WEST AFRICAN JOURNAL OF MEDICINE

ORIGINAL ARTICLE

The Conundrum of Polytrauma on the Jos Plateau

L'enigme Des Polytraumatismes Au Plateau De Jos

K. N. Ozoilo, H. C. Nwadiaro, D. Iya, A. Z. Sule

ABSTRACT

BACKGROUND: **The leading cause of morbidity and mortality from the end of the first year of life to the forty fifth is trauma. This is true worldwide but especially so in our environment. In no other situation are the complexities of the management of trauma more manifest than in the context of polytrauma. For this we undertake to study the problem of polytrauma in Jos.**

AIMS AND OBJECTIVES: **To determine the frequency and pattern of occurrence of poly trauma in Jos university teaching hospital.**

PATIENTS AND METHODS: **Consecutive patients presenting with polytrauma to the casualty department were prospectively studied. Data regarding demographics and a detailed description of injuries were entered into a proforma and collated over a one-year period.**

RESULTS: **A total of 131 patients were studied. There were 103 males and 28 females giving a male to female ratio of 3.7:1. The ages ranged from 2 to 61 years with a mean of 28.4** ±12.4 years. Road traffic accident was the most common aetiology in 113 (86.3%) patients, while falls 7 (5.3%), gunshots 5 (3.8%) and assaults 2 (1.6%) were observed. The most frequently encountered injuries were head, extremity and chest in 71.8%, 68.5% and 29.2% respectively. The combinations most frequently observed were head\extremity (43.5%), head\chest (17.6%) and chest\extremity (10.7%) injuries. Complications were observed in 20.6% while death occurred in 7.6%.

CONCLUSION: Polytrauma occurs with sufficient frequency to warrant serious attention. As majority follow RTA, there is a need to intensify measures aimed at improving road safety. There is also a need to establish pre-hospital care\ambulance services. It is suggested that improved orthopaedic and neurosurgical care will lead to improved polytrauma care and most importantly, the establishment of dedicated trauma teams in tertiary institutions is proposed as a prelude to the establishment of regional trauma centers. WAJM 2012; 31(1): 52–57.

Keywords: Trauma, Polytrauma, Jos.

RÉSUMÉ

CONTEXTE: La première cause de morbidité et de mortalité de la fin de la première année de vie à l'âge de 45 ans est le traumatisme. Ceci est vrai à l'échelle mondiale et plus particulièrement dans notre environnement. Plus que dans toute autre situation, la complexité de la prise en charge des traumatismes est manifeste. Pour cette raison nous avons entrepris d'étudier le problème des poly traumatismes à Jos.

BUTS ET OBJECTIFS: Déterminer la fréquence et les aspects des poly traumatismes à l'Hôpital Universitaire de Jos.

PATIENTS ET METHODES: Une série consécutive de patients consultant au service des Urgences a été étudiée de façon prospective. Les données démographiques et la description détaillée des traumatismes ont été recueillies dans une fiche de collecte de données et colligées sur une période d'une année.

RESULTATS: AU total 131 patients ont été étudiés. Il y'avait 103 hommes et 28 femmes soit un sexe ration de 3,7:1. La moyenne d'âge était de 28,4 ±12,4 ans avec des extrêmes de 2 et 61 ans. Les accidents de la circulation constituaient la principale étiologie avec 113 (86,3%) patients, tandis que les chutes ont été retrouvées chez 7 (5,3%) patients, les traumatismes par armes à feu chez 5 (3,8%) et les agressions chez 2 (1,6%) patients. Les principaux sièges de traumatisme étaient la tête, les extrémités et le thorax avec respectivement 71,8%, 68,5% et 29,2%. Les combinaisons traumatiques les plus fréquemment trouvées étaient tête\extrémité (43,5%), tête\thorax (17,6%) et thorax\extrémité (10,7%). Des complications ont été observées dans 20.6% tandis qu'un décès était survenu dans 7,6%

