

Therapeutic Efficacy of Ultrasonography Guided Thoracocentesis and Intrapleural Urokinase Instillation Through Tube Thoracostomy in the Management of Loculated Effusions.

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Abstract:

Aims: To assess and compare the management of loculated effusions in patients by ultrasonography (usg) guided simple thoracocentesis and by intrapleural urokinase instillation through intercostal drain and to study the residual pleural thickening by radiological follow up in the study sample. **Patients and methods:** A total of 34 patients were observed of which 30 patients were included in the study. They were allocated in to two groups of which one group received intrapleural urokinase (n = 15) and the other was treated by usg guided thoracocentesis of pleural fluid in the locules (n = 15). The urokinase (1,00,000 IU) was administered into the pleural cavity per day for 5 days via an intercostal tube (ICT). **Results:** In both groups biochemical analysis of pleural fluid was exudates. Out of 30, 16 were tuberculous effusions, 10 were synpneumonic bacterial effusions, 4 were poly microbial empyemas. In terms of patient comfort and lesser duration of hospitalization, it was better in usg guided thoracocentesis group (an average of 5 days)when compared to ICT insertion with urokinase instillation group(an average of 8 days). In terms of effectiveness of procedures, it was better in urokinase group (80%)when compared to usg guided thoracocentesis group(53.3%) based on post discharge and after 1 month follow up by chest x ray in both groups. **Conclusion:** Our study showed that patients with loculated pleural effusion treated with urokinase suffered less from residual pleural thickening, as measured after one month, than those treated by usg guided thoracocentesis.

Key-words: loculated effusions, usg guided thoracocentesis, intra pleural urokinase instillation.

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I. Introduction

Complicated parapneumonic effusions, complicated tubercular effusions, empyemas, hemothorax and malignant effusions are the most common causes of loculated effusions. Loculations develop due to delayed initiation and inappropriate use of medical management with anti tubercular drugs or antibiotics and delayed initiation of pleural space drainage. Loculation was suggested by persistent fluid despite an adequate trial of simple drainage, radiographic demonstration of septation or drainage of a volume of fluid far less than expected by computed tomography scan. The management options in such cases consist of ultrasound guided thoracocentesis of each locule, insertion of pigtail catheters one in each locule, simple intercoastal drain with suction, use of intrapleural fibrinolytics, use of thoracoscopic adhesionolysis, minimally invasive video assisted thoracic surgery (VATS) or more invasive conventional thoracotomy and decortication. Though VATS and other invasive procedures are very effective, they are not routinely practiced in India due to limited access, affordability and patients' phobia for major surgical procedures. So our current study highlights the use of intrapleural urokinase fibrinolytic therapy as a safer, easier and cost effective option for loculated effusions.

Aims and objectives: The aims and objectives of this study were (a) To assess and compare the management of loculated effusions in patients by usg guided simple thoracocentesis and by intrapleural urokinase instillation through intercoastal drain and (b) To study the residual pleural thickening by radiological follow up in the study sample.

II. Materials and Methods

Study design : A Prospective observational interventional comparative study.

Study population: All the eligible patients with loculated effusions admitted in a tertiary care hospital during August 2019 to January 2021.

Sample Size: A total of 34 patients were observed of which 30 patients were included in the study. They were allocated in to two groups, 15 in each group.

Study period: Study was carried out from August 2019 to January 2021.

Inclusion criteria:

- 1) Patients who had loculated effusion on chest x ray or ultrasound or computed tomography.
- 2) Patients who were willing for the study.
- 3) Patients who were hemodynamically stable and fit for thorocentesis or intercoastal tube thoracostomy and intrapleural urokinase fibrinolysis.

Exclusion criteria:

- 1) Patients who do not give consent.
- 2) Patients with very severe breathlessness.
- 3) Patients with poor general condition.
- 4) Patients with blood dyscrasias, abnormal bleeding and clotting times.
- 5) Patients with recent myocardial infarction.
- 6) Patients with Broncho pleural fistula.
- 7) Patients who had H/O bleeding diathesis, stroke or significant hemorrhage in the preceding six months or who were treated with intravenous fibrinolytics for myocardial infarction or ischemic stroke by any route in the past 2 years.

