Monaldi Archives for Chest Disease

Monaldi Archives for Chest Disease 2025; 95:3197
doi: 10.4081/monaldi.2024.3197

Efficacy of povidone-iodine as an effective pleurodesing agent: an experience from a teaching hospital

Hasnain Mahboob, Talha Mahmud

Department of Pulmonology, Shaikh Zayed Hospital, Federal Postgraduate Medical Institute, Lahore, Pakistan

Abstract

The management of persistent malignant pleural effusion (MPE) or uremic pleural effusions requires the removal of pleural fluid and the prevention of recurrence through pleurodesis. Pleurodesis involves injecting a sclerosing agent into the pleura to encourage adhesion between the two layers, ultimately obliterating the pleural space. Povidone-iodine is a potential pleurodesing agent.

This quasi-experimental study was conducted at the Department of Pulmonology, Shaikh Zayed Hospital, Federal Postgraduate Medical Institute, Lahore, Pakistan, over 1 year (March 2021 - March 2022). A total of 70 patients with MPE, uremic pleural effusions, and secondary spontaneous pneumothorax (SSP) were enrolled after meeting the inclusion criteria. The pleurodesis procedure involved administering a mixture of 20 mL of 10% povidone-iodine solution and 30 mL of normal saline through a chest tube, followed by clamping for 3 hours. Patients were scheduled for follow-up visits at 2, 4, 8, and 12 weeks. Data was analyzed using SPSS version 20.0.

The average age of participants was 53.26 years (+13.71). Of the 70 patients, 39 (55.7%) were male and 31 (44.3%) were female. 62 patients (88.57%) had pleural effusion, and 8 patients (11.42%) had pneumothorax. The procedure was successful in 84.3% of patients, with varying success rates by diagnosis: MPE (81%), uremic pleural effusion (92%), and SSP (75%). Statistical analysis revealed significant positive effects of povidone-iodine on procedure outcomes (p=0.048) and effectiveness in preventing pleural effusion recurrence (p=0.028).

This study indicates that 10% povidone-iodine can serve as a viable alternative to other pleurodesis agents, yielding standard-quality pleurodesis in 84.3% of patients. It is readily available, cost-effective, and has minimal adverse effects.

Key words: malignant pleural effusion, pneumothorax, pleurodesis, povidone-iodine, uremic effusion.

Correspondence to: Talha Mahmud, Department of Pulmonology, Shaikh Zayed Hospital, Federal Postgraduate Medical Institute, Lahore, Pakistan.
Tel: +923014397549. E-mail: drmtalha@hotmail.com

Introduction

The pleurae are thin membranes that line the lungs and the chest wall, with a small space between them called the pleural gap [1]. Pleural effusion, the accumulation of fluid in this space, is a common complication of various diseases, including congestive heart failure, pneumonia, malignancy, chronic liver disease, and uremic pleuritis [1]. Malignant pleural effusion (MPE) occurs when cancer cells invade the pleural space, increasing fluid production and decreasing absorption capacity [2]. MPE is associated with poor prognosis and can cause symptoms such as shortness of breath, chest pain, and cough [3]. Uremic pleural effusion is another type of inflammatory pleural effusion that can occur in patients with chronic renal disease and uremia [4]. Spontaneous pneumothorax, characterized by air accumulation in the pleural space, can occur in patients with or without underlying pulmonary disease [5]. Pleurodesis, a procedure involving the injection of a chemical into the pleural space to cause adhesion between the pleural layers, is a treatment option for recurrent malignant and uremic pleural effusions and spontaneous pneumothorax [6]. Povidone-iodine, a topical antiseptic, has been suggested as a potential agent for pleurodesis [7]. The primary objective of this study was to evaluate the effectiveness of povidone-iodine pleurodesis (PIP) administered through a chest drain, as a palliative measure to prevent recurrent MPE, uremic pleural effusion, and secondary spontaneous pneumothorax (SSP).

Materials and Methods

This quasi-experimental study was conducted at the Department of Pulmonology at Shaikh Zayed Hospital, FPGMI, Lahore, Pakistan, over a period of 1 year (March 2021-March 2022). Patients diagnosed with malignant or uremic pleural effusions, or those presenting with SSP at the outdoor department or admitted to the indoor pulmonology ward, were included in the study. The sample size of 70 participants was calculated using the formula [Z^2] (1-α/2) × P × (1-P) / d^2, where Z(1-α/2) = 1.96 for a 95% confidence level, p=0.9 (anticipated efficacy of povidone-

iodine), and d=0.07 (margin of error). A non-probability convenient sampling technique was employed to recruit participants.

