Variation in perioperative care for recurrent primary spontaneous pneumothorax: a Dutch survey

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Abstract: Surgery is the recommended treatment for patients with recurrent primary spontaneous pneumothorax (PSP) or persistent air leakage after conservative treatment. Although frequently performed, there is no consensus about optimal perioperative care. Also, great variability in management has been demonstrated among paediatric populations. We conducted an online survey among Dutch (cardio)thoracic surgeons to analyse the variation in treatment and perioperative care. This survey was based on a clinical case of an adult male with recurrent PSP. Forty-five Dutch (cardio)thoracic surgeons completed the survey, comprising a response rate of 70% of all hospitals in the Netherlands. Only 62% of the respondents routinely perform a preoperative chest computed tomography scan. Video-assisted thoracoscopic surgery is used in 100% of the cases with pleurectomy as the preferred pleurodesis technique in 89%. Regarding chest tube policy, most surgeons (69%) leave the tube in place for a fixed number of days (variable range of 1–5) and 31% remove the chest tube based on absence of air leakage only. The most applied analgesic technique is thoracic epidural analgesia (78%). Our findings expose considerable variability in perioperative care for adults with PSP. Optimizing and standardizing chest tube policy and pain management may enhance the efficacy of perioperative care by potentially reducing length of stay, costs and variability.

Keywords: Primary spontaneous pneumothorax (PSP); perioperative care; surgical treatment

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Introduction

Primary spontaneous pneumothorax (PSP) has an incidence of 12.3 cases per 100,000 young healthy males (1). Treatment is primarily conservative using aspiration or drainage; however, recurrence rates are reported up to 48%. Surgical intervention is recommended in patients presenting with recurrent PSP or persistent air leakage (>5 days) after conservative treatment (2).

However, conclusive evidence is lacking on which type of pleurodesis (chemical or mechanical) is the optimal technique to prevent future recurrences. Although a meta-analysis suggested a slightly lower recurrence rate after chemical pleurodesis when compared to mechanical pleurodesis, low quality evidence with high heterogeneity between studies precludes firm recommendations (3). Likewise, no conclusive evidence exists on best type of postoperative pain management. Although the PROSPECT guidelines recommend loco-regional analgesia

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instead of thoracic epidural analgesia (TEA) in thoracic surgery, evidence is lacking to establish such advice after pleurodesis (4). In addition, optimal postoperative chest tube management is unclear. Postoperative chest tubes are historically left in place for at least 3 days, irrespective of absent of air or fluid leakage, since this period was considered necessary for adequate pleurodesis. However, Furuya *et al.* showed that early chest tube removal is safe and feasible (5). This lack of consensus regarding the optimal perioperative care for patients with recurrent PSP is also reflected by the lack of recommendations on the management of postoperative pain and chest tubes by the American College of Chest Physicians (ACCP) and British Thoracic Society (BTS) (2,6). Moreover, the quality of guidelines is moderate to low, contributing to variation in management of PSP (7).

A survey among paediatric surgeons demonstrated a large variety in treatment of PSP in children. We postulate comparable variability among adults, despite these are treated by specialized thoracic surgeons (8,9). With the upcoming interest in enhanced recovery after thoracic surgery (ERATS), evidence based perioperative care protocols are crucial to decrease morbidity and length of hospital stay (LOS). The aim of this study is to get an overview of the variation in perioperative care of adults with PSP in the Netherlands as a first step to standardise care. We present the following article in accordance with the SURGE reporting checklist (available at https://ales.amegroups.com/article/view/10.21037/ales-22-67/rc).

Methods

Survey

An online case-based survey was designed using Google Forms. The survey consisted of 19 multiple choice questions regarding diagnostic management, preferred surgical treatment, postoperative pain management and chest tube policy. This survey was designed by two senior thoracic surgeons and was based on a standard clinical case of a male patient with recurrent PSP after conservative treatment (Appendix 1). All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Ethical approval and written informed consent were waived due to the voluntary decision of the respondents to complete this survey.

Participants

In the Netherlands, (cardio)thoracic surgeons perform all surgeries for PSP in adults. Therefore, the survey was sent by email to all members of the Dutch Society of Lung Surgery and the Dutch Society of Thoracic Surgery via the secretaries of these societies. In this way all certified (cardio) thoracic surgeons from 43 hospitals in the Netherlands were contacted. Participation was voluntary and no incentives were provided. One reminder was sent for completion of the survey.

Analysis

Surveys that were completed for at least 90% were eligible for analysis to secure a proper overview of practice per hospital. The response rate was calculated by dividing the number of hospitals with at least one completed survey through the total number of invited hospitals. Results were analyzed with descriptive statistics using Statistical Package for Social Sciences (version 22.0, IBM, Armonk, NY, USA).