Materials:

- 1) Routine blood investigations like complete blood picture, bleeding time, clotting time, renal and liver function tests.
- 2) Peripheral blood smear.
- 3) ECG
- 4) Chest x ray, ultrasonography, Contrast Entrast Computed Tomography.
- 5) Diagnostic thoracocentesis of pleural fluid biochemical, pathological, microbiological analysis by pleural fluid PH, total cell count, differential count, sugar, protein, ADA (Adenosine de aminase), LDH (Lactate de hydrogenase), cellblock for histopathology, gram staining, acid fast staining/ZN staining, culture and antibiotic sensitivity, gene expert.
- 5) Equipments for thoracocentesis and intercostal drainage of pleural fluid by tube thoracostomy and for intrapleural urokinase instillation.

Methods:

In one group under aseptic conditions, ultrasound of chest was done. Locules with pleural fluid and septations were identified. Pleural fluid from each locule was aspirated under ultrasound guidance. Instruments like syringe with needle, 3way cannula, intravenous infusion set are needed for this procedure.

In the other group under aseptic conditions with 2% lignocaine local instillation on the side of effusion in 4th or 5th intercostal space in mid axillary line or at the site marked where there was maximum amount of loculated pleural fluid intercoastal tube was inserted and connected to a romodrain bag. After some amount of pleural fluid is drained, when there is further pleural fluid in locules and septations as evident by chest x ray or ultrasound or CT chest, urokinase 1,00,000 units diluted in 50 ml normal saline was instilled through intercostal tube in to pleural space. The intercostal tube was clamped for 3 hours. After the clamp was removed, pleural fluid was drained in to the bag due to fibrinolytic property of urokinase which breaks the locules, septations, thick fibrous strands in viscous pleural fluid. The procedure was repeated for 5 days depending on radiological resolution and till further no more pleural fluid was drained. We used an average of 3,00,000 units of urokinase for most patients, a maximum of 5,00,000 units was used for few patients.



Figure 1 - Image showing pleural fluid in loculations in ultrasound.

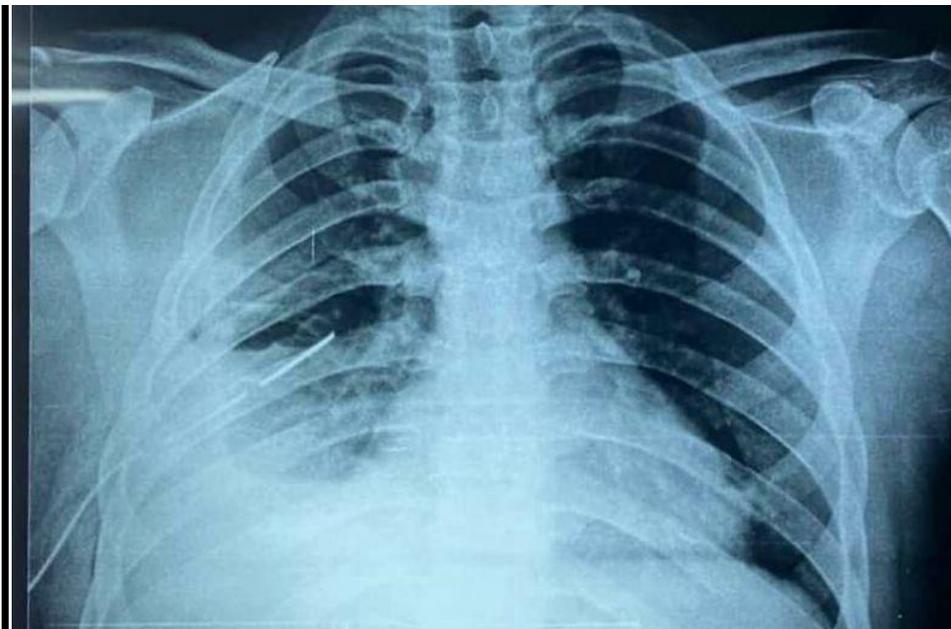


Figure 2- Chest X ray showing right loculated effusion with intercostal tube in situ.

