Online Appendix A5 BTS Guideline for Pleural Disease

Section A Spontaneous pneumothorax

Question A5 Evidence Review and Protocol

A5 In adults with spontaneous pneumothorax what is the optimal operation for improving clinical outcomes?

Contents

Question Evi	idence Review	2
Background		2
Outcomes		2
Evidence rev	/iew	2
Evidence sta	itements	4
Recommend	lation	4
Research Re	ecommendation	4
Meta-analyse	es	5
Figure A5a	Pneumothorax recurrence	5
Figure A5b	Length of hospital stay	5
Figure A5c	Further treatment (surgery, chest drain, conservative management)	5
Figure A5d	Duration of air leak – chest drain in situ	6
Figure A5e	Duration of air leak – prolonged air leak	6
Figure A5f	Complications	6
Risk of bias	summary	7
GRADE anal	yses	7
Recommend	ation Table	9
Question De	tails	9
SUMMAR'	Y OF JUDGEMENTS	9
TYPE OF	RECOMMENDATION	9
CONCLUS	SIONS	10
References .		11
Question Pro	otocol	12

Question Evidence Review

A5 In adults with spontaneous pneumothorax what is the optimal operation for improving clinical outcomes?

Background

Thoracic surgery for pneumothorax can be broadly divided into two different types, i) resection of lung parenchyma (often visible sub-pleural blebs or bullae) to remove the suspected source of the current air leak and prevent future potential sources of air leaks; and ii) surgical pleurodesis to obliterate the pleural space via an inflammatory symphysis of the visceral and parietal pleura to prevent the accumulation of air within that space and prevent any future episodes of pneumothorax. The former requires a 'bullectomy' a form of wedge resection using stapler equipment and can also include the use of a 'sealant' (such as glue and a mesh) to further fortify the site of lung resection. The latter can be achieved through a number of different methods intraoperatively including pleural abrasion, partial pleurectomy and talc poudrage. The aim of this review was to compare these two main types of pneumothorax surgery for the treatment of spontaneous pneumothorax in adults.

Outcomes

Pneumothorax recurrence, length of hospital stay, further treatment (surgery, chest drain, conservative management), pain and breathlessness, duration of air leak, complications, quality of life and mortality

Evidence review

The literature search identified 133 abstracts for review, of which 10 studies were relevant to the review. Two studies were randomised controlled trials^{1,2} and the remainder retrospective cohort studies³⁻¹⁰. One study specifically investigated secondary pneumothorax in patients with emphysema.² All studies reported data outcomes for patients undergoing bullectomy alone (+/- sealant) and those underdoing surgical pleurodesis.

It should be noted that there were differences within the data that should be taken into consideration:

- i) The commonest form of surgical pleurodesis within the studies was pleural abrasion, with talc pleurodesis and pleurectomy being under-represented within these studies. It has previously been published that pleural abrasion may represent a weaker form of pleurodesis in comparison to the other two methods.¹¹
- ii) There is variability within the two surgical groups in a number of studies e.g. whether a sealant was used during a bullectomy, the type of sealant used in a bullectomy and the type of surgical pleurodesis.

Pneumothorax recurrence

All studies reported on pneumothorax recurrence, but meta-analysis (<u>Figure A5a</u>) showed no difference in the rate of pneumothorax recurrence between bullectomy (<u>93 per 1000 patients (75 to 114</u>)) and surgical pleurodesis (<u>93 per 1000</u>) for the treatment of spontaneous pneumothorax in adults.

Length of hospital stay

Length of hospital stay was reported in four studies.^{1-3,5} Meta-analysis showed no difference in the length of hospital stay between pneumothorax treatment with bullectomy or surgical pleurodesis, but there was significant inconsistency between the studies (Figure A5b).

Further treatment (surgery, chest drain, conservative management)

Three studies reported the need for further treatment^{1,3,5}, but meta-analyses showed no difference in the need for further treatment, the need for surgery, the need for chest drain or the need for conservative management following bullectomy or surgical pleurodesis (<u>Figure A5c</u> and <u>Table A5a</u>).

