# PLEURAL DRAINAGE AND ITS ROLE IN MANAGEMENT OF THE ISOLATED PENETRATING CHEST INJURIES DURING THE WAR TIME IN SARAJEVO, 1992.-1995.

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## Abstract

Penetrating chest injuries are the most frequent causes of serious demage and death in wounded indivisuals. In reports from the last wars where wounds caused by high velocity projectiles predominated, thoracotomies were perfomed in about 15% of the wounded individuals, mostly encompassing injuries of the heart and great vessels, accomanied by massive bleeding that could not be resolved by chest tube insertion.

This retrospective analysis was performed on the medical records of 477 patients tretaed for isolated penetrating chest injuries in Department of Thoracic Surgery Clinical Center of the University in Sarajevo between april 1992 - june 1995. We analised the ways of their menagement with special view on pleural drainage, indication for this method and results of treatment. 398 (83,4%) wounded individuals have been treated with pleural tube inserting as definitive mesaure and for the urgent thoracotomy there were 79 (16,6%) patients left. Average hospital treatment in wounded drained patients was 7,68 days. With shrapnels there were 357 (74,84%) wounded individuals, and with bullet 120 (25,16%) wounded individuals. The complications of plaural tube inserting were - empyema in 34 (7,13%) patients and there were no other complications. Chest tube inserting as definitive mesaure was used in 398 (83,44%) patients. Chest tube inserting as preoperative measure (urgent thoracotomy) was used in 79 (16,56%) patients. There were 460 (96,44%) healed patients. Death occurred in 17 (3,56%) patients.

KEY WORDS: Chest injuries, pleural drainage

## Introduction

Chest injuries represent a very complex patho-physiological and therapeutic problem. Hamilton Bailey in one occasion in 1977 said: "A great number of surgeons feel unfortunate when they have to face the problem of urgent chest condition, they find pathophysiological events in urgent chest condition unclear, physical signs hard and complicated for interpretation, and the chest X-ray in many cases misterious". The main specificity of thoracic injuries is in disturbed intrathoracic pressures and existence of reflected zones on thoracic organs. The basis in managing thoracic injuries is regulating intrathoracic pressures and providing respirations, as well as supressing shock. Treatment or management of isolated chest injuries includes a group of measures for fast removal of patho-physiological disturbances which endanger respirations. The objective of pleural drainage is fast establishment of disturbed endopleural relations, in other words reestablishment of the disturbed negative pressure in pleural cavity. With drainage and making the pressure negative in pleural cavity we can establish:

- Evacuation of fluid collections in pleural cavity
- Evacuation of air collections in pleural cavity
- Re-expansion of the lungs

In successfully placed pleural drainage, in most cases, restitution of pleural and lung function will be achieved. The need for pleural drainage was first recognized in the antic period. Hipocrat was the first to use pleural drainage in treatment of empyema sacatum with metal tube insertion. Playfair introduced the underwater drainage in 1875, and Hewit described closed drainage one year later. However, the greatest merit for the use of pleural drainage we owe to Bülau, for this simple and effective principle of closed pleural drainage with permanent sucction, which is named after him today. He used it for the first time in 1876 for treating empyema sacatum. Apart from the original indication, today, pleural drainage is used for liquidation of fluid and air collections in pleural cavity, and for re-expansion of the lungs. Patho-physiological manifestations in chest injuries are the result of cumulative and mutual actions of different disturbances in respiratory and cardio-circulatory function, which lead to hypoxy, hypovolemy and heart disfunction.
THE OBJECTIVE
The objective is to determine, with this retrospective analysis that was performed on the medical records of 477 patients treated for isolated penetrating chest injuries in Department of Thoracic Surgery Clinical Centre University of Sarajevo between April 1992 - June 1995, the following:

- therapeutic value of pleural drainage
- possible complications after the use of pleural drainage
- solving the complications that followed the pleural drainage
- defining the parameters of the patient's condition before the urgent thoracotomy

## Material and Methods

*Material*

This retrospective analysis was performed on the medical records of 477 patients treated for isolated penetrating chest injuries in Department of Thoracic Surgery Clinical Centre University of Sarajevo between April 1992 - June 1995. All casualties were wounded by the fire arm, sharpnel or projectiles. The patients were from all age groups and both genders. In most cases before performing pleural drainage chest X-ray and laboratory diagnostics were made, which was used along with physical examination as indication for this type of intervention. Casualties with combined injuries which could have significantly influenced the patients condition, were not included in this group. In all patients the following procedures were performed:

- Primary surgical treatment of the wound with sealing the present perforation (aperture)
- Antitetanus prophylaxis
- Antibiotic prophylaxis therapy (Cristal penicillin 2,0 MU, Gentamicin 2×80mg, and Metronidazol 3×500mg)

*Method*

In hemato- and hematopneumothorax pleural drainage was performed in fourth and fifth intercostal space in the medium axillary line, and in pneumothorax the drainage was done in previously mentioned place and also in the second intercostal space. The procedure was performed in local anaesthesia (Xylocain 2%) 10-15 ml. If the re-expansion of the lungs and evacuation of the liquid collections (blood) could not be achieved with one drain, another drain was placed in the second intercostal space in medioclavicular line or in the sixth intercostal space in the back axillary line. Thoracic drains used were 16-32 Ch with the conductor (troacar).

