

# Profile of thoracic trauma victims submitted to chest drainage

## *Perfil dos pacientes vítimas de trauma torácico submetidos à drenagem de tórax*

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### ABSTRACT

**Objective:** to describe and compare the variables involved in trauma victims undergoing thoracic drainage. **Methods:** we conducted a retrospective, analytical, descriptive, cross-sectional study, with medical records of patients attended at the Trauma Service of the Curitiba Evangelical University Hospital between February 2011 and January 2014. **Results:** there were 488 patients undergoing chest drainage, 84.7% men and 15.3% women, with an average age of 38.2 years. Attendances usually occurred at night, without predominance between open or closed mechanism, gender or age group. The majority of patients with thoracic trauma requiring drainage were diagnosed by anamnesis and physical examination (41.1%) and drained in the emergency room (80.8%). Most of the patients (66.2%) had another associated lesion, mostly some abdominal viscera. Complications were present in 16.6% (81 patients), most of them due to drainage positioning error (9.2%). The mean hospital stay was 15 days and drainage lasted for an average of 8.1 days, with no statistical difference between open and closed trauma. The clinical outcome was discharge in most cases. **Conclusion:** the profile of patients with thoracic trauma is that of young men, attended at night, with some other associated lesion. Although diagnosis and treatment were rapid and most often without the need for complex examinations, the time of drainage, hospitalization and complications were higher than in the literature, which can be explained by the drainage being made at the Emergency Room and the presence of associated injuries.

**Keywords:** Thoracic Injuries. Drainage. Wounds and Injuries.

### INTRODUCTION

Trauma in general has been increasing in recent years and is the third leading cause of death, and the first in individuals under 40 years<sup>1</sup>.

Chest trauma is an important cause of preventable death, especially in young men between the ages of 20 and 30. The injuries are due to auto accidents (particularly motorcycle ones) and intentional injuries, stabbing and gunshot wounds, with variable frequency according to the region studied<sup>2-4</sup>.

Most thoracic lesions are represented by pneumothorax, hemothorax or hemopneumothorax, and can be resolved with simple procedures performed in the emergency room, such as chest drainage. Few cases (10% to 30%) require thoracotomy<sup>5-8</sup>.

The present study aims to know the profile of the victims of thoracic trauma who underwent chest drainage at the Curitiba Evangelical University Hospital (HUEC), as well as the complications and treatments given to these patients.

### METHODS

We conducted a retrospective, analytical, cross-sectional study through the analysis of medical records of patients suffering from thoracic trauma submitted to pleural drainage attended at the emergency department and admitted to the General Surgery group ward of the Curitiba Evangelical University Hospital (HUEC) between February 2011 and January 2014.

We included in the study patients of both genders, all ages, submitted to closed drainage in water seal, with or without multiple organ traumatism, with blunt or penetrating thoracic trauma. We excluded the victims of thoracic trauma who died before the surgeon's conduct or who had conservative treatment.

We analyzed the following variables: trauma mechanism, age, gender, associated lesions, approach, clinical outcome (hospital discharge or death), hospitalization time, use of antibiotics and admission diagnosis method. Associated lesions were stratified by body segment and by involvement of parenchymal or hollow organs.

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We present the quantitative variables by means, medians, minimums, maximums and standard deviations, and qualitative ones by frequencies and percentages. We used the Student's t test for independent samples for quantitative variables when comparing the patients' groups defined by the type of trauma, open or closed. For the evaluation of the association between the type of trauma with qualitative variables, we applied the Fisher's exact test or the Chi-square test. Values of  $p < 0.05$  indicated statistical significance. We analyzed the data using the IBM SPSS Statistics v.20 software.

The project was approved by the Ethics in Research Committee, CAAE 49521615000000103, on 09/24/2015.

## RESULTS

The study included 488 patients, 409 (84.7%) being men and 74 (15.3%) women, with a mean age of 38.2 years. There was no predominance of open ( $n=258$ ; 52.9%) or closed ( $n=230$ ; 47.1%) trauma. In men, open trauma was more common ( $n=221$ ; 86.3%) than closed one ( $n=188$ , 82.8%) and in women closed trauma ( $n=39$ ; 17.2%) was more prevalent ( $n=35$ ; 13.7%), with no statistical difference between groups. We found no relationship between the type of trauma and the patient's age (Table 1). Most of the visits occurred in the early morning ( $n=164$ , 33.6%) and at night ( $n=146$ , 29.3%). In the open trauma group, most of the occurrences took place during the early morning ( $n=91$ , 36.3%) followed by the night ( $n=66$ , 22.6%), morning ( $n=57$ , 22.1%), and afternoon ( $n=44$ , 17.05%). In the victims of closed

trauma the attendances occurred predominantly at night ( $n=77$ , 33.5%) followed by the early morning ( $n=73$ , 31.7%), afternoon ( $n=42$ , 18.3%) and morning ( $n=38$ , 16.5%), with no statistical difference.