Table	A5a: Comparison	of the risk of	of need for	further	treatment for	ollowing	bullectomy	or surgical	pleurodesis
for the	treatment of spon	taneous pne	eumothora	x in adu	llts				

		Risk of need for further treatment (per 1000 patients)					
Further treatment	No. datasets	Bullectomy	Surgical pleurodesis				
Combined*	8	<u>42 (32 to 54)</u>	<u>42</u>				
Further surgery	3	<u>50 (34 to 76)</u>	<u>49</u>				
Chest drain	2	<u>28 (17 to 47)</u>	<u>44</u>				
Conservative management	3	<u>45 (28 to 73)</u>	<u>45</u>				

* Combined – combined subgroup data (further surgery, chest drain and conservative management)

Pain and breathlessness

Pain was reported in two studies^{1,5}, but was reported in different formats, A summary of the results is shown in <u>Table A5b</u>.

Table A5b: Comparison of post-operative chest pain following surgical pleurodesis or bullectomy alone for the treatment of pneumothorax

Study	Pain type	Bullectomy	Surgical pleurodesis	p						
	VAS (mean ± SD score) (mm)									
Horio 2002⁵	Post-operative chest pain	11.8 ± 0.9	11.0 ± 8.5	NS						
% patients (no. patients)										
Lee 2014 ¹	Residual pain	38.6% (292/757)	51.3% (337/657)	<0.001						
	Occasional pain*	34.3% (260/757)	42.9% (282/657)	NS						
	Intermittent pain [†]	3.8% (29/757)	5.2% (34/657)	NS						
	Daily pain [‡]	0.4% (3/757)	3.2% (21/657)	NS						

* Not requiring analgesia

[†] Requiring intermittent analgesia

[‡] Requiring daily analgesia

NS - not significant; VAS - visual analogue scale

Breathlessness was not reported in any study.

Duration of air leak

Seven studies reported on duration of air leak, with six reporting actual duration^{1-3,5,8,10} and six reporting duration greater than 5 days^{1,3-5,8,10}, but meta-analysis showed no difference in the duration of air leak (Figure <u>A5d</u>), or the duration of air leak greater than five days (Figure A5e) between bullectomy or surgical pleurodesis for the treatment of spontaneous pneumothorax.

Complications

Seven studies reported on complications^{1-5,8,10}, but three reported no complications in both experiment arms (bullectomy and surgical pleurodesis), so could not be included in the meta-analysis^{4,5,8}. Meta-analysis of the remaining studies^{1-3,10} showed no difference in the risk of complications between bullectomy or surgical pleurodesis for the treatment of spontaneous pneumothorax (<u>62 per 1000 patients (44 to 88)</u> compared with <u>81 per 1000</u> respectively) (Figure A5f).

Quality of life

No studies reported on quality of life.

Mortality

Seven studies reported mortality rate at day 30 following bullectomy alone or surgical pleurodesis for the treatment of pneumothorax.^{2,3,5-9} Six of these studies reported no deaths in either experimental arm (bullectomy or surgical pleurodesis)^{2,3,5,7-9}, with the final study reporting two deaths following surgical pleurodesis (2/235 subjects), but both subjects underwent thoracotomy prior to adoption of VATS⁶.

Evidence statements

There appears to be no difference in pneumothorax recurrence (<u>Very low</u>), length of hospital stay (<u>Very low</u>), the need for further treatment (surgery, chest drain or conservative management) (<u>Very low</u>), duration of air leak (<u>Very low</u>), complications (<u>Very low</u>) or mortality (**Ungraded**) following bullectomy or surgical pleurodesis for the treatment of spontaneous pneumothorax in adults

There was insufficient evidence to comment on pain and breathlessness and quality of life following bullectomy or surgical pleurodesis for the treatment of spontaneous pneumothorax in adults

