Treatment of Penetrating Chest Injuries during the 1992-1995 War in Bosnia and Herzegovina

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Aim. To assess the need for and significance of immediate thoracotomy compared to conservative treatment (thoracostomy and/or thoracocentesis) of penetrating chest injuries.

Methods. Retrospective analysis was performed on medical records of 743 war wounded patients treated for chest injuries in the Department of Surgery, University Hospital Tuzla, between January 1992 and December 1995. Minimally invasive (tissue saving) surgery was the most frequent method applied, which usually included sutures of the lungs after débridment of margins and hemostasis, followed by atypical resection.

Results. Out of 743 patients, there were 414 (55.7%) cases of immediate thoracotomy, whereas 295 (39.7%) who were treated conservatively, including thoracostomy and/or thoracocentesis. Twenty four (3.2%) patients died at admission, and 10 (1.3%) did not require any surgical treatment. The most frequent complications were secondary wound infection (10.8% in the conservative treatment group and 2.5% in the group treated by thoracotomy), pleural effusion (19.3% in the conservatively treated group and 10.8% in the group treated by thoracotomy), and empyema (5.1% in the conservatively treated group and 13.4% in the group treated by thoracotomy).

Conclusion. Our results are similar to those reported for other war situations but surgeries were very often performed on the basis of subjective judgements on the severity of the patient’s clinical condition and necessity for thoracotomy.

Keywords: Bosnia and Herzegovina; chest injuries; hospitals, military; lung injury, acute; mortality; thoracic surgery; thoracotomy; thoracostomy; war

Approximately 15% of the war injuries are related to the chest (1). The basis for successful management of thoracic trauma is effective cardiopulmonary resuscitation followed by an early detection and early treatment of life-threatening injuries (2).

The experience from Vietnam and Cambodia stressed the importance of immediate thoracotomy (3,4). In the 1992 Lebanon conflict, where shrapnel and high velocity missile wounds predominated, 71% of the casualties required thoracotomy (3). In the civilian setting, thoracotomy is necessary in only 27% of the penetrating chest wounds (5). On the other hand, Roostar reported that less than 13% of the wounded in the Afghanistan war required thoracotomy (6). In reports from the 1991-1995 wars in Croatia and Bosnia and Herzegovina, where wounds caused by high velocity projectiles predominated, thoracotomies were performed in about 15% of the wounded, mostly encompassing injuries of the blood vessels, esophagus, and diaphragm, accompanied by massive bleeding that could not be resolved by chest tube insertion (7). Our aim was to estimate the role and significance of immediate thoracotomy compared to conservative treatment (thoracostomy and/or thoracocentesis) of war penetrating chest injuries.

Medical records of all patients with penetrating chest injuries treated at the Tuzla University Hospital, in a period from January 1992 to December 1995, were reviewed. Department of Surgery of the Tuzla University Hospital was the main surgical center for about a million people in the northeastern and central Bosnia. It provided care for the majority of the wounded. The treatment of the wounded was performed in conditions of military blockade, shortage of drinking water and electricity, continuous inflow of a large number of wounded, and a limited number of adequately qualified medical personnel.

Patients and Methods

During the period from January 1992 to December 1995, 3,844 patients were treated in the Department of Surgery of the Tuzla University Hospital; of those, 743 (19.3%) had penetrating chest injuries. The last group was the object of this study.

Six hundred and thirty four (85.3%) were soldiers and 109 (14.7%) civilians; man predominated among them (683; 91.9%). The age of patients varied from 2 to 70 years with an average of 31±10. The patients were divided into two groups: those treated by thoracostomy and/or thoracocentesis and...
those treated by immediate thoracotomy.

In the group of patients treated by thoracostomy and/or thoracocentesis, the following conditions where reviewed: possible initial hemorrhage, quantity of 24 h drainage, drainage duration, development of complications in the course of treatment, general medical care, isolation and culture of microorganisms, and antibiotic therapy. In the group treated by immediate thoracotomy, we also reviewed the most frequent intrathoracic injuries, type of the operative procedures performed, and postoperative complications.