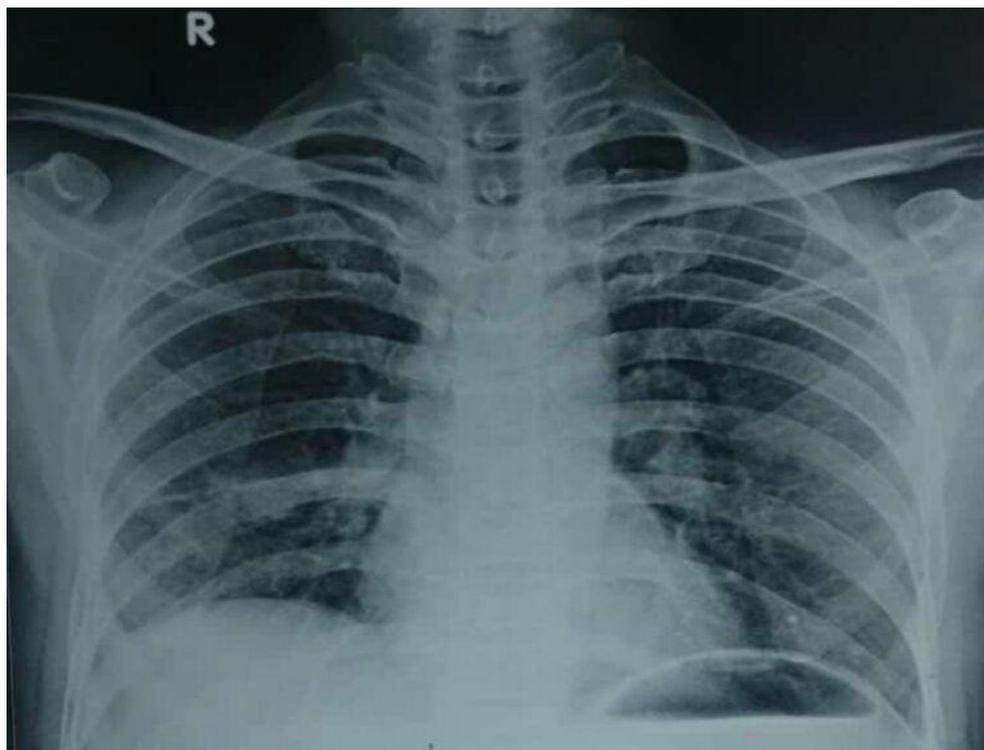


Figure 3 - Chest x ray showing radiological resolution of right loculated effusion after 1 month in intrapleural urokinase instilled patient.