CONCLUSION: Les poly traumatismes surviennent avec une fréquence suffisante pour susciter une grande attention. Puisque la majorité survient après un accident de la circulation, il est urgent de prendre des mesures pour améliorer la sécurité routière. Il y'a aussi nécessité de mettre en place des services d'ambulances médicalisées pour la prise en charge pré hospitalière. Il est attendu que l'amélioration de la prise en charge orthopédique et neurochirurgicale va améliorer la prise en charge des poly traumatismes et de façon plus importante la mise en place d'équipes dédiées aux traumatismes dans les établissements de santé tertiaires est proposée comme prélude à la mise en place de centres régionaux pour les traumatismes. **WAJM 2012; 31(1): 52–57.**

Mots clés: Traumatisme, Poly traumatisme, Jos.

Surgery Department, Jos University Teaching Hospital, Jos. Plateau State, Nigeria
Correspondence: Dr Ken Ozoilo, c\o Surgery Department, Jos University Teaching Hospital, Jos. Plateau State, Nigeria E-mail: drkenozoilo@yahoo.com

INTRODUCTION

The leading cause of death, hospitalization, and short and long term disability from the end of the first year of life to the forty-fifth is trauma.[1–3] The toll exacted by trauma cuts across the individual, family and the national economies since it is the productive segment of the population that is mainly affected. In addition there is loss in terms of personal sorrow grief and hardship. The strain on the health care systems is also considerable.

Studies from Europe and North America estimate the cost of trauma in the range of several billions of dollars per anum.[2] Although developing societies such as ours lack comparative statistics,[5] the cost is higher because despite a lower volume of vehicular traffic, developing countries show demonstrably higher road traffic accident (RTA) rates.[6] There is an increasing yearly trend in trauma, which is directly attributed to rising rates in developing countries.[6] The Nigerian Federal Road Safety Corps (FRSC) reports that on the average, about 53 RTAs occur daily in Nigeria in which about 19 persons die and a further 55 sustain varying injuries.[7]

Donald Trunkey has demonstrated a trimodal pattern of mortality as a function of time following trauma.[4] Fifty percent of all mortalities occur within the first 30 minutes, 30% occur over the following four hours and 20 % occur days to weeks after trauma. Prevention is the only practicable intervention for the first group but aggressive early resuscitation and timely competent surgical intervention do improve outcome in the later two. It follows that 50% of trauma fatalities (the last two groups) are potentially preventable.

Polytrauma is said to exist when there is significant injury to two or more systems or two or more organs in one system. These patients are particularly at risk because the extent of their injuries may not be fully appreciated on presentation. Polytrauma epitomises the complexities of the challenges of the management of trauma.

There is a dearth of information on polytrauma from developing countries such as ours and it is to address this problem that this study was in our local institution.

PATIENTS AND METHODS

This prospective study was conducted at the Jos University Teaching Hospital (JUTH), which serves as a referral centre for Plateau State and much of North-Central Nigeria. It was conducted over the one-year period between July 2002 and June 2003 inclusive. Approval was obtained from the hospital ethical committee. Consent was obtained from patients or responsible relatives.

Patient Selection

All trauma patients presenting to the casualty department, with two or more significant injuries were included in the study. They were recruited at the point of presentation in casualty. Data concerning patients were entered into a proforma. Information extracted included age, sex, aetiology of trauma, means of transportation to hospital, pre-hospital intervention and interval between trauma and presentation.

Treatment

Management was according to the Advanced Trauma Life Support (ATLS)(R)[8] protocol. Initial primary survey proceeded simultaneously with institution of resuscitative measures. Following haemodynamic stabilization of the patients, a thorough secondary survey was carried out and a detailed description of their injuries catalogued. Vital signs were taken at 30-minute intervals or more frequently as dictated by the degree of physiological derangement. Radiologic investigations were carried out as indicated while specimen for other ancillary haematologic and biochemical tests were ordered on all patients following venous access at the beginning of resuscitation.

After the secondary survey, patients were admitted and definitive management instituted. For some patients, this involved operative and other surgical procedures. For those that had operations, detailed descriptions of operative findings were recorded. All patients then had a further tertiary survey in the wards within 24 hours of admission in which missed injuries were sought. Patients were followed up while on admission and any complications or other outcome of treatment noted.