The inclusion criteria comprised adult patients over 18 years of age, of both genders, with lungs fully expanded to the chest wall after chest tube insertion for pleural effusion or pneumothorax. Patients with a confirmed diagnosis of MPE by fluid cytology or biopsy, uremic pleural effusions (fibrinous pleuritis on pleural biopsy), or SSP evident on chest radiograph were eligible for inclusion. Conversely, patients with a known allergy to povidone iodine, hypothyroidism, prior history of pleurodesis, trapped lung, or those who were critically ill and unfit for medical interventions were excluded. Additionally, patients with pleural effusions resulting from congestive heart failure, pneumonia, or chronic liver disease were not included in the study.

Data collection procedure

Following the Institutional Review Board approval, 70 patients meeting the inclusion criteria were enrolled in the study. Informed written consent was obtained from all participants prior to the procedure. The pleurodesis procedure involved administering 2% lignocaine solution (3mg/kg, approximately 200 mg/20 mL) intrapleurally for pain control, followed by a mixture of 20 mL 10% povidone-iodine solution and 30 mL normal saline intrapleurally through the chest tube over 5 minutes for pleurodesis. The chest tube was clamped for 3 hours to allow for dwell time. If necessary, the procedure was repeated if fluid output in patients with pleural effusions did not decrease to <150 mL/48 hours or if the pneumothorax recurred. Failure was defined as the need for a third pleurodesis attempt through the same chest tube during the same hospitalization.

Patients were closely monitored for complications during hospitalization and were followed up after discharge at 2, 4, 8, and 12 weeks, with chest radiography and ultrasound to evaluate disease recurrence. Success was defined as radiographic resolution of pleural effusion or pneumothorax without the need for repeat pleural drainage procedures or chest tube placement. Conversely, failure was defined as recurrent pleural effusion or pneumothorax requiring repeat intervention.

Statistical analysis

Data analysis was performed using SPSS version 20.0. Descriptive statistics were used to summarize the data, with age presented as mean ± standard deviation. Categorical variables, including gender, smoking status, hemithorax involvement, pleural fluid status on chest radiograph, and post-procedural interventions, were described using frequency and percentages. The Chi-square test was employed to compare success rates between different parameters, such as disease type and pleural effusion type. Success rates were reported as frequency and percentage at the final follow-up visit. Statistical significance was set at $p \leq 0.05$, indicating a significant difference between groups if the p-value was less than or equal to 0.05.

Results

The study enrolled 70 individuals with a mean age of 53.26±13.71 years and a median age of 70 years. The gender distribution was 39 (55.7%) males and 31 (44.3%) females. Most patients (81.4%) were nonsmokers, while 17.1% were smokers. Right-sided pleural disease was more frequent (62.9%) compared to left-sided disease (37.1%) (Table 1).

The study included patients with MPE (n=37, 52.8%), uremic pleural effusions (n=25, 35.71%), and SSP (n=8, 11.4%). Chest radiography revealed the following distribution of pleural effusion: large effusions (occupying >50% of the hemithorax) in 29 patients (46.7%), moderate effusions (occupying <50% of the hemithorax) in 24 patients (38.7%), and small effusions (obliterating the ipsilateral hemidiaphragm shadow) in 9 patients (14.5%). The color of the pleural fluid was varied, with the majority being reddish in 39 (62.90%), followed by dark yellow, light yellow, red-brown, and turbid (Table 2).

Diagnostic pleural biopsy methods in patients with MPE and uremic pleuritis included either ultrasound-guided Abram's closed-needle biopsy in 13 patients (21%) and through pleuroscopy/medical thoracoscopy techniques in 49 patients (79%). Diagnoses of MPE were primarily made by histopathology, as inconclusive

Table 1. The descriptive statistics of age, gender, smoking status, side, and type of pleural disease.

Variables		n	Mean
Age		70	53.26 9±13.709
Variables		**Frequency (n)**	**%**
Gender	Male	39	55.7
	Female	31	44.3
Smoking	Ex-smoker	1	1.4
	No	57	81.4
	Yes	12	17.1
	Total	70	100.0
Side of pleural disease	Left	26	37.1
	Right	44	62.9
	Total	70	100.0
Type of pleural disease	Pleural effusion	62	88.5
	Pneumothorax	8	11.4
	Total	70	100

atypical fluid cytology was positive in 17% patients with malignancy. Uremic pleuritis was diagnosed in patients with advanced renal disease and refractory pleural effusion (non-responsive to hemodialysis), characterized by histopathological evidence of fibrinous pleuritis.

