

# Management of pneumothorax differs across Denmark

Ulrik Winning Iepsen<sup>1</sup> & Thomas Ringbæk<sup>2</sup>

## ABSTRACT

**INTRODUCTION:** Pneumothorax is a common problem in Denmark. Guidelines recommend insertion of small-bore ( $\leq 14$  Fr) chest tubes or simple needle aspiration in spontaneous pneumothorax. Our objective was to investigate the management of pneumothorax in Danish hospitals.

**MATERIAL AND METHODS:** We undertook a questionnaire survey at all Danish acute hospitals enquiring about current practice in the management of pneumothorax. A questionnaire was sent to 35 hospitals in May 2013. After follow-up in September 2013, a total of 32 completed questionnaires were assessed.

**RESULTS:** We found that three hospitals (10.7%) used simple needle aspiration in primary spontaneous pneumothorax. The majority of the hospitals treated all types of pneumothorax by inserting chest tubes with a traditional small thoracotomy (75%), and most hospitals used large-bore ( $> 14$  Fr) chest tubes (85.7%). There were no regional differences in the management of pneumothorax among the five regions in Denmark ( $p > 0.05$ ), but we found a trend towards use of less invasive techniques in hospitals with departments of either Respiratory Medicine or Thoracic Surgery.

**CONCLUSION:** Management of pneumothorax in Denmark is mainly based on insertion of a large-bore ( $> 14$  Fr) chest tube by a traditional small thoracotomy. Only a few hospitals in Denmark use minimally invasive techniques in the management of spontaneous pneumothorax. We speculate that implementation of these techniques may reduce hospital admission time for patients with spontaneous pneumothorax in Denmark.

**FUNDING:** not relevant.

**TRIAL REGISTRATION:** not relevant.

Pneumothorax is defined as air in the pleural cavity. It can be classified as traumatic, iatrogenic, primary spontaneous and secondary spontaneous. Primary spontaneous pneumothorax occurs in patients without predisposing lung disease and secondary spontaneous pneumothorax in patients with a predisposing lung disease, most commonly chronic obstructive pulmonary disease [1].

Guidelines on the management of pneumothorax depend on the type and size of the pneumothorax and of its symptoms, e.g. pain and dyspnoea [2-4]. The British Thoracic Society and the Danish Lung Society en-

courage simple needle aspiration of air from the pleural cavity as the first choice for the vast majority of primary spontaneous pneumothoraxes. Simple aspiration is only recommended in small-sized ( $< 2$  cm) secondary spontaneous pneumothorax and only if the patient shows no signs of breathlessness. In case of simple aspiration without effect and in secondary spontaneous pneumothorax with either symptoms or a large-sized pneumothorax ( $> 2$  cm), drainage with the use of a small size chest tube ( $\leq 14$  Fr) is recommended. In Denmark, pulmonary physicians recommend small-sized chest tubes ( $\leq 14$  Fr) placed with Seldinger technique (tube over guidewire) [4], while surgeons recommend large-bore tubes (20-28 Fr) inserted with traditional small thoracotomy and digital exploration [5]. However, knowledge on practices in this area in Denmark is sparse.

In a recent study on patients with spontaneous pneumothorax from a Danish university hospital, we found that smaller chest tubes were superior to larger chest tubes inserted with a surgical technique [6]. None of the investigated patients had a simple aspiration performed. The aim of this study was to describe the management of pneumothorax in all Danish hospitals in general and to describe the use of simple aspiration in spontaneous pneumothorax in particular.

## MATERIAL AND METHODS

We sent a questionnaire to all Danish hospitals with emergency departments in May 2013 enquiring about the management of pneumothorax. In this brief questionnaire, we invited the respondents to outline which types of pneumothorax they treated and to comment on their usage of simple needle aspiration, the technique used for chest tube placement, and the size of the chest tubes used (**Figure 1**). The questionnaire was sent to 35 hospitals. Hospitals were included if they had an emergency department or other inpatient acute medical or surgical units. Hospitals were identified from the websites of the five national regions that administer hospitals in Denmark. The questionnaire was addressed personally to the head of the relevant department. Follow-up was made in September 2013 when non-respondents were sent a reminder. In total, 32 hospitals responded after follow-up. Four respondents were excluded because they did not receive acute patients with

## ORIGINAL ARTICLE

1) Centre of Inflammation and Metabolism and Centre for Physical Activity Research, Department of Infectious Diseases, Rigshospitalet  
2) Department of Pulmonary Medicine, Hvidovre Hospital

Dan Med J  
2014;61(3):A4803


 FIGURE 1

Questionnaire.