Results

45 surgeons from 30 different hospitals completed the survey (response rate of 70% from all hospitals; 30/43). Forty surveys (89%; 40/45) were complete and 5 had one question unanswered (11%; 5/45). In general, one surgeon completed the survey on behalf of all surgeons from the same hospital. The results are presented in *Table 1*.

Diagnostics

Routine preoperative chest computed tomography (CT) scan was used by 28 surgeons (62%). Chest X-rays before and after chest tube removal and at the postoperative outpatient clinic visit were performed in 47%, 24% and 27%, respectively.

Surgical treatment

All surgeons recorded video-assisted thoracoscopic surgery (VATS) as the standard surgical approach. The number of surgical ports used for VATS differed in using 1, 2 or 3 incisions in 33% (15/45), 24% (11/45) and 42% (19/45), respectively. In 82% (37/45) pleurectomy plus bullectomy was the preferred treatment. The extent of pleurectomy varied with 44% (20/45) removing the upper one-third and

Table 1 Results of the online case-based survey

Survey among (cardio)thoracic surgeons	Items	Respondents, n (%)
Total		45 (100.0)
Preoperative		
Preoperative chest CT-scan	Yes	28 (62.2)
	No	17 (37.8)
Perioperative		
Surgical approach	VATS	45 (100.0)
	1-port	15 (33.3)
	2-port	11 (24.4)
	3-port	19 (42.2)
	Thoracotomy	0 (0.0)
Type of surgery	Pleurectomy	2 (4.4)
	Pleurectomy + bullectomy	37 (82.2)
	Pleurectomy + bullectomy + talcage	1 (2.2)
	Bullectomy + talcage	5 (11.1)
If pleurectomy	Upper 1/3	20 (44.4)
	Near-total pleurectomy	18 (40.0)
	Total pleurectomy	3 (6.7)
	No pleurectomy is done	4 (8.9)
Standard apical wedge resection	Yes	16 (35.5)
	No	29 (64.4)
Bullectomy if bullae present on CT scan	With air leak	
	Yes	45 (100.0)
	No	0 (0.0)
	Without air leak	
	Yes	42 (93.3)
	No	3 (6.7)
Postoperative		
Chest tube management		
Amount of chest tubes	1	44 (97.8)
	2	1 (2.2)
Chest tube thickness	<20 Fr	8 (17.8)
	20 Fr	17 (37.8)
	24 Fr	14 (31.1)
	>24 Fr	5 (11.1)
	Unknown	1 (2.2)

Table 1 *(continued)*

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Survey among (cardio)thoracic surgeons	Items	Respondents, n (%)
Drainage modalities	Water seal (–8 cmH_2O)	19 (42.2)
	Suction <–10 cmH_2O	12 (26.7)
	Suction >–15 cmH_2O	3 (6.7)
	Suction ≥–10 cmH_2O and ≤–15 cmH_2O	11 (24.4)
Chest tube removal	Immediately when full lung expansion and no air leak	14 (31.1)
	After a set number of days (1 to 5)	31 (68.9)
Minimum number of days with chest tube in place	1	4 (8.9)
	2	13 (28.9)
	3	11 (24.4)
	4	0 (0.0)
	5	2 (4.4)
	Not applicable	15 (33.3)
Diagnostic management		
Routine postoperative chest X-ray (POD 0 or 1)	Yes	16 (35.6)
	No	28 (62.2)
	Unknown	1 (2.2)
Chest X-ray	Before chest tube removal	
	Yes	21 (46.7)
	No	22 (48.9)
	Unknown	2 (4.4)
	After chest tube removal	
	Yes	11 (24.4)
	No	33 (73.3)
	Unknown	1 (2.2)
	Postoperative control at the outpatient clinic	
	Yes	12 (26.7)
	No	33 (73.3)
Pain management		
Technique	Thoracic epidural analgesia	35 (77.8)
	Intravenous medication	5 (11.1)
	Paravertebral block single-shot/continuous	5 (11.1)

CT, computed tomography; VATS, video-assisted thoracoscopic surgery; Fr, French; POD, postoperative day.

40% (18/45) performing near-total pleurectomy. Chemical pleurodesis with talcage is used in 11% (5/45) as initial treatment. Only 4 surgeons declared not to use pleurectomy and one surgeon preferred both chemical and mechanical pleurodesis after bullectomy.

Postoperative pain management

TEA was the preferred perioperative analgesic technique (78%), whereas loco-regional techniques (11%) and systemic analgesia (11%) were less frequently used.