In the majority of cases, thoracic injury was diagnosed through history and physical examination ( $n=200$ , 41.1%) and simple chest radiography ( $n=155$ , 31.8%), followed by computed tomography (CT) ( $n=129$ , 26.5%). Among the open traumas, anamnesis and physical examination were mostly sufficient for the diagnosis ( $n=146$ , 56.8%), followed by the use of radiography ( $n=76$ , 29.6%) and CT ( $n=33$ , 12.8%). Among the closed traumas, there was a greater need for complementary tests for diagnosis, CT being the main diagnostic medium ( $n=94$ , 40.9%), followed by radiography ( $n=79$ , 34.3%) and anamnesis and examination ( $n=54$ ; 23.5%), with statistical difference between the groups ( $p < 0.001$ ).

The majority of cases were drained at the Emergency Room ( $n=391$ , 80.8%), the remainder being divided into drains inserted at the Operating Room ( $n=44$ , 9.1%), ICU ( $n=28$ ; 5.8%) and infirmary ( $n=21$ ; 4.3%), with unilateral drainage in 394 cases (81.7%). The main site of drainage was the Emergency Room for both open ( $n=198$ ; 77.3%) and closed ( $n=193$ , 84.65%) traumas. In the open traumas the second position was occupied by drainages in Operating Room ( $n=31$ , 12.1%) followed by infirmary ( $n=14$ , 5.5%) and ICU ( $n=13$ , 5.1%). In closed traumas the second position was occupied by the ICU ( $n=15$ , 6.6%) followed by the Operating Room ( $n=13$ , 5.7%) and infirmary ( $n=7$ , 3.1%), with statistical difference between the groups ( $p=0.04$ ). Unilateral drainage was more common in open traumas ( $n=214$ ,

**Table 1.** Comparison between type of trauma and age, hospital stay and drainage time.

Variable	Type of Trauma	N	Average	Standard Deviation	Maximum	Minimum	p value
Age (years)	Open	255	34.7	14.4	85	9	<0.001
	Closed	256	42.1	16.4	89	13	
Hospital stay (days)	Open	258	13.8	15	90	2	0.142
	Closed	230	16.3	21.8	215	1	
Drainage time (days)	Open	252	7.8	6.3	35	1	0.233
	Closed	224	8.4	6	36	1	

**Table 2.** Associated injuries

Associated Injuries	N	%
Thorax	102	20.9
Limbs	75	15.4
Traumatic Brain Injury	60	12.3
Liver	52	10.6
Hollow viscera	40	8.2
Spleen	36	7.4
Spinal Cord	19	3.4
Kidney	8	1.6
Pancreas	3	0.6
Other	3	0.6

83.6%) than in closed ones (n=180, 79.6%) and bilateral drainage was more common in closed traumas (n=46, 20, 4%) in relation to the open ones (n=42; 16,4%), with no statistical difference between the groups.

The majority of cases were pneumothorax (n=199, 40.8%) followed by hemopneumothorax (n=189, 38.7%) and hemothorax (n=94, 19.3%). In the open trauma group, the most frequent lesion was hemopneumothorax (n=118, 45.7%) followed by pneumothorax (n=82, 31.8%) and hemothorax (n=58, 22.5%). In the closed trauma group, the most frequent lesion was pneumothorax (n=117, 50.9%) followed by hemopneumothorax (n=71, 30.9%) and hemothorax (n=36, 15.65%), with statistical difference between groups (p<0.01).

Patients were also stratified for presence of abdominal hollow viscus injuries associated with chest trauma, which were more prevalent in the open trauma group (n=40; 15.6%) than in the closed group (n=4; 1.7%) with statistical difference (p<0.001). Most patients had at least one associated lesion (n=323, 66.2%), represented mostly by other abdominal injuries. The stratification of the associated lesions can be observed in table 2.

The mean hospital stay was 15 days (±18.5) and the drainage time was 8.1 days (±6.1), with no statistical difference when the open and closed groups were compared (Table 1). Complications were present in

81 patients (16.6%), being more common in the open group (n=43, 16.7%) than in the closed group (n=38, 16.5%), with no statistical difference. Complications can be observed in table 3.

