

## MANAGEMENT OF PATIENTS WITH POST- TRAUMATIC EXPOSED BONES AT MOI TEACHING AND REFERRAL HOSPITAL, ELDORET, KENYA

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### ABSTRACT

**Background:** The global frequency for open long bone fracture is at least 11.5 cases per 100,000 persons per year. Precise published research information regarding the characteristics and the management of patients with post- traumatic exposed bones for Africa, Kenya and Moi Teaching and Referral Hospital- Eldoret is non- existent. This study will provide the much needed research information.

**Objective:** To assess the characteristics of patients with post- traumatic exposed bones with their management at Moi Teaching and Referral Hospital, Eldoret.

**Setting:** Moi Teaching and Referral Hospital, Eldoret, Kenya.

**Design:** Hospital based descriptive retrospective study.

**Subjects:** One hundred and ninety six patients managed for post- traumatic exposed bones between 1<sup>st</sup> January, 2006 and 31<sup>st</sup> December, 2010.

**Methods:** The medical records (files) were retrieved from the Records Department; data was gathered, recorded in observation checklist, organized, cleaned and analyzed in the statistical package for social science software version 19.

**Results:** Males-167, females-29; ratio: 5.76:1. Mean age: 32.51 years (SD=13.26). Referrals were 51%, at least 60% were of low literacy and income earning status. All patients had exposed bones due to open fractures (97%) and degloving injuries (3%). Road traffic accidents were responsible in 49.5% of the patients. Duration of ailment was 0-300 days (median= 1.00). All patients benefited from surgical interventions. Waiting time for surgery was 0-67 days (median= 1.00); while number of procedures were 1-9 (mean= 2, (SD=1.6)). Survival was 99.5%; length of hospitalization was 2- 177 days (median= 24.00; mean= 36.3 days (SD= 32.8)). The main complication was infection (62 patients). Follow up was adhered to by 59% of the patients.

**Conclusions and Recommendations:** Majority of patients were: referred, males, of low literacy and low income earning status. All patients had exposed bones and benefited from one form or another of the numerous surgical interventions with satisfactory outcome. Scarcity of resources remained major challenge. There is need to create awareness and empower people socio-economically; as well as providing resources required in prevention, control and treatment of this disorder.

**Key words:** Exposed bones, Debridement, Fracture stabilization, Coverage procedure

### INTRODUCTION

Exposed bone due to trauma occurs when the soft tissue cover is lost, and may occur in isolation or may be associated with other injuries (1-7). There are many forms of trauma; mechanical and non- mechanical (8-10). Risks and pre- existing medical conditions have been documented as being associated with many cases of trauma (3, 8, 11- 13).

The global frequency for long bone fracture is estimated as at least 11.5 patients per 100,000 persons per year (1, 14). According to some sources (15), each year 3.5- 6.0 million fractures occur in United States, while in the European literature at least 150,000 fractures are open types, whereas in India, at least 4.5 million open fractures occur annually.

In Africa however, there is paucity of published literature hence there is no precise figure (2, 16). The same applies to Kenya and Moi Teaching and Referral Hospital, Eldoret.

Road traffic accidents contribute greatly. It is reported that 50-60 million people suffer disabling injuries globally, while at least 1.2 million per year die. In Europe and America 8 and 13 deaths per 100,000 persons occur per year respectively. Africa continent leads with 32 deaths per 100,000 people per year (17), while in Kenya it is at least 3000 per year (18).

Trauma commonly affects the males in their most economically productive age group. It may affect any region of the body, with the lower limbs leading in most instances (14, 19- 22). The traumatized individual

needs prompt and appropriate care at both the scene of injury and the health institution (15,16,23). The care is often complex, requiring expertise of surgeons (orthopaedic, plastic and vascular), support staff and well equipped theaters (1,23-28). Rehabilitation is important component of care (29,30). Even after discharges from the wards, prolonged follow up are necessary (2).

Prior to the current advancements in the care of such patients, majority ended up with loss of limbs through amputations and disarticulations (31). However, the intricacies involved in the current techniques and the resources in general are too far from being understood by the stakeholders to respond expectantly, thus a major setback is still experienced by the management team.

There are several implications for the patients with post- traumatic exposed bones. At the individual level, the hospitalization costs are high; hence a drain to the family resources and hence increase in poverty. The individual patient is left with disability (personal, functional and social). At the national level, the man-hour loss translates into production loss. At the health care level, patients strain or overburden the existing meager resources (human, financial and facilities) among others (15, 29).