Description of Injuries

The Glasgow Coma Scale[9] was used to categorise head injuries into mild (GCS 13–15), moderate (GCS 9 to 12) and severe (GCS 3-8). The injury severity score (ISS) [10] , which divides the body into six regions namely; head and neck, face, chest, abdominal and pelvic cavity, extremity and pelvic ring and external (skin), was used to assign severity following full definition of injuries. For the purpose of this study, spinal injuries were categorised separate from head injuries, and pelvic fractures cleaved from extremity injuries. The injuries were therefore categorised into the following body regions: head, spine, face, chest, abdomen, pelvis, extremity and external (skin).

Analysis

Data so collected were analyzed using EPI info2002 computer software. Students T test and chi-square (χ^2) employed in the statistical analysis and a p-value of < 0.05 was accepted as significant.

RESULTS

One hundred and thirty one patients were recruited into the study. The age distribution ranged from 2 to 61 years with a mean of 28.4 ± 12.4 years. There were 103 males and 28 females giving a male to female ratio of 3.7: 1(Table 1).

Aetiology

Road traffic accident was the most frequent aetiological factor; accounting for 113 cases (86.3%), while falls from heights accounted for 7 (5.3%). Injuries sustained due to gunshots and at civil

Table 1: Age and Sex Distribution of Patients

Age (years)	Number	
	Female	Male
< 10	5	8
11 – 20	3	17
21 – 30	10	40
31 – 40	5	21
41 – 50	3	13
51 – 60	1	4
> 60	1	0
Total	**28**	**103**

unrests accounted for 5 (3.8%) and 3 (2.3%) respectively while in 2 patients (1.6%) injuries were due to assaults. One patient (0.8%) sustained his injury in the work place (Table 2).

Table 2: Aetiology of Polytrauma

Aetiology	No.	%
RTA	113	86.3
Falls	7	5.3
Gunshot	5	3.8
Civil Unrest	3	2.3
Assault	2	1.6
Occupational	1	0.8
Total	**131**	**100.0**

Presentation

Fourteen patients (10.6%) had pre-existing conditions prior to the trauma. Alcohol intoxication accounted for half of these (5.3%). Four females (3.2%) were gravid. Among these, there were 2 foetal wastages and one maternal death. In one patient each (0.8%) there was pre-existing hypertension, psychiatric illness and epilepsy.

Eighteen patients (13.7%) presented within one hour of injury, 60 (48.8%) presented within four hours while 39 (20.3%) presented beyond 24-hours. Transportation to hospital was by means of public transport in 79 (60.3%), personal vehicles in 25 (19.1%) or by the police/ FRSC in 25 (19.1%). Only two patients (1.6%) were conveyed to the hospital by means of an ambulance. There was no record of pre-hospital intervention in any of the patients.

There were 336 injuries with a mean of 2.6 $\pm$ 0.7. Seventy-three patients (55.7%) sustained injury to two regions of the body while 45 (34.4%) had injury to three regions. In 11 patients (8.4%) there was injury to four regions while in one patient each (0.8%) there was injury to five and six regions respectively.

Pattern of Injury

The most frequently injured region was the head, in 94 (71.8%) patients (Table 3). Of these, 84 (89.4%) were closed while 10 (10.6%) were open injuries. On the basis of the Glasgow Coma Scale, injuries were classified as mild (GCS 13–15) in 67 (71.3%), moderate (GCS 9–12) in 14 (14.9%) and severe (GCS 3–9) in 13 (13.8%) patients. It was most often associated with extremity injury, which occurred in 57 (60.6%) head injured patients. (χ^2=1.76, p=0.19).

Table 3: Frequency of Injury by Regiions

Region	No.	%
Head	94	71.8
Extremity	84	64.1
Chest	38	29.0
Abdomen	22	16.8
Skin	22	16.8
Face	18	13.7
Spine	14	10.7
Pelvis	9	6.9
Total	***131**	***100.0**

**NB: All patients necessarily sustained injury to more than one body region.*
Total and percentage are with respect to study population.