The majority of patients had a good evolution and were discharged (n=401, 82.2%), without statistical difference between open (n=214, 82.9%) and closed (n=187, 81.3%) trauma. In all, 87 patients died (17.8%), with no statistical difference between the open (n=44, 17.1%) and closed (n=43, 18.7%) trauma groups. Victims of closed trauma required more ICU admission (n=98; 42.6%) than those with open trauma (n=79; 30.7%), with statistical difference (p<0.01).

## DISCUSSION

Chest trauma is an important cause of morbidity and mortality, which affects the economically active population and results in losses of productive days and damage to the economy and the public health system. It is also a major cause of preventable deaths. It involves young people, mainly men, and its incidence varies according to the region studied and the mechanism of trauma, the penetrating ones in individuals slightly younger (average of 34.7 years) than those victims of closed traumas (average of 38.2 years)<sup>4</sup>.

The causes are represented mainly by automobile accidents and intentional penetrating injuries. The predominance of the mechanism varies according to the region studied, with intentional penetrating trauma (stabbing and firearms) being a common cause in some Brazilian capitals (Goiânia, Manaus, São Luiz, Curitiba), while in developed countries the closed trauma represents

**Table 3.** Complications.

Complication	Frequency	Percentage
Positioning error	45	56.2
Infection	27	33.8
Fistula	5	6.3
Retained Clot	2	2.5
Persistent Bleeding	1	1.3
Total	80	100

the main cause<sup>4,9</sup>. We expected a greater incidence of open traumas (of violent origin) in the night and early morning, but we observed no statistical difference between open and closed traumas as a function of the moment of the trauma.

Closed trauma occurs mainly due to traffic accidents, especially motorbikes, followed by run-overs. The fall comes soon after, being an important cause in elders.

Larger thoracic injuries that affect ventilatory mechanics and that need to be recognized and managed immediately during the primary examination include hypertensive pneumothorax, open pneumothorax, flail chest and pulmonary contusion, and massive hemothorax<sup>5</sup>. The data showed that pneumothorax was the most frequent lesion in our service. Hemopneumothorax was the most frequent finding in open thoracic trauma, whereas pneumothorax was the most frequent in the closed one. These results differ from studies such as that of Souza<sup>4</sup>, which showed the predominance of hemothorax as an injury in victims of traffic accidents with blunt thoracic trauma.

As stated earlier, most chest traumas are preventable causes of death. With simple, standardized and relatively inexpensive methods, it is possible to diagnose and often treat them in the Emergency Room<sup>5,10</sup>. The anamnesis and physical examination were sufficient for the diagnosis and consequent drainage in 41.1% of the cases. In the open traumas treated at the HUEC, anamnesis and physical examination were sufficient for diagnosis in 56.6% of the cases. However, when the closed lesions were analyzed, they were only diagnosed in 23.5%. It is a low index, which can be explained by primary care being performed by training general surgery residents and by the occurrence of minor injuries that went unnoticed in primary care and were identified in imaging tests in the secondary evaluation.

In cases where the diagnosis is doubtful, and in which the patient's clinical conditions allow to perform complementary examinations, these are indicated in the secondary examination, the chest radiography being the first choice. In many cases, it is sufficient for diagnosis, indication of treatment and follow-up<sup>5,11</sup>. This was the

second most used diagnostic method in the present study (31.8% of cases). In the case of closed traumas, chest CT was the most requested exam, being used for diagnosis in 40.87% of cases of closed traumatizations. One explanation for this is that tomography allows the early diagnosis of other associated thoracic and abdominal lesions, which could go unnoticed at first. They are present in an expressive number of patients with thoracic traumatism. CT is also more sensitive for thoracic lesions than plain radiography<sup>12,13</sup> as well as a more accurate diagnostic method when complications are suspected<sup>11</sup>.

Associated lesions are present in a significant number of thoracic traumas. In the literature, they are around 36%<sup>13</sup>, and in our study, 66.2% of the patients had some other lesion. Most were in extremities, cranioencephalic and abdominal. This higher incidence can be justified by the large number of polytrauma patients admitted to the service.

The mean drainage time was eight days and the hospitalization time was 15 days. A similar study performed in Curitiba shows a drainage time of approximately seven days and hospitalization of ten<sup>14</sup>. Other works show an average of three to five days of hospitalization and five of drainage, with no difference in relation to open and closed traumas<sup>4,11,14,15</sup>. The longer hospitalization time can be explained by the existence of associated injuries, as well as the presence of drainage complications, which can also increase drainage time.