	Yes	No	Don't know
<b>Are acute patients with pneumothorax treated in your department?</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Which types of pneumothorax are treated in your department?</i>			
Primary spontaneous	<input type="checkbox"/>		
Secondary spontaneous	<input type="checkbox"/>		
Iatrogenic pneumothorax	<input type="checkbox"/>		
Traumatic pneumothorax	<input type="checkbox"/>		
<b>Are patients with pneumothorax treated by simple needle aspiration of air from the pleural space?</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Which types of pneumothorax are treated with simple aspiration in your department?</i>			
Primary spontaneous	<input type="checkbox"/>		
Secondary spontaneous	<input type="checkbox"/>		
Iatrogenic pneumothorax	<input type="checkbox"/>		
Traumatic pneumothorax	<input type="checkbox"/>		
<b>Are patients with pneumothorax treated by inserting a chest tube?</b>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Which technique is used for inserting chest tubes in your department?</i>			
Chest tubes with a small thoracotomy (blunt dissection technique and digital exploration)	<input type="checkbox"/>		
Chest tubes without a small thoracotomy (Seldinger technique, tube over guide wire)	<input type="checkbox"/>		
Pig-tail chest tube (trochar technique, pig-tail catheter)	<input type="checkbox"/>		
A thoracic vent (trochar technique, integrated Heimlich valve)	<input type="checkbox"/>		
Other techniques used	Please describe: <input type="text"/>		
Do not know	<input type="checkbox"/>		
<b>Which chest tube sizes are used in your department?</b>			
Large sized chest tubes > 14 Fr (> 14 Ch)	<input type="checkbox"/>		
Small sized chest tubes ≤ 14 Fr (≤ 14 Ch)	<input type="checkbox"/>		

spontaneous pneumothorax in their clinic. Three hospitals never responded. A total of 28 completed questionnaires were included.

We subsequently divided the responding hospitals into those with a Department of Respiratory Medicine or Thoracic Surgery and those with no Department of Respiratory Medicine or Thoracic Surgery, **Table 1**. A Department of Respiratory Medicine was defined as a department approved for postgraduate medical specialist training.

### Statistics

Data were analysed with the statistical package (SPSS) version 20.0, IBM, Chicago, USA. We analysed our data using the  $\chi^2$ -test for categorical data and Fischer's exact test for dichotomous data. A two-sided p-value of < 0.05 was considered significant.

*Trial registration:* not relevant.

### RESULTS

Nearly all hospitals (92.9%) treated primary spontan-

eous pneumothorax, and 15 (53.6%) treated all types of pneumothorax, **Table 1**. Only three (10.7%) hospitals used simple aspiration for pneumothorax and five (17.9%) for iatrogenic pneumothorax. None of them used simple aspiration for the other types of pneumothorax in question.

All hospitals in the analysis used chest tubes in the management of pneumothorax, and 21 (75%) used the surgical technique with small thoracotomy. Eight (21.6%) hospitals used pig-tail catheters, and six used a thoracic vent – a small-sized portable chest tube with an integrated one-way valve (21.4%). Large-sized chest tubes (> 14 Fr) were used by 24 (85.7%) of the hospitals and ten (35.7%) hospitals exclusively used large-sized chest tubes. Small-sized chest tubes (≤ 14 Fr) were used by 18 (64.3%) hospitals, and four (14.3%) hospitals exclusively used small-sized chest tubes (**Table 1**).

There was no difference in the management of pneumothorax between the five regions in Denmark ( $p > 0.05$ ). But we found a small difference in the management of pneumothorax in hospitals with a specialist department, either a department of respiratory medicine or a department of thoracic surgery. It seems that hospitals with specialist departments more frequently tend to use the less invasive techniques like pig-tail catheters or simple aspiration for iatrogenic pneumothorax ( $p < 0.05$ ), and we also observed a non-significant trend towards the use of simple aspiration for primary spontaneous pneumothorax, **Table 1**.