The prevention aspects are challenging, ideally requiring mobilization of the stakeholders and the need to provide and effectively use the available resources, observing the established regulations and intensifying the awareness through education among others (13, 17, 18, 32- 35).

The study objective was to assess the characteristics of patients with post- traumatic exposed bones with

their management at Moi Teaching and Referral Hospital, Eldoret.

## MATERIALS AND METHODS

*Setting:* The study was conducted at MTRH, in the orthopaedics section, following approval by the Institutional Research and Ethics Committee (Ref: IREC/2009/106; Approval Number: 000429) and the Hospital administration (Ref: ELD/MTRH/R.6/VOL. II/2007) both dated 11<sup>th</sup> September, 2009.

*Design:* This was a hospital based descriptive retrospective study.

*Subjects:* One hundred and ninety six patients managed for post- traumatic exposed bones between 1<sup>st</sup> January 2006 and 31<sup>st</sup> December 2010, based on the established eligibility criteria.

*Methods:* Included records search and non- probability purposive sampling of 323 patients. These were subjected to eligibility criteria to get sample size of 196 patients. Included were patients with post-traumatic exposed bones who benefited from surgical interventions while excluded were patients who died on admission and could not benefit from surgical interventions, or patients whose files had inadequate information. Data was gathered, recorded in observation checklist, organized, cleaned and analyzed in the statistical package for social science software version 19.

## RESULTS

The characteristics of patients can be seen in Table 1. It should be noted that at least 60% of the patients were of low literacy and income earning status.

**Table 1**  
*The characteristics of patients*

Gender	Males= 167; Females=29; (Total= 196); Ratio= 5.76:1
Age (years)	Range=3- 70; Mean= 32.51; (SD=13.26; median= 30.5; Modal class= 21- 30; mode=28)
Education level (%)	Nil=3.6; primary= 59.7; secondary= 22.4; tertiary= 14.3
Occupation/ income (%)	Nil= 17.35; low= 59.2; medium= 11.7; high= 11.7
Marital Status (%)	Single=32.1; married=64.8; separated/divorced and widow=1.5 each
Residence (%)	Within Uasin Gishu County= 49.5; outside UGC= 50.5.
Referral status (%)	Overall: Referrals= 51 (4.6= from within UGC);
Denomination (%)	Christians= 94.9; Muslims= 2.55; traditional= 2.55

*The management of patients:* All patients had exposed bones due to open fractures (97%) and degloving injuries (3%) in association with polytrauma (36.8%). Although road traffic accidents were responsible in the majority of patients, the other causes (8.2%) included falls while jumping over the fences (12 patients),

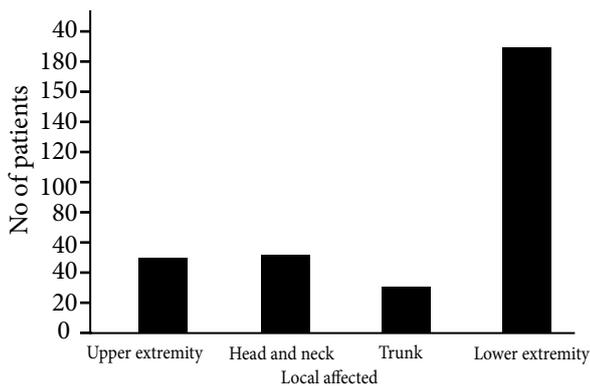
trapped by the wheel spokes while playing and burns in the epileptic (1 patient each). It should be noted that all patients benefited from surgical interventions (debridements, irrigation, fracture stabilizations and coverage). The other features can be seen in Tables 2 and 3, and Figures 1, 2 and 3.