Postoperative chest tube management

In 98% (44/45) one chest tube was left in place for postoperative drainage. The chest tube sizes were 20 and 24 French in 38% (17/45) and 31% (14/45), respectively. Regarding timing of chest tube removal, 31% (14/45) removed the chest tube based on the absence of air leakage and complete lung expansion, whereas 69% (31/45) left the tube in place for a fixed period varying from 1 to 5 days. Thirteen respondents (29%) left the chest tube routinely in place for at least 2 days and another 13 (29%) respondents for 3 or even more.

Discussion

Our study, aimed to get an overview of the variation in perioperative care of adults with PSP in the Netherlands, exposed great variability in perioperative diagnostic imaging, uni- or multiportal surgery, pain treatment and chest tube management. We demonstrated that pleurectomy through VATS is the preferred surgical pleural intervention for (recurrent) PSP. Choices are probably based on surgeon's experience and training as well as personal preferences, due to lack of high quality evidence (7).

The value of perioperative imaging remains debatable. Preoperative CT was routinely performed by only 62% of respondents. However, it may be of added value when underlying lung pathology or bullae are expected, given the presumption that these are risk factors for recurrence (2). According to our survey nearly all respondents declared to remove bullae when demonstrated on CT independent of the presence of air leakage. Literature suggests perioperative inspection also to be sufficient to detect bullae although high resolution CT is more accurate and thus may be of added value (10). Contradistinctions in literature may explain the variability in usual care regarding the use of preoperative CT scan. Furthermore, routine postoperative chest X-ray prior to or following chest tube removal was performed by our respondents in 47% and 24% respectively, whereas at least 25% did not use chest X-rays at all. According to a review by Sepehripour *et al.*, routine radiographs are not of added value compared to radiographs based on clinical indication (11). Since clinical signs, suggestive for pathology, are a significant predictor of re-intervention, radiographs should only be made based on clinical signs. Guideline recommendations or standardized protocols regarding the use of imaging diagnostics may result in a decrease of the current variety.

Although VATS was the preferred surgical approach for all respondents, the number of used surgical ports differed considerably. Several non-randomized studies showed uniportal VATS to be comparable with three-portal VATS in terms of mortality, recurrence and complications. However, uniportal VATS resulted in less paresthesia, less postoperative pain and higher patient satisfaction in the short term (12). Based on these findings, uniportal VATS may have a slight preference over multiportal VATS.

According to previous guidelines, the first surgical step is bullectomy followed by chemical or mechanical pleurodesis (2). This is in accordance with our survey in which 93% of respondents perform bullectomy followed by pleurectomy as preferred pleurodesis technique (82%, 37/45), whereas only a few (11%, 5/45) use chemical pleurodesis with talc. Remarkably, chemical pleurodesis is not frequently used in the Netherlands, while a recent meta-analysis by Sim *et al.* suggests chemical pleurodesis to be slightly superior to mechanical pleurodesis in terms of hospital stay and recurrence rate, although most included studies were of low methodological quality (3). Only one randomized trial was included and several studies using pleural abrasion instead of pleurectomy, precluding strong recommendations on which technique should be preferred. High quality research comparing pleurectomy and chemical pleurodesis is necessary to provide adequate evidence on the preferred pleurodesis technique.

Furthermore, our survey demonstrates that TEA is the preferred analgesic technique in 78% of the respondents, despite TEA being associated with hypotension, bladder dysfunction and immobilisation. Compared to parenteral opioids, TEA does not contribute significantly in minimizing perioperative pain after VATS pleurectomy for PSP (13). Likewise, progressive fast-track protocols show that single-shot loco-regional techniques such as paravertebral blocks (PVB) are efficient and can potentially

lead to earlier discharge (14). Comparative research of TEA versus PVB should be done to evaluate potential benefits in this relatively young patient group.

Finally, almost all surgeons prefer one postoperative chest tube, although chest tube size and timing of chest tube removal varied substantially. There is no consensus regarding the optimal chest tube size. In 56% a chest tube of 20 French or less is used whereas 42% of the respondents use a chest tube of 24 French or more. Unfortunately, the survey did not provide information on the rationale of choosing a certain size of chest tube, however there seems to be no correlation between size and amount of pain (15). The choice for the size of the chest tube should therefore not be based on minimizing pain. A review by Dearden *et al.*, investigating the timing of chest tube removal, demonstrated that studies had different chest tube protocols and that the length of hospital stay was directly related to chest tube duration. This study supported chest tube removal as early as postoperative day 2 in case no complications had occurred and the chest X-ray findings were satisfactory (16). Interestingly, Furuya *et al.* demonstrated that chest tube removal on the same day of surgery is safe and reported a mean LOS of only 1 day (5). Thus far, high quality evidence on optimal chest tube duration is still missing which results in variation of clinical practice, merely based on personal experience or doctrine. Additional research is necessary to standardize chest tube management and optimize LOS.