Recommendation

Surgical pleurodesis and/or bullectomy can be considered for the treatment of spontaneous pneumothorax in adults (Conditional)

Research Recommendation

• Further research is needed to determine optimal type of surgical pleurodesis (e.g. pleurectomy, abrasion, talc) and adjunct (e.g. bullectomy) for the treatment of spontaneous pneumothorax in adults

Meta-analyses

	Bullectomy		Surgical pleurodesis		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	M-H, Fixed, 95% Cl
Cho 2009	5	98	4	99	2.6%	1.26 [0.35, 4.56]	
Hatz 2000	5	72	0	37	0.4%	5.73 [0.33, 100.83]	
Horio 2002	8	50	1	53	0.6%	8.48 [1.10, 65.39]	
Ingolfsson 2006	0	21	15	235	1.7%	0.35 [0.02, 5.59]	
Lee 2014	99	757	93	657	64.7%	0.92 [0.71, 1.20]	+
Liu 2016	2	35	10	43	5.8%	0.25 [0.06, 1.05]	
Ohno 2000	17	174	23	250	12.3%	1.06 [0.58, 1.93]	
Park 2012	6	92	12	165	5.6%	0.90 [0.35, 2.31]	
Uramoto 2012	31	199	4	15	4.8%	0.58 [0.24, 1.44]	
Zhang 2017	7	120	3	225	1.4%	4.38 [1.15, 16.61]	
Total (95% CI)		1618		1779	100.0%	1.00 [0.81, 1.23]	•
Total events	180		165				
Heterogeneity: Chi ² = 16.40, df = 9 (P = 0.06); l ² = 45%							
Test for overall effect	: Z = 0.03 (F	^o = 0.98)		Eavours pleurodesis Eavours bullectomy			

Figure A5a Pneumothorax recurrence

Figure A5b Length of hospital stay

	Bu	llecton	ıy	Surgical pleurodesi			s Mean Difference		Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% Cl	IV, Fixed, 95% CI
Cho 2009	3.2	2	98	3.5	1.8	99	10.5%	-0.30 [-0.83, 0.23]	-+-
Horio 2002	5.5	2.1	50	3.9	1.3	53	6.4%	1.60 [0.92, 2.28]	
Lee 2014	3.4	1.96	757	3.4	1.75	657	79.4%	0.00 [-0.19, 0.19]	•
Liu 2016	7.86	1.73	35	11.09	2.33	43	3.7%	-3.23 [-4.13, -2.33]	
Total (95% CI) 940 852						852	100.0%	-0.05 [-0.22, 0.13]	
Heterogeneity: Chi*: Test for overall effec	= 71.53, t: Z = 0.5	at = 3 (3 (P =	P < 0.00 0.60)	-4 -2 0 2 4 Favours pleurodesis Favours bullectomy					

Figure A5c Further treatment (surgery, chest drain, conservative management)