**Table 2**  
*Presentation*

Symptoms	Pain, swelling. Deformity, wounds exposing bones (open fractures, degloved injury), loss of function in all patients among other complains
Duration (days)	0- 300; mean= 8.26, (SD= 33.206; median= 1.00; mode= 1)
Causes (%)	Road traffic accidents=49.5; assaults=32.1; occupational=10.2; others=8.2
Risks/co-morbidity (Number)	Alcoholism=12; drugs=1; epilepsy=3; psychosis=2; DM=1
Signs (%)	General: Ill-looking= 96.9; vital signs derangements=74.6 Local: Head/neck=23; Upper extremity=22; trunk=12; lower extremity=94 Systemic: CNS=7.1; Cardio-Respiratory=0.5; Abdominal-pelvic=5.6
Investigations (%)	Lab: Hb<10g%=23; deranged UEC=77; microbials (microscopy/culture/sensitivity)=7 Radiological: Radiographs=100; CT scan=5

**Figure 1**

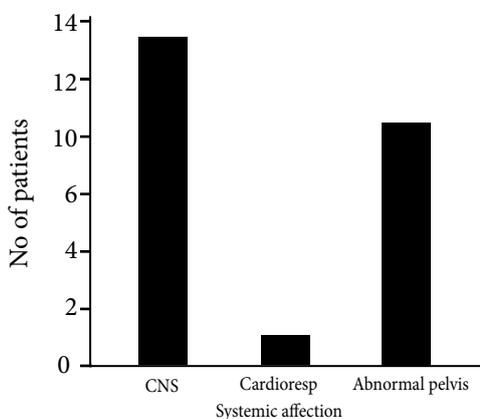
*Local affection in patients with post- traumatic exposed bones.*



*The lower extremities suffered most with 184 patients.*

**Figure 2**

*Systemic affection in patients with the post- traumatic exposed bones.*



*The central nervous system was the leading in systemic affection.*

**Figure 3**

*The ulna was exposed as seen in the diagram; similarly the radius was exposed and could be appreciated when the forearm was supinated. This was Gustilo- Anderson III C injury. Systematic debridements, irrigation with normal saline and external fixation were done.*

*Young male with exposed radius and ulna (Rt) following gunshot*



**Table 3***Treatment options and outcome*

Initial care (%)	Advanced trauma and life support = 50
Specific care (%)	Debridement/stabilization=35.4; systematic debridement=16.6; debridement/open reduction internal fixation= 19; debridement/coverage=12.4; others=35.4; Gustilo- Anderson I- III (4, 45, 51)
Waiting time (days)	0- 67; mean=3.43, (SD= 6.554, median=1.00; mode= 1); longest for Gustilo II
Procedures (Number)	1- 9; mean= 2.41, (SD= 1.64; median= 2.00; mode=1)
Outcome (%)	Survived= 99.5; died= 0.5
Complications (Number)	Infections=62; joint stiffness=22; fracture non-union=5; others=14
Hospitalization (days)	2- 177; mean= 36.3; (SD= 32.9; median= 24; mode= 7)
Follow- up at 6 months (%)	Adherence= 59

**DISCUSSION**

*The characteristics of patients:* The majority of the patients (51%) were referred, with only 9% from health institutions within Uasin Gishu County (UGC), while 91% from the health institutions outside the UGC. This is expected as Moi Teaching and Referral Hospital (MTRH) serves as a referral center. The remaining 49% of the patients sought surgical care without necessarily being referred. The mean age of the patients and the male gender preponderance fall under the group most economically productive, being involved in various activities. The majority of the patients were married, with commitment to take care of the family. The males being the bread winners have to go out to fend for the family, as well as engaging in many social activities hence predisposed to injuries. These results concur well with what have already been documented by several authors (2, 14, 16). The ailment affected more males than females with the commonest age group being 20-40 years old (14). The male to female ratios were found by Adegbehingbe *et al* (16) to be 2.52:1 and 2.9:1 by Adeleke *et al* (2).

*The management of patients:* At presentation to the accident and emergency center in the casualty triage followed, whereby 50% of the patients were of the emergency category, the remaining being non-emergency, mostly from other health institutions, where presumably they had been stabilized. The former were quickly subjected to the primary survey and resuscitation as well as prioritization care concept, till reasonable stability was achieved. Then all the patients were subjected to secondary survey, relevant investigations and planned treatment modalities. These results concur well with Advanced Trauma and Life Support protocol as documented by American College of Surgeons Committee on Trauma (23) and other authors (16, 23, 25). The results on clinical features (symptomatology) though diverse concur well with those in reports by Court- Brown *et al* (14) and Melvin *et al* (23).

