THORACIC TRAUMA EPIDEMIOLOGICAL, CLINICAL, RADIOLOGICAL AND EVOLUTIONARY ASPECTS ABOUT 84 CASES

DAH MOHAMED BILAL, MARWA MOHAMED LEMINE SEIV, MOHAMED MOHAMED VALL, YAHYA TFEIL

ABSTRACT

Introduction: *Thoracic trauma is common and remains a health problem.*
Objectives: *to analyse the epidemiological, clinical, radiological and evolutionary aspects of thoracic trauma in the intensive care unit of the National hospital centre in Nouakchott.*
Patients and methods*: this is a retrospective, single-centre, descriptive study with analytical aims covering 84 cases of thoracic trauma over a period of 2 years between September 2015 and August 2017.*
Results: *There were 49 cases of closed thoracic trauma and 35 cases of open thoracic trauma. The average age of the patients was 34.83±17.16 years (5.5 to 86 years) with a male predominance of 94%. Stroke was the leading cause (45.23%). The clinical picture on admission was dominated by respiratory distress (64 cases).*
Systematic chest X-rays and CT scans (61 cases) revealed: rib fractures in 35 cases, rib flaps in 5 cases, pneumothorax in 20 cases, haemothorax in 15 cases, haemopneumothorax in 52 cases and pulmonary contusion in 28 cases. CT was able to demonstrate its superiority by identifying lesions that had gone unnoticed on standard radiography.
All patients had received general analgesia (84 cases). Thoracic drainage was performed in 79 cases. Emergency surgery was used in 3 patients.
The outcome was favourable in 78 cases, apart from 1 case of pneumonia and 1 case of atelectasis. Four patients died, 3 of them had associated severe head injuries.
Conclusion: *Thoracic trauma is common, and remains serious in the context of polytrauma. Close collaboration between the intensive care unit, the surgeon and radiologist is necessary for rapid and effective patient management.*

KEYWORDS: *thorax, trauma, computed tomography, treatment*

INTRODUCTION

Thoracic trauma is common and remains a major health problem [48]; it is one of the main factors in morbidity and mortality in the first four decades of life, accounting for almost 25% of mortality [39]. Thoracic injury is observed in 33% of trauma victims from all causes, and 50% of deaths following a road traffic accident are related to thoracic trauma [27]. In Europe, MVAs are the main cause of thoracic trauma, accounting for 9,000 deaths per year in France [27]. A study carried out in Rhône by a team from INRETS [4] on road accident victims showed that the most serious injuries concern the head and thorax. In Morocco and Mali [6,16], TT account for around 1% of admissions to emergency departments. In almost 85% of cases, the therapeutic strategy for TT is based on good pain control or simple chest drainage [18]. In Mauritania, there is no data yet on thoracic trauma. According to this background we conducted this study, the aim of which was to analyse the epidemiological, clinical, radiological and evolutionary aspects of thoracic trauma.

MATERIALS AND METHODS

This is a monocentric descriptive retrospective study with an analytical aim over a period of 2 years (from September 2015 to August 2017), conducted in the intensive care unit of the Nouakchott National Hospital Centre.

It receives patients referred from various departments of the other health facilities in the capital and from the interior of the country. All patients with thoracic trauma hospitalised in the intensive care unit were included.

The files were processed on the basis of a survey form. Incomplete records were not included. The demographic and medical parameters, the characteristics of the thoracic trauma (circumstances, mechanism, type), the place of the accident, the time taken to take charge, the means of transport used, the length of hospitalisation, the methods of therapeutic management and evolution.

Data were entered and analysed using IBM SPSS (20.0) statistical software.

RESULTATS

From September 2015 to August 2017, we recorded 109 cases of thoracic trauma out of a total of 876 patients admitted to the intensive care unit of the CHN, which corresponds to a frequency of 12.44%.Twenty-five patients were not included in our study, reducing the number of our patients to 84. The average age of our patients was 34.83 ± 17.6 years, ranging from 5 to 86 years.

