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Analysis of epidemiology, lesions, treatment and outcome of 354 consecutive cases of blunt and penetrating trauma to the chest in an African setting

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Summary

Background. The proportion of death and disability related to trauma is increasing in Third-World countries. Thoracic trauma is significantly involved, but few data are available on this issue in African countries with specific local conditions.

Methods. The aim of the study is to analyse the diagnosis and management procedures in thoracic trauma in a typical African country. The records of 354 patients admitted to an emergency unit for chest trauma over a 13-year period were retrospectively analysed.

Results. The sample included patients with 231 cases of blunt and 123 of penetrating trauma to the chest; their mean age was 41.86 years, and the male:female ratio was 4.2:1. The majority (*N*=226) of the injuries were sustained in road traffic accidents, and the most common lesions were rib fractures (50.3%) and haemothorax (38.7%). The diagnosis was based on physical examination and standard chest radiographs in most cases. At least one associated lesion was found in 260 (73.45%) patients. The mean injury severity score (ISS) for our patients was 16.39. Most patients were managed conservatively (*N*=303); thoracotomy was performed mostly on penetrating trauma patients. Morbidity occurred in 49 patients, mainly affecting those treated with thoracic drainage, and 27 patients (7.6%) died. Factors related to mortality were ISS score and association with neurotrauma.

Conclusions. Chest trauma can be managed in our Cameroonian environment, with morbidity and mortality comparable with that of Western countries. Diagnosis must still rely on physical examination, chest radiographs and thoracic echography, which are affordable tools.

Trauma is progressively becoming a leading cause of death and disability in African and other Third-World countries.[1] Thoracic trauma significantly contributes to trauma-related morbidity and mortality.[2,3] Blunt trauma is more frequent, with road traffic accidents accounting for the majority of cases.[4,5]

Most patients admitted with thoracic trauma undergo conservative management; only a few will need a thoracotomy, which is usually performed in a higher proportion of patients presenting with penetrating trauma.[3,6] Patients who survive thoracic trauma can end up with serious impairment of respiratory function. Mortality is usually low and seems to correlate with injury severity score (ISS) and the presence of associated lesions.[4] The management of thoracic trauma in an African environment presents a special challenge because of the limitations in equipment and technology, and the poorly organised health systems. Few studies have been conducted in such conditions,[7,8] which possibly apply to more than 75% of all cases of chest trauma in the world. Our study aimed to analyse the epidemiology, nature and severity of lesions found in thoracic trauma patients, as well as their treatment modalities and outcomes, in a more or less typical African city.

Patients and methods

This retrospective study was conducted in the General Reference Hospital in Yaoundé. We included all patients ≥15 years old, admitted to the emergency department for thoracic trauma during the period 1 January 1991 and 31 December 2003. Cases of gunshot wounds and patients with incomplete files were excluded.

Patient data included age, sex, trauma mechanism, nature of the thoracic lesion and associated lesions, modalities of management of the thoracic lesion, and final outcome. Data sources included admission registers in emergency departments and in wards, patients' files and postoperative notes.

The initial diagnosis was based on clinical examination and morphological work-up consisting of standard chest radiograph and computed tomography (CT) scanning of the thorax in selected cases. The severity of the trauma was assessed using the ISS. Data on patient follow-up were also considered; they were based mainly on repeated clinical examination and standard chest radiograph. Blunt and penetrating trauma were compared in terms of rate of thoracotomy and mortality using the chi-square test. We also performed a univariate analysis of factors affecting mortality using Student's *t*-test; $p<0.05$ was considered significant.

TABLE I. DISTRIBUTION OF OUR PATIENTS ACCORDING TO AGE GROUP

Age group (yrs)	*N*	%
<20	**16**	**4.51**
20 - 29	**47**	**13.28**
30 - 39	**116**	**32.77**
40 - 49	**87**	**24.57**
50 - 59	**49**	**13.85**
60 - 69	**27**	**7.62**
≥70	**12**	**3.40**
Total	**354**	**100**

Results

We included 354 patients from a total of 389 thoracic traumas recorded during the study period; 35 patients were excluded: 9 were <15 years old, and there were 6 gunshot wounds and 20 incomplete files. With 286 males, the male:female ratio was 4.2:1. The ages ranged from 15 - 87 years, with a mean of 41.9±16.3 years (Table I). There were 231 (65.3%) cases of blunt trauma; the trauma occurred during a road traffic accident in 226 (63.8%) cases. We also recorded 39 falls, 19 domestic accidents, and 70 traumas as a result of criminal assault.

All the patients included had at least 1 standard chest radiograph performed; CT of the thorax was performed on 87 patients. The thoracic lesions included 178 rib fractures (of which 5 cases were flail chest), 137 cases of haemothorax, 48 of pneumothorax, 12 sternum fractures, 5 diaphragm ruptures (1 bilateral), 2 direct stab wounds to the heart, and 2 cases of rupture of the right main bronchi. Association of these lesions was not an uncommon finding, the most common being that of rib fractures and haemothorax.

