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Efficacy of Fixing Chest Tube to Chest Wall from Both Sides versus Single Side Fixation with Silk One Breaded Suture

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ABSTRACT

Objective: To determine the efficacy of fixing chest tube to chest wall from both sides versus single side fixation with silk one suture.

Study Design: Comparative cross sectional study.

Place and Duration of Study: Combined Military Hospital, Kharian Pakistan, from Mar 2021 to Jan 2022.

Methodology: Two hundered Patients undergoing chest intubation at CMH Kharian and referred from peripheral hospitals were considered in the study and divided into two groups. In our setup (Group-A), chest tubes were fixed with a chest wall with silk breaded sutures from both sides, compared to patients referred from peripheral hospitals (Group-B), who had chest tubes fixed to the chest on a single side. They were analyzed for system leakage at the chest wall, to and fro movements of the chest tube and accidental dislodgement.

Results: Unilateral chest intubation was done in 193(96.5%). Right sided intubations were 112(56%) and 81(40.5%) were left sided. Most chest intubations done were either blunt or penetrating thoracic trauma 52(26%), early empyema thoracis 50(25%), primary pneumothorax 30(15%), indeterminate pleural effusion 28(14%), secondary pneumothorax 24(12%) and malignant pleural effusion 16(08%). System leakage was 2(02%) in group A to 13(13%).No chest tube was moved to and fro in Group-A and 12(12%) in Group-B. In Group-A, accidental dislodgement was 3(03%), and 6(06%) patients had such complication in Group-B.

***Conclusion*:** Chest tube fixation with chest wall with silk one breaded suture gives better support to the chest tube from all sides and minimizes the chances of system leakage, to-and-fro movements, and accidental dislodgement compared to fixation of the chest tube from only one side.

Keywords: Accidental dislodgement, chest intubation, fixity to chest wall, system leakage.

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INTRODUCTION

Chest tubes are placed in the chest wall to drain fluid; it can be blood, effusion or pus, or to remove the air from the pleural cavity. We are selective in placing drains operatively, but they are part and parcel of the procedure after opening up the chest wall.[1] Drain can get dislodged or fail to produce an effective closed system to work effectively. If such complication occurs, it can result in morbidity or mortality of the patient, especially if a chest tube is involved.[2] Dislodgement of chest drains has the potential to cause serious morbidity and even mortality. Many techniques for securing chest drains to the skin have been described.[3-6]

We describe a simple yet effective technique for securing large bore drains to the skin using a single suture type.[7] Certain factors are vital for the security and functionality of the chest tube: the snugness of the wound around the drain, the method of fixation adopted, and external pull on the chest tube either from the weight of the underwater seal system or patient mobility post-operatively. The fixation method used depends on the individual surgeon. This study analyses the surgeon's choice as per the experience of applying fixation sutures either on both sides or on one side of the chest tube in terms of system leakage at chest wall level, to and fro movements of the chest tube at the chest wall and accidental dislodgement of a chest tube. In the literature, there are many methods of fixation of chest tubes. However, to our knowledge, no study qualitatively examines the security of fixation and compares them.

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METHODOLOGY

The comparative cross sectional study was conducted at Combined Military, Hospital Kharian Pakistan, from March 2021 to January 2022 after approval by the Hospital Ethical Review Committee.

The sample size was calculated by using the "Effect Size technique" (ES), with ES=0.52, α=0.05 and a 95% confidence interval. Two hundred patients were divided into groups of 100 using the "consecutive Sampling technique".

Inclusion Criteria: Patients of either age and age group, with chest tubes placed in the chest in the operation theatre or Outpatient Department of Combined Military Hospital, Kharian and kept longer than seven days and patients already had chest tubes placed more than seven days and were referred from peripheral hospitals for further management were included.

Exclusion Criteria: All patients with chest tubes removed before seven days or passed away in a week and having tubes in the chest other than proper chest tubes from Combined Military Hospital Kharian or referred from other hospitals were excluded.