Analyzed data:

From patient's history we analyzed :

- Gender
- Year of birth
- Profession
- Mechanism of getting injured
- The localisation of the chest wall defect and its size

From the temperature lists we analyzed :

- Initial hemorrhage
- Vital parameters
- Record about the activity of the placed drain (especially the number of drains and the duration of the drainage)

From the chest X-rays we analyzed:

- Presence of hemato- or pneumothorax
- Evolution of local septic complications

From the discharge lists we analyzed :

- Duration of the hospitalisation
- Postoperative complications
- Patient's condition during the discharge from the hospital

| Gender | Number of injured individuals | Percentage |
|---|---|---|
| Male | 398 | 83,44 |
| Female | 79 | 16,56 |
| Total | 477 | 100,00 |

TABLE 1. Gender distribution

| Injuries caused by | Number of injured individuals | Percentage |
|---|---|---|
| Sharpnel | 357 | 74,84 |
| Bullet | 120 | 25,16 |
| Total | 477 | 100,00 |

TABLE 2. The cause of injuries

| Localization | Number of injured individuals | Percentage |
|---|---|---|
| Right side | 227 | 47,59 |
| Left side | 217 | 45,49 |
| Bilaterally | 33 | 6,92 |
| Total | 477 | 100,00 |

TABLE 3. Chest injuries localization

| Type of injury | Number of injured individuals | Percentage |
|---|---|---|
| Hematothorax | 35 | 7,34 |
| Pneumothorax | 27 | 5,66 |
| Hematopneumothorax -closed | 345 | 72,33 |
| Hematopneumothorax - open | 70 | 14,68 |
| Total | 477 | 100,00 |

TABLE 4. Type of injury distribution

## Results

The total number of 477 patients were treated for penetrating chest injuries in Department of Thoracic Surgery Clinical Centre University of Sarajevo between April 1992 - June 1995.

## Discussion

A considerable number of penetrating chest injuries, great mortality on the war field, frequent and severe complications, have given these injuries a special place in war surgery. Every patient with penetrating chest injury appear severely injured, and because of that fast evacuation and assesment of general condition are essential. Because the survival depends on the quantity of hemorrhage, extent of the pulmonary tissue damage, a fast decission has to be made about the adequate therapy. Potentially lethal injuries seek fast diagnosis and adequate therapy30. Baring in mind today's war surgery organization, it is possible to provide a part of help on the battle field, while the other part depends on the team's competence and a possibility of transport and prompt evacuation7. Regardless of the sanitation department organization level, a patient with chest injury should receive help in the following order:

| | Number of injured individuals | Percentage |
|---|---|---|
| Definitive drainage | 398 | 89,04 |
| Preoperative drainage (thoracotomy) | 49 | 10,96 |
| Total | 477 | 100,00 |

TABLE 5. Type of the definitive management

| | Number of injured individuals | Percentage |
|---|---|---|
| Definitive drainage | 398 | 83,44 |
| Complications-empyema | 34 | 8,54 |
| Cured with drainage | 395 | 99,25 |
| Died after drainage | 3 | 0,75 |
| Preoperative drainage (thoracotomy) | 79 | 16,56 |
| Cured after thoracotomy | 68 | 86,08 |
| Died after thoracotomy | 11 | 13,92 |

TABLE 6. Type of definitive management and complications

1. Remove tracheo-bronchial obstruction
2. Stop the bleeding and compensate the lost volume while alleviating the pain
3. Close the chest wall apertures
4. Decompress the pleural or pericardial space3

Most surgeons agree that the closed thoracic drainage is the choice of initial treatment in penetrating chest injuries. Chest injuries that occurred after the wounding period show a number of complications which develop as the result of the lung and pleural trauma. They take a very important place in treating chest injuries and can be divided in lung complications and pleural complications. In our material pleural complications (empyema) prevailed. Lung complications were atelectasis and pneumonia. Pneumonia starts on the infection basis which occurs on the pulmonary tissue damages.Atelectasis was noticed in less patients treated with pleural drainage and it can be assumed that its most common cause is hemoaspiration because of the bronchi occlusion caused by blood effusion, although atelectasis can occur also by bronchial compression by liquid or air collections in pleural cavity. Pain caused by the injuries of the chest bone system, favored the evolution of ateletasis because it unabled coughing and caused respiration disturbances. Different authors emphasized that long-lasting atelectasis in some patients results in parenchyma fibrosis which limits the expansion43. The only effective control is the chest X-rays which should be done every day. Although the preventive antibiotic therapy is discussible according to some authors20, the others recommend it, especially when there is difficult evacuation of the lung secrete36. A patient with this complication should be supervised at all times. Patients in this study group were given antibiotics, as the part of war doctrine. With antibiotic therapy all effort should be done to prevent and treat retention of the bronchial secrete, as effective as possible using respiratory gymnastics. Effusions and in most cases empyema were the pleural complications noticed in this study. The best prevention of the infection is:

- Aseptic operation work
- Debridman
- Complete evacuation of the pleural collection
- Re-expansion of the lungs
- Physiotherapy
- Prevention of atelectasis

## Conclusion

Pleural drainage represents the initial choice of treatment in managing the penetrating chest injuries.
With pleural drainage we can achieve:
1. Fast regulation of the disturbed (disrupted) intrathoracic pressures
2. Fast removal of the patho-physiological disturbances in pleural cavity
3. Lung re-expansion
4. Providing respirations
5. Repression of the shock stimulation
6. Fast healing
7. Short hospitalization
8. Fast rehabilitation
9. Prompt return of the injured person on to the war field or working place

Convenient sides of pleural drainage are:
1. Great number of personnel is not needed for performing pleural drainage
2. Pleural drainage can be performed in relatively short time
3. Pleural drainage is economically justified
4. Pleural drainage does not have a significant number of complications

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