### DISCUSSION

#### Aspiration

A British Thoracic Society audit on pleural procedures from 2010 found that aspiration was attempted in 58% of the investigated cases of primary spontaneous pneumothorax [7]. We found that only three (10.7%) hospitals in Denmark used simple needle aspiration in the treatment of primary spontaneous pneumothorax. None of the hospitals that participated in our survey used simple aspiration in the treatment of secondary spontaneous pneumothorax. The guidelines from the United Kingdom and Denmark recommend simple aspiration as the first choice for treatment of patients with primary spontaneous pneumothorax and in selected cases of secondary spontaneous pneumothorax [3, 4]. Recommendations from the British Thoracic Society are different to those of the American College of Chest Physicians which do not recommend simple aspiration [2]. The evidence on the use of simple aspiration in primary spontaneous pneumothorax is sparse. A recent randomised trial has shown better outcomes than with traditional chest tubes [8]. In a Cochrane review, Wakai et al investigated the few randomised trials on simple

aspiration compared with chest tubes in primary spontaneous pneumothorax. Although no differences in outcomes were found, a weak association between simple aspiration and reduced hospitalisation was seen [9].

### Size of chest tubes

The British Thoracic Society recommends that only small-bore chest tubes ( $\leq 14$  Fr) be used in the treatment of spontaneous pneumothorax if simple aspiration fails [3], and the British Thoracic Society national audit from 2010 showed that 83% of all chest tubes inserted in the United Kingdom were small-sized chest tubes ( $\leq 14$  Fr) placed with the Seldinger technique [7]. In contrast, we found that the majority of chest tubes inserted in Denmark were large-sized chest tubes placed with traditional small thoracotomy.

### Techniques used in the placement of chest tubes

In general, two types of techniques are used when inserting a chest tube with or without a small thoracotomy [10]. In our survey, 75% of the included hospitals used a surgical technique with a small thoracotomy and digital exploration of the pleural cavity. This technique is common in Denmark and recommended by the surgeons for all types of pneumothorax [5]. A recent retrospective

study showed that pneumothorax patients who had a chest tube placed with a surgical technique more often experienced complications such as bleeding, infections, subcutaneous emphysema and displacement of the chest tube than patients treated with a non-surgical technique [6]. But the knowledge on outcome after these two different techniques is sparse.

### Days of hospitalisation

Parlak et al compared simple aspiration to traditional chest tubes in the treatment of pneumothorax. Their study found significantly shorter hospital stays in the simple aspiration group (2.4 days) than in the chest tube group (4.4 days) and no difference in readmission rates with one-year follow-up [8]. In our recent retrospective study, we found a longer mean admission time for primary spontaneous pneumothorax (8.5 days), but when we looked at the technique used for the placement of the chest tubes, patients with surgically placed large-bore chest tubes had significantly longer mean admission times than patients with chest tubes placed with a non-surgical technique (11.8 versus 6.9 days,  $p = 0.004$ ). None of the studied patients had simple aspiration performed [6], which may have reduced the mean admission time further.



TABLE 1

			Hospitals with or without a department of respiratory medicine or thoracic surgery, n		Hospitals that treat acute cases of pneumothorax.
	All hospitals, n (N = 28)	% of total	with (N = 15)	without (N = 13)	
<i>Type of PT treated</i>					
Primary spontaneous	26	92.9	14	12	
Secondary spontaneous	25	89.3	14	11	
Iatrogenic	23	82.1	14	6	
Traumatic	19	67.9	8	11	
All types	15	53.6	7	8	
<i>Treatment by simple aspiration</i>					
Aspiration at primary spontaneous PT	3	10.7	3	0	
Aspiration at secondary spontaneous PT	0	0	0	0	
Aspiration at iatrogenic PT	5	17.9	5*	0	
Aspiration at traumatic PT	0	0	0	0	
<i>Treatment by insertion of chest tube</i>					
Chest tube with small “thoracotomy”	21	75	10	11	
Chest tube without small “thoracotomy”	8	28.6	4	4	
Pig-tail	8	28.6	7*	1	
Thoracic vent	6	21.4	5	1	
<i>Size of chest tubes used</i>					
≤ 14 Fr	18	64.3	11	7	
> 14 Fr	24	85.7	13	11	
Exclusively ≤ 14 Fr	4	14.3	2	2	
Exclusively > 14 Fr	10	35.7	4	6	

PT = pneumothorax.

\*)  $p < 0.05$  between hospitals with or without a department of respiratory medicine or thoracic surgery.

 **FIGURE 2**

The Tru-Close thoracic vent is a portable small-bore chest tube.