There was a clear male predominance, with 79 men (94%) and 05 women (6%), giving a sex ratio of 15.8 M/F. Table I is a crosstabulation table that allows us to study the existence of a relationship between the age groups and the circumstances in which the thoracic trauma occurred, using the Chi2 statistical test.

In our study, 38 cases of thoracic trauma (45.23%) were caused by road traffic accidents, followed by assaults in 33 cases (39.28%), falls in 10.76% and work-related accidents.

The type of MVA victim was not specified in 39.47% of cases. However, when it was specified, pedestrians were the group most affected.

Knives were the most common weapon used in assaults.

Closed chest trauma was the most frequent type of trauma in our series. Table III is a crosstabulation table which allows us to study the relationship between the circumstances in which the thoracic trauma occurred and whether it was open or closed, using the chi2 statistical test.

MVAs were the main cause of closed chest injuries, while penetrating chest injuries were caused by VBCs. The Chi2 test was highly significant with a pv=0.00 with a V of cramer of 91.6% (Cf. appendix SPSS 2).

The delay in ECP was not specified for 21 patients. When it was specified, the frequency of patients treated within the first 24 hours of the accident was 92.06% (58 cases), and those treated after 24 hours was 6.34% (4 cases), with extremes ranging from 30 minutes to 2 days.

All patients were initially transported to a care facility by non-medical means.

Clinical respiratory symptoms were dominated by chest pain, found in 95.23% of patients (80 cases), followed by dyspnoea in 76.2% (64 cases), see table IV.

Haemodynamic status was stable in 90.47% of patients (76 cases) on admission to intensive care.

79 patients (94.04%) were clearly conscious on admission to intensive care. We noted 3 cases of paraplegia.

Chest X-rays were taken systematically in all patients. The various lesions observed on the X-ray are shown in Table V.

Chest CT scans were performed in 61 patients (72.61%). Its results were not found in 7 patients. The various lesions found are listed in Table VI.

Pulmonary ultrasound was not used in any of our patients.

No patient underwent cardiac ultrasound.

ECGs were performed in 4 patients. No electrical abnormalities were detected.

None of the patients included had a troponin assay.

Arterial gasometry was not performed.

In our series, extra-thoracic lesions were present in 37 patients, i.e. 44.04% of cases. These various lesions are shown in Table VII.

Therapeutic management began at the receiving health facility (CHN emergency department, regional hospital, health centre, etc.) and then continued at the CHN intensive care unit.

73 patients (86.9%) received oxygen therapy via nasal cannula or face mask. Chest drainage was performed in 79 patients (94.04%). No patient was intubated.

Crystalloid or colloid filling was initiated in all patients with haemodynamic instability (8 cases). Red blood cells were transfused in 12 patients (14.28%); the amount transfused ranged from 1 to 4 red blood cells, with an average of 1.83 units per patient transfused. Vasopressor amines were used in only one patient (1.19%).

Systemic analgesia was introduced in all patients. A combination of tier 1 and tier 2 analgesics was used most frequently.

All patients received systemic antibiotic therapy.

The combination of amoxicillin and clavilanic acid was used most frequently.

Emergency surgical treatment was indicated in 3 patients with diaphragmatic rupture.

Adjuvant treatments

- Satisfactory rehydration.

- Tetanus vaccination in case of penetrating chest trauma or other associated wounds.

- Prevention of thromboembolic disease with LMWH.

- Prevention of stress gastritis and its complications with H2 blockers and/or PPIs.

- Enteral feeding via gastric tube in comatose patients.

- Nursing care

All our patients are systematically monitored as soon as they are admitted to the intensive care unit. This includes monitoring of

- Respiratory: Dyspnoea, respiratory rate, SPO2 and chest tube.

- Hemodynamic: blood pressure, pulse and diuresis.

- Neurological: Glasgow score and neurological examination.

- Biological: tests requested depending on the clinical context (blood count, urea, creatinine, blood ionogram, etc.).

- Radiological: A follow-up chest X-ray was carried out systematically in all drained patients.