This was one of the first surveys assessing the national variation in treatment of PSP in adults. However, two simultaneous surveys regarding the management of PSP were performed during the conduct of our study. Both surveys also demonstrated large variability in clinical practice (8,9). In contrast to our survey, the previous surveys have been performed among general paediatric surgeons confining to a paediatric population. Moreover, Soyer *et al.* included respondents from 44 countries resulting in an average of three respondents per country, thereby focusing merely on between-country variability (8). Our respondents represented 70% of all Dutch hospitals providing thoracic surgery, thereby mapping the variability of the current thoracic practice in the Netherlands. The fact that our survey was confined to Dutch hospitals may be regarded as a limitation. However, since our results are in line with the previous surveys, we feel that our exposed clinical variability is generalizable to a broader international practice. In contrast to the other surveys, we also explored postoperative pain management which is of added value in establishing the topics for future research. Although 70% of thoracic centres were represented in our survey, the answers provided through a survey may be subjective in nature and not always reflect local clinical protocols, which is a common limitation of surveys. Interestingly, some thoracic surgeons that completed the survey were from the same hospital but provided different answers, not only demonstrating variability between hospitals but also within hospitals. Another potential limitation of assessing variability through a survey, is that desirable answers are provided whereas data from daily practice will be more unbiased.

Conclusions

This national online survey gives an overview of current thoracic surgical practice for PSP in the Netherlands and demonstrates large variability in perioperative treatment for PSP in adults. Particularly reducing variability and optimizing chest tube policy and pain management may significantly improve efficacy by enhancing recovery and reducing LOS and costs. Well-designed studies focusing on these topics, as well as comparing chemical with mechanical pleurodesis in patients with recurrent PSP, are needed to provide evidence for optimal standardized surgical care.

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Footnote

Reporting Checklist: The authors have completed the SURGE reporting checklist. Available at https://ales.amegroups.com/article/view/10.21037/ales-22-67/rc

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://ales.amegroups.com/article/view/10.21037/ales-22-67/coif). The authors have no conflicts of interest to declare.

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to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Ethical approval and written informed consent were waived due to the voluntary decision of the respondents to complete this survey.

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Supplementary

Appendix 1

Survey

Case: Six month ago a 28 years old healthy man had his first pneumothorax which was successfully treated conservatively with drainage. Now he has a recurrent primary spontaneous pneumothorax for what surgical intervention is indicated.

Questions

1. In which hospital are you working?
2. Is a preoperatively chest CT-scan made in this situation?
   a. Yes
   b. No
3. What is the preferred surgical approach?
   a. Video-assisted thoracoscopic surgery (VATS)
   b. Thoracotomy
4. In case of a thoracoscopic surgery, how many surgical portals are used?
   a. 1
   b. 2
   c. 3
5. What is the preferred type of surgery?
   a. Pleurectomy
   b. Pleurectomy plus bullectomy
   c. Pleurectomy plus bullectomy plus talcage
   d. Bullectomy plus talcage
6. In case of a pleurectomy, what kind of pleurectomy?
   a. Upper 1/3
   b. Near-total pleurectomy
   c. Total pleurectomy
   d. No pleurectomy is done
7. In case a chest CT-scan is made preoperatively and there are present bullae without air leakage, are you doing a bullectomy?
   a. Yes
   b. No
8. In case a chest CT-scan is made preoperatively and there are present bullae with air leakage, are you doing a bullectomy?
   a. Yes
   b. No
9. Is a standard apical wedge resection performed?
   a. Yes
   b. No
10. How many chest tubes are used?
    a. 1 chest tube
    b. 2 chest tubes
11. What size of chest tube is used?
    a. <20 French
    b. 20 French
    c. 24 French
    d. >24 French

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12. What is the drainage modality used postoperatively?
    a. Water seal
    b. Suction <–10 cmH_2O
    c. Suction >–15 cmH_2O
    d. Suction ≥–10 cmH_2O and ≤–15 cmH_2O
13. When are the chest tubes removed?
    a. Immediately, in case of no pneumothorax nor air leak
    b. After a fixed amount of days
14. In case of a standardized set of days, how many days is the chest tube left in place?
    a. 1 day
    b. 2 days
    c. 3 days
    d. 4 days
    e. 5 days
    f. Not applicable
15. Is a routine postoperative chest X-ray made on postoperative day 0 or 1?
    a. Yes
    b. No
16. Is a chest X-ray made before chest tube removal?
    a. Yes
    b. No
17. Is a chest X-ray made after chest tube removal?
    a. Yes
    b. No
18. Is a chest X-ray made during the postoperative control at the outpatient clinic?
    a. Yes
    b. No
19. Which technique for pain management is used next to oral pain medication?
    a. Epidural analgesia
    b. Intravenous medication
    c. Single shot paraspinal block

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