Chest drainage is a simple procedure but with a considerable number of complications<sup>6</sup>, varying from drainage position error and subcutaneous insertion to late complications such as empyema<sup>2,6</sup>. The place the drainages are performed is believed to be associated with the high complication rate; most of them happen in the Emergency Room, lacking aseptic conditions, which can lead to a higher incidence of infection. Some studies show that drains inserted in the Emergency Room are more likely to require drainage repositioning and, therefore, the chances of infection increase. Some authors claim that drainage by residents has a greater chance of technical failures, with a higher rate of complications<sup>6,16,17</sup>.

Infections (33.8%) and positioning errors (52.5%) were the main complications found, which can

be reduced with drainage in a Operating Room, since in 80.8% of cases drainage was performed in the Emergency Room, where the antiseptic conditions are not ideal. Similar complication rates were found by other authors, with indices around 30%, with those of infectious origin being the most common<sup>14</sup>. A factor that contributes to the increase of complications is the presence of retained hemothorax, especially when it results from open wounds caused by stabbing injuries in patients over 39 years of age and with drained volume between 300 and 599 ml<sup>11</sup>. An explanation for this is that wounds by the knives can carry germs into the thoracic cavity and the blood retained serves as a culture medium for infections<sup>18</sup>.

The mortality rate of 17.8% was slightly higher than those found in two emergency hospitals in São Paulo (8.3% and 9.9%) and one in Goiânia (11%)<sup>18,19</sup>. The international mortality rates are similar to the latter, not exceeding 10%<sup>13,20,21</sup>. Other studies performed in Curitiba, however, show a mortality rate similar to ours, of 17.3%<sup>14</sup>. The mortality discrepancy may be due to the

profile of the patients treated in these hospitals, which receive more severe polytrauma patients, with mortality from other non-thoracic injuries. Likewise, the need for ICU admission was also high in a study carried out in Curitiba, reaching 27.5% of the visits<sup>14</sup> but still lower than ours, which reached 36.3%, higher in the victims of closed trauma. Comparing the types of trauma, there was no significant difference in the risk of death.

We conclude that victims of thoracic injury submitted to pleural drainage obey the trauma profile of the Brazilian population, being represented by a young male subject, victim of both closed and open trauma. Events usually occur at night, and the diagnosis is made by clinical examination, the drainage being performed at the emergency room. Victims usually have some associated injury, most commonly of abdominal viscera. There was no difference between the victims of open and closed trauma in relation to hospital stay, drainage time or complications, although victims of blunt trauma had a greater need for ICU admission.

## R E S U M O

**Objetivo:** descrever e comparar as variáveis envolvidas nos pacientes vítimas de trauma torácico submetidos à drenagem de tórax. **Métodos:** estudo transversal descritivo analítico retrospectivo realizado com prontuários de pacientes atendidos no Serviço de Trauma do Hospital Universitário Evangélico de Curitiba entre fevereiro de 2011 e janeiro de 2014. **Resultados:** neste período foram atendidos 488 pacientes, 84,7% homens e 15,3% mulheres, com média de idade de 38,2 anos. Os atendimentos geralmente ocorreram à noite sem predomínio entre mecanismo aberto ou fechado e/ou em relação ao sexo ou idade. A maioria dos pacientes com trauma torácico que necessitaram de drenagem teve diagnóstico feito por anamnese e exame físico (41,1%) e foram drenados no pronto socorro (80,8%). Grande parte dos pacientes (66,2%) teve outra lesão associada, na maioria alguma víscera abdominal. Complicações estiveram presentes em 16,6% (81 pacientes), a maior parte por erro de posicionamento do dreno (9,2%). O tempo médio de internamento foi 15 dias e de drenagem, 8,1 dias, sem diferença estatística entre trauma aberto e fechado. O desfecho clínico envolveu alta na maioria dos casos. **Conclusão:** o perfil dos pacientes com trauma torácico é o de homens jovens, atendidos durante a noite, com alguma outra lesão associada. Apesar do diagnóstico e do tratamento serem feitos de modo rápido e, na maior parte das vezes, sem a necessidade de exames complexos, o tempo de drenagem, internamento e complicações foram mais alto do que na literatura, o que pode ser explicado pela drenagem no próprio pronto-socorro e pela presença de outras lesões associadas.

**Descritores:** Ferimentos e Lesões. Traumatismos Torácicos. Drenagem.

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Received in: 17/10/2016

Accepted for publication: 03/11/2016

Conflict of interest: none.

Source of funding: none.

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