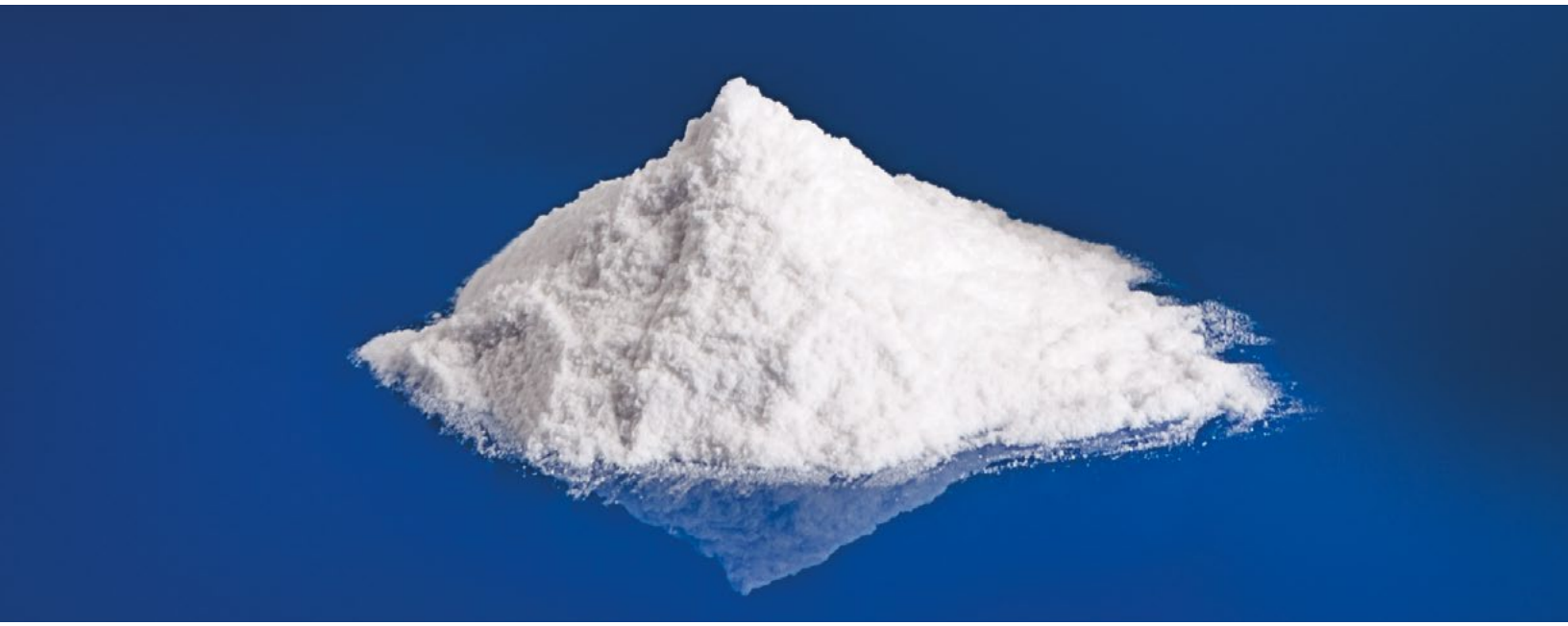
WHITE PAPER

Why talcum pleurodesis with STERITALC® remains the method of choice.

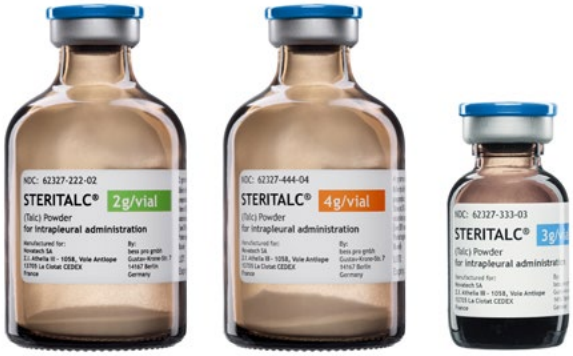
A critical look at autologous blood pleurodesis and Iodopovidone



Boston Medical Products
a bess group company

Why talc remains the pleurodesis agent of choice

As the world's most commonly used pleurodesis agent today, talc boasts the largest body of evidence on efficacy and the most comprehensively evaluated and evidenced adverse events profile. While talc remains the pleurodesis agent of choice in patients with malignant pleural effusions,[1–4] its use in patients with pneumothorax (including recurrent pneumothorax) has been limited – largely due to unfounded concerns regarding cases of acute respiratory distress syndrome (ARDS) and the presence of asbestos.[5–7]



In the USA, STERITALC® is approved as a pharmaceutical product.

