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EFFICACY OF POVIDONE-IODINE AS A PLEURODESIS AGENT IN PATIENTS WITH MALIGNANT PLEURAL EFFUSION

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Abstract

Background: *Malignant pleural effusion (MPE) is a common complication of advanced malignancies, significantly affecting patient quality of life.* ***Objective:*** *To evaluate the efficacy and safety of povidone-iodine as a pleurodesis agent in patients with malignant pleural effusion.*

Methods: *This descriptive case series was conducted at the Department of Pulmonology, Mayo Hospital, Lahore from 20 December 2024 to 2 June 2025. A total of 64 patients with cytologically or histologically confirmed MPE underwent chemical pleurodesis using 10% povidone-iodine. A chest tube was inserted to drain the effusion, followed by instillation of a mixture of povidone-iodine, lidocaine, and normal saline.*

Results: *Out of 64 patients, 50 (78.1%) achieved complete response, 9 (14.1%) had partial response, and 5 (7.8%) experienced treatment failure. Minor complications included chest pain (29.7%), fever (10.9%), and nausea (6.3%). No major adverse events were reported. Treatment efficacy was not significantly associated with age, gender, primary malignancy type, or comorbidities.*

Conclusion: *Povidone-iodine demonstrated high efficacy and safety as a pleurodesis agent in patients with malignant pleural effusion. It offers a cost-effective, accessible, and well-tolerated alternative to talc, especially suitable for use in low-resource settings.*

INTRODUCTION

Malignant pleural effusion (MPE) is defined as the accumulation of fluid in the pleural space, characterized by the presence of cancer cells diagnosed through pleural fluid analysis or by pleural biopsy. The most frequent causes of MPE are malignancies originating in the lungs, breast, and lymphatic system, with lung cancer being the primary cause in men and breast cancer in women. Other neoplasms that can lead to MPE include mesothelioma, lymphoma and ovarian cancer [1,2]. Malignant pleural effusion can be managed by chemical pleurodesis, recurrent thoracentesis, pleurectomy and chronic indwelling pleural catheter. Chemical pleurodesis is the best palliative treatment for recurrent effusions of end stage malignancies. A wide spectrum of chemical agents has been used for pleurodesis, but the search for the ideal agent for pleurodesis continues [3,4]. The optimal pleurodesis

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agent should combine high efficacy, high molecular weight, low regional clearance, accessibility, affordability, ease of administration, and minimal side effects. Current pleurodesis agents, including cyclines (tetracycline, doxycycline), talc, bleomycin, and povidone, often induce pleural injury and inflammation, leading to coagulation activation and collagen production, thereby preventing pleural effusion. However, an agent meeting all these ideal criteria remains to be identified [5,6]. Sterile talc has been believed to be the most effective of the chemical agents in cases of malignant pleural effusion and now thoracoscopic approach using talc insufflations seems to be the most appropriate method of chemical pleurodesis. Nonetheless, it is a major issue on its safety.(6) Povidone-iodine is an antiseptic topical antimicrobial that consists of iodine. The action of povidone-iodine is believed to be associated with superior sclerosis even though the exact mechanism of action is unknown. Also, the iodine possesses high oxidant and cytotoxic actions, which can trigger a strong inflammatory reaction in the wall of any style that has fluid.(7) It is quite fungible and very affordable. Thyroid dysfunction may result as a result of the usage of topical povidone-iodine and other iodine-base contrast agent [8].

In their clinical trial on 63 cases of idiopathic malignant pleural effusion (MPE) with which the percentage of effective results was 73-80, Kahrom et al. found that the rate of efficacy after pleurodesis using povidone-iodine was 82.2 percent when the patient received a chest tube [8]. Likewise, the efficacy rate of pleurodesis with povidone-iodine reached 72.2 in 26 (out of 36) patients who were treated using a thoracostomy tube (Godazandeh et al., 2013) [9]. Also, recently analyzed results of Makkar et al. (2017) that included 104 patients with malignant effusion; the mean age of patients was 53 years, the mean length of review was 7.8 months; 79 percent of people did not develop fluid re-accumulation within the period observed [7]. Povidone-iodine is an antiseptic solution that is broad-spectrum antimicrobial and therefore can be applicable as a sclerosing agent since it is cost-effective, accessible, and whose safety is favourable. Although its application in other medical fields is very common, little research has been conducted on the effectiveness of povidone-iodine in pleurodesis of patients with malignant pleural effusion. This study would also analyze the effectiveness of the usage of povedone-iodine as a pleurodesis agent in MPE patients. The research proposal by filling this gap in the literature aims to offer an evidence-based advice to support the management of MPE and possibly offer a cost-effective solution to patients.