At least one associated lesion was found in 73.5% of patients. The most frequent associated lesions included appendicular skeletal fractures in 119 patients, and neurotrauma in 87 patients; most of the cases of trauma to the spinal cord were located in the cervical spine.

The ISSs of our patients ranged from 3 to 48, with a mean of 16.4±12; taking an ISS <16 to be of mild severity and a score >24 to be severe, Table II shows that more than 60% of patients could be classified as having mild trauma. Sixty-two patients were admitted to the intensive care unit for at least one day; they included all cases classified as severe trauma and all cases for which a thoracotomy was performed.

The majority (*N*=303) of patients in this series were treated conservatively, including 164 patients who underwent

TABLE II. CLASSIFICATION OF PATIENTS ACCORDING TO SEVERITY OF TRAUMA AS INDICATED BY ISS SCORE

Mild trauma (ISS<16)	Moderate trauma (ISS 16 - 24)	Severe trauma (ISS>24)
214 (60.5%)	**122 (34.5%)**	**18 (5.1%)**

TABLE III. UNIVARIATE ANALYSIS OF INFLUENCE OF DIFFERENT FACTORS ON MORTALITY

Factor	Group	*N*	Mortality	Significance
Age	**<49 years**	**266**	**22 (8.3%)**	**Not significant**
	>50 years	**88**	**5 (5.7%)**	
Nature of trauma	**Blunt**	**231**	**16 (6.2%)**	**Not significant**
	Penetrating	**123**	**11 (8.4%)**	
AIS for thorax	**<4**	**311**	**16 (5.1%)**	**Significant**
	4	**43**	**11 (25.6%)**	
ISS	**<25**	**336**	**13 (3.9%)**	**Significant**
	>24	**18**	**14 (77.8%)**	
Neurotrauma	**Present**	**87**	**13 (14.4%)**	**Significant**
	Not present	**267**	**14 (5.2%)**	
Need for thoracotomy	**Yes**	**51**	**9 (17.6%)**	**Not significant**
	No	**303**	**18 (5.4%)**	

thoracic tube drainage. A thoracotomy was performed in 51 patients (14.4%); penetrating trauma was at the origin of 38 (74.5%) indications for a thoracotomy, which represented 30.9% of all patients with penetrating trauma and was significantly higher than the 5.6% rate in blunt trauma ($p<0.001$). The indication for thoracotomy was an excess tube thoracostomy output in 51% of cases; other indications included shock, cardiac tamponade, rupture of a main bronchus, diaphragmatic rupture and fibrothorax. An associated laparotomy was performed in 8 patients; 1 thoracotomy was non-therapeutic.

The most frequent findings during thoracotomy included 26 pulmonary contusions and 17 pulmonary lacerations, all with active bleeding. A wedge resection was performed in 37 patients operated on, and discovered to have a pulmonary contusion or laceration. Simple pneumonorraphy was performed in the other cases; no major pulmonary resection was performed.

Morbidity occurred in 49 of our study patients, and included 10 patients treated conservatively, 33 patients treated with tube thoracostomy, and 6 patients who underwent thoracotomy. Complications included 3 cases of adult respiratory distress syndrome, 4 cases of consumption coagulopathy, 36 cases of secondary bleeding that required either thoracotomy (N=26) or repeated thoracocentesis (N=10), 2 cases of empyema thoracis, 1 case of fibrothorax, 2 cases of sub-cutaneous emphysema, and 1 case of wrong placement of the thoracic tube which was discovered to be sub-cutaneous (the tube was replaced).

The overall mortality rate in our study was 7.6%; those who died included 14 patients with an ISS score >25. As shown in Table III, the following factors appeared to be significantly associated with an increased risk of death in a univariate analysis: ISS >25, an abbreviated injury scale (AIS) score of the respiratory system of 4, and associated neurotrauma. Age, the nature of trauma (either blunt or penetrating) and thoracotomy as part of the management did not seem to significantly influence survival.

Discussion

This study is an original description of thoracic trauma management in a very specific environment characterised by limited technical infrastructure and the absence of any social assistance. Some of the circumstances described here might be considered too far from what is gold standard elsewhere, but we must point out that more than 75% of the world's surgeons work under such conditions. We therefore believe it is of interest to set out special guidelines for this specific environment.

Our study shows that thoracic trauma occurred mainly in younger patients (aged 20 - 49 years), which could be because young people are the most active and mobile. Similar age groups and gender ratios have been demonstrated in other recent series.[4]

The thoracic lesions in our study are quite limited; in particular, no critical lesions such as rupture of the trachea or injury to the great vessels was found, which is probably because patients with such lesions will, in the absence of pre-hospital management, probably die at the place where the injuries were sustained.