Patients undergoing chest intubation at Combined Military Hospital, Kharian and patients already chest intubated and referred from peripheral hospitals were considered in our study. Both sets of patients were divided into two groups. In our setup, (Group-A), chest tubes were inserted in local anaesthesia and were fixed to the chest wall with silk-breaded sutures from both sides as compared to patients being referred from peripheral hospitals (Group-B) with chest tubes fixed to the chest wall with silk 1 on a single side. Both groups were analyzed for system leakage at the chest wall level, to and fro movements of the chest tube at the chest wall, and accidental dislodgement of the chest tube. Chest tubes with underwater seals were used, and fixation involved silk one breaded suture.

The data was entered in the Statistical Package for Social Sciences (SPSS) version 21.0 and analyzed. Mean and standard deviation were calculated for quantitative variables. Frequency was presented for qualitative variables in both groups.

RESULTS

Two hundred patients were included, with a hundred patients in each group. Unilateral chest intubation was done in 193(96.5%). Right sided intubations were 112(56%) and 81(40.5%) were left sided. Patients were divided into two groups. Group-A comprised patients who were chest intubated in Combined Military Hospital, Kharian by a thoracic surgeon with a chest tube fixed to the chest wall by silk one suture on both sides of the chest tube (Figure-1). Group-B had patients referred from peripheral hospitals with chest tubes fixed to the chest walls with a silk 1 suture on one side of the chest tube (Figure-2). In our study, indications for which Most chest intubation was done were either blunt or penetrating thoracic trauma (52,26%), early empyema thoracis (50, 25%), primary pneumothorax (30,15%), indeterminate pleural effusion (28,14%), secondary pneumothorax (24,12%) and malignant pleural effusion (16,08%), as shown in Figure-3. System leakage was 2(02%) in Group-A to 13(13%).No chest tube was moved to and fro in Group-A and 12(12%) in Group-B. In Group-A, accidental dislodgement was 3(03%), and 6(06%) patients had such complications in Group-B, as shown in the Table.

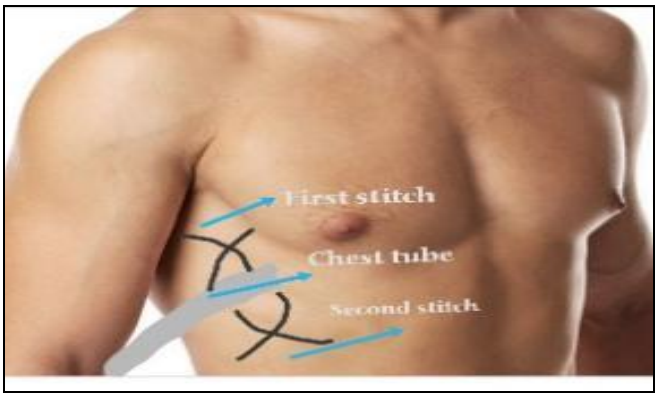

Figure-1: Silk stitch on both sides of Chest Tube (Group-A)

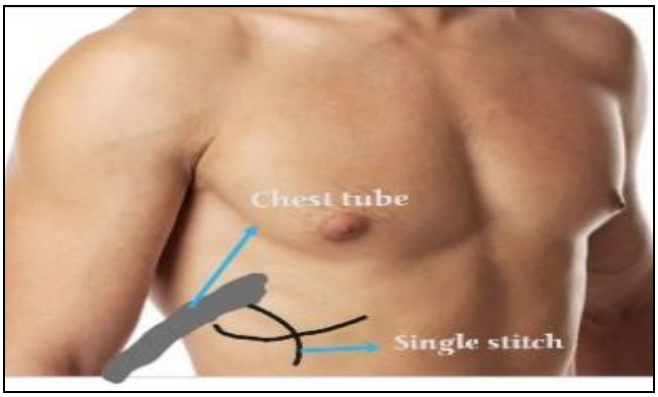

Figure-2: Silk stitch on one side of Chest Tube (Group-A)

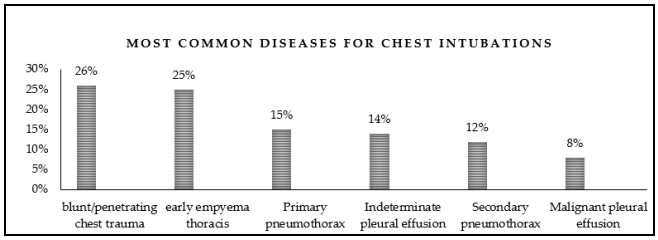

Figure-3: Most Common indications for Chest Intubations (n=200)