Objective

To determine the efficacy of pleurodesis with povidone-iodine in patients with malignant pleural effusion at tertiary care hospital.

Methodology

This Descriptive case series was conducted at Department of Pulmonology at Mayo Hospital Lahore from 20 December 2024 to 2 June 2025. The sample size of 64 is calculated by assuming the efficacy of 79%, 10% margin error, and confidence level of 95% [7]. Data were collected through Non-probability consecutive sampling.

Inclusion Criteria

Patients were included in the study if they met all of the following criteria:

- Age between 18 to 75 years, of either gender
- Confirmed diagnosis of malignant pleural effusion through pleural fluid cytology or pleural biopsy showing malignant cells
- Life expectancy of at least 3 months
- Re-accumulation of pleural effusion after therapeutic thoracentesis, necessitating pleurodesis
- Provided written informed consent to participate in the study

Exclusion Criteria

Patients were excluded if they:

- Had received systemic chemotherapy or thoracic radiotherapy within the past 4 weeks
- Had severe comorbid conditions (e.g., cardiac, renal, hepatic, or respiratory failure)
- Had pleural effusion of non-malignant origin (e.g., tuberculosis, heart failure, empyema)
- Had abnormal thyroid function tests

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- Had undergone prior pleurodesis for malignant pleural effusion on the same side
- Had encysted or loculated effusions
- Had known bleeding disorders
- Had extensive thoracic skin infiltration by tumor

Data Collection Procedure

After obtaining ethical approval from the Institutional Review Board, eligible patients were recruited. The procedure, potential risks, and benefits were explained, and informed consent was obtained. Demographic and clinical information including age, sex, duration of pleural effusion, type of primary malignancy, and comorbidities (such as hypertension and diabetes) were documented. Each patient underwent clinical examination, chest radiography, and laboratory evaluation to confirm eligibility. A 24 Fr chest tube was inserted in the 5th intercostal space at the mid-axillary line and connected to an underwater seal drainage system. Complete drainage of pleural fluid was achieved, followed by confirmation of lung re-expansion via chest X-ray. Drainage of less than 100 ml over 24 hours was considered adequate for pleurodesis. A mixture of 20 ml of 10% povidone-iodine (pH 4.5–5.5), 10 ml of 1% lidocaine, and 30 ml of normal saline was instilled through the chest tube. The tube was clamped for 6 hours. During this time, patients were rotated every 30 minutes between the left lateral, right lateral, prone, and supine positions to ensure uniform distribution of the agent. After unclamping, the chest tube remained in place until daily drainage reduced to less than 100 ml and no air leak was detected. A chest X-ray was performed to confirm adequate lung expansion, after which the tube was removed. A final chest X-ray was done post-drain removal, and if satisfactory, the patient was discharged on the same day. Patients were followed up at 3 months after the procedure. Clinical and radiological assessments were performed to evaluate recurrence of pleural effusion. Data were recorded on a structured data collection form.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables such as age, volume of pleural effusion, and duration of symptoms were expressed as mean ± standard deviation (SD). Categorical variables including gender, type of primary malignancy, comorbidities, and pleurodesis efficacy were presented as frequencies and percentages. Post-stratification chi-square test was applied to evaluate the association of potential confounders (e.g., gender, malignancy type, effusion volume, comorbidities, age, duration of effusion) with treatment efficacy. A p-value less than 0.05 was considered statistically significant.

