Section: Respiratory Medicine

Original Research Article

STUDY ON EFFECTIVENESS AND SAFETY OF INTRAPLEURAL STREPTOKINASE FIBRINOLYSIS IN PATIENTS WITH COMPLEX PARAPNEUMONIC EFFUSION AND EMPYEMA

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ABSTRACT

Background: Para pneumonic effusion (PPE) is an exudative pleural effusion manifesting as a complication secondary to mainly pneumonia. Complex PPE refers to PPE with multiple loculations on imaging, PPE is associated with increased morbidity, mortality and prolonged hospital stays requiring aggressive treatment and interventions. Standard management includes antibiotics and pleural drainage via chest tube. Open Thoracotomy and VATS (Video Assisted Thoracoscopic Surgery) provide effective drainage in gross loculated effusions or empyema but limited by risk, cost, and availability. Intrapleural fibrinolysis with streptokinase improves fluid drainage, reduces surgical referral and morbidity in these patients. **Materials and Methods:** This was a cross sectional study conducted at a Tertiary Care Hospital from June 2024–May 2025 which included 20 patients with Loculated Parapneumonic effusion and Empyema. Objectives were to assess the efficacy and safety of intrapleural fibrinolysis with streptokinase. Informed written consent was taken from patients meeting inclusion criteria. Intrapleural Streptokinase 250,000 U in 100 mL saline was instilled through Intercostal tube over 10-15 min once daily over 3–5 days with routine standard of care. Patients were monitored for clinical, radiological improvement and adverse outcomes. **Result:** In this study, mean age of the patients 53 years and majority were males 13(65%). Most common clinical presentations were cough (95%) followed by fever and shortness of breath. Diabetes Mellitus was the common comorbid illness. 70 % patients had Loculated Parapneumonic effusion and 30% had Empyema. Clinical and radiological improvement occurred in 80%, while 20% required surgical referral. Mean drainage increased from 175±84.32 ml to 695±362.51 ml post-fibrinolysis, which was statistically significant. There were no serious adverse events reported. **Conclusion:** Intrapleural Streptokinase effectively facilitates pleural fluid drainage and is safe, affordable treatment option in complex PPE.

INTRODUCTION

Parapneumonic effusion (PPE) is defined as the accumulation of pleural fluid secondary to pneumonia, lung abscess, bronchiectasis.[1] It is estimated that parapneumonic effusions occur in approximately 20–40% of patients hospitalized with pneumonia, and a significant proportion of these progress to complicated parapneumonic effusion or empyema if not adequately treated.[2] Pleural infection continues to be associated with considerable morbidity and mortality, with reported death rates ranging from 10% to 20%, comparable to those observed in patients hospitalized with severe pneumonia.[3]

The cornerstone of management of complicated parapneumonic effusion and empyema includes appropriate antimicrobial therapy combined with pleural space drainage using intercostal chest tube.[3] However, the presence of fibrinous septations and loculations frequently limits the effectiveness of tube thoracostomy alone, resulting in persistent sepsis and

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treatment failure. In such cases, surgical intervention in the form of video-assisted thoracoscopic surgery (VATS) or open decortication may be required, although these procedures may not be feasible in all patients due to advanced age, comorbid illness, or limited surgical availability.[4]

Intrapleural fibrinolytic therapy has been proposed as a less invasive alternative to surgery, with the aim of enhancing pleural drainage by enzymatic degradation of fibrinous septations within the pleural cavity.[5] Intrapleural fibrinolytic agents are Streptokinase, Urokinase, Tissue plasminogen activator (tPA), Deoxyribonuclease (DNase).[6] Though tPA and DNase are recommended as per current guidelines, Streptokinase provides a cost effective and safer alternative in patients with financial constraints. Streptokinase, derived from β-hemolytic streptococci, activates plasminogen to plasmin, leading to fibrin breakdown and facilitating evacuation of infected pleural fluid.[7] Several earlier studies suggested that intrapleural streptokinase improves radiological resolution, enhances pleural drainage, and reduces the need for surgical intervention in patients with loculatedparapneumonic effusion and empyema.[5-7]

Objectives:

1. To evaluate the efficacy of Intrapleural Streptokinase in Loculated Parapneumonic effusion and Empyema
2. To assess the safety of Intrapleural Streptokinase therapy.

MATERIALS AND METHODS

This was a prospective, cross-sectional study conducted at tertiary care hospital in Karnataka, South India over a period of 12 months from June 2024 to May2025. A total of 20 patients were included in the study using a non-probability sampling method. Patients with loculated PPE on imaging (Chest X-ray / USG Thorax /CT Thorax) were included and those with long-standing empyema, uncontrolled Hypertension, recent trauma or hemorrhage, stroke, bleeding disorder , anticoagulant therapy , recent use of Streptokinase were excluded.