STERITALC® is not associated with ARDS

Rare but important side effects resulting from the systemic absorption of talc have been reported.[8–11] Most reports of acute respiratory distress syndrome (ARDS), however, have emanated from studies conducted in North America and the UK which used small particle, non-calibrated talc and/or doses up to and exceeding 10 g per hemithorax.[6,11–13] These striking regional differences soon gave rise to concerns about a link between particle size and extrapleural talc deposition resulting in pleural inflammation.[14] Clinical trials conducted by Maskell et al.[15] suggested that hypoxemia and ARDS following talc pleurodesis are likely to be linked to lung and systemic inflammation and that those inter-country differences in incidence may be linked to talc particle size. Similar results have been reported elsewhere[16] but contrast with a large multicenter, prospective cohort study which reported no talc-related ARDS among a total of 558 patients with malignant pleural effusions.[17]

Maskell et al.'s[15] decision to use chemically identical talc products from the same manufacturer effectively dispelled another hypothesis about talc and ARDS, namely that ARDS could be linked to the presence of contaminants in the talc preparations used.[18,19] Crucially, the use of smaller doses of calibrated large-particle talc – standard practice in Europe – is associated with a low incidence of ARDS and serious hypoxemia.[1,14,18] STERITALC® is a size-calibrated talc product.

STERITALC® is asbestos-free

Concerns regarding the harmful effects of asbestos contamination have likely had their origin in early reports of miners exposed to impurities in talc dust resulting in malignant disease, and more specifically mesothelioma.[20,21] However, preparations intended for either cosmetic or medical use have been subject to testing since the 1970s.[22,23] Despite this fact, and despite the lack of any evidence to support a causal relationship between talc and mesothelioma,[21,23–26] many authors continue to advise against the use of talc.[13,27]

Why the interest in alternatives?

The main driving factor behind the growing interest in alternative sclerosants, however, appears to be local availability and cost.[13] Especially in regions of the world in which graded talc is not (or not easily) accessible,[28] physicians rely on identifying and/or developing alternative sclerosants.[28–31]

Table 1: Interventions included in Cochrane systematic reviews (2004 to 2020)

Intervention	Shaw & Agarwal 2004[32]	Clive et al. 2016[33]	Dipper et al. 2020[1]
Talc (poudrage)	✓	✓	✓
Talc (slurry)	✓	✓	✓
Talc via IPC			✓
Bleomycin	✓	✓	✓
Tetracyclines	✓	✓	✓
Doxycycline	✓	✓	✓
Iodine		✓	✓
C *parvum*	✓	✓	✓
IPC	✓	✓	✓
IPC – not daily drainage			✓
IPC – daily drainage			✓
Mitoxantrone	✓	✓	✓
Mustine	✓	✓	✓
Mepacrine	✓	✓	✓
Interferon		✓	✓
Triethylenethiophosphoramide		✓	✓
Adriamycin		✓	✓
OK-432		✓	✓
Silver nitrate		✓	✓
Cisplatin		✓	✓
Autologous blood			✓
Urokinase			✓
Streptokinase			✓
Endostatin			✓
Mistletoe			✓

The continued surge in the number and popularity of alternative pleurodesis agents is best illustrated by the ever-increasing size and scope of relevant systematic reviews published over the past two decades. For their 2004 Cochrane review and meta-analysis of pleurodesis for malignant effusions, for instance, Shaw & Agarwal[32] took into account a total of 36 randomized controlled trials (RCTs) totaling 1,499 participants and evaluating a total of 11 sclerosants. Due to the paucity of available data at the time, their more detailed analysis was limited to just six sclerosants (talc, bleomycin, tetracyclines, Corynebacterium parvum, mitoxantrone and mepacrine), with a particular focus on just three (talc, bleomycin and tetracyclines). In their 2016 follow-up review, Clive et al.[33] evaluated 62 randomized trials including 3,428 participants. Having initially planned to report on 14 interventions, the authors subsequently added further sclerosants whose existence they had not been aware of prior to the start of their review.

The sheer speed of developments within the field meant that the next update, undertaken just two years later,[1] featured a number of additional interventions and sclerosants (see Table 1 for details of these developments).

Talc remains the sclerosant of choice

While the scope of the reviews has increased enormously over the past two decades, their conclusions regarding the safety and efficacy of talc have remained consistent. Shaw & Agarwal[32] concluded that the available evidence supported "the use of talc as the sclerosant of choice, and thoracoscopic pleurodesis as the preferred technique for pleurodesis based on efficacy". Clive et al.[33] stated that talc poudrage is more effective in MPE than a number of other frequently used methods (including tetracycline and bleomycin).

The most recent network meta-analysis on interventions for the management of pleural effusions by Dipper et al.[1] found talc poudrage and talc slurry to be "effective methods for achieving a pleurodesis, with lower failure rates than a number of other commonly used interventions".

In terms of adverse effects, the authors concluded there was little evidence of differences in the levels of fever and pain associated with the commonly used sclerosants (when compared with talc slurry). There was also little evidence of a difference in mortality rates when compared with talc slurry.

Much interest. Little evidence

Despite a clear and robust evidence base in favor of talc,[1–3,34–38] the debate regarding the best pleurodesis agent continues:[7,39] a situation that is mainly due to the paucity of high-quality studies and the sheer heterogeneity of study designs (types of interventions, methods of patient selection, and doses used). This situation is further exacerbated by the fact that secondary outcomes and adverse events are reported in a highly inconsistent manner, making evidence-based recommendations at best a challenge, at worst impossible.[1,32,33]

The British Thoracic Society (BTS), the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR), and the American Thoracic Society (ATS) currently recommend chemical pleurodesis using either talc poudrage or talc slurry.[2,3,34,36]

The revised BTS guidelines[35] (which have been under consultation since June 2022) remain extremely cautious in their approach, providing carefully worded statements regarding the reliability or lack of robustness of findings and refraining from giving recommendations where the evidence remains unsatisfactory. While this is the correct approach to evidence-based medicine, it does not provide much guidance to physicians having to navigate the latest innovations or making a determination regarding the quality of the available evidence. The current landscape of confusing and often contradictory information is perhaps best illustrated by exploring the evidence available on two alternative pleurodesis agents, and how these compare to talc.