The majority of patients attributed causes to trauma by the RTAs, while few had risk factors and pre-existing medical conditions. Again these results concur well with those in reports by several authors (12-14,21,22), including Melvin *et al* (23). The duration of ailment ranged from few hours to 300 days, with a mean of 8.26 days (SD= 33.206). Within 8 hours of injury, only 18.37% of patients had reported to MTRH, Eldoret. The figure was 69.9% within 24 hours. These results were in contrast to those of Adeleke *et al* (2), whereby within the same periods 51% and 93% of patients had been seen respectively. In our set up this can be attributed to characteristics of patients and inadequate resources at the health institutions.

The road traffic accidents in this study were multifactorial and included motor vehicles, tractors, motorcycles, bicycles, combined harvesters and handcart versus the vulnerable population. The results of this study showed that 78 out of 97 patients (80.41%) had the trauma due to motor vehicle category, with the majority reporting having been hit by moving vehicles. The “*boda boda*” had significant contribution too (16 out of 97; or 16.5%). Other significant contributions were from assaults (32.1%) and occupation related (10.2%). These aetiological factors documented in our results concur well with what have been documented by several authors (1,14,19,23).

The results of the study identified some pre-existing medical conditions (diabetes mellitus, epilepsy and psychosis) and risk factors (alcohol and drugs) that were present in the patients and concur well with those in reports by several authors (8,12,13), including Melvin *et al* (23). Alcoholism and drug intoxications in particular have gained prominence in the young patients involved in road traffic accidents (3, 11).

The results of the study show that the majority of the patients (96.6%) were generally ill or sick looking, with several having deranged vital sign parameters (pulse, respiratory rate, blood pressure and temperature). The results of this study concur well with

those in published reports by several authors (14, 16, 19- 22). According to Court- Brown *et al* (19), at least 24% of all the fractures involved the tibia due to the fact that it has less soft tissue cover as compared to the other long bones of the body, hence being the most predisposed.

At this health institution, the concept of taking instant photographs of patients with Post- Traumatic Exposed Bones (PTEB) injured regions prior to application of dressings has not been effected; rather it depended on the interest of the surgeon taking care of the patient at the time of admission. In Britain, the British Orthopaedic Association and British Association of Plastic Surgeons Working Party (24) recommend the practice, which has several advantages, including helping in further decision making as documented by several authors (14, 24).

A total of 21.9% of the patients had to be urgently transfused blood, majority (13.3%) being of blood group O rhesus positive. Several patients (76.45%) had deranged parameters (urea, creatinine and electrolytes among others). These results of the study concur well with those in published reports already documented by several authors including Adegbehingbe *et al* (16).

The results of pus swab analysis showed that *Staphylococcus aureus* was the commonest microbe in this locality, with surprising resistance pattern to the commonly used antimicrobials. This showed how serious the post-traumatic exposed bones were, being associated with high degree of tissue devitalization and contamination hence infection, necessitating serious measures to be undertaken. Melvin *et al* (23) and other authors (14,16) have documented the presence of infections, with the *Staphylococcus aureus* leading and having tendency to unique antibiotic resistance patterns.

Scarcity of resources (finance, material, technology and human among others) in health institutions in developing countries is a common problem, making patients await surgical procedures for unnecessarily long duration, increasing chances of complications. Referral logistics- unavailability of ambulance services also contribute to delays. The results in this report concur well with what have been documented by several authors (2, 4).

As for wound and hence bone coverage the majority were easily achieved by undermining the edges then approximating by using the “Donati-Allgower suture pattern” as documented by Melvin *et al* (23). However, 66 patients needed the complex closure, as recommended by Cross II *et al* (15).

## CONCLUSIONS

The majority of patients with post- traumatic exposed bones were referred. The disorder affected more males than females, with majority having achieved

primary level of education and engaged in low income generating activities. The symptomatology was diverse. Plain radiographs formed the bulk of investigations. The majority of the patients benefited from systematic debridements, irrigation with normal saline, fracture stabilization and coverage procedures despite constrained resources. Though the outcome was satisfactory, high morbidity, disability and some mortality were experienced.

