.7%).

*Histological diagnosis obtained:* benign 35 (27%), mesothelioma 40 (30%), other malignancy 38 (29%), no biopsies taken 10 (8%), inadequate biopsies 6 (4%), tuberculosis 3 (2%). Subsequent further tissue biopsy was required for 12 (9%):

1 bronchoscopy, 7 video-assisted thoroscopies and 4 image-guided pleural biopsies.

#### 2014 BTS PLEURAL PROCEDURES AUDIT

The national audit cycle in 2014 will just focus on chest drain insertions for pleural fluid and will record if the following key criteria have been met.

- ▶ Written consent should be taken for all chest drain insertions (except when the patient's condition precludes this).
- ▶ Real-time TUS guidance should be used for all pleural procedures for fluid.
- ▶ Chest drains should be inserted in a dedicated clean area and not at the patient's bedside except in life-threatening presentations.
- ▶ Good written documentation of the procedure should always occur, including preprocedural checks and postprocedural observations.
- ▶ The accidental dislodgement of chest drains should be avoided by adequate fixation techniques.

#### SUMMARY

These results suggest that there has been an improvement in important areas of pleural procedure practice between the two audit periods. In particular, the taking of written consent for chest drain insertion for fluid (44% vs 25%), and the use of appropriate ultrasound guidance (69% vs 52%) have increased. Consent practice for drains for pneumothorax remains variable with low rates of written consent. It should be noted that if the patient lacks capacity, completion of consent form 4 is required, so there is written documentation in the medical records. The data suggests that opportunities to minimise the number and invasive nature of pleural procedures are being missed with underuse of aspiration as a first-line management in spontaneous primary pneumothorax, and overuse of chest drains in the management of undiagnosed pleural effusions. This audit report provides a national UK dataset against which departments may benchmark their procedure, practice and complication rates.

**Contributors** All authors contributed to the planning, conduct, and reporting of the work described in this article. CEH and NAM are responsible for the overall content of the article.

**Competing interests** None.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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