Results

The study included 64 patients with a mean age of 58.3 ± 10.6 years, and a male predominance (59.4%). Lung cancer was the most frequent primary malignancy (45.3%), followed by breast and ovarian cancers. Comorbidities included hypertension in 32.8% and diabetes in 26.6%. The average duration of pleural effusion was 3.2 months, with a mean drainage volume of 1230 mL. A complete response to pleurodesis was observed in 78.1% of patients, while partial response and treatment failure were noted in 14.1% and 7.8%, respectively.

Table 1: Demographic and Clinical Characteristics of Patients (n = 64)

Variable	Value
Age (years), Mean ± SD	58.3 ± 10.6
Gender	
– Male	38 (59.4%)
– Female	26 (40.6%)
Primary Malignancy	
– Lung	29 (45.3%)
– Breast	18 (28.1%)
– Ovarian	8 (12.5%)

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– Others	9 (14.1%)
Comorbidities	
– Hypertension	21 (32.8%)
– Diabetes Mellitus	17 (26.6%)
Duration of Pleural Effusion	3.2 ± 1.6 months
Volume of Effusion Drained	1230 ± 340 ml
Complete Response	50 (78.1%)
Partial Response	9 (14.1%)
Treatment Failure	5 (7.8%)

The most commonly reported complication following pleurodesis was chest pain, occurring in 29.7% of patients. Fever and nausea were seen in 10.9% and 6.3% of cases, respectively.

Table 2: Adverse Effects Observed Post-Pleurodesis

Complication	Frequency (n)	Percentage (%)
Chest Pain	19	29.7%
Fever	7	10.9%
Nausea	4	6.3%
Severe Reactions	0	0.0%

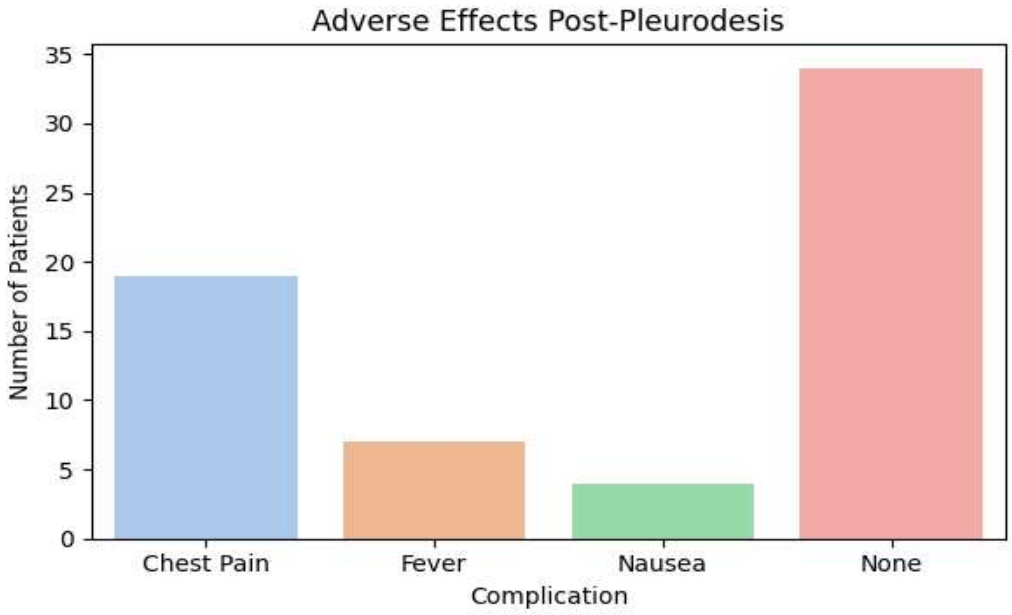

Figure 1: Adverse effect post-pleurodesis

Efficacy of pleurodesis was slightly higher in patients aged ≤60 years (81.8%) compared to those >60 years (73.1%), but the difference was not statistically significant (p = 0.414). Gender and type of malignancy also showed no significant impact on response. Although patients without hypertension had a higher success rate (87.5%) compared to those with hypertension (66.7%), this trend did not reach statistical significance (p = 0.093).