Overall, the PIP procedure was successful in 59 patients (84.3%) and unsuccessful in 11 patients (15.7%) up to the 4th follow-up (12 weeks). Success rates varied by diagnosis, with MPE achieving an 81% success rate (30/37) and a 19% failure rate (7/37), uremic pleural effusion achieving a 92% success rate (23/25) and an 8% failure rate (2/25), and SSP pneumothorax achieving a 75% success rate (6/8). Statistical analysis using the Chi-square test revealed significant positive effects of povidone-iodine on procedure outcomes (p=0.048) and effectiveness in preventing pleural effusion recurrence (p=0.028), indicating povidone-iodine as an effective pleurodesis agent (Table 3).

During hospitalization following the PIP, most patients (69%) experienced mild to moderate pain, which was effectively managed with analgesics. Additionally, 28.5% of patients developed fever, which resolved within 24 hours. Laboratory tests revealed mild, self-limiting elevations in serum transaminases [alanine transaminase (ALT), aspartate transaminase (AST)] in some patients, and hyponatremia was observed in 18.5% of individuals (13 patients). These findings suggest that the PIP procedure was generally well-tolerated, with most patients experiencing manageable side effects that resolved promptly.

Discussion

In patients with recurrent pleural effusion or pneumothorax and an expandable lung, pleurodesis is a vital treatment option to prevent further pleural space complications. This procedure can be administered through different techniques, including bedside talc pleurodesis *via* chest tube, thoracoscopic talc poudrage, or post-thoracoscopic talc slurry [8]. The majority of patients in our study (37 out of 70) had MPE, for which pleurodesis is a recommended treatment approach to prevent recurrence and provide palliative care [8]. Additionally, we identified patients with end-stage renal disease who presented with exudative lymphocytic pleural effusions, unresponsive to diuretic therapy and adequate hemodialysis, as having uremic pleuritis [9]. After ruling out other potential causes of chronic pleural effusions, these patients underwent PIP, as recommended. The diagnosis of uremic pleuritis was confirmed by histopathological findings from pleural biopsy, which showed characteristic fibrinous pleuritis [9]. We also included cases of SSP (selective patients with underlying emphysema and non-persistent air leak), and treated them with PIP pleurodesis, as a method of

Table 2. Pleural disease type on chest radiograph and frequency of different colors of pleural fluid.

Variables		Frequency (n)	%
Pleural effusion size on chest radiograph	Large	29	46.77
	Moderate	24	38.70
	Small	9	14.51
SSP	Symptomatic (any size)	8	11.42
Pleural fluid gross appearance	Reddish	39	62.90
	Dark yellow	10	16.12
	Light Yellow	5	8.06
	Red-brown	4	6.45
	Turbid	4	6.45
	Total	62	100

SSP, secondary spontaneous pneumothorax.

Table 3. Stratification of diagnostic aspects and treatment results by disease type and condition.

Variables		Frequency (n)	%
Method of pleural biopsy in pleural effusions	Abram's closed needle	13	21
	Pleuroscopy guided	49	79
	Total	62	100.0
Method of chest tube placement	Ultrasound guided	22	31.4
	Pleuroscopy guided	48	68.6
	Total	70	100.0
Pleural effusion	**Success n (%)**	**Failure (n)**	**p**
Malignant	30 (81)	7	
Uremic	23 (92)	2	0.048*
Total	53 (85.4)	9	
Type of disease	**Success n (%)**	**Failure (n)**	**p**
Pleural effusion	53 (85.4)	9	
Pneumothorax	6 (75)	2	0.028*
Total	59 (84.28)	11	

*p=0.05 significance using the Chi-square test.

chemical pleurodesis used in a similar Pakistani study [10]. In patients with SSP who are unable or unwilling to undergo surgical intervention, intrapleural injection of a chemical irritant, such as talc or a tetracycline derivative, is recommended, provided these options are available [8]. In developing countries like Pakistan, talc is not readily available as a registered product, making it inaccessible to many patients who require chemical pleurodesis due to its high cost. This highlights a critical need for affordable and accessible alternatives to address the gap in healthcare resources. Fortunately, several cheaper chemical irritants have been successfully used to induce pleurodesis, including bleomycin, silver nitrate, and iodopovidone (povidone iodine), offering potential solutions to bridge this gap [10,11].