Injury involving the extremities occurred in 84 patients (64.1%). There were 105 injuries in all. Of these, 72 (68.5%) were simple, 33 (31.4%) were compound. Femoral fractures were seen in 36 of the 84 patients representing 42.9%, being the most frequently occurring extremity injury.

Injury to the chest occurred in 38 patients accounting for 29.2% of all patients. Injury was blunt in 33 (86.8%) and penetrating in 5 (13.2%) patients respectively. It was associated with abdominal injury in 11patients. (28.9%) [χ^2=25.66, p=0.01].

Twenty-two patients with abdominal injury accounted for 16.8% of all patients. Injury was blunt in 16 (72.7%) and penetrating in 6 (27.3%). Seven of the patients with abdominal injury (31.8%) were managed conservatively while 13 (59.1%) were managed operatively. At Laparotomy, the spleen and diaphragm were the most frequently injured organs 5 (22.7%) each, while the large bowel and liver were injured in 4 (18.2%) patients each. Small bowel injury occurred in 3 (13.6%) patients while mesenteric injury and retroperitoneal haematoma were found in 2 (9.1%) patients each. One patient (4.5%) had ruptured urinary bladder.

Twenty-two patients sustained injury to the skin, representing 16.8% of all patients. The Injuries consisted of extensive lacerations and abrasions in 16 (72.7%) and 7 (31.8%) patients respectively, while one patient suffered flame burns (4.4%).

Eighteen patients with facial injury accounted for 13.7% of all patients studied. Injuries consisted of mandibular fracture in 10 (55.6%), lacerations in 3 (16.7%), fracture of the nasal bridge in 3 (16.7%) and abrasions in 2 (11.1%) patients respectively.

There were 14 patients with spinal injury accounting for 10.7% of all patients. Of these, 9 (64.3%) were stable injuries while 5 (35.7%) were unstable. Complete cord transection occurred in 5 (35.7%) patients while 9 patients (64.3%) had incomplete spinal injuries. The spinal segment most frequently affected was cervical in 6 (42.9%) patients. Thoracic and lumbar injures were seen in 5 (35.7%) and 3 (21.4%) patients respectively.

Pelvic injuries were present in 9 patients accounting for 6.9% of the study population. It consisted of stable fracture in 7 (77.8%) and unstable fracture in 2 (22.2%) patients respectively. Four (44.4%) patients with pelvic injury were haemo-dynamically unstable and 5 (55.6%) were haemo-dynamically stable. The most common combinations of injury encountered were head\extremity in 57 patients (43.5%) head\chest in 23 (17.6%) and head/skin in 15 (11.5%). Head\abdomen and chest\abdomen occurred equally in 11 patients each (8.4%) (Table 4).

Management

Forty-six patients required operative management of their injuries (35.1%). In

Table 4: Pattern of Combination of Injuries Sustained

Combination	No.	%
Head/Extremity	57	43.5
Head/Chest	23	17.6
Head/Skin	15	11.5
Head/Abdomen	11	8.4
Chest/Abdomen	11	8.4
Others	14	10.6
Total	**131**	**100.0**

36 of these (78.2%) only one procedure was necessary. In 9 patients (19.6%) two procedures were carried out at the same sitting while in one patient, (2.2%), three different procedures were done.

Outcome

Two patients (1.6%) each had a missed injury on initial evaluation. One of them died. Complications were observed in 27 patients (20.6%). There were 30 complications in all. Wound infection occurred in 10 (33.3%) patients while urinary tract infection and bed sores were seen in 4(13.3%) each (Table 5). Ten deaths were recorded (10.6%) (Table 6). Eighty percent of the deaths occurred in patients with severe head injury.

Table 5: Complications

Complication	No	%
Wound Infection	10	33.3
Urinary Tract Infection	4	13.3
Bed Sores	4	13.3
Chest Infection	2	6.6
Others	10	33.3
Total	**30**	**100**

Table 6: Distribution of Mortality

Injury	Number	Percentage
Head	8	80
Spine	1	10
Face	0	0
Chest	7	70
Abdomen	2	20
Pelvis	1	10
Extremity	6	60
Skin	2	20

Note: All patients had multiple injuries so number and percentage exceed actual number of mortalities and 100% respectively.