The average length of hospital stay for patients was 4.92 days, with extremes of

1 and 17 days. A stay of 3-6 days was observed in 36 cases (42.9%).

A favourable outcome was observed in 78 patients (92.85%). We noted 1 case of pneumonia and 1 case of atelectasis.

Four patients died, corresponding to a mortality rate of 4.76%. All deaths occurred in the context of polytrauma caused by MVAs. Three of the patients who died had associated severe head injuries.

After their stay in intensive care, 70.24% of patients (59 cases) were transferred home and 29.76% (21 cases) were referred to other services.

TABLEAUX

Table I: Distribution of age groups according to the circumstances in which the trauma occurred

		Circumstances of occurrence				
		AVP.	Agression.	Chute.	AT.	Total
Age group	5-14	2	00.	01.	00	03
	15-24	5	20.	04.	01.	30
	25-34	6	09.	00.	01	16
	35-44	10.	02.	00.	00	12
	45-54	6.	00.	02.	02	10
	55-64	7.	01.	00.	00	08
	65-74	1.	01.	00.	00	02
	75-84	1.	00.	01.	00	02
	85-94	0.	00.	01.	00	01
Total		38.	33.	09.	04	84

Table II: Mechanism of thoracic trauma

		Effectif	Percentage %
Type of victim (n= 23)	Passager Conducteur moto Pieton	9 2 12	39,13 8,7 52,17
Type of agression (n=33))	Arme blanche Cornes d'animaux	32 1	97 3
Type of fall (9)	Hauteur≥3m Escaliers	6 3	66,66 33,33
Nature of the accident (4)	Ecrasement par camion Manipulation moteur Machine éléctrique	2 1 1	50 25 25

Table III: Distribution of types of open or closed trauma according to the circumstances in which the accident occurred

Circumstances of the accident					
		AVP	AGRESSION	CHUTE.	AT. TOTAL
Type of trauma	TTF	38	32	7	3 49
	TTO.	O	1	2	1 35
	TOTAL	38	33	9	4. 84

Table IV: Data from respiratory examination

	Effectif	Pourcentage %
Douleur thoracique	80	95,23
Dyspnée	64	76,2
Fracture costale palpable	9	10,7

Fracture sternale palpable	1	1,2
Emphysème sous cutané	34	40,5
Sd d'épenchement liquidien	10	11,9
Sd d'épenchement aérique	17	20,2
Sd d'épenchement mixte	28	26,2

Table V: Results of the frontal chest X-rays

	Effectif	Pourcetage %
Fracture costale	33	39,3
Fracture clavuiculaire	6	7,1
Hémothorax	13	15,5
Pneumothorax	20	23,8
Hémopneumothorax	52	61,9
Contusion pulmonaire	12	14,3
Pneumomédiastin	3	3,57
Hernie diaphragmatique	2	

Table VI: Chest CT scan results.

	Effectif	Pourcetage %
Fracture costale	31	36,90
Volet costal	5	5,95
Fracture sternale	1	1,19
Fracture homoplate	5	5,95
Fracture rachidienne	3	3,57
Hémothorax	14	16,66
Pneumothorax	15	17,85
Hemopneumothorax	34	40,47
Contusion pulmonaire	26	30,95
Pneumomediastin	11	13,04
Hernie diaphragmatique	3	3,57

Table VII: Frequency of associated lesions

	Effectif	Pourcentage %
Traumatisme cranien	15	17,85
Traumatisme maxillofacial	7	8,33
Traumatisme rachis cervical	4	4,76
Traumatisme rachis lombaire	3	3,57
Traumatisme abdominal	7	8,33
Fracture non chirurgicale du bassin	2	2,38
Taumatisme des membres	26	30,95

DISCUSSION

Trauma to the thorax represents a special entity within severe traumatology, as in the rest of traumatology. The consequences of the respiratory dysfunction that accompanies thoracic trauma are likely to be life-threatening and/or aggravate associated injuries.