Iodopovidone

Iodopovidone (aka povidone-iodine) is a broad-spectrum and low-cost antiseptic agent widely available in different forms (e.g., topical solution, topical ointment, shampoo, and surgical scrub). Hailed as a low-cost alternative to talc, its efficacy appears to be similar to talc and superior to bleomycin.[30,40]

There have been just three RCTs comparing talc products with iodopovidone. In their RCT involving 73 patients with either MPE or pneumothorax, Agarwal et al.[19] found iodopovidone to be equally as effective as cosmetic talc (with similar, minor side effects) when instilled by tube thoracostomy. Their overall preference for iodopovidone (and perhaps the motivation behind the study) appeared to be grounded in the fact that the medicated form of talc is both expensive and difficult

Table 2: High-quality and lower-quality evidence on iodopovidone vs talc

Article	Type of article/study	N	Diagnosis	Success rate
Agarwal et al. 2011[19]	RCT	73 (39 iodopovidone v 34 cosmetic talc)	MPE (38) and pneumothorax (35)	Complete response: 92.3% in iodopovidone group, 88.2% in talc group. Complete or partial success by indication: MPE: 90% with talc, 95% with iodopovidone; pneumothorax: 100% for both talc and iodopovidone
Mohsen et al. 2011[41]	RCT	42 (22 talc, 20 povidone-iodine)	MPE	Complete or partial response: Talc: 91%, Pov: 85% Failure: Talc 9%, Pov 15%
Ibrahim et al. 2015[42]	RCT	39 (21 talc v 18 povidone-iodine)	MPE	Talc: 80.9% Pov:72.2%
Kahrom et al. 2017[29]	Prospective observational study	63	MPE	82.2% complete or good response (failure after 6 months 17.8%)
Matus & Ho 2019[46]	Retrospective review	13	MPE	76.9% complete pleurodesis
Garzón et al. 2020[47]	Retrospective review	45	MPE	93.3% had either complete or partial resolution of effusions
Terra et al. 2020[48]	Retrospective chart review	114 (iodine in 52%, silver nitrate 46%, talc 2%)	MPE	Pooled data only. Recurrence in 3.5%, repeat procedure in 1.8%

to obtain in India and that cosmetic talc would therefore have to be checked for particle size and the absence of asbestos prior to use. The unavailability of talc in Egypt "despite its cost effectiveness" was also the motivation behind the RCT conducted by Mohsen et al.,[41] which compared talc poudrage (using STERITALC®) with iodopovidone in 42 patients with MPE. While based on a relatively small sample size, their findings (a complete response rate of 85 % for iodopovidone vs 97 % for talc) certainly support iodopovidone as a safe pleurodesis agent with an efficacy close to that of talc and the potential to reduce time spent in hospital. Ibrahim et al.[42] tested the instillation of iodopovidone vs talc slurry (also using STERITALC®) in 39 patients with MPE. While patients in the talc group reported slightly more (moderate) pain, talc appeared to produce lower levels of fever than iodopovidone. With an overall success rate (complete and partial response) of 80.9 %, talc slurry proved superior to iodopovidone (72.2 %). Due to the small numbers involved, however, this difference was not reported as significant.

Iodine, however, is not without its own inherent problems. In addition to causing severe allergic reactions, particularly in individuals with allergic diathesis, it can also precipitate thyrotoxicosis in patients with subclinical hyperthyroidism.[30,43] Hypertensive peaks and postoperative visual loss have also been reported following iodopovidone pleurodesis.[44,45]

Evidence-based practice requires evidence

The three RCTs summarized above illustrate the difficulties involved in interpreting limited data from relatively small studies involving highly heterogeneous methodologies (with differences

Duration of hospital stay	Complications	Other	Compared with
No information	Pain: All patients experienced chest pain. Fever: 4/39 in iodopovidone, 5/34 in talc group Empyema: 1/39 in iodopovidone, 1/34 in talc group. ARDS – none Hypotension - none	Time to pleurodesis: 1 day (1-2) in iodopovidone group, 1 day (1-1.25) in talc group	Cosmetic talc (sterilized and asbestos-free, particle size 20-60 mm), slurry
Talc: 5.7 ± 2 Pov: 4.5 ± 1.1	Pain Talc: 18% vs 0% in Pov Fever Talc 18% v 5% in Pov		STERITALC®, 4 g, poudrage
Talc: 4.7 ± 1.2 Pov: 4.2 ± 1.0	Pain none: Talc 33.3, Pov 50 Pain minor: Talc 57.1, Pov 50 Pain moderate: Talc 9.5, Pov 0 Pain severe: Talc 0, Pov 0 Fever: Talc 19.2, Pov 22.3		STERITALC®, 5 g, slurry
No information	26.9% mild to moderate pain. No patient showed pleuritic chest pain, dyspnea, hypotension, visual loss, or fever.		
No information	31% intra-procedural pain, 8% pleural space infection	Median time to pleurodesis 5 days (range 3 to 35)	
No information	20% chest pain	Mean chest tube duration was 5 days	
No information	Pooled data only. 68.4% had adverse events, of which grade ≥28.1%: in order of frequency: hypoxia 17/31, severe pain 12/31. 4 deaths directly related to procedure		