The mean Injury Severity score was 17.4 ± 9.9 SD. The mean duration of hospital stay was 23.5 days ± 33.8 SD. Mortality did not correlate well with number of injuries in each patient 2.9 0.87 (P = 0.2), but was associated with significantly higher mean Injury Severity Score 32.3 12.9 (P < 0.0001).

DISCUSSION

Trauma remains a leading cause of morbidity and mortality in our environment and with about 10 patients presenting every month in this particular institution with polytrauma, it represents a significant problem for the health care systems. The age and sex distribution further confirms that it is the mobile and productive segment of the population that is mainly affected.[1–3]

Aetiology

In keeping with findings from other studies,[11–13] road traffic accident was the major aetiological factor, accounting for 86.3 %. The contribution of other factors was of considerably lesser significance.

Presentation

Alcohol intoxication was found in 5% of the study population and might have been higher if objective tests using the blood or breath were employed. The adverse effect of trauma on pregnancy was reflected in the one maternal death and two foetal wastages.

The fact that only two patients (1.6%) were conveyed to the hospital in an ambulance reflects the primitive state of ambulance services in our environment. There was no record of any form of pre-hospital care, when evacuation was effected by the police and/or the Federal Road Safety Corp. The implication of this is that trauma mortality will remain high because some patients that might have been saved by timely pre-hospital intervention will continue to perish. Adeyemi-Doro has long since emphasized that institution of pre-hospital care is one of the challenges facing trauma care in this country.[14]

The mean interval before presentation was 33.9 + 14.2 hours. This is not surprising given the primitive nature of pre-hospital care and the serious deficits in disaster management and preparedness. The implication is that patients belonging to the 2nd mode of Trunkey's tri-modal pattern of mortality, who are salvageable with timely intervention will continue to die. Our efforts presently hospital based reflect attempts to intervene in mostly the 3rd mode, which accounts for only 20%.

Pattern of Injury

Approximately 72% of all polytraumatised patients sustained head injury. This is twice the figure quoted by Bartolomeo from Germany.[15] This study further supports the assertion of other authors that head injury accounts for most of the mortality and morbidity following polytrauma.[16,17] Forty eight percent of all complications and 80% of all mortality occurred in patients with severe head injury (SHI).

The next most frequently encountered injury in polytraumatised patients is orthopaedic injuries, which were present in 64.1% of the study population. Disturbingly up to 33% of these patients subsequently signed and left the hospital against medical advice - opting for traditional fracture management once the associated injury had been taken care of. This unhealthy practice of absconding to the traditional bonesetter has been the subject of extensive work by Nwadiaro *et al.*[18–20]

A chest injury rate of 29% is only slightly less than the 35–40% quoted in foreign literature.[2] The pattern of associated injuries closely parallels what was reported by Nakayama[21] and Taylor[22] i.e. head, orthopaedic and abdominal injuries occur in up to 70%. As in foreign literature where it is said to contribute to 75% of mortalities,[2] it was present in 70% of all polytrauma patients who eventually died. In Adejuyigbe's series, 26 of 195 children with abdominal injury also had lung laceration or contusion and a further patient had sternal fracture. Although representing only 13% in that series, it is instructive to note that all died.[23]

Sixteen percent of patients had abdominal injury. Blunt injury predominated in 73%, in contrast to findings from mainly North America where penetrating predomominates owing to higher incidents of gunshots. The spleen and diaphragm were the most frequently injured organs, followed by liver, bowel, and the retroperitoneum. This pattern of intra-abdominal organ involvement is consistent with previous studies from this hospital.[24] The mortality of 2 patients supports the assertion that abdominal injury is not a common cause of death in polytrauma.[25]

Injuries involving the skin tend to be trivialised but could be life threatening especially when it is the site of massive haemorrhage. It must also be remembered that the extensive full thickness burn is the most severe form of trauma. In this study 16.8% of the patients had skin injury and these were not associated with any long-term sequelae.