In our study, we adhered to the British Thoracic Society guidelines for managing recurrent uremic and MPEs [8]. To control procedural pain, we administered lignocaine 2% (3 mg/kg; maximum 250 mg) intrapleurally *via* the chest tube immediately before instilling iodopovidone pleurodesis. Subsequently, we instilled a mixture of 20 mL 10% povidone-iodine solution and 30 mL normal saline intrapleurally through the chest tube over 5 minutes, similar to the dose used in a local study by Umer *et al*. [10]. This approach ensured effective pain management and pleurodesis. Following the administration of iodopovidone pleurodesis, the chest tube was clamped for a dwell time of 3 hours. It was then unclamped to monitor fluid output over the next 24-48 hours. Daily chest radiographs and bedside ultrasound assessments were performed to confirm lung expansion and monitor any intrapleural fluid accumulation. Notably, the optimal duration of chest tube drainage after sclerosing agent delivery remains debated, but one study suggests that a shorter duration of 24 hours compared to 72 hours does not compromise the success rate of pleurodesis, regardless of the pleural fluid drainage rate [12]. In our setting, where many patients have limited financial resources, we adopted a conservative approach. We retained the chest tube and repeated the intrapleural instillation of iodopovidone if there was persistent drainage of fluid output more than 150ml after 48 hours (8 patients, 11.4%) or if pneumothorax recurred (1 patient, 1.42%). We defined treatment failure as the need for a third pleurodesis attempt through the same chest tube during the same hospitalization. If this occurred, we either switched to an alternative agent, such as bleomycin or talc, to achieve successful pleurodesis or removed the chest tube if the patient preferred to discontinue further attempts at pleurodesis.

Patients were closely monitored for any complications during their hospitalization. During hospitalization after PIP, the majority of patients (69%) reported mild to moderate pain, which was effectively managed with analgesics. Additionally, 28.5% of patients developed fever, which resolved within 24 hours. Dyspnea and temporary elevations in blood pressure were observed in 10% of patients (7 individuals). Laboratory tests revealed mild, self-limiting elevations in serum transaminases (ALT, AST) in some patients, and 4.2% of individuals (3 patients) experienced hyponatremia. Furthermore, 6 patients (8.5%) developed temporary hypothyroidism, which also resolved spontaneously. These findings indicate that the PIP procedure was generally well-tolerated, with most patients experiencing manageable side effects that resolved promptly, consistent with previous studies on the adverse events related to PIP [10,13].

Following discharge, the patients underwent follow-up evaluations at 2, 4, 8, and 12 weeks, which included chest radiography and ultrasound assessments to evaluate potential disease recurrence. This comprehensive follow-up schedule enabled us to track patient progress and detect any signs of recurrence in a timely manner. We defined success as the radiographic resolution of pleural effusion or pneumothorax, without the need for repeat pleural drainage procedures or chest tube placement. Conversely, failure was defined as the recurrence of pleural effusion or pneumothorax requiring repeat intervention during the 12-week follow-up period. This binary outcome measure allowed us to clearly assess the efficacy of the pleurodesis procedure. Chemical pleurodesis is reported to have a success rate of up to 90% but it depends on the agent used, the underlying condition, medications, and the presence of fluid in the pleural space at the time of the procedure [8]. Our study demonstrated that PIP had a significant positive impact on pleural effusion, with a reduced risk of procedure failure. The overall success rate was 84.3%, and up to 75% in patients with SSP at the fourth follow-up, similar to the study by Umer *et al*. [10]. Notably, our findings align with those of Banerjee *et al.*, who investigated the efficacy of povidone-iodine for pleurodesis in managing primary and SSP, further validating the effectiveness of this treatment approach [14]. The results of our study align with those of Wang *et al*., who compared the effectiveness and safety of talc and povidone-iodine for pleurodesis in patients with MPE [15]. Their study found that 78% of patients in the talc group and 70% in the povidone-iodine group achieved full or partial responses, with no in-hospital deaths related to the procedure. Our study similarly found a high success rate of 88.6% with PIP. Consistent with the findings by Wang *et al*., our results suggest that povidone-iodine is a suitable alternative to talc for achieving effective pleurodesis in patients with MPE. The outcomes of our study closely mirror those of Muthu *et al*., who investigated the efficacy of iodopovidone in achieving pleurodesis in MPE [16]. Their study reported a combined success rate of 90%, which is comparable to our observed success rate of 88.6%. Agarwal *et al*. conducted a randomized trial in which patients with pleural effusion or pneumothorax were randomly assigned to undergo chemical pleurodesis with either iodopovidone or talc. The trial included patients who required pleurodesis for their condition. At the 1-month follow-up, the iodopovidone group achieved a success rate of 84.2% (almost similar to our results), compared to a success rate of 78.9% in the talc group [17].