ranging from type of talc used to method of administration). The majority of research available is in the form of retrospective reviews, a type of study that is associated with increased bias and inconsistencies in the quality and availability of relevant clinical information. Table 2 lists some examples of non-RCT studies within this field. These range from higher-quality prospective studies on the safety and efficacy of iodopovidone (but without a comparator) to often very small retrospective studies with highly heterogeneous outcomes which range from 'complete response' and 'complete or partial response' to 'failure rate' in a study involving pooled data for different pleurodesis agents.

While retrospective studies can provide valuable information on outcomes and complications, and provide a useful illustration of the ways in which local differences pertaining to clinical experience and the availability and cost of sclerosants may inform local preferences and reporting, they do not constitute robust clinical evidence. RCTs remain the gold standard for evidence-based decision-making.

The paucity of high-quality data on iodopovidone vs talc currently precludes any definitive statements and recommendations.

Autologous blood pleurodesis (ABP)

ABP appears to be mainly used for sealing postoperative air leaks (see Table 3, page 10) and has been reported as showing promise in expediting the resolution of this surgical complication.[49] The literature supporting the use of talc for this indication appears limited,[50,51] possibly due to concerns about talc as a permanent foreign body

with the potential to cause inflammation. The use of ABP has been more widely studied in this patient group.

Without robust evidence, ABP remains experimental

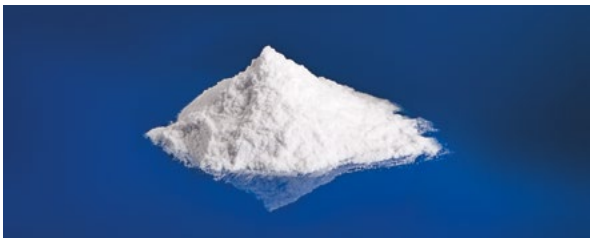
Of three randomized controlled trials involving ABP,[31,52,53] only one has compared ABP with talc.

In 2006, Shackcloth et al.[52] conducted an RCT comparing ABP with standard treatment. Given that standard treatment was tube thoracostomy alone, the study effectively compared ABP-based pleurodesis with no pleurodesis. Perhaps unsurprisingly, ABP proved far superior to 'standard treatment' at achieving cessation of air leak, in addition to having the potential to expedite discharge from hospital. Naturally, these results do not permit inferences to be drawn about the efficacy of ABP compared to other sclerosants. Similar problems are attached to the clinical trial by Andreetti et al.[53]

Instead of comparing ABP-based pleurodesis to other, comparable procedures, the study was effectively designed as a dose-ranging study to determine the most effective volume of autologous blood to use for pleurodesis. The trial was able to confirm that 100 ml of autologous blood appear to be more effective than 50 ml at achieving a rapid cessation of air leak and earlier discharge. However, it also revealed that the higher dose was associated with increased side effects. Due to their sole focus on ABP, both of these studies should therefore be regarded as relatively early stage, exploratory research.

Only one RCT comparing ABP with talc

The only RCT to have compared ABP with talc[31] is also the only RCT to date to have explored use of ABP in patients with MPE. While 100 ml autologous blood followed by 50 ml saline proved less effective at achieving pleurodesis than 4 g STERITALC® in 100 ml saline (82 % vs 87 %, respectively), ABP was reported to cause less fever and pain and reduced time to discharge (10.2 ± 2.7 compared with 12.8 ± 3.4 in the talc group). The study, however, had a number of limitations. Firstly, the reporting of pleurodesis-related complications was in the hands of unblinded physicians.



An unfortunate shortcoming given that side effects are one of the most crucial aspects in ascertaining a sclerosant's safety profile. Secondly, the study only considered short-term efficacy (at 30 days). While perhaps unsurprising given the early stage of ABP research, this is in stark contrast to the availability of robust long-term data for talc, taken at 60, 90 and even 180 days.[54,55] Further studies will be needed to explore the long-term efficacy of ABP.

There is also an ongoing lack of consensus regarding the optimal blood volume to be instilled, meaning that more research will be needed to explore the relationship between dose, efficacy and adverse events.

Physician preference is a driving force

The motivation behind the Keeratichananont et al.[31] study may provide an interesting insight, the authors averring that "in real clinical practice", talc is "significantly associated with both minor (...) and major adverse events", including ARDS – despite the fact that this statement contradicts

the robust RCT-based evidence of even the most recent Cochrane review[1]. It suggests that physician preference may be a strong driver in the search for alternative sclerosants and in the selective reporting of the available evidence. In their discussion, the authors concede that the "unique respiratory and systemic toxicities" mentioned are only associated with doses "much higher than 5 g" and "small particle size talc". Notwithstanding this qualifying comment, they do not shy away from emphasizing the need to find alternatives to talc due to "ongoing concern regarding the safety of talc administration" per se. The authors' failure to comment on the fact that neither ABP nor talc were associated with any serious side effects is perhaps particularly telling in this regard.