	Bullect	omy	Surgical ple	urodesis	;	Risk Ratio	Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	M-H, Fixed, 95% Cl	
1 Surgery								
Cho 2009	1	98	4	99	3.7%	0.25 [0.03, 2.22]		
Horio 2002	5	50	1	53	0.9%	5.30 [0.64, 43.80]		
Lee 2014	40	757	35	657	35.0%	0.99 [0.64, 1.54]	- <u>+</u> -	
Subtotal (95% CI)		905		809	39.7%	1.02 [0.68, 1.54]	•	
Total events	46		40					
Heterogeneity: Chi ² =	3.94, df =	2 (P = 0.	14); I² = 49%					
Test for overall effect:	Z = 0.10 (P = 0.92)					
2 Chest drain								
Cho 2009	2	98	2	99	1.9%	1.01 [0.15, 7.03]		
Lee 2014	22	757	31	657	31.0%	0.62 [0.36, 1.05]		
Subtotal (95% CI)		855		756	32.9%	0.64 [0.38, 1.07]	◆	
Total events	24		33					
Heterogeneity: Chi ² =	0.23, df=	1 (P = 0.	63); I² = 0%					
Test for overall effect:	Z=1.71 (P = 0.09))					
3 Conservative								
Cho 2009	2	98	1	99	0.9%	2.02 [0.19, 21.92]		
Horio 2002	3	50	0	53	0.5%	7.41 [0.39, 139.97]		→
Lee 2014	37	757	26	657	26.0%	1.24 [0.76, 2.02]	_ _	
Subtotal (95% CI)		905		809	27.4%	1.36 [0.85, 2.18]	◆	
Total events	42		27					
Heterogeneity: Chi ² =	1.54, df =	2 (P = 0.	46); I² = 0%					
Test for overall effect:	Z=1.30 (P = 0.19))					
Total (95% CI)		2665		2374	100.0%	0.99 [0.76, 1.29]		
Total events	112		100					
Heterogeneity: Chi ² =	9.88, df =	7 (P = 0.	20); I ² = 29%			<u> </u>		
Test for overall effect:	Z = 0.08 (P = 0.94)			0.01	I U.1 1 10 1	UU
Test for subaroup diff	erences: (⊃hi² = 4.i	61. df = 2 (P =	0.10), I ² :	= 56.6%		Favours pieurodesis - Favours pullectomy	

Figure A5d Duration of air leak – chest drain in situ

	Bullectomy Surgical pleure			pleurodesis Mean Difference			Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% Cl
Cho 2009	1.7	1.8	98	1.9	1.8	99	7.2%	-0.20 [-0.70, 0.30]	-+
Horio 2002	1.9	1.1	50	1.7	1.1	53	10.1%	0.20 [-0.23, 0.63]	- -
Lee 2014	2.4	1.64	757	2.4	1.6	657	63.7%	0.00 [-0.17, 0.17]	•
Liu 2016	4.91	1.29	35	7.47	2.12	43	3.1%	-2.56 [-3.32, -1.80]	
Park 2012	2.91	1.54	92	2.82	1.28	165	13.3%	0.09 [-0.28, 0.46]	
Zhang 2017	6.59	4.29	120	4.76	2.67	225	2.6%	1.83 [0.99, 2.67]	
Total (95% CI)			1152			1242	100.0%	-0.02 [-0.15, 0.12]	4
Heterogeneity: Chi ² =	Heterogeneity: Chi ^z = 62.83, df = 5 (P < 0.00001); l ^z = 92%							-	
Test for overall effect	Z = 0.22	? (P = 0	1.82)						Favours pleurodesis Favours bullectomy

Figure A5e Duration of air leak – prolonged air leak

Bullectomy		Surgical pleu	irodesi	s	Risk Ratio	Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	M-H, Fixed, 95% Cl
Cho 2009	7	98	5	91	8.6%	1.30 [0.43, 3.95]	
Hatz 2000	3	72	0	37	1.1%	3.64 [0.19, 68.73]	
Horio 2002	3	50	1	53	1.6%	3.18 [0.34, 29.57]	
Lee 2014	30	757	28	657	49.5%	0.93 [0.56, 1.54]	
Park 2012	4	92	8	165	9.5%	0.90 [0.28, 2.90]	
Zhang 2017	4	120	26	225	29.8%	0.29 [0.10, 0.81]	
Total (95% CI)		1189		1228	100.0%	0.83 [0.57, 1.21]	•
Total events	51		68				
Heterogeneity: Chi² =	Heterogeneity: Chi² = 7.25, df = 5 (P = 0.20); l² = 31%						
Test for overall effect	: Z = 0.96 ((P = 0.3)	3)			0.0	Favours pleurodesis Favours bullectomy