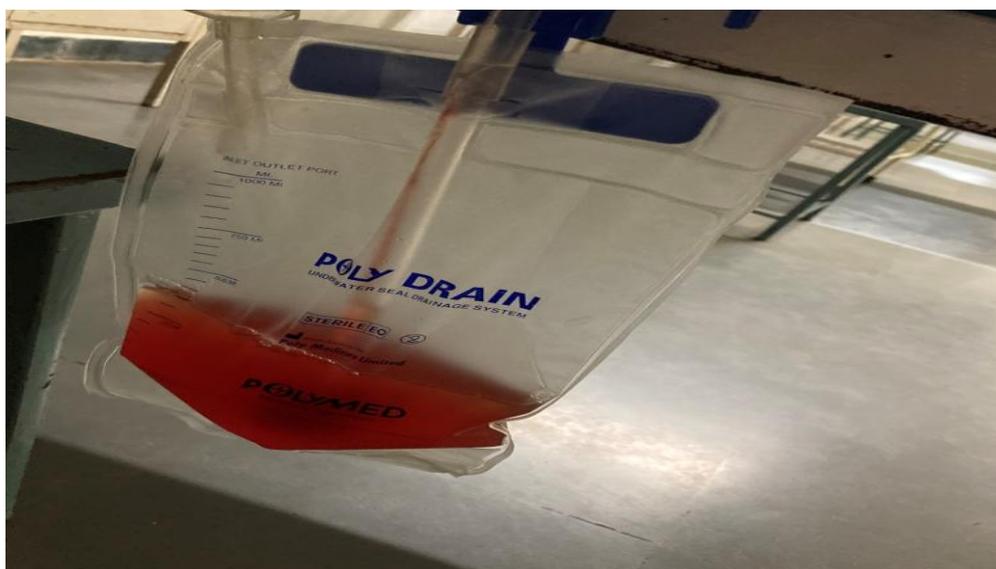


Figure 4 – Image showing reddish pleural fluid with fibrotic bands in romodrain bag after intrapleural urokinase instillation

III. Results

In study sample out of 30 patients, 24(80%) were male and 6(20%) were female. Based on pleural fluid biochemical, pathological, microbiological analysis by pleural fluid PH, total cell count, differential count, sugar, protein, ADA (Adenosine de aminase), LDH (Lactate de hydrogenase), cellblock for histopathology, gram staining, acid fast staining/ZN staining, culture and antibiotic sensitivity, gene expert, 16 out of 30 loculated effusions in the present study sample were tuberculous effusions which constitute 53.3%, 10 were synpneumonic effusions which constitute 33.3% and 4 were polymicrobial empyemas which constitute 13.3%. Average duration of hospitalization for management of loculated effusions by usg guided thoracocentesis was 5 days, whereas by intrapleural urokinase instillation through tube thoracostomy it was 8 days. Radiological

outcome measured by repeat chest x ray during follow up was 80% for intrapleural urokinase instillation when compared to usg guided thoracocentesis which was 53.3%.



Table 1- Bar diagram showing gender distribution in sample.

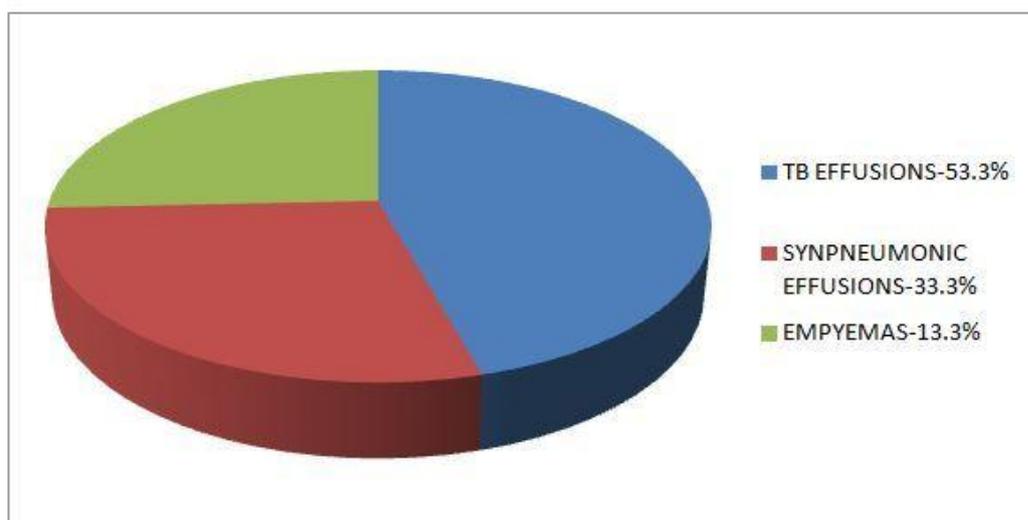


Table 2- Pie diagram showing etiology of effusions.