A persistent lack of robust data

As with iodopovidone, the majority of ABP-related research currently available is in the form of retrospective reviews. Table 3 lists some examples of non-RCT studies on ABP, which help illustrate the vast variability in hypotheses tested and outcomes reported. A retrospective case review by Akar et al.[56] compared patients with persistent air leak who had received 60 ml of autologous blood with patients who had received 120 ml of autologous blood. The higher dose resulted in a much-reduced length of hospital stay – mirroring results of the Andreetti et al. trial.[53] In contrast to the Andreetti[53] trial, however, the higher dose also produced considerably more pain. As the precise mechanism of autologous blood pleurodesis remains to be fully understood[56] and because the majority of air leaks seal spontaneously,[57,58] much of the literature in this particular area of study remains concerned with efficacy and dosing. A recent study by Hasan et al.[59] in 2021, for instance, compared ABP using 90 ml of autologous blood with no ABP. While chest drain removal occurred sooner in patients receiving 90 ml of autologous blood, discharge outcomes were actually better in patients who had not received ABP, with 95.9 % of the no ABP patients being discharged within 21 days, compared to just 83.7 % of the ABP patients.

The wide variability in hypotheses studied and outcomes reported, and the paucity of data on ABP vs talc (and ABP in MPE), make it impossible to view this choice of sclerosant as anything other than experimental.

Further research, including randomized controlled trials comparing ABP with talc and other, more established sclerosants will be needed in order to build a more comprehensive and robust evidence base on both safety and efficacy. Until then, the use of ABP should be restricted to the realm of clinical research.

Table 3 High-quality and lower-quality clinical evidence on ABP vs talc

Article	Type of article/ study	N	Diagnosis	Success rate	Duration of hospital stay	Complications	Other	Compared with
Shackcloth et al. 2006[52]	RCT	20 (10 with ABP 120 ml, 10 without)	Persistent air leak after lobectomy	ABP: Median interval from first treatment to effective seal: 1 day No ABP: median interval was 3 days. 80% still had air leak on postoperative day 10 and crossed over into study arm	ABP: time to discharge 12 days No ABP: time to discharge 13.5 days	Fever: ABP: 10% No ABP: 20% Empyema: ABP: 0% No ABP: 5%	ABP: Median duration of air leak 5 days No ABP: Median duration of air leak 11 days	N/A
Andreetti et al. 2007[53]	RCT	25 (12 ABP 50 ml, 13 ABP 100 ml)	Air leak after pulmonary lobectomy	Air leaks stopped 2.3 ± 0.6 in 50 ml group 1.5 ± 0.6 in 100 ml group	Tube withdrawn 24 hours after cessation of air leak, discharged after another 24 hours	None observed	Air leakage sealed within 72 hours in all patients	ABP 100 ml
Keeratichananont et al. 2018[31]	RCT	110 (56 ABP 100 ml, 54 talc slurry)	MPE	Pleurodesis success rate at 30 days: ABP: 82% Talc: 87%	ABP 10.2 ± 2.7 versus 12.8 ± 3.4 in Talc group	Pain: 9% needed opioids in ABP group, 28% in Talc group Fever: ABP 9% vs 28% in Talc group		STERITALC® (slurry), 4 g
Akar et al. 2020[56]	Retrospective review	42 (20 receiving 60 ml blood, 22 receiving 120 ml blood)	Persistent air leak of more than seven days	60 ml: 50% air leak stopped in first 48 hours vs 90.9% in 120 ml group	60 ml: 9.6 ± 3.6 days vs 4.7 ± 1.2 days in 120 ml group	60 ml: 10% pain 120 ml: 27.3% pain	60 ml: cessation of air leakage 4.5±2.8 days, time to tube removal 7.5±3.3 days vs 2.1±1.2 days and 3.1±1.3 days respectively in 120 ml group	ABP 120 ml
Hasan et al. 2021[59]	Retrospective cohort study	139 (ABP 90 ml vs no ABP)	Prolonged postoperative air leak	First ABP administration was successful in 22/34 patients (64%). 21/22 (95%) of these patients had resolution of the air leak within first 24 hours. Chest drain removed within 30 days: 100%. No ABP: chest tube removal within 30 days: 89%	ABP: discharge within 21 days: 83.7% No ABP: discharge within 21 days: 95.9%	None reported	ABP: mean 11 days to chest drain removal No ABP: mean 16 days to chest drain removal	N/A