Figure A5f Complications

Bullectomy S		Surgical ple	urodesi	s	Risk Ratio	Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	M-H, Fixed, 95% Cl
Cho 2009	14	98	14	99	16.7%	1.01 [0.51, 2.01]	+
Lee 2014	46	757	45	657	57.8%	0.89 [0.60, 1.32]	
Liu 2016	1	35	2	43	2.2%	0.61 [0.06, 6.50]	
Zhang 2017	7	120	28	225	23.4%	0.47 [0.21, 1.04]	
Total (95% CI)		1010		1024	100.0%	0.80 [0.59, 1.10]	•
Total events	68		89				
Heterogeneity: Chi² = 2.47, df = 3 (P = 0.48); l² = 0%						L O	
Test for overall effect:	Z=1.37 (F	P = 0.17;)			-	Favours pleurodesis Favours bullectomy

Risk of bias summary



GRADE analyses

In adults with spontaneous pneumothorax what is the optimal operation for improving clinical outcomes?

Population: Adults (18+) with spontaneous pneumothorax undergoing surgery **Intervention**: Bullectomy alone

Comparator: Surgical pleurodesis (talc, abrasion, other technique)

Outcome	Number of participants (studies)	Estimate of effect	Quality of the Evidence (GRADE)
Length of hospital stay	1792 (4 studies)	0.05 days lower (0.22 lower to 0.13 higher) in the intervention group	⊕⊖⊖⊖ VERY LOW ^{a,b}
Duration of air leak (chest drain in situ)	2394 (6 studies)	0.02 days lower (0.15 lower to 0.12 higher) in the intervention group	⊕⊖⊖⊖ VERY LOW ^{a,b}

Explanations

a. High risk of bias across the studies

b. Serious inconsistency across the studies

In adults with spontaneous pneumothorax what is the optimal operation for improving clinical outcomes?

Population: Adults (18+) with spontaneous pneumothorax undergoing surgery

Intervention: Bullectomy alone

Comparator: Surgical pleurodesis (talc, abrasion, other technique)

Outcome	Number of	Relative effect	Anticipated ab	solute effects	Quality of the	
	(studies)	(95% CI)	Pleurodesis	Bullectomy	Evidence (GRADE)	
Recurrence	3397 (10 studies)	RR 1.00 (0.81 to 1.23)	93 per 1000	93 per 1000 (75 to 114)	⊕OOO VERY LOW ª,b	
Further treatment	5039 (3 studies)	RR 0.99 (0.76 to 1.29)	42 per 1000	42 per 1000 (32 to 54)	UERY LOW a,b,c	
Further treatment – surgery	1714 (3 studies)	RR 1.02 (0.68 to 1.54)	49 per 1000	50 per 1000 (34 to 76)	⊕⊖⊖⊖ VERY LOW ^{a,b,c}	
Further treatment – chest drain	1611 (2 studies)	RR 0.64 (0.85 to 2.18)	44 per 1000	28 per 1000 (17 to 47)	⊕⊖⊖⊖ VERY LOW ^{a,d,e}	
Further treatment – conservative	1714 (3 studies)	RR 1.36 (0.85 to 2.18)	33 per 1000	45 per 1000 (28 to 73)	⊕⊖⊖⊖ VERY LOW ^{a,d,e}	
Duration of air leak – prolonged air leak	2417 (6 studies)	RR 0.83 (0.59 to 1.1)	87 per 1000	70 per 1000 (51 to 96)	⊕⊖⊖⊖ VERY LOW ^{a,d,e}	
Complications	2034 (4 studies)	RR 0.8 (0.54 to 1.08)	81 per 1000	62 per 1000 (44 to 88)	⊕⊖⊖⊖ VERY LOW ^{a,e}	
CI: Confidence interval						

Explanations

a. High risk of bias across the studies

b. Serious inconsistency across the studies

c. Serious imprecision, CIs cross both MIDs

d. Some inconsistency across the studies

e. Some imprecision, CIs cross one MID

Recommendation Table

Question Details

POPULATION:	Adults (18+) with spontaneous pneumothorax undergoing surgery
INTERVENTION:	Bullectomy alone
COMPARISON:	Surgical pleurodesis (talc, abrasion, other technique)
OUTCOMES:	Pneumothorax recurrence; length of hospital stay; further treatment (surgery, chest drain, conservative management); pain and breathlessness; duration of air leak; complications; quality of life; mortality