Data Collection and Methodology: After obtaining written informed consent, standard 24F or 28F Chest tubes was inserted with Ultrasound guidance. Streptokinase (2.5 lakh units in 100 mL of normal saline once daily) was instilled through the chest tube, clamped for 2 hours and patients were repositioned to distribute the medication. Tube was declamped after 2 hours and patients were monitored for clinical improvement, drainage amount, radiological changes, and adverse events. All patients received standardized broad-spectrum antibiotic coverage simultaneously. Fibrinolysis was stopped by 3rd day if no significant improvement in drain or in development of any serious adverse events such as intrapleural hemorrhage, severe hypersensitivity/anaphylactic reaction, hypotension. All data were collected in excel sheet and analysed using SPSS-25 (Statistical Package for the Social Sciences).

Statistical Analysis: Descriptive variable expressed as number and Percentage. Continuous variable expressed as Mean and Standard Deviation. For the comparision of Pre and Post variable, paired T test was used and p value <0.05 was considered as Statistically Significant.

RESULTS

A total of 20 patients (M:F - 13:7) were included in the study [Figure 1]. The mean age of the study population was 52.8 ± 17.4 years, with ages ranging from 18 to 81 years.

The most frequently reported symptom was cough (95%, n-19), followed by fever (85%, n-17), expectoration (75%, n-15), shortness of breath (70%, n-14) and Chest pain (35%, n-7). [Figure 2]

Regarding comorbid conditions, Type 2 Diabetes Mellitus (T2DM) was the most common, present in 55% (n-11) of patients followed by Hypertension 50%(n-10). [Table 1]

Inflammatory Markers: The mean white blood cell (WBC) count was 15,383 ± 6,030 cells/mm³, and the mean C-reactive protein (CRP) level was 125.95 ± 69.56 mg/L, indicating significant systemic inflammation. [Table 2]

Pleural Fluid Analysis: Pleural fluid analysis revealed a mean glucose level of 59.57 ± 6.59 mg/dl, protein concentration of 4.86 ± 0.81 g/dl, Lactate dehydrogenase (LDH) of 1900.8 ± 1280.85 U/L [Table 2]. Pleural fluid culture-sensitivity tested positive for Klebsiella Pneumoniae in 2 out of 20 patients. 70 % patients had complex PPE and 30% had complex parapneumonic empyema. [Figure 3]

Clinical, Radiological Improvement & Safety

80% of patients showed clinical and radiological improvement with Streptokinase fibrinolytic therapy whereas 20% showed no improvement and required surgical management. [Figure 4]

Pre-fibrinolytic drainage was 175±84.32 ml and Post fibrinolytic drainage improved to 695±362.51ml, which was statistically significant. [Table 3]

Regarding adverse events, 25% (n-5) patients had adverse events with Fever (n-5) and Chest pain (n-2), None of the patients had serious adverse events.

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Table 1: Co morbidities of study population

SI.NO	Co morbidities	n (%)
1	Diabetes Mellitus	11(55)
2	Hypertension	10(50)
3	Chronic kidney diseases	2(10)
4	Chronic Liver disease	1(5)
5	H/O Pulmonary Tuberculosis	1(5)

Table 2: Laboratory findings.

SI.NO	Variable	Mean+/- SD
1	WBCs (cells/mm3)	15,383 ± 6,030
2	CRP (mg/L)	125.95 ± 69.56
3	Pleural Fluid LDH (U/L)	1900.8 ± 1280.85
4	Pleural Fluid protein (g/dL)	4.86 ± 0.81
5	Pleural Fluid Glucose(mg/dL)	59.57 ± 6.59

Table 3: Drainage of pleural fluid Pre and post fibrinolysis with Streptokinase

Variable	Pre(ml)	Post(ml)	p-value
	Mean±SD		
Fibrinolysis	175 ± 84.32	695 ± 362.51	<0.001