References

1. Dipper A, Jones HE, Bhatnagar R, Preston NJ, Maskell N, Clive AO. Interventions for the management of malignant pleural effusions: a network meta-analysis. *Cochrane Database Syst Rev*. 2020;4:CD010529. doi:10.1002/14651858.CD010529.pub3
2. Roberts ME, Neville E, Berrisford RG, Antunes G, Ali NJ, BTS Pleural Disease Guideline Group. Management of a malignant pleural effusion: British Thoracic Society Pleural Disease Guideline 2010. *Thorax*. 2010;65 Suppl 2:ii32-40. doi:10.1136/thx.2010.136994
3. Feller-Kopman DJ, Reddy CB, DeCamp MM, et al. Management of Malignant Pleural Effusions. An Official ATS/STS/STR Clinical Practice Guideline. *Am J Respir Crit Care Med*. 2018;198(7):839-849. doi:10.1164/rccm.201807-1415ST
4. Bibby AC, Dorn P, Psallidas I, et al. ERS/EACTS statement on the management of malignant pleural effusions. *Eur Respir J*. 2018;52(1):1800349. doi:10.1183/13993003.00349-2018
5. de Campos JR, Vargas FS, de Campos Werebe E, et al. Thoracoscopy talc poudrage : a 15-year experience. *Chest*. 2001;119(3):801-806. doi:10.1378/chest.119.3.801
6. Rehse DH, Aye RW, Florence MG. Respiratory failure following talc pleurodesis. *Am J Surg*. 1999;177(5):437-440. doi:10.1016/s0002-9610(99)00075-6
7. Noppen M. Who's (still) afraid of talc? *Eur Respir J*. 2007;29(4):619-621. doi:10.1183/09031936.00001507
8. Zhang W, Zhao YL, Li SJ, Zhao YN, Guo NN, Liu B. Complications of thoracoscopic talc insufflation for the treatment of malignant pleural effusions: a meta-analysis. *J Cardiothorac Surg*. 2021;16(1):125. doi:10.1186/s13019-021-01475-1
9. Gonzalez AV, Bezwada V, Beamis JF, Villanueva AG. Lung injury following thoracoscopic talc insufflation: experience of a single North American center. *Chest*. 2010;137(6):1375-1381. doi:10.1378/chest.09-2020
10. Campos JR, Werebe EC, Vargas FS, Jatene FB, Light RW. Respiratory failure due to insufflated talc. *Lancet*. 1997;349(9047):251-252. doi:10.1016/S0140-6736(05)64860-X
11. Rinaldo JE, Owens GR, Rogers RM. Adult respiratory distress syndrome following intrapleural instillation of talc. *J Thorac Cardiovasc Surg*. 1983;85(4):523-526.
12. Colt HG, Davoudi M. The ideal pleurodesis agent: still searching after all these years. *Lancet Oncol*. 2008;9(10):912-913. doi:10.1016/S1470-2045(08)70239-0
13. Lee YCG, Baumann MH, Maskell NA, et al. Pleurodesis practice for malignant pleural effusions in five English-speaking countries: survey of pulmonologists. *Chest*. 2003;124(6):2229-2238. doi:10.1378/chest.124.6.2229
14. Ferrer J, Montes JF, Villarino MA, Light RW, García-Valero J. Influence of particle size on extrapleural talc dissemination after talc slurry pleurodesis. *Chest*. 2002;122(3):1018-1027. doi:10.1378/chest.122.3.1018
15. Maskell NA, Lee YCG, Gleeson FV, Hedley EL, Pengelly G, Davies RJO. Randomized trials describing lung inflammation after pleurodesis with talc of varying particle size. *Am J Respir Crit Care Med*. 2004;170(4):377-382. doi:10.1164/rccm.200311-1579OC
16. Arellano-Orden E, Romero-Falcon A, Juan JM, Ocaña Jurado M, Rodriguez-Panadero F, Montes-Worboys A. Small particle-size talc is associated with poor outcome and increased inflammation in thoracoscopic pleurodesis. *Respiration*. 2013;86(3):201-209. doi:10.1159/000342042
17. Janssen JP, Collier G, Astoul P, et al. Safety of pleurodesis with talc poudrage in malignant pleural effusion: a prospective cohort study. *Lancet*. 2007;369(9572):1535-1539. doi:10.1016/S0140-6736(07)60708-9
18. Ferrer J, Villarino MA, Tura JM, Traveria A, Light RW. Talc preparations used for pleurodesis vary markedly from one preparation to another. *Chest*. 2001;119(6):1901-1905. doi:10.1378/chest.119.6.1901
19. Agarwal R, Paul AS, Aggarwal AN, Gupta D, Jindal SK. A randomized controlled trial of the efficacy of cosmetic talc compared with iodopovidone for chemical pleurodesis. *Respirology*. 2011;16(7):1064-1069. doi:10.1111/j.1440-1843.2011.01999.x