In our context, thoracic trauma represents 12.34% of hospitalisations in the intensive care unit of the CHN. The 15-24 age group is the most affected, with an average age of 38.4. Men are the most affected group, in 94% of cases. The high frequency of thoracic trauma in young people could be explained by the hyperactivity and risk-averse behaviour of this population. In the literature, there is little data on the frequency of admission of thoracic trauma to intensive care. However, Veysi et al [49] found in their study that 37.5% of FTT patients were admitted to intensive care. In Morocco and Mali [6, 16], the frequency of admission of TT to emergency departments is around 1%. The young age of thoracic trauma patients has also been observed in several series (6;24;25;35;41;45).

In our study, MVAs were the main cause of thoracic trauma with a frequency of 45.2%, followed by assaults in 39.3%. In cases where the data were specified, pedestrians were the group most affected, accounting for 52.17% of victims. This high frequency of victims among pedestrians can be explained by the absence of pedestrian crossings on major roads and the carelessness of motorists. Our results differ markedly from those of Pierre M [29], whose study carried out in France revealed a percentage of pedestrian casualties of 1.5% in MVAs. This difference could be explained by the existence of pedestrian crossings, the modernisation of traffic lanes, the development of road signs and, above all, compliance with the highway code, thus reducing the risk of accidents.

Bladed weapons were used in almost all assaults (96.96%), with no firearms reported. This predominance of the use of edged weapons in assaults can be explained by their easy access and the absence of regulations governing their circulation. On the other hand, in the USA and in certain African countries where there are armed conflicts, assaults with firearms predominate.

We recorded 49 cases of TTF (58.33%) and 35 cases of TTO (41.67%). The predominance of TTFs can be explained by the fact that they are the prerogative of MVAs, the main cause of thoracic trauma in our context. Our results are comparable to those found in other African and European countries (see Table XXI).

The time taken for initial treatment was not specified for 21 patients (25% of cases). According to the available data (73 cases), 92.06% of patients received treatment within the first 24 hours, and 6.34% after 24 hours (treatment times ranging from 30 minutes to 2 days). Elsewhere, ECP times are more precise (16.32). In the literature [10], a shorter response time reduces morbidity and mortality in severe TT.

All patients were initially transported to a healthcare facility by non-medical means. This result proves the absence of pre-hospital medicine in Mauritania. Our results contrast with those of Yapobi [52], for whom medical transport by the SAMU was noted in 100% of cases. SFAR experts recommend medical transport for any patient presenting potential severity criteria or signs of vital distress [48].

76.2% of patients were in respiratory distress on admission to the intensive care unit. In the literature, this frequency varies between 69.2 and 100% [35].

A haemodynamic state was unstable in more than nine percent of patients on admission to the intensive care unit. Elsewhere, this frequency varies from 21.7% to 51% [35]. Our lower results compared with the literature can be explained by the fact that our study was carried out in the intensive care unit and not in the emergency department. As a result, patients in circulatory distress are first stabilised or die before being transferred to the ICU.

Neurological distress can only be diagnosed after circulatory and ventilatory distress have been corrected [20,44]. In our study, 3.57% of patients were admitted with a Glasgow score ≤ 8. This score is found in 9.25 to 21.7% of cases depending on the series.

Although the lack of sensitivity and performance of chest X-rays compared with CT scans is well known, a supine chest film is still routinely taken on admission to look for pleural effusion that needs to be drained urgently [5]. In our series, a frontal chest X-ray was performed routinely in all patients. This result is similar to that of Benchekroun [6], in whom chest radiography was also performed systematically in all patients. No use of lung

ultrasound in the context of thoracic trauma was observed in our study, which can be explained by its non-availability in the intensive care unit of the CHN. Ultrasound is capable of diagnosing pneumothorax or haemothorax not visible on a frontal chest film [26].

In our series, 61 patients (72.61%) had undergone thoracic CT, which had shown its superiority in the diagnosis of certain lesions, such as flail ribs, fractures of the sterneum, scapula and cervical spine, as well as pulmonary contusion and diaphragmatic hernia.