### Outpatient management

Primary spontaneous pneumothorax is a common problem in Denmark that affects young and otherwise healthy people. Internationally, the management strategies in primary spontaneous pneumothorax are shifting towards simple aspiration and ambulatory follow-up instead of traditional chest tubes and hospital admission [11]. A Belgian study found that it was possible to reduce hospital-stay costs by applying simple aspiration as the first step in an outpatient management algorithm. If simple aspiration failed or the lung collapse was extensive, they inserted a portable small-bore chest tube connected to a Heimlich valve and sent the patient back home [12]. This technique is also used in Denmark. Thus, six (21.4%) hospitals in our survey answered that they used the thoracic vent or a similar system. The thoracic vent is a portable small-bore chest tube with an integrated Heimlich valve (**Figure 2**) the use of which has been investigated in several studies [6, 13-15].

### Limitations

There are several limitations to our study. Since our questionnaire was not validated, the study holds a certain risk of inter- and intra-observer variability. However, as our questionnaire consisted of short questions and non-qualitative answers (e.g. yes or no and size), we estimate that the risk of inter- and intra-observer variability is low (see Table 1). With a response rate of 91% and relatively consistent answers, we believe that our results describe the current practice in PT management in Denmark fairly well, but we urge readers to regard our results conservatively.

Implementation of minimally invasive techniques in Denmark like simple aspiration and a portable small-bore chest tube connected to a one-way valve may reduce hospital admissions and hospital days in patients with spontaneous pneumothorax. We recommend a

prospective feasibility study in which patients with spontaneous pneumothorax are managed with minimally invasive techniques in a Danish outpatient setting in order to clarify the safety and outcome of this management strategy.

**CORRESPONDENCE:** Ulrik Winning Iepsen. E-mail: [ulrik\\_winning@hotmail.com](mailto:ulrik_winning@hotmail.com).

**ACCEPTED:** 17 January 2014.

**CONFLICTS OF INTEREST:** none. Disclosure forms provided by the authors are available with the full text of this article at [www.danmedj.dk](http://www.danmedj.dk).

### LITERATURE

1. Sahn S, Heffner J. Spontaneous pneumothorax. *N Engl J Med* 2000; 342:868-74.
2. Baumann M H, Strange C, Heffner J et al. Management of spontaneous pneumothorax. An American College of Chest Physicians Delphi Consensus Statement. *Chest* 2001;119:1-20.
3. MacDuff A, Arnold A, Harvey J. Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010;65(suppl 2):ii18-ii31.
4. Perch M, Andersen H, Larsen K R. Guidelines: pneumothorax. Danish Lung Society, 2010. [www.lungemedicin.dk/](http://www.lungemedicin.dk/) (1 Nov 2013).
5. Neckelmann K. Surgically insertion of chest tube. *Ugeskr Læger* 2006; 168:2062.
6. Iepsen UW, Ringbæk T. Small-bore chest tubes seem to perform better than larger tubes in treatment of spontaneous pneumothorax. *Dan Med J* 2013;60(6):A4644.
7. Hooper C, Maskell N et al. British Thoracic Society national pleural procedures audit 2010. *Thorax* 2011;66:636-7.
8. Parlak M, Uil SM, van den Berg JWK. A prospective, randomised trial of pneumothorax therapy: manual aspiration versus conventional chest tube drainage. *Respir Med* 2012;106:1600-5.
9. Wakai A, O'Sullivan R, McCabe G. Simple aspiration versus intercostal tube drainage for primary spontaneous pneumothorax in adults. *Cochrane Database Syst Rev* 2007;(1):CD004479.
10. Havelock T, Teoh R, Laws D et al. Pleural procedures and thoracic ultrasound: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010;65(suppl 2:ii):61-76.
11. Brims FJH, Maskell NA. Ambulatory treatment in the management of pneumothorax: a systematic review of the literature. *Thorax* 2013;68: 664-9.
12. Massongo M, Leroy S, Scherpereel A et al. Outpatient management of primary spontaneous pneumothorax: a prospective study. *Eur Respir J* 2013 13 June (e-pub ahead of print).
13. Ambalavanan S. The use of thoracic vents in the management of pneumothoraces. *European Respiratory Disease* 2007;2:34-5.
14. Rögglä M, Wagner A, Brunner C et al. The management of pneumothorax with the thoracic vent versus conventional intercostal tube drainage. *Wien Klin Wochenschr* 1996;108:330-3.
15. Samelson SL, Goldberg EM, Ferguson MK. The thoracic vent. Clinical experience with a new device for treating simple pneumothorax. *Chest* 1991;100:880-2.