20. Wild P, Leodolter K, Réfrégier M, Schmidt H, Zidek T, Haidinger G. A cohort mortality and nested case-control study of French and Austrian talc workers. *Occup Environ Med*. 2002;59(2):98-105. doi:10.1136/oem.59.2.98
21. A survey of the long-term effects of talc and kaolin pleurodesis. Research Committee of the British Thoracic Association and the Medical Research Council Pneumoconiosis Unit. *Br J Dis Chest*. 1979;73(3):285-288
22. Pierce JS, Riordan AS, Miller EW, Gaffney SH, Hollins DM. Evaluation of the presence of asbestos in cosmetic talcum products. *Inhal Toxicol*. 2017;29(10):443-456. doi:10.1080/08958378.2017.1392656
23. Hunt I, Barber B, Southon R, Treasure T. Is talc pleurodesis safe for young patients following primary spontaneous pneumothorax? *Interact Cardiovasc Thorac Surg*. 2007;6(1):117-120. doi:10.1510/icvts.2006.147546
24. Finley BL, Benson SM, Marsh GM. Cosmetic talc as a risk factor for pleural mesothelioma: a weight of evidence evaluation of the epidemiology. *Inhal Toxicol*. 2017;29(4):179-185. doi:10.1080/08958378.2017.1336187
25. Viskum K, Lange P, Mortensen J. Long term sequelae after talc pleurodesis for spontaneous pneumothorax. *Pneumologie*. 1989;43(2):105-106
26. Lange P, Mortensen J, Groth S. Lung function 22-35 years after treatment of idiopathic spontaneous pneumothorax with talc poudrage or simple drainage. *Thorax*. 1988;43(7):559-561. doi:10.1136/thx.43.7.559
27. Ghio AJ, Roggli V, Light RW. Talc should not be used for pleurodesis in patients with nonmalignant pleural effusions. *Am J Respir Crit Care Med*. 2001;164(9):1741; author reply 1741. doi:10.1164/ajrccm.164.9.correspondence_c
28. Mourad IA, Abdel Rahman ARM, Aziz SA, Saber NM, Fouad FA. Pleurodesis as a palliative treatment of advanced lung cancer with malignant pleural effusion. *J Egypt Natl Canc Inst*. 2004;16(3):188-194
29. Kahrom H, Aghajanzadeh M, Asgari MR, Kahrom M. Efficacy and Safety of Povidone-iodine Pleurodesis in Malignant Pleural Effusions. *Indian J Palliat Care*. 2017;23(1):53-56. doi:10.4103/0973-1075.197958
30. Agarwal R, Khan A, Aggarwal AN, Gupta D. Efficacy & safety of iodopovidone pleurodesis: a systematic review & meta-analysis. *Indian J Med Res*. 2012;135(3):297-304
31. Keeratichananont W, Kaewdech A, Keeratichananont S. Efficacy and safety profile of autologous blood versus talc pleurodesis for malignant pleural effusion: a randomized controlled trial. *Ther Adv Respir Dis*. 2018;12:1753466618816625. doi:10.1177/1753466618816625
32. Shaw P, Agarwal R. Pleurodesis for malignant pleural effusions. *Cochrane Database Syst Rev*. 2004;(1):CD002916. doi:10.1002/14651858.CD002916.pub2
33. Clive AO, Jones HE, Bhatnagar R, Preston NJ, Maskell N. Interventions for the management of malignant pleural effusions: a network meta-analysis. *Cochrane Database Syst Rev*. 2016;(5):CD010529. doi:10.1002/14651858.CD010529.pub2
34. MacDuff A, Arnold A, Harvey J, BTS Pleural Disease Guideline Group. Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax*. 2010;65 Suppl 2:ii18-31. doi:10.1136/thx.2010.136986
35. Maskell, Rahman N, Mark Roberts. BTS Guideline for Pleural Disease On behalf of the BTS Pleural Guideline Development Group Draft for Public Consultation June 2022. Published online June 2022. Accessed January 20, 2023. https://www.brit-thoracic.org.uk/document-library/guidelines/pleural-disease/pleural-disease-2010/
36. Comité Científico de SEPAR. *Manuel SEPAR de Procedimientos 9: Procedimientos en patología pleural -II-*. Publicaciones Permanyer; 2006. https://issuu.com/separ/docs/procedimientos9/39
37. Tschopp JM, Bintcliffe O, Astoul P, et al. ERS task force statement: diagnosis and treatment of primary spontaneous pneumothorax. *Eur Respir J*. 2015;46(2):321-335. doi:10.1183/09031936.00219214
38. Baumann MH. Management of spontaneous pneumothorax. *Clin Chest Med*. 2006;27(2):369-381. doi:10.1016/j.ccm.2005.12.006
39. Heffner JE, Huggins JT. Management of secondary spontaneous pneumothorax: there's confusion in the air. *Chest*. 2004;125(4):1190-1192. doi:10.1378/chest.125.4.1190
40. Bagheri R, Noori M, Rajayi M, et al. The effect of

iodopovidone versus bleomycin in chemical pleurodesis. *Asian Cardiovasc Thorac Ann*. 2018;26(5):382-386. doi:10.1177/0218492318778485