In both groups, primary surgical treatment of the chest wall wounds was done with a closure of the defect, and antitetanus and antibiotic prophylaxis was administered (intravenous triple antibiotic therapy: crystal penicillin 2.0 M units six-time daily, gentamycin 80 mg and metronidazole 500 mg, three time daily each).

Statistical analysis was performed using the inverse proportions test.

Results

Four hundred and fourteen wounded persons (55.7%) were treated surgically by thoracotomy and 295 (39.7%) conservatively, by thoracostomy and/or thoracocentesis. Ten of the wounded (1.3%) needed only clinical observation for marginal closed pneumothorax (4 cases) or minimal hematopneumothorax (6 cases). Twenty four wounded persons (3.2%) died during admission or in the surgery theater without any surgical procedure.

One hundred patients (24.2%) in the group treated by thoracotomy and 18 (6.1%) in the group treated by thoracostomy and/or thoracocentesis were in shock on admission.

More than half of the patients (58.0%) had associated injuries, mostly of the abdomen (216 or 50.1%), followed by the extremities (142 or 32.9%) and head and neck (73 or 16.9%). The most frequently injured abdominal organs were liver, spleen, and stomach (Table 1).

Ribs and scapulae were the most frequently injured chest wall structures in both groups (Table 2).

Lesion of the vessels were found only in the group treated by thoracotomy (Table 2). In that group, the most often injured intrathoracic organs were lungs, heart, and great vessels (Table 3).

Diaphragmatic injuries were also frequent (Table 3).

Table 1: Injured abdominal organs associated with penetrating war chest injuries

Table 2: Injured structures of thoracic wall in patients with penetrating chest injuries who were subsequently treated by thoracotomy or conservatively

Table 3: Distribution of 662 injuries of chest organs in patients treated by thoracotomy

Preoperative thoracic drainage rate in the thoracotomy group ranged from 50 mL to 1500 mL (average 372 mL) at the first hour, and from 50 mL to 2200 mL (average 839 mL) at 24 h. The average duration of drainage was 7.7 days.

Thoracic drainage rate in the group treated by thoracostomy and/or thoracocentesis ranged from 50 mL to 1500 mL (average 267 mL) at first hour, and from 50 mL to 2200 mL (average 564 mL) at 24 h. The average duration of drainage was 6.7 days. The average amount of fluid obtained by means of thoracocentesis was 693±18 mL.

Thoracotomy only was performed in 308 (82.8%) of the wounded and thoracophrenolaparatomy in 61 (16.4%). The longitudinal sternotomy was performed in 3 cases (0.8%).

In operative treatment, conservative procedures dominated: suture of lungs after débridment of the wound margins and hemostasis and atypical resection (Table 4). The most frequent localization of the injury in the lungs was the right lower lobe (27.5%), followed by the left lower lobe (24.9%), right upper lobe (18.4%), left upper lobe (17.0%) and right middle lobe (12.1%).

The most frequent complications included infection at the wound entrance (Table 5); it was more frequent in the operatively treated group, but the difference was not significant (p>0.05). The most frequent causes of infections were Pseudomonas aeruginosa (27.0%), Proteus mirabilis (16.2%), Klebsiella spp. (10.8%), and Streptococcus faecalis (8.1%).

Pleural effusions were more frequent in patients treated conservatively but the difference was not significant (Table 5). Empyema was more frequent in the operatively treated group but also without statistical significance (Table 5). Total mortality rate in the group treated by thoracotomy was 26.1% (Table 6). The most frequent cause of mortality was bleeding. There were two deaths in the group treated by thoracostomy and/or thoraco- centesis. Both patients died in the Intensive Care Unit due to thoracic hemorrhage. Their thoracic injuries were treated by drainage but, obviously, they should have been operated on (thoracotomy).