SUMMARY OF JUDGEMENTS

	JUDGEMENT						
PROBLEM	No	Probably no	Probably yes	Yes		Varies	Don't know
DESIRABLE EFFECTS	Trivial	Small	Moderate	Large		Varies	Don't know
UNDESIRABLE EFFECTS	Large	Moderate	Small	Trivial		Varies	Don't know
CERTAINTY OF EVIDENCE	Very low	Low	Moderate	High			No included studies
BALANCE OF EFFECTS	Favours the comparison	Probably favours the comparison	Does not favour the intervention or the comparison	Probably favours the intervention	Favours the intervention	Varies	Don't know

TYPE OF RECOMMENDATION

Strong recommendation against the intervention	Conditional recommendation against the intervention	Conditional recommendation for either the intervention or the comparison	Conditional recommendation for the intervention	Strong recommendation for the intervention
		\boxtimes		

CONCLUSIONS

Recommendation

Surgical pleurodesis and/or bullectomy can be considered for the treatment of spontaneous pneumothorax in adults

Justification

There appears to be no difference in pneumothorax recurrence (<u>Very low</u>), length of hospital stay (<u>Very low</u>), the need for further treatment (surgery, chest drain or conservative management) (<u>Very low</u>), duration of air leak (<u>Very low</u>), complications (<u>Very low</u>) or mortality (**Ungraded**) following bullectomy or surgical pleurodesis for the treatment of spontaneous pneumothorax in adults

There was insufficient evidence to comment on pain and breathlessness and quality of life following bullectomy or surgical pleurodesis for the treatment of spontaneous pneumothorax in adults

Subgroup considerations

There were no subgroups to consider

Research priorities

Further research is needed to determine optimal type of surgical pleurodesis (e.g. pleurectomy, abrasion, talc) and adjunct (e.g. bullectomy) for the treatment of spontaneous pneumothorax in adults

References

- 1. Lee S, Kim HR, Cho S, et al. Staple line coverage after bullectomy for primary spontaneous pneumothorax: a randomized trial. *Annals of Thoracic Surgery*. 2014;98(6):2005-2011.
- 2. Liu Y, Xie D, Chi C, Lin X, Lin C. Combined application of fibrin sealant and polyglycolic acid felt in surgery for pneumothorax due to emphysema. *International Journal of Clinical and Experimental Medicine*. 2016;9(2):4182-4185.
- Cho S, Ryu KM, Jheon S, Sung SW, Kim BH, Huh DM. Additional mechanical pleurodesis after thoracoscopic wedge resection and covering procedure for primary spontaneous pneumothorax. *Surgical Endoscopy.* 2009;23(5):986-990.
- 4. Hatz RA, Kaps MF, Meimarakis G, Loehe F, Muller C, Furst H. Long-term results after video-assisted thoracoscopic surgery for first-time and recurrent spontaneous pneumothorax. *Annals of Thoracic Surgery*. 2000;70(1):253-257.
- 5. Horio H, Nomori H, Kobayashi R, Naruke T, Suemasu K. Impact of additional pleurodesis in video-assisted thoracoscopic bullectomy for primary spontaneous pneumothorax. *Surgical Endoscopy.* 2002;16(4):630-634.
- Ingolfsson I, Gyllstedt E, Lillo-Gil R, Pikwer A, Jonsson P, Gudbjartsson T. Reoperations are common following VATS for spontaneous pneumothorax: Study of risk factors. *Interactive Cardiovascular and Thoracic Surgery*. 2006;5(5):602-607.
- 7. Ohno K, Miyoshi S, Minami M, et al. Ipsilateral recurrence frequency after video-assisted thoracoscopic surgery for primary spontaneous pneumothorax. *Japanese Journal of Thoracic & Cardiovascular Surgery*. 2000;48(12):757-760.
- 8. Park JS, Han WS, Kim HK, Choi YS. Pleural abrasion for mechanical pleurodesis in surgery for primary spontaneous pneumothorax: is it effective? *Surgical Laparoscopy, Endoscopy & Percutaneous Techniques*. 2012;22(1):62-64.
- 9. Uramoto H, Shimokawa H, Tanaka F. What factors predict recurrence of a spontaneous pneumothorax? *Journal Of Cardiothoracic Surgery.* 2012;7:112.
- 10. Zhang Z, Du L, Feng H, Liang C, Liu D. Pleural abrasion should not routinely preferred in treatment of primary spontaneous pneumothorax. *Journal of Thoracic Disease*. 2017;9(4):1119-1125.
- 11. Bille A, Barker A, Maratos EC, Edmonds L, Lim E. Surgical access rather than method of pleurodesis (pleurectomy or pleural abrasion) influences recurrence rates for pneumothorax surgery: systematic review and meta-analysis. *General Thoracic & Cardiovascular Surgery*. 2012;60(6):321-325.