41. Mohsen TA, Zeid AAA, Meshref M, et al. Local iodine pleurodesis versus thoracoscopic talc insufflation in recurrent malignant pleural effusion: a prospective randomized control trial. *Eur J Cardiothorac Surg*. 2011;40(2):282-286. doi:10.1016/j.ejcts.2010.09.005
42. Ibrahim IM, Dokhan AL, El-Sessy AA, Eltaweel MF. Povidone-iodine pleurodesis versus talc pleurodesis in preventing recurrence of malignant pleural effusion. *J Cardiothorac Surg*. 2015;10:64. doi:10.1186/s13019-015-0270-5
43. Fradkin JE, Wolff J. Iodide-induced thyrotoxicosis. *Medicine (Baltimore)*. 1983;62(1):1-20. doi:10.1097/00005792-198301000-00001
44. Wagenfeld L, Zeitz O, Richard G. Visual loss after povidone-iodine pleurodesis. *N Engl J Med*. 2007;357(12):1264-1265. doi:10.1056/NEJMc070128
45. Andrade Neto JD, Terra RM, Teixeira RM, Pereira SV, Pego-Fernandes PM. Safety Profile of the Use of Iodopovidone for Pleurodesis in Patients with Malignant Pleural Effusion. *Respiration*. 2015;90(5):369-375. doi:10.1159/000440727
46. Matus I, Ho P. Ambulatory Iodopovidone Instillation Via Indwelling Pleural Catheters For Malignant Pleural Effusions. *J Bronchology Interv Pulmonol*. 2019;26(4):290-292. doi:10.1097/LBR.0000000000000599
47. Garzón JC, Edward Vinck E, Carolina Cárdenas D, Jaime Téllez L. Video-assisted thoracoscopic iodopovidone pleurodesis for malignant pleural effusions in moderate to high-risk Colombian patients. *J Cardiovasc Thorac Res*. 2020;12(4):328-333. doi:10.34172/jcvtr.2020.52
48. Terra RM, da Costa PB, Dela Vega AJM, Pêgo-Fernandes PM. Adverse events after pleurodesis in patients with malignant pleural effusion. *J Thorac Dis*. 2020;12(7):3507-3513. doi:10.21037/jtd-19-3850
49. French DG, Plourde M, Henteleff H, Mujoomdar A, Bethune D. Optimal management of postoperative parenchymal air leaks. *J Thorac Dis*. 2018;10(Suppl 32):S3789-S3798. doi:10.21037/jtd.2018.10.05
50. Liberman M, Muzikansky A, Wright CD, et al. Incidence and risk factors of persistent air leak after major pulmonary resection and use of chemical pleurodesis. *Ann Thorac Surg*. 2010;89(3):891-897; discussion 897-898. doi:10.1016/j.athoracsur.2009.12.012
51. Manley K, Coonar A, Wells F, Scarci M. Blood patch for persistent air leak: a review of the current literature. *Curr Opin Pulm Med*. 2012;18(4):333-338. doi:10.1097/MCP.0b013e32835358ca
52. Shackcloth MJ, Poullis M, Jackson M, Soorae A, Page RD. Intrapleural instillation of autologous blood in the treatment of prolonged air leak after lobectomy: a prospective randomized controlled trial. *Ann Thorac Surg*. 2006;82(3):1052-1056. doi:10.1016/j.athoracsur.2006.04.015
53. Andreetti C, Venuta F, Anile M, et al. Pleurodesis with an autologous blood patch to prevent persistent air leaks after lobectomy. *J Thorac Cardiovasc Surg*. 2007;133(3):759-762. doi:10.1016/j.jtcvs.2006.10.042
54. Bhatnagar R, Luengo-Fernandez R, Kahan BC, Rahman NM, Miller RF, Maskell NA. Thoracoscopy and talc poudrage compared with intercostal drainage and talc slurry infusion to manage malignant pleural effusion: the TAPPS RCT. *Health Technol Assess*. 2020;24(26):1-90. doi:10.3310/hta24260
55. Kolschmann S, Ballin A, Gillissen A. Clinical efficacy and safety of thoracoscopic talc pleurodesis in malignant pleural effusions. *Chest*. 2005;128(3):1431-1435. doi:10.1378/chest.128.3.1431
56. Akar E, Haberal MA, Şengören Dikiş Ö. The effectiveness of blood amount used in pleurodesis to prevent prolonged air leakage. *Turk Gogus Kalp Damar Cerrahisi Derg*. 2020;28(1):175-180. doi:10.5606/tgkdc.dergisi.2020.18659
57. Bronstein ME, Koo DC, Weigel TL. Management of air leaks post-surgical lung resection. *Ann Transl Med*. 2019;7(15):361. doi:10.21037/atm.2019.04.30
58. Dugan KC, Laxmanan B, Murgu S, Hogarth DK. Management of Persistent Air Leaks. *Chest*. 2017;152(2):417-423. doi:10.1016/j.chest.2017.02.020
59. Hasan IS, Allen MS, Cassivi SD, et al. Autologous blood patch pleurodesis for prolonged postoperative air leaks. *J Thorac Dis*. 2021;13(6):3347-3358. doi:10.21037/jtd-20-1761

Notes

Notes

Dr. Karen Schafheutle has a Master's degree in Environmental Analysis and Health and completed her PhD in Epidemiology.
As a Senior Trial Manager and Research Governance Manager at the University of Manchester she headed medical research projects including clinical trials as well as governance, and risk compliance across all faculties. Dr. Karen Schafheutle joined bess group as Clinical Affairs Manager in 2022.

STERITALC®

Manufactured by

Novatech
new biotechnology for life
a bess group company

Exclusive U.S. Distributor

Boston
Medical Products
a bess group company

BMP-MR-PPI-STERITALC Whitepaper Blut Jod_EN Rev.1

Boston
Medical Products
a bess group company

Boston Medical Products, Inc.
70 Chestnut Street
Shrewsbury, MA 01545 USA
Tel.: +1 (508) 898-9300
Fax: +1 (508) 898-2373
www.bosmed.com • info@bosmed.com