

## Penetrating Chest Trauma: Tube Thoracostomy with Application of Low Pressure Continuous Suction, Management and Outcome, the Rate and Identifying the Causes in Iraqi Kurdistan Region, Sulaimanyah City

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### ABSTRACT

**Background and Objectives:** Penetrating chest trauma is still common in the developing countries as elsewhere. We studied the rate, causes and the outcome in patients with penetrating chest trauma who managed by tube thoracostomy with application of continuous low pressure suction. The aims of the study were to see the rate of penetrating chest injuries in sulaimanyah city, identifying its causes and to evaluate the effectiveness of tube thoracostomy and applying continuous low pressure suction.

**Methods:** This study was conducted in the department of thoracic and cardiovascular surgery, sulaimani teaching hospital, sulaimanyah city from July 2007 to October 2009.

This study included 48 patients. 40/48 patients were male and 8/48 female. The average age was 27.2 years (range, 16-50). They sustained a penetrating chest trauma from firearm (gunshots) or stabbing wound. They underwent tube thoracostomy and continuous low pressure suction applied to their chest drains.

**Results:** In our study 21/48 patients were injured by stabbing by knife, 19/48 were injured by gunshots, 5/48 by shell (mines, explosion) and 3/48 by sharp objects. Full lung expansion was achieved in forty (83%) patients. Partial lung expansion or pneumothorax was present in eight (17%) patients. Three patients (6%) developed complications.

**Conclusions** Our study showed that stab wounds and gunshots constitute the main cause of penetrating chest trauma in our area. Placing chest tubes on continuous low pressure suction helps evacuation of blood, expansion of lung and prevents the development of clotted haemothorax. It also reduces the time to removal of chest drains and the hospital stay.

**Key words:** Penetrating chest trauma, low pressure suction, tube thoracostomy.

### INTRODUCTION:

Sulaimani Teaching hospital is situated in the center of sulaimanyah city, Kurdistan region, Iraq. It has the main accident and emergency department of sulaimani city. Penetrating injuries of the chest are a common cause of admission to the hospitals, especially those with first line emergency departments. Its main causes are chest stabbing by knives, sharp object or gunshots, in addition to shell injury (mines, explosion). Conservative management of these cases, by the

thoracostomy and in-hospital observation to manage any complications that may evolve is the main line of treatment<sup>1-3</sup>. Pleural effusion and pneumothoraces have been well described and managed by different authors in the past. Chest tubes are routinely placed in the pleural cavity after thoracic surgery & in cases of haemo- or pneumo-thoraces in chest trauma. Penetrating chest trauma has become common in certain parts of the world due to present situation in tribal areas. The first line of management after resuscitation in these patients is tube thoracostomy

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with analgesia<sup>4</sup>. Tube thoracostomy not only quantify the amount of drainage and the air leak but also characterizes the nature of fluid through the transparent tubing during management<sup>5</sup>. After tube thoracostomy following surgery or chest trauma, there are two schools of thought for their management. One favors application of low pressure suction to the chest tubes arguing that it hastens the evacuation of collection and expansion of lung by creating negative pressure in the pleural cavity leading to shorten the duration of air leak and the time to removal of chest drains. The other argue that applying suction to the chest tubes might aggravate & prolong air leak as well as the time to removal of chest drain and thus can adversely affect the recovery process and increase the hospital stay and costs<sup>6, 7</sup>. Cerfolio et al<sup>8, 9</sup> tested the hypothesis that suction was counter productive in patients with lung resection surgery in terms of duration of air leak and the time to removal of chest tubes. They found that duration of air leak was about half of that in water seal group as compared to suction group. In Marshall et al<sup>10</sup> study it was found that suction was helpful in evacuation of bloody discharge from the pleural cavity. We studied the benefits of low pressure suction in evacuating the blood from pleural cavity. The aim of our study was to know the main causes of penetrating chest injuries in our city and to evaluate whether continuous low pressure suction would help expansion of lung, evacuation of pleural collection and reduce the time to removal of chest drains in patients with penetrating chest trauma.

## MATERIAL AND METHODS

This study was carried out in the department of thoracic and cardiovascular surgery Sulaimani Teaching Hospital, Sulaimanyah city from July 2007 to October 2009. Informed written consent was taken from patients to be placed in this study. 48 patients with penetrating chest trauma, either fire arm injuries or stab