We excluded gunshot wounds because of their relatively low number; in fact, this is a striking feature of our study as, in many published series, gunshot wounds invariably accounted for a significant proportion of traumas.[4,6,7] This discrepant feature possibly indicates better local control of firearms and a lack of pre-hospital management of thoracic trauma.

Most patients in our study exhibited blunt trauma – a finding compatible with most comprehensive series[3,4,7] rates as high as 95% have been described.[4] Differential analysis excluding gunshot wounds shows that blunt trauma is usually a result of road traffic accidents, as demonstrated by other studies;[4,5] penetrating trauma is usually related to criminal violence or domestic accidents.

The importance of physical examination in our environment is overwhelming; it has been shown to be more sensitive than chest radiograph.[9] Our morphological investigations were limited to chest radiograph and thoracic CT scanning, which are considered as basic complements to repeated physical examination. Mirvis considers that chest radiography remains the primary screening study for the assessment of victims of chest trauma; but CT, and particularly multidetector CT (MDCT), is progressively changing the imaging approach to thoracic trauma patients.[10]

Echography of the chest – a common and affordable tool for an African setting – is unfortunately not used routinely in our practice; it has shown to be superior to the standard radiograph in the diagnosis of rib fractures and haemothorax,[11] but Soffer *et al.* described it as less accurate.[12]

Rib fractures are the most frequent lesion. Similar results occurred in large series.[4,5] Liman *et al.* indicated that the number of fractured ribs could be significantly related to the presence of haemothorax or pneumothorax.[5] Haemothorax was noted in isolation in 38.7% of our patients, representing patients who did not undergo thoracotomy, but a pulmonary contusion or laceration was the most frequent lesion found when the patient was operated on; this was also found in other studies.[13] According to Rashid *et al.*, pulmonary contusion is considered to be a relatively benign lesion that does not add to the morbidity or mortality of patients with blunt chest trauma, if managed properly.[13] An isolated thoracic lesion is known to be a rare finding; associated lesions described in our study are usually the most frequent.[4]

Despite the high frequency of associated lesions in our patients, more than half of them had trauma of mild severity according to the ISS, which explains the low rate of patients admitted to intensive care unit. Segers *et al.* described an average ISS of 27.8.[4]

The great majority of patients admitted with thoracic trauma are usually treated with observation and/or tube thoracostomy and/or mechanical ventilation.[4] Contradictory findings have also been described.[6] Tube thoracostomy is generally considered to be a safe procedure even when performed in the field.[14]

The rate of thoracotomy described in our study is comparable with most series published so far.[4,6,7,15] A thoracotomy is often performed for haemorrhage;[2-4] a significantly greater proportion of penetrating traumas have been described as indications for thoracotomy.[3,6]

The mortality rate in our study is comparable with that of major European studies.[4,16] It could be expected to be higher because of inferior infrastructure, but this apparent discrepancy could be explained by the fact that we excluded gunshot wounds and that few cases of severe trauma (with lesions of the aorta, heart or trachea described in other

studies) present, because they probably never reach the hospital. This is especially so for older patients, according to Patel *et al*.[17] Factors affecting mortality are variable, according to different studies. Liman *et al*. describe mortality rate as a function of severity of trauma.[5] Kulshrestha *et al*. relate mortality to different factors, including old age (contrary to our findings and those of Patel *et al*.),[17] presence of penetrating chest injury, long bone fracture, and fracture of more than 5 ribs.[16] Adegboye *et al*. described an operative mortality of 22%, comparable with our result in similar conditions, but they included gunshot wounds.[7]

As many studies indicate, mortality is a function of the ISS, AIS score for the respiratory system and associated lesions. Other trauma scores have been found to be even more predictive of outcome;[18] neurotrauma is known to be a factor predictive of death.[4,16]

Conclusions

Thoracic trauma rarely appears as an isolated lesion in our series; blunt trauma is more frequent and often occurs as a result of road traffic accidents. Most patients can be managed conservatively. The rate of thoracotomy is greater than that for penetrating trauma. Mortality is low and influenced by ISS and associated neurotrauma. It is likely that better organisation of health systems and improved management of surgical emergencies from the place of accident will increase the rate of severe trauma that can be managed properly, and so decrease overall mortality. Diagnosis and management can still rely to a great extent on physical examination and the use of simple and affordable tools such as standard radiograph and thoracic echography. Sophisticated tools such as CT scanning and video-assisted thoracoscopy would not be considered a priority in our environment.

The algorithm for management of chest trauma in our environment will continue to rely to a large extent on thorough physical examination and extended use of standard chest radiograph and thoracic echography, provided that local specialists are properly trained to cope with the challenges.

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