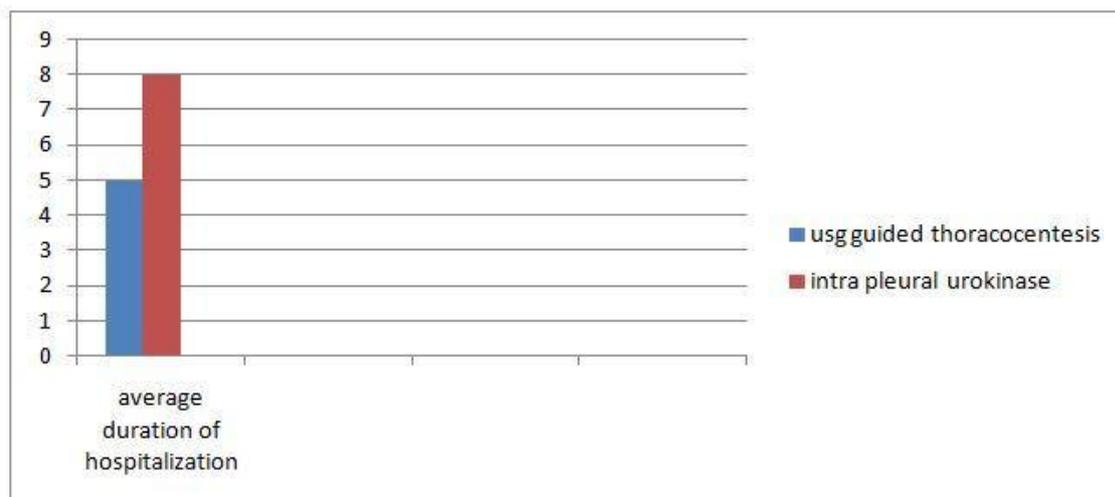


Table 3- Bar diagram showing average duration of hospitalization in both study groups.

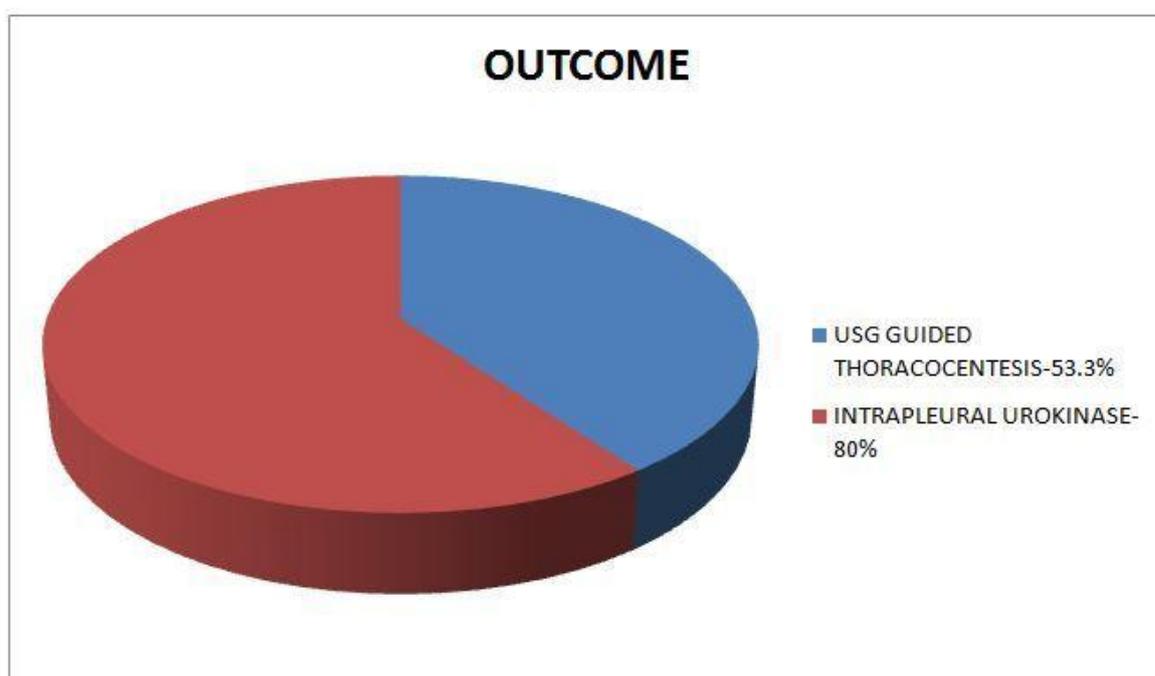


Table 4- Pie diagram showing radiological outcome in both study groups.