Question Protocol

Field	Content	
Review Question	In adults with spontaneous pneumothorax undergoing surgery, what is the optimal operation for improving clinical outcomes?	
Type of review question	Intervention review	
Objective of the review	A question comparing surgical techniques in patients with spontaneous pneumothorax undergoing surgery (Bullectomy alone versus talc poudrage, pleurectomy or abrasion). Which is the best surgical approach?	
Eligibility criteria – population / disease / condition / issue / domain	Adults (18+) with spontaneous pneumothorax undergoing surgery	
Eligibility criteria – intervention(s)	Bullectomy alone	
Eligibility criteria – comparators(s)	Surgical pleurodesis (talc, abrasion, other technique)	
Outcomes and prioritisation	Recurrence Length of hospital stay Further treatment (pleural and surgical procedures) Pain / breathlessness Duration of air leak Complications Quality of life Mortality	
Eligibility criteria – study design	RCTs Prospective comparative studies Case series of >100 patients	
Other inclusion /exclusion criteria	Non-English language excluded unless full English translation Conference abstracts, Cochrane reviews, systematic reviews, reviews Cochrane reviews and systematic reviews can be referenced in the text, but DO NOT use in a meta-analysis	
Proposed sensitivity / subgroup analysis, or meta- regression	None	

Selection process – duplicate screening / selection / analysis	Agreement should be reached between Guideline members who are working on the question. If no agreement can be reached, a decision should be made by the Guideline co-chairs. If there is still no decision, the matter should be brought to the Guideline group and a decision will be made by consensus		
Data management (software)	RevMan5	Pairwise meta-analyses Evidence review/considered judgement. Storing Guideline text, tables, figures, etc.	
	Gradeprofiler	Quality of evidence assessment	
	Gradepro	Recommendations	
Information sources – databases and dates	MEDLINE, Embase, PubMED, Central Register of Controlled Trials and Cochrane Database of Systematic Reviews 1966 - present		
Methods for assessing bias at outcome / study level	RevMan5 intervention review template and NICE risk of bias checklist (follow instructions in ' <i>BTS Guideline Process Handbook – Intervention Review</i> ')		
Methods for quantitative analysis – combining studies and exploring (in)consistency	If 3 or more relevant studies: RevMan5 for meta-analysis, heterogeneity testing and forest plots (follow instructions in ' <i>BTS Guideline Process Handbook – Intervention Review</i> ')		
Meta-bias assessment – publication bias, selective reporting bias	 GRADEprofiler Intervention review quality of evidence assessment for each outcome (follow instructions in '<i>BTS Guideline Process Handbook – Intervention Review'</i>) 		
Rationale / context – what is known	In patients undergoing surgical treatment for their spontaneous pneumothorax a number of different surgical techniques are employed. We need to review the current literature to answer the question; What is the best technique in terms of patient satisfaction and low recurrence rates?		