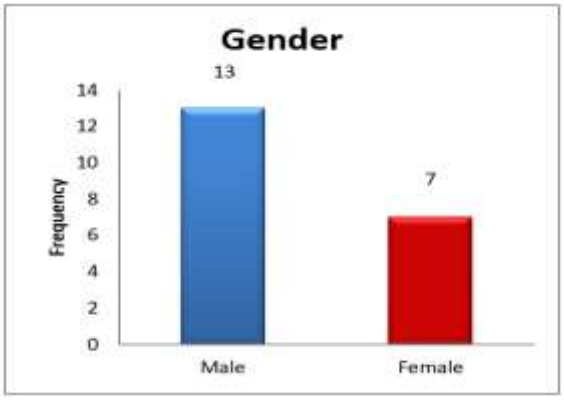

Figure 1: Gender distribution

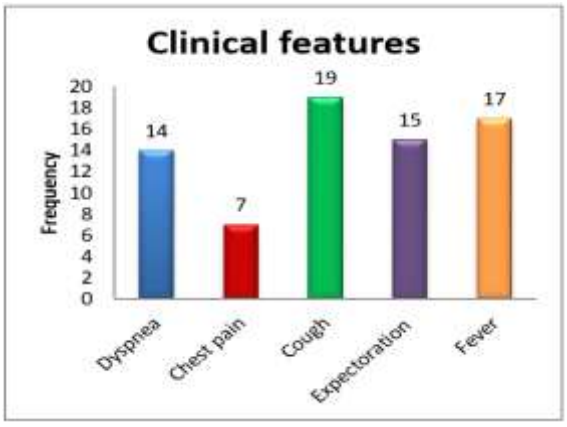

Figure 2: Clinical features

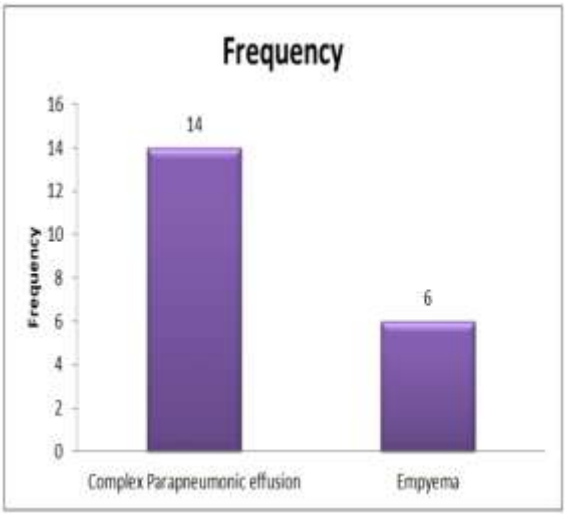

Figure 3: Distribution of PPE

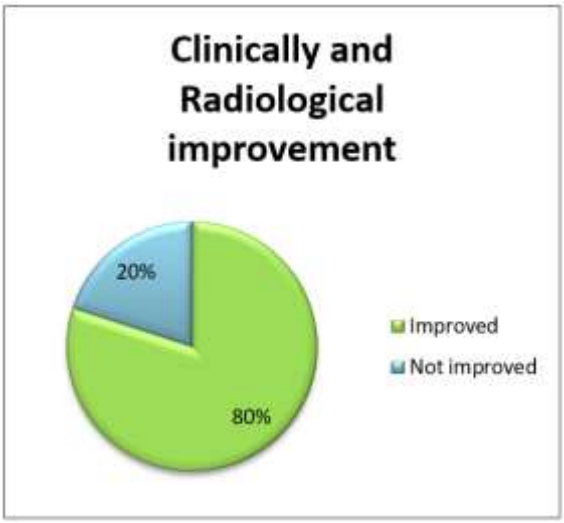

Figure 4: Clinical & Radiological Improvement

DISCUSSION

Regarding clinical manifestations in our study, Cough (95%) was the most frequent symptom, followed by fever (85%), expectoration (75%), a

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dyspnea (70%) and a chest pain (35%). In a study by Singh et al8, 90% of the participants in the streptokinase group had cough and fever, 80% had dyspnea, and 10% had chest discomfort and gastrointestinal (GI) symptoms.

In our study amount of fluid drained after fibrinolysis with Streptokinase was 695±361.51ml, which was significant. Haytham Mohamed Abd El Moaty et al,[9] study has shown that average amount of fluid drained by using the streptokinase was 878±168.6 mL. According to the Nyat Kooi Chin et a1,[10] study, patients in the Streptokinase therapy group had a substantially higher volume of pleural fluid drained from them (2.0 L) than those in the Drain only group (1 L). Saxena and Maturu,[11] discovered that the average amount of fluid drained by using the streptokinase was 1,379.23± 771.9 mL.

In current study, 80% patients had clinical and radiological improvement, while 20% patients required surgery. Amay omar et al,[12] study showed complete adhesiolysis was recorded in 60% of cases and partial success in 24% while the procedure failed in 16% of cases. Similar studies by Bouros et al,[13] and Diacon et al[14] demonstrated > 80% of patients receiveing Streptokinase had clinical and radiological improvement.

In our study, Fever and Chest pain were common adverse events post fibrinolysis. Similar studies by Khalil IM et al,[15] and Haytham Mohamed Abd El Moaty et al,[9] on safety of intrapleural streptokinase showed fever and chest pain among most common adverse events with none of them reporting serious events as in our study.

CONCLUSION

Intrapleural Streptokinase is significantly effective in facilitating pleural fluid drainage, reducing surgical referral and morbidity in patients with complex PPE. It is also safer and affordable management choice in resource limited settings as well as in patients who are not fit enough to undergo invasive high risk surgeries

Limitations: Our study had smaller sample size and was conducted at single centre, so a larger sample with multicentre studies would further validate efficacy and safety of Intrapleural fibrinolysis with streptokinase in resource limited settings and in patients with economic constraints.

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