IV. Discussion

In the present study of 30 loculated effusions, the male to female ratio was 4:1 which was comparable to Enrique Cases Viedma et al ^[1] in his study on loculated tb pleural effusions indicating a strong male predisposition in incidence of pleural infections and loculated pleural effusions. Tuberculous loculated effusions accounted for majority in our study which is due to high incidence of tuberculosis in developing countries like India.^[2] In present study based on diagnostic pleural fluid analysis, they were diagnosed as tuberculous effusions, syn pneumonic effusions and poly microbial empyemas. Patients were randomized for interventions by usg guided thoracocentesis and intrapleural urokinase instillation and the patients were medical managed as per diagnosis in both groups. Tuberculous effusions were treated by anti tuberculosis chemotherapy regimen for 6 months according to National Tuberculosis Elimination Programme NTEP. Synpneumonic effusions and empyemas were treated with empirical antibiotic therapy initially and shifted to appropriate antibiotic therapy based on gram staining, culture, antibiotic sensitivity of pleural fluid for 10 to 14 days.

In the present study, the amount of pleural fluid drained was more in intrapleural urokinase group which was reflected in average duration of hospitalization days i.e. 8 days in urokinase group and 5 days in usg guided thoracocentesis group. This was comparable to study done by Bourous D et al ^[3] in which urokinase in 15 patients (11 with Complicated pleural effusion and 4 with empyema) were compared with normal saline in

16 patients (13 with Complicated pleural effusion and 3 with empyema) with pleural infection resulting in significantly more fluid drainage in urokinase group.

In our study, we observed the pleural fluid drain more haemorrhagic and fibrin strands in drain on intrapleural urokinase instillation with successive doses. This was probably due to lysis of adhesions and pleural reaction. However systemic complications like fever, chest pain, rash, bleeding diathesis, change in bleeding time, clotting time and other blood parameters were not observed with a dose of 1 lakh units per day for 3-5 days. But caution must be taken as there were rare case reports of side effects like fever, chestpain in < 10% of patients, ventricular fibrillations, major bleeding complications.^[4-6]

In the present study, radiological outcome measured by repeat chest x ray during follow up was 80% for intrapleural urokinase instillation when compared to usg guided thoracocentesis which was 53.3%.

In a randomized control study conducted by Tuncozgur B et al^[7] on 49 patients with parapneumonic empyema where patients were randomly assigned to receive either intrapleural urokinase or normal saline for five consecutive days, the urokinase group had shorter time for defervescence, shorter need for hospitalization and a lower need for decortication.

In several case reports,^[8,9] non-randomized^[10] and randomized trials,^[11,12] the use of intrapleural fibrinolytics had shown encouraging results. Failure of fibrinolysis is commonly used to assess effectiveness of both procedures radiologically and is defined as the need for surgical referral.^[13] In the present study, failure of fibrinolysis was less in urokinase group indicating lower need for major thoracic surgeries like Video Assisted Thoracoscopic Adhesiolysis VATS, Decortication.

V. Conclusion

The therapeutic efficacy for management of loculated effusions was high in terms of radiological outcome in intrapleural urokinase instillation through tube thoracostomy group (80%) than ultrasonography guided thoracocentesis group. Our study showed that patients with loculated pleural effusion treated with urokinase suffered less from residual pleural thickening, as measured after one month, than those treated by usg guided thoracocentesis. Intra pleural urokinase instillation reduced the need of video assisted thoracoscopic surgery adhesiolysis of locules and need for decortication surgery which had risk due to anaesthesia complications, surgery complications and mortality risk. It can be tried in elderly who are unfit for surgery, who refuse surgery and where there were limited access to complicated thoracoscopic procedures. It is therefore suggested that the administration of intrapleural urokinase through ICT is a safe, effective and simple treatment for those patients with loculated effusions.

Conflicts of Interest

There are no conflicts of interest.

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Ethics Committee clearance

Institutional ethics committee approved the study.

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