Table 4: Surgical procedures applied in 414 patients with chest organs injuries
In 10.8% of the conservatively treated patients and in 2.5% of the operatively treated cases, Gram-negative infection of the wound entrance was observed. Less frequent wound infection in the surgically treated group can be explained with a better débridement of the wound entrance. Infections of all types of operative wounds amounted to 17.0% of all the cases. Other complications included pleural effusion found in 19.3% of the cases in the group treated conservatively and 10.8% in the group treated by thoracotomy.

Discussion
A patient with thoracic injury must be regarded as a very serious case (3). Crucial parts in providing care are immediate evacuation and prompt estimation of the general status. Since the survival depends on the amount of hemorrhage, and the extent of lung and heart damage, it is important to make timely and proper decision on the adequate therapeutic measures. According to experiences reported from the Vietnam, Cambodia, and Lebanon, the most frequent approach in the treatment of penetrating chest injuries is immediate thoracotomy (3,4,8).

However, the reports regarding recent wars in Croatia and Bosnia and Herzegovina are different. Croatian reports revealed that thoracotomy was performed in about 15% of the patients with penetrating chest wall injuries (7). In the besieged Sarajevo during 1992, thoracotomy was performed in 10.9% of the wounded with isolated chest injuries and in 17.1% of the patients with combined chest injuries (9).

Indications for immediate thoracotomy have been determined (3,10,11) and they include wounds in the proximity of the heart and great vessels, evident cardiac tamponade, hemodynamic instability and weak response on resuscitation, evident esophageal injury, injuries of trachea, major bronchi and diaphragm, massive air leak, and radiological signs of blood retention in spite of drainage. The amount of initial hemorrhage, amount, and duration of prolonged hemorrhage through a chest tube (3,10,11) are equivocal indications. Contraindications for thoracotomy in patients with the chest injuries are: removal of foreign bodies, minimal hemothorax, pulmonary hematomas, pulmonary parenchymal laceration, blast injuries of lungs, and heart contusion (11).

Indications for thoracotomy should be seriously considered, which means that the majority of pulmonary parenchymal lacerations in our cases could have been managed conservatively. In most of the cases, a state of shock, defects of chest wall, transmediastinal wounds, and cardiac tamponade were indications for an immediate thoracotomy. However, surgeries were very often performed on the basis of subjective judgements on the severity of the patient’s clinical condition and necessity of thoracotomy. For example, preoperative thoracic drainage rate in the patient group treated by thoracotomy ranged from 50 mL to 1500 mL at the first hour, and from 50 mL to 2200 mL at 24 h, indicating that initial and prolonged hemorrhage was not the crucial criterion for operation for our surgeons. This accounts for a relatively higher percentage of thoracotomies. Actually, state of shock and initial and prolonged hemorrhage must be observed and estimated at the same time.

The thoracoabdominal injuries encompassed less than one third of all the injured. The most frequently injured organs were that of the upper abdomen and lower lobes of the lungs, resulting probably for a common projectile.

The mortality rate of 14.8% was similar to those reported in the respective literature, where mortality ranges from 3% to 15% (1,10). In our experience, the major causes of higher mortality of our patients treated by thoracotomy (26.1%) were long evacuation time (2 hours on average), inadequate first aid, and extensiveness of the injuries. The surgeries performed in some patients were actually last desperate efforts to help dying patients.

It is necessary to point out some specificities of the war in Bosnia and Herzegovina the account for high percentages of thoracotomies: continuous inflow of the great number of wounded and frequent disregard of specific indications for immediate thoracotomy; also, surgical approach was frequently practiced in situations where it was not necessary. We think that a significantly higher number of patients can be treated by the conservative method alone, including thoracostomy with closure of the chest wall openings. This decreases the number of immediate thoracotomies, that should be used according to more precise indications.

Acknowledgement
We kindly appreciate Dr Hamza Mujagiæ’s continuous support and advice during the preparation of this manuscript.

References

Received: February 2, 1998
Accepted: September 24, 1998

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