sharp objects or falling on sharp objects who underwent tube thoracostomy were included in the study. Patients with multiple traumas, blunt chest trauma and those intubated for pulmonary or pleural disease and those who underwent thoracotomy were excluded from the study. Detailed general physical and systemic examination, chest radiograph, full blood count were done for all patients. During the study period chest physiotherapy and early mobilization was administered to all the patients. Patients with suction protocol had their chest tubes attached to wall suction unit(SME\_BD 11\_1200) vacuum 0—200 and full, capacity 1200cc,Samsung medical co.ltd. Wall suction run by central oxygen plant of the hospital 24 hrs a day. It was continuously applied to the chest drains and only interrupted at the time of bottle change or patient going to wash rooms (less then 10 minutes at one time). Chest tubes were regularly assessed for drainage and air leak. Lung expansion was assessed clinically by listening to air entry in the morning and evening rounds and radio logically by chest X-rays when indicated. Chest tubes were removed when there was serous discharge of less than 100 ml per day and no air leak as well as clinical and radiological evidence of lung expansion. All the patients were discharged home after the removal of chest drains. Full lung expansion was defined as clinical evidence of bilateral equal air entry and radiological presence of lung markings up to the periphery and acute costophrenic angles on chest X-ray. Chest X-rays with visible lung border short of lateral chest wall and absent lung markings with or without blunted costophrenic angles were defined as pneumothorax or partial lung expansion. No lung expansion was defined as any response of lung to water seal or suction from the beginning. The patients where discharged from the hospital one day after removal of the chest tube, Patients were later followed in the out patients clinic for an average of three months or according to

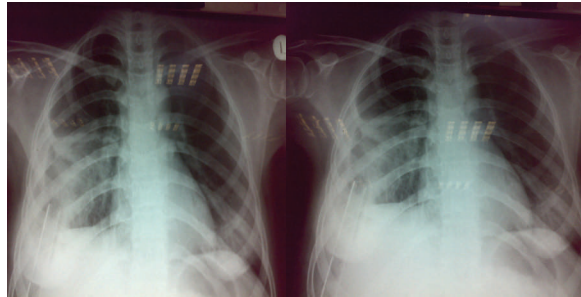


**The wall suction unit used in our study.**

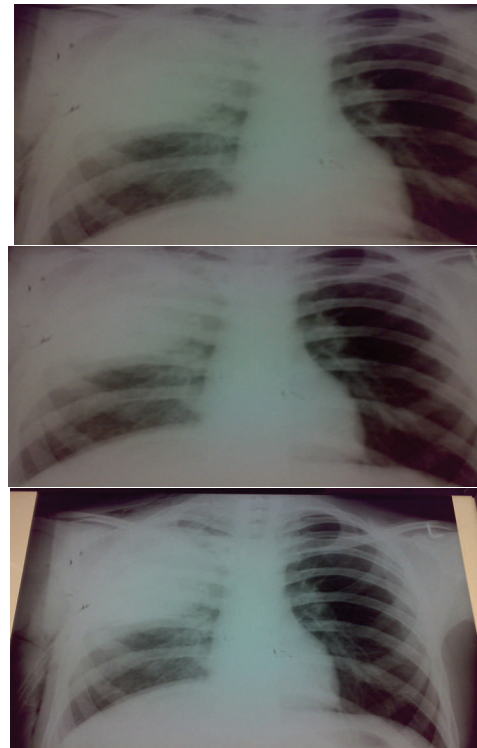
### RESULT:

The study included 48 patients. 40 /48 patients (83.33%) were male and 8/48 (16.66) female. The average age was 27.2 years (range, 16-50). 21/48(43.75%) were injured by stabbing by knife, 19/48(39.6%) were injured by gunshots, 5/48(10.4) by shell (mines, explosion) and 3/48 (6.25%) by sharp objects (RTA, falling). The sites of the wounds were mostly located anteriorly and on the upper half of the chest. The tube drained air mainly in 10 (20.8%) patients and blood mainly in 25 (52%) patients and 13(27%) drained both blood and air and the amount of blood drained was between 500 and 3000ml. This amount was decreasing during the hourly observations till removal of the tube. Full lung expansion was achieved in forty (83%) patients. Partial lung expansion or pneumothorax was present in eight (17%) patients. The mean times to removal of chest drains were  $9.3 \pm 3.4$  (3 to 21) days. The length of hospital stay was  $12.4 \pm 3.63$  days .one patient (2%) developed lung abscess after discharge and managed as out patient and improved completely .one patient (2%) developed subcutaneous collection at site of chest tube and doesn't need admission. One patient (2%) need insertion of another chest tube at second intercostals space mid clavicular line