Rib fractures were the most common parietal injury, occurring in 41.66% of patients. A patient with even isolated rib fractures should be monitored for clinical signs likely to develop into respiratory distress (23). Dimitov.Iv et al (13) showed in a study of 212 cases of rib fractures following FTT that rib fractures are a marker of the severity of thoracic trauma and that mortality increases proportionally with the number of fractured ribs. The percentage of rib fractures found in our series (41.66%) is comparable to that found in Benchekroun (37.5) [6] and Coulibaly (43.15) [11].

Chest flaps generally occur in violent accidents involving severe chest trauma with compression phenomena. The result is a dislocation of the thoracic wall, leading to paradoxical breathing and rapidly worsening respiratory failure, with death occurring in 40% of cases [9], and its detection is facilitated by CT volume reconstructions. Apart from spinal lesions, thoracic flaps are the most severe parietal lesions in closed trauma patients [5]. In our series, the frequency was 5.95% (5 cases); in the literature, it varies between 9 and 15% [33].

Sternal fracture Rare in our study, it was identified in only 1 patient (1.19%). Sternal fractures are the result of direct trauma and generally occur about 2 cm from the mani-brio-sternal joint. These fractures are easily diagnosed on sagittal reconstruction CT, even in cases of minimal displacement. They occur in around 8-10% of closed chest injuries [5].

Fractures of the thoracic spine were found in three of our patients, a frequency of 3.57%. Any serious thoracic trauma should be investigated systematically. The frequency of spinal fractures varies from 5 to 20% according to the authors. [17,19]. Vertebral trauma is common in high-kinetic trauma.

The frequency of diaphragmatic ruptures in our study was around 3.57% (3 cases), all on the left side. Diaphragmatic injuries should be considered in all cases of thoracic trauma [7]. In the literature, they are relatively rare, with an incidence of 1 to 7% in patients with severe TTF [43].

Pulmonary contusions were frequent in our series, occurring in 33.33% of our patients. Haemorrhagic pulmonary contusions are the most common pulmonary lesions in closed trauma. It is one of the main causes of morbidity and mortality in thoracic trauma.

In our series, haemothorax was present in 17.85% of cases. Haemothorax may be one of the lesions responsible for vital distress during thoracic trauma. Their haemodynamic impact generally predominates over their respiratory impact due to the effect of blood spoliation, which can represent up to 30% of the total blood mass. They are present in 30% of cases following thoracic trauma [18].

In our series, pneumothorax was present in 23.81% of patients. It is important to identify this aerial spillage, even if it is minimal, because a rapid increase in the size of the pneumothorax may occur during mechanical ventilation of patients. The combination of haemothorax and pneumothorax was present in 61.9% of patients. In the literature, this association is found by several authors (3; 12; 46), but with less frequency.

Several types of thoracic lesions were not observed in our series, in particular lesions of the heart and large thoracic vessels, tracheobronchial ruptures and oesophageal lesions.

The frequency of heart wounds in the literature is variable, with damage to the large vessels ranging from 4 to 5% [42].

In almost 85% of cases of TT, the therapeutic strategy is based on good pain control or simple chest drainage [18].

In our study, drug treatment was the most commonly used type of treatment. All patients received systemic analgesia with a combination of stage 1 and 2 analgesics and antibiotics (amoxicillin/clavilanic acid was the most common combination). Seventy-nine patients underwent chest drainage. The SFAR experts [48] recommend immediate drainage of any complete pneumothorax, or any fluid or air effusion responsible for respiratory and/or haemodynamic repercussions. They also suggest draining a haemothorax of more than 500ml (ultrasound criteria and/or CT scan).

In the case of a minor, unilateral pneumothorax with no clinical repercussions, drainage is not systematic. In this case, simple monitoring with a new control X-ray is recommended.

Our patients had a length of stay of 3 to 6 days in 42.9% of cases, with an average length of stay of 4.2 days. This result is similar to that of Fatima T [16] who found an average hospital stay of 3.5 days.