Table: Complications of Chest Intubations (n=200)

Complications	Group-A (n=100)	Group-B (n=100)
System Leakage	02	13
To and fro movement of chest tube	00	12
Accidental dislodgement of chest tube	03	06

DISCUSSION

Insertion of intercostal chest tube drainage is commonly done in the management of either blunt or penetrating thoracic trauma in addition to in-de-terminate pleural effusion, secondary pneumothorax, malignant pleural effusion, early empyema thoracic and primary pneumothorax.8 It is often performed by junior medical personnel in an emergency during the initial resuscitation period in a stressful environment. Approximately one-fifth of all intercostal chest tube insertions are associated with complications. In a retrospective review of over 1000 intercostal chest tube insertions, 7% of the complications observed were due to inadequate fixation, resulting in dislodgement. The risk of dislodgement is mostly seen during the transit or transfer of a casualty.[9] In a military setting, this may involve the movement of a casualty in a non-permissive environment and includes a transfer on and by air, either by helicopter or aeroplane, road vehicle and from deep seas to offshore hospitals as well as between stretchers and hospital beds.[10] In military or civil setups, the chest intubation and fixation technique has not been standardized in our country. However, general principles are followed, as taught in Advanced Trauma Life Support guidelines.[11] This paper aims to propose a version of a tried and tested technique of securing intercostal chest tubes with surgical knot tying by hand on either side of the chest tube, and this study describes and demonstrates an easily teachable, robust and reproducible technique for securing intercostal chest tube. We would advocate using this technique among surgically and non-surgically trained medical personnel and suggest that this should become the standardized technique for securing intercostal chest tubes across the military and non-military setup.

The British Thoracic Society guidelines re-commend using two sutures: one to secure the tube and the other to close the skin.[8] Complicated purse string methods result in unsightly scars. Many of the methods described in the literature are probably enthusiastically used by their authors. Technical reports often modify existing methods used by surgeons.[12,13]

Although the methods using adhesive methods alone may work well in a hairless, dry operative setting, we were more interested in securing by suture methods.[14] Many studies aimed to secure the drain internally, whether through the drain or the drain holes, to use prolene or nylon to avoid the braided silk alternative.[15,16]

Some surgeons tried passing sutures through the lumen of the drain, creating the question of whether such suture material in the lumen prevented the evacuation of clots. Surgeons in externally based fixation mostly use silk due to its increased friction quality.[17] Very few studies were conducted on drain pull-out tested manually on mannequins after fixation by experienced surgeons. Some researchers tested external ventricular drains for pull-out force and used them in neurosurgery to treat hydrocephalus.[18-20]

The strength of our study is our pragmatic approach, in that the fixation application mimicked real-life intermittent forces on the chest tubes. We concentrated on the interface of the fixation method and the chest tube itself, the closed underwater drainage system, and the to and fro movements of chest tubes by the chest wall, removing the suture skin interface as an additional factor. However, the findings need to be interpreted in the context of the study's limitations. Our study was conducted on the application of sutures on both sides of chest tubes as compared to chest tubes fixed by one side, a system of chest tube failure due to single-side suture application, and we also focused on to and fro movements of the chest tube on the chest wall.

We recommend using one silk suture on both sides of chest tubes for better fixation and snug fixation of a chest tube. Although further clinical studies would be necessary, we feel that adding the suture on both sides of the chest tube would reduce any chance of displacement and add security in the

clinical setting. We found that the silk one ties on both sides of the chest tube used to be cheap.

CONCLUSION

Chest tube fixation with chest wall with silk one breaded suture gives better support to the chest tube from all sides and minimizes the chances of system leakage, to-and-fro movements, and accidental dislodgement compared to fixation of the chest tube from only one side.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

AR & YS: Data acquisition, critical review, approval of the final version to be published.

FAM AW: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

IA & SM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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