Conclusions

Our study confirms the effectiveness of 10% povidone-iodine as a pleurodesis agent, offering a promising alternative to traditional options. With its advantages of availability, cost-effectiveness, and favorable safety profile, povidone-iodine is a viable option for managing pleural effusions. This research contributes to existing literature, highlighting the benefits of povidone-iodine for pleurodesis and aiming to inform clinical practice and raise awareness among healthcare professionals.

Limitations

Additionally, the study was conducted in a specific population and setting, which may limit the generalizability of the findings to other populations and settings. These limitations highlight the need for future studies with larger sample sizes, control groups, and longer follow-up periods to confirm and expand upon the findings of this study. The follow-up period was also relatively short, which may not accurately reflect the long-term efficacy and safety of the

treatment. Furthermore, the study was conducted in a specific population and setting, which may limit the generalizability of the findings to other populations and settings.

References

1. Light RW. Pleural effusion. N Engl J Med 2002;346:1971-7.
2. Antony VB, Loddenkemper R, Astoul P, et al. Management of malignant pleural effusions. Am J Respir Crit Care Med 2001;163:816-22.
3. Sahn SA. State of the art. The pleura. Am Rev Respir Dis 1988;138:184-234.
4. Rashid-Farokhi F, Pourdowlat G, Nikoonia MR, et al. Uremic pleuritis in chronic hemodialysis patients. Hemodial Int 2013;17:94-100.
5. MacDuff A, Arnold A, Harvey J, et al. Management of spontaneous pneumothorax: British Thoracic Society pleural disease guideline 2010. Thorax 2010;65:ii18-31.
6. Sonoda A, Jeudy J, White CS, et al. Pleurodesis: indications and radiologic appearance. Jpn J Radiol 2015;33:241-5.
7. Ibrahim IM, Dokhan AL, El-Sessy AA, et al. Povidone-iodine pleurodesis versus talc pleurodesis in preventing recurrence of malignant pleural effusion. J Cardiothorac Surg. 2015 1;10:64.
8. Roberts ME, Rahman NM, Maskell NA, et al. British Thoracic Society guideline for pleural disease. Thorax 2023;78:s1-s42.
9. Light RW. Pleural effusion due to miscellaneous diseases. In: Pleural diseases. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2020. pp. 354-5.
10. Umar M, Haq ZU, Khan I, et al. Experience of Iodopovidone pleurodesis at a tertiary care hospital in Peshawar. J Saidu Med Coll 2021;11:123-7.
11. Caglayan B, Torun E, Turan D, et al. Efficacy of iodopovidone pleurodesis and comparison of small-bore catheter versus large-bore chest tube. Ann Surg Oncol 2008;15:2594.
12. Goodman A, Davies CW. Efficacy of short-term versus long-term chest tube drainage following talc slurry pleurodesis in patients with malignant pleural effusions: a randomised trial. Lung Cancer 2006;54:51-5.
13. Andrade Neto JD, Terra RM, Teixeira RM, et al. Safety profile of the use of iodopovidone for pleurodesis in patients with malignant pleural effusion. Respiration 2015;90:369-75.
14. Banerjee SN, Ta RK, Chatterjee K. The efficacy and safety of povidone-iodine as a pleurodesis-inducing agent in spontaneous pneumothorax: an experience from a tertiary care hospital. J Med Sci 2018;38:170-5.
15. Wang X, Wang G, Zhang H, et al. Pleurodesis with povidone-iodine versus talc in malignant pleural effusion: a retrospective study. Chest 2016;149:A442.
16. Muthu V, Dhooria S, Sehgal IS, et al. Iodopovidone pleurodesis for malignant pleural effusions: an updated systematic review and meta-analysis. Support Care Cancer 2021;29:4733-42.
17. Agarwal R. Iodopovidone: an inexpensive and effective agent for chemical pleurodesis. Lung Cancer 2007;55:253-4.

Received: 10 September 2024; Accepted: 2 October 2024; Early view: 18 December 2024.

Contributions: both authors have contributed significantly and agree with the content of the manuscript. Both authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of interest: the authors declare that they have no competing interests, and all authors confirm accuracy.

Ethics approval and consent to participate: the study protocol was approved by the Institutional Review Board approval (IRB, Shaikh Zayed Medical Complex, Lahore: SZMC/IRB/Internal/0083/2021).

Informed consent: written informed consent was obtained from all patients involved in this research.

Patient consent for publication: not applicable.

Availability of data and materials: the data used to support the findings of this study are available from the corresponding author upon request.

Acknowledgments: the authors wish to thank all the staff of the Department of Pulmonology for their support.