The outcome was favourable in 78 patients, i.e. 92.85% of cases. This result is consistent with that of Benchekroun [6], whose study showed a favourable outcome in 91.35% of cases.

In our series, 2 patients (2.46%) had complications: 1 case of pneumonia and 1 case of atelectasis.

Liman ST [24] has shown in his study that the incidence of mortality in severe TT rises from 4-8% to 13-15% when there is associated involvement of only one other organ and to 30-35% when there is associated involvement of 2 organs. In our study, 4 patients died (4.76%). Three of these patients had associated severe head injuries.

CONCLUSION

Thoracic trauma is common and constitutes a health problem. It remains serious in the context of polytrauma. Close collaboration between the intensive care unit, the surgeon and the radiologist is necessary for rapid and effective patient management. At the end of our study, we concluded that it is necessary to develop and organise pre-hospital and hospital management of medical and surgical emergencies. The public authorities and civil society also need to be made aware of the need to combat road accidents and assaults effectively.

REFERENCES:

1. ALRAJAB S, YOUSSEF AM, AKKUS NI, CALDITO G. Pleural ultrasonography versus chest radiography for the diagnosis of pneumothorax: review of the literature and meta-analysis. Crit Care 2013;17(5):R208.
2. ASENSIO JA, PETRONE P. Diaphragmatic injury. In: Cameron JL, editor. Current Surgical Therapy, 8th ed. Philadelphia: Elsevier Mosby Co: 2004. P.946-955.
3. ATOINI F. Les traumatismes thoraciques graves: Evaluation et réflexions à propos d'une série de 54 cas. Thèse méd. Rabat 2004 N°=179
4. BAKER C., OPPENHEIMER L., STEPHENS B., LEWIS F., TRUNKEY D. Epidemiology of trauma deaths. Ann J Surg, 140: 144- 150, 1980.
5. BEIGELMAN-AUBRY C, BALEATO S , LE GUEN M , BRUN A-L ET P GRENIER Traumatismes du thorax : lésions élémentaires. Journal de Radiologie 2008;89:1797-811
6. BENCHEKROUN I Les traumatismes thoraciques isolés : à propos de 81 cas. Thèse médecine Rabat 2013.
7. BENEZET J.F., L'HERMITE J., DE LA COUSSAYE J.E. Prise en charge des traumatismes thoraciques fermés dans les 1ère 24 heures.
8. BLERY M, LACOMBE P, JACQUENOD P ET CHAGNONS. Traumatismes de la paroi thoracique. Encycl. Med. Chir. (Paris France) Radiodiagnostic II, 31 – 035. A10, 12 – 1987, 7 P.
9. N. CHERNI, S. JOUINI, A. LABIB, S. BRIKI, R.M. ZO'O, Y. MOISON, Y.-T. JOUBERT Imagerie des traumatismes fermés du thorax. Feuillets de Radiologie 2007, 47, n° 2,95-107. Elsevier Masson SAS
10. 10. CARLI P, LEJAY M. Réanimation initiale des traumatismes fermés du thorax : Traumatismes thoraciques et abdominaux. Rev Prat (Paris) 1997 ; 47, 9 : 951-957

11. COULIBALY B. Etude des traumatismes du thorax dans les services des urgences Chirurgicales et de traumatologie de l'HGT. Thèse de médecine 2000.

12. DABADIEPH ,SZTARK F, MAZIERES J. Epidémiologie et mécanismes des lésions traumatiques du thorax. In : Coriat P., Carli P. La dysfonction cardiaque aigue en réanimation – les Traumatismes du thorax; J.E.P.U 1995.

13. DIMITROV . IV, IV. NOVAKOV, P. BONEV, A. UCHIKOV. An analysis of 212 cases of rib fractures due to blunt thoracic trauma. Trakia Journal of Sciences, No 3, pp 220-223, 2017

14. ENDERSON BL. ABDALLA R., FRAME SB. , CASEY MT., GOULD H. MAULL KL Tube thoracostomy for occult pneumothorax : A prospective study of its use J.Trauma. 1993; 35(5) ; P : 726 – 30.