Facial injury occurred in 13% of the patients. The potentials for immediate threat to the airway and for disfigurement in the long-term make it mandatory not to underestimate the facial injury whenever it occurs.

The spinal injury rate of 10.7% is les than what obtains abroad.[13] The pattern of commonly associated injuries (head, chest, extremity) is generally in keeping with Igun's earlier work from this institution.[26] In keeping with Solagberu's [27] series, the cervical region was most frequently injured (6 patients or 42.9%) followed by the thoracic (5 or 35.7%) and then the lumbar (3 or21.4%). The fact that 20% of the complications and 10 percent of all mortality occurred in spinal injured patients reaffirms the fact that spinal injury portends a poor prognosis in patients with polytrauma.[11]

The vast majority of patients who sustain polytrauma have either sustained a head injury or an orthopaedic injury. It follows that efforts to improve the management of these patients must include efforts at improving neurological and orthopaedic trauma care. Although those who sustain a chest injury are a great risk of mortality, it is gratifying to know that majority are amenable to simple measures (specifically, chest tube insertion).

Outcome

One of the two patients with missed injuries died. This emphasizes the need to be thorough in the evaluation of the patient especially during the tertiary trauma survey. The complication rate of 20.6% implies a lot of burden on the patient and the health system from these injuries. Ten percent of the patients died but majority of them (80%) had head injury, further stressing the importance of head injury as a major cause of death in polytraumatised patients. The mean injury severity score of 17.4 shows that polytrauma is typically associated with very severe injuries and is therefore deserving of energetic management especially during the phase of initial care.

Conclusions/Recomendations

Since RTA remains the commonest aetiology for trauma, efforts at decreasing its occurrence need to be emphasized. These include better road design and maintenance, more stringent vehicle certification, driver education and general behavior modification. In this respect, trauma is a very important public health issue.

There is a need to establish emergency medical services and pre-hospital care in our environment. This should be an integral part of the Emergency Medical Response and Disaster Preparedness Programmes. The importance of this can be projected when one considers that the mean ISS was 17.4, above the standard definition of severe injury (ISS 16),[3] a finding in patients who are presenting to hospital belatedly (mean interval before presentation of 33 hours).

Perhaps the most important factor associated with the improved quality of care and outcome of trauma in advanced societies notably in the United States of America has been the establishment of dedicated trauma teams in hospitals and the designation of appropriately equipped institutions as trauma centers. (Levels I to III). Not only has this demonstrably been associated with far better outcome, but has served as the corner stone of the trauma care systems obtainable there.[25] This has predictably led to the emergence of yet another super-specialty - Trauma Surgery. It is strongly recommended that this model be replicated in our environment if we are to have any hope of unraveling and containing the scourge of trauma in general and poytrauma in particular in our society.

REFERENCES

1. Burch JM, Francois RJ, Moore EE. Trauma. In: Schwartz SI, Spencer FC, Shires GT. *et al:* (Eds). Principles of surgery 7th ed. McGraw Hill 1999; (7): 155–221.
2. Litwin GM. Trauma: Management of the injured patient. In: Sabiston DC: (Ed) Davis Christopher Textbook of surgery. Vol. 1 Igaku Shoin Saunders. 1981; (12): 368–415.
3. Robertson C, Redmond AD. (Eds). Epidemiology and measurement of trauma. In: The management of major trauma. Oxford University Press. 1992: 5–27.
4. Trunkey DD. Trauma, accidental and intentional injuries account for more years of life lost in the US than cancer and heart disease. Among the prescribed remedies are improved preventive efforts, speedier surgery and further research. *Scientific American.* 1983; **249:** 28–35.
5. Achampong EQ, Anyanwu CH, Ohaegbulam SC, Yeboah ED. Management of the injured patient: Penetrating and non Penetrating injuries. In: Badoe EA, Achampong EQ, da Rocha-Afodu JT. (Eds). Principles and practice of surgery including pathology in the tropics. Assemblies of God literature centre, Accra 2000; (3): 142-77.
6. Oestern HJ. Management of polytrauma patients in an international comparison. Unfallchirug. 1999; **102:** 80–91.
7. Vanguard vol. 119 No 49669. 4. 02 Pg 38.
8. Advanced Trauma Life Support ® course manual. American college of surgeons. 6th edition. 1997.
9. Teasdale G, Jennett B. assessment of coma and impaired consciousness. A practical scale. Lancet. 1974; 2: 81-84.
10. Baker SP, O'Neil B, Haddon W, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *Journal of Trauma.* 1974; **14:** 187–96.
11. Hebert JS, Burnham RS. The effect of polytruama on patients with traumatic spine injury: A prospective database of spine fractures. *Spine* 2000; **25:** 55–60.
12. Rabinovici R, Ovadia P, Mathiak G, Abdullah F. Abdominal injuries associated with lumbar spine fracture in blunt trauma. *Injury* 1999; **30:** 471–4.
13. Prasad VS, Schwartz A, Bhutani R, Sharkey PW, Schwartz ML. Characteristics of cervical spine and spinal cord injuries in a polytrauma population: Experience from a regional trauma unit. *Spinal Cord Aug* 1999; **37:** 560–8.
14. Adeyemi-Doro HO. Trends in trauma care in Nigeria. *African Journal of Trauma.* 1 2003; (1): 35–8.