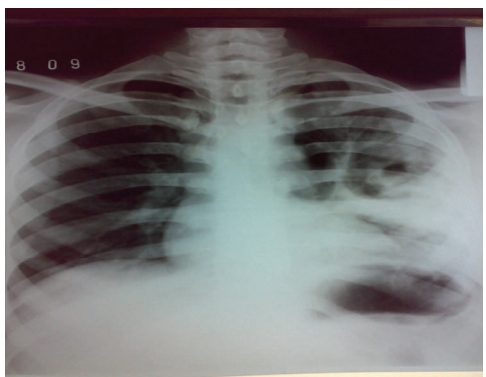
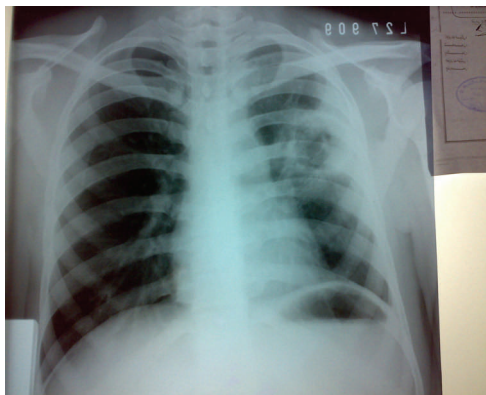
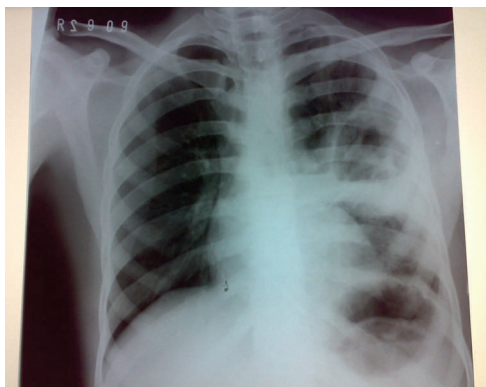
achieve full lung expansion. Regarding the chest wall wounds, they healed well with simple debridement and primary suturing when needed, however the wounds of the gun shot and the fall on the sharp object where left to heal without suturing. The chest tube duration was 3-21 days (mean  $9.3 \pm 3.4$ ). There was no mortality in the study. (Figures A, B, C), (Tables 1, 2, 3 &4)



**Figure A:** this patient had haemo-pneumo thorax



**Figure B:** fully expanded lung with pulmonary hematoma



**Figure C:** patient developed air leak (significant)with collapsed lung after sustaining bullet injury then after discharging from hospital he developed lung abscess .

**Table 1:** Age&Sex distribution of 48 patients with chest injuries.

Age (years)	Sex		Total %
	M	F	
<20	7	2	9(18.7)
20-39	28	4	32(66.7)
40-50	5	2	7(14.7)
Total	40	8	48(100)

**Table 2:** Causes of penetrating chest injuries in 48 patients

Causes	No. %
Stabbing	21(43.75)
Gunshots	19(39.6)
Shell injuries	5(10.4)
Sharp objects (RTA, Falling)	3(6.25)
Total	48(100)

**Table 3:** Complications in 2 patients

Complications	No. %
Lung Abscess	1(2%)
Wound Infection	1(2%)

**Table 4:** Amount of blood drained over 5 days in 48 patients

Amount	No. %
500-999	25(52%)
1000-1999	15(31.3%)
2000-3000	8(16.7%)
Total	48(100)

**DISCUSSION :**

Civilian violence resulting in penetrating chest trauma continues to be a common cause of admission to the hospital for the treatment of its complications and reducing its mortality. Its common causes are stabbing by knife and gunshot injuries. The percentage of these causes varies in different countries according to the accessibility of firearms to the civilian population, being more when it is easy accessible<sup>3</sup>. This study shows that in our region stabbing with knives and gunshots were shown to be the main causes of penetrating chest wounds. This study established that in patients with penetrating chest trauma treated with tube thoracostomy, continuous low pressure suction achieves full lung expansion in significantly large number of patients. The application of suction to the chest tubes also significantly reduced the duration of chest tube removal and thus the hospital stay of the patient. Cerfolio *et al*<sup>8,9</sup> have found suction as counter productive in cases of lung resection surgery stating that applying suction to the chest drains prolonged the duration of air leak and the time to removal of chest drain. The reason might have been the long length of the resection margin and the diseased lung for which surgery had been undertaken. Suction might have aggravated the air leak through the resection margin and thus slowed down the healing process. However Marshall *et al*<sup>10</sup> has found suction to be helpful in evacuating blood from the pleural cavity and apposition of the two surfaces together. Thoracic surgeons generally agree that most patients with especially penetrating chest injuries could be managed adequately by closed thoracostomy tube drainage with applying continuous suction, Inci *et al*<sup>11</sup> reported the percentage to be between 62.1 and 91.4. This goes in favor of our study where suction was helpful in evacuation of blood and expansion of lung. When suction is applied to the chest drain combined with

lung movement's helps to prevent blood from clotting while suction expedites its removal from the pleural cavity<sup>12</sup>. In a study by Marshall *et al*<sup>10</sup> there were more pneumothoraces of significant size in patients placed on water seal. The same findings are also stated by other studies. In a study by Adel *et al*<sup>13</sup> on hundred post thoracoscopy patients, 16% developed pneumothorax in those who were on water seal only and none in patients on suction. These patients had to be put back on suction to treat their pneumothoraces. In our study too, only 17% of patients had pneumothorax or partially expanded lung in those on suction. The chest tube duration and the time to removal of chest drains was significantly shortened in patients on suction which resulted in their short hospital stay. It shows the importance of suction in patients with tube thoracostomy after penetrating chest trauma. It helps early evacuation of blood before it gets clotted, expansion of lung and thus early recovery from the injury.

**CONCLUSION:**

We concluded that penetrating chest trauma is common in our region and the main cause is by stabbing and gunshots. Placing patients with tube thoracostomy after penetrating chest trauma on continuous low pressure suction helps evacuation of blood, expansion of lung and reduce the chances of clotted haemothorax. Thus it definitely helps in reducing the number of thoracotomies performed for clotted haemothorax and

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