Table 3: Association of Patient Factors with Pleurodesis Efficacy

Variable	Efficacy (%)	p-value
Age ≤ 60 vs > 60	81.8% vs 73.1%	0.414

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Male vs Female	76.3% vs 80.7%	0.672
Lung vs Non-lung Cancer	79.3% vs 77.1%	0.823
With vs Without Diabetes	70.6% vs 83.8%	0.274
With vs Without HTN	66.7% vs 87.5%	0.093

At the 3-month follow-up, 81.3% of patients showed no re-accumulation of pleural fluid, indicating a sustained complete response to pleurodesis. Minimal re-accumulation, suggestive of a partial response, was observed in 12.5% of cases. Only 6.2% experienced significant re-accumulation, categorized as treatment failure.

Table 4: Re-accumulation of Pleural Effusion at 3-Month Follow-Up (n = 64)

Outcome Category	Frequency (n)	Percentage (%)
No Re-accumulation (Complete Response)	52	81.3%
Minimal Re-accumulation (Partial Response)	8	12.5%
Significant Re-accumulation (Failure)	4	6.2%

Discussion

This study evaluated the efficacy and safety of povidone-iodine as a pleurodesis agent in patients with malignant pleural effusion. The results demonstrated that povidone-iodine achieved a complete response in 78.1% of patients, with an additional 14.1% showing partial response, and only 7.8% experiencing treatment failure. With this, the results confirm the increasing body of evidence that povidone-iodine is an easy-to-tolerate and highly effective pleurodesis agent in malignant effusions. The rate of efficacy recorded in this study is similar to the other recordings recorded in the past that varied between 70% and 90 percent in povidone-iodine pleurodesis. A past study had also reported an overall response rate that exceeded 75% showing a similar result as that of talc-based pleurodesis [10]. Although talc is the gold standard, its high cost and access in the low resource areas promote the use of povidone-iodine as an alternative option. Lung-breast cancers were the predominant primary malignancies linked with malignant pleural effusion in our cohort, as one would expect of pleural metastases in epidemiological terms [11]. There was no correlation of any statistically significant nature between efficacy of pleurodesis and type of primary malignancy and hence the said agent of povidone-iodine has proven to be effective encoding a wide range of cancers as well. Likewise, age, gender and comorbid conditions like diabetes and hypertension did not have significant effects in determining treatment outcome although patients who did not have hypertension or diabetes had numerically higher success rates [12]. Notably, the procedure was tolerated without any major complications observed. Other side effects like chest pain (29.7%), fever (10.9%), and nausea (6.3%) were minor occurrences, which were self-limiting and could be treated by supportive measures. This is in agreement with previous findings that povidone-iodine causes sufficient pleural inflammation to support adhesion with few systemic signs of toxicity. Conversely, agents such as talc have been implicated in severe though rare complications that are characterized by acute respiratory distress syndrome especially when used as a poudrage application in the administration of general anesthesia [13]. This points to the possible safety benefit of povidone-iodine in sick or elderly hospitals. Povidone-iodine's antimicrobial property is another advantage; it may lessen the likelihood of empyema or secondary infection in immunocompromised oncology patients, which is a concern with other agents [14]. In our study, no infective complications were noted post-pleurodesis, which may in part be attributed to the antiseptic nature of povidone-iodine. One of the key practical benefits observed was the ability to complete the entire pleurodesis procedure at the bedside with minimal infrastructure, making it especially feasible in resource-constrained healthcare systems [15-17]. Following drain removal, patients were discharged the same day, resulting in a shorter hospital stay and lower costs [18]. However, it is necessary to acknowledge some limitations. This was a one-center study with a small sample size and a three-month follow-up period, which may not have captured long-term recurrence rates. Additionally, although response was evaluated radiologically and clinically, patient-reported outcomes such as dyspnea

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scores and quality of life measures were not formally assessed. To confirm these findings, additional randomized controlled trials comparing povidone-iodine to other agents like talc, doxycycline, and bleomycin should be conducted.

Conclusion

It is concluded that povidone-iodine is an effective, safe, and low-cost sclerosing agent for pleurodesis in patients with malignant pleural effusion. The majority of patients in this study achieved complete or partial control of fluid reaccumulation with minimal adverse effects. Given its widespread availability, ease of administration, and favorable safety profile, povidone-iodine represents a practical alternative to conventional agents such as talc, especially in resource-limited settings.

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