15. Bartolomeo S, Michelutto V. Epidemiological study on high grade trauma. Friuli VG major study group Minerva Anestestiologica 1999; **65:** 348–52.
16. Kreklau B, Schieller EE, Meissner A, Dasch RH. How much does high-grade trauma determine the prognosis of polytraumatised patients? *BJS Suppl.* 1994; **81:** 127.
17. Acosta JA, Yang JC, Winchell RJ, Simmons RK, Fortlage DA, Hollingsworth-Fridlund P. Lethal injuries and time to death in a level 1 trauma centre. Journal of the American College of Surgeons 1998; **186:** 528–33.
18. Nwadiaro HC, Liman HU, Onuh IM, Ozoilo KN. Presentation of complications among orthopaedic in patients. *Nigerian Journal of Surgical Sciences* 1999; **9:** 34–7.
19. Nwadiaro HC, Nwadiaro PO, Kidmas AT. Principles of traditional bone setting in the middle belt of Nigeria: a critical appraisal. *Nig Journal of Surgical Research.* 3 4 2004; **6:** 114–8.
20. Nwadiaro HC, Nwadiaro PO, Kidmas AT, Ozoilo KN. Outcome of traditional bone setting in the middle belt of Nigeria. Nig. Journal of Surgical Research. 8: 2006, 39–43.
21. Nakayama DK, Ramenofsky ML, Rowe MI. Chest injuries in childhood. *Ann Surg.* 1989; **210:** 770–5.
22. Taylor G, Eichelberger M. Abdominal CT in comatose children. *Ann of Surg* 1989; **210:** 225–33.
23. Adejuyigbe O, Aderounmu AO, Adelusola KA. Abdominal injuries in Nigerian children. *J R Coll Surg Edin.* 1992; **37:** 29–33.
24. Yiltok SJ. The pattern of abdominal injuries in patients undergoing laparotomy for abdominal trauma in the Jos University Teaching Hospital. Dissertation submitted to National Postgraduate Medical College of Nigeria. 1999: 3–11.
25. Magin MN, Erli HJ, Mealhase K, Paar O. Multiple trauma in children: patterns of injury – treatment strategy – outcome. *European Journal of Paediatric Surgery*. 1999; (915): 316–24.
26. Igun GO, Obekpa OP, Ugwu BT, Nwadiaro HC. Spinal injuries on the Plateau State, Nigeria. *East African Medical Journal.* 1999; **76:** 75–9.
27. Solagberu BA. Spinal Cord injuries in Illorin, Nigeria. *WAJM.* 2002; **21:** 230–2.
28. Hoff WS, Reilly PM, Rotondo MF, DiGiacomo JC, Schwab W. The importance of the command physician in trauma resuscitation. *Journal of Trauma: Injury, Infection and Critical Care.* 1997; **43:** 772–7.