## RECOMMENDATIONS

Emanating from the results of the study the following recommendations are suggested:

- (i) Based on the characteristics of the patients, there is need to educate, create and intensify the awareness and engage in publicity campaigns about the seriousness of the post- traumatic exposed bones and the associated injuries; and involve all the stakeholders, spearheaded by health professionals.
- (ii) Every attempt should be made to empower people socio-economically so as to be able to take prompt action and be able to actively participate in the self-care. The Ministry of Sports and Youth Affairs can spearhead this aspect and oversee efficient use of youth funds.
- (iii) There is need also to target the specific aetiological factors, risks and pre- existing medical conditions in order to come up with solutions

## REFERENCES

1. Clough, T.M. and Bale, R.S. Audit of open tibial diaphyseal fracture management at a district accident center. *Ann R Coll Surg Eng.* 2000; **82**(6):436- 440.
2. Adeleke, O.I., Temitope O.A., Ogunlade, S.O., Ajibade B.O., Nottidge, T.E. and Anyorinde, R.O. The changing trends in the pattern of tibial fractures in Nigeria. A review of 70 cases. *J Orthopedics.* 2008; **5**(2) e4.
3. Sawyer, J.R., Kelly, D.M., Kellum, E. and Warner, W.C. Orthopaedic aspects of all- terrain vehicle-related injury. *J Amer Acad Orthopaed Surg.* 2011; **19** (4): 219- 225.
4. Ebong, W.W. The pattern of fractures and dislocations in Western Nigeria. *Injury.* 1978; **9**: 221- 224.
5. Nicoll, E.A. Fractures of tibial shaft: a survey of 705 cases. *J Bone Joint Surg.* 1964; **46-B**: 373- 387.
6. Humphries, R.L., Stone, C.K., Stapczynsk, J.S., and Florea, S. An assessment of paediatric all-terrain vehicle injuries. *Paediatr Emerg Care.* 2006; **22**(7): 491- 494.
7. Gougoulias, N.E., Khanna, A. and Maffulia, N. Open tibial fractures. Are children adults? *Hippokratia.* 2009; **13**(3): 147- 153.

8. Cavadas, P.C. Limb salvage in a burn patient with a muscle- free flap. *Annals of Burns and Fire Disasters*, vol. XIII- no.1. March 2000.
9. Klein, L., Dousa, P., Zajicek, R., Pafcuga, I. and Tokarik, M. Specific aspects of the treatment of patients with multiple mechanical burn injuries. *Acta*, 2008; vol 50. Available at: [www.medbc.com/medtline/.../acta/vol\\_50/.../vol50n1p17.asp](http://www.medbc.com/medtline/.../acta/vol_50/.../vol50n1p17.asp)
10. Parrett, B.M., Pomahac, B., Demling R.H. and Orgill, D.P. Fourth- degree burns to the lower extremity with exposed tendon and bone: a ten-year experience. *J Burn Care Res*. 2006; **27**: 34- 39.
11. Odero, W., Khayesi, M. and Heda, P.M. Road traffic injuries in Kenya: Magnitude, causes and status of intervention. *Injury Control Safety Promotion*. 2003; **10**: 53- 61. Available at: [Webpage: \\_http://www.bmj.com/cgi/eletters/333/573/860](http://www.bmj.com/cgi/eletters/333/573/860)
12. Hall, A.J., Bixler, D., Helmkamp, J.C., Kraner, J.C. and Kaplan J.A. Fatal all- terrain vehicle crashes: Injury types and alcohol use. *Am Prev Med*. 2009; **36**(4): 311- 316.
13. Testerman, G.M. 300 all- terrain vehicle crashes: An East Tennessee trauma center's experience. *Tenn Med*. 2009; **102**(8): 45- 47.
14. Court- Brown, C.M., Rimmers, S., Prakash, U. and McQueen, M.M. The epidemiology of open long bone fractures. *Injury*. 1998; **29**: 529- 534.
15. Cross III, W.W. and Swiontkowski, M.F. The principles in the management of open fractures. *Indian J Orthop*. 2008; **42**(4): 377- 386.
16. Adegbehingbe, O.O., Oginni, L.M., Olorunnisola, O.A. and Akanbi, O.O. Exposed bone syndrome: Classification and scoring of exposed long bone. *The Internet J Orthop Surg*. 2008; **8**(1) 1-4.
17. WHO. (1999). Global status report on road safety: Time for action. Available from: ([www.who.int/violence\\_injury\\_prevention/road\\_safety\\_status/2009](http://www.who.int/violence_injury_prevention/road_safety_status/2009)).
18. Central Bureau of Statistics, CBS (2006). Statistical abstract. Ministry of Planning and National Development, Kenya. The Government Printer, Nairobi, pp 190- 191.
19. Court-Brown, C.M. and McBirnie, J. The epidemiology of tibial fractures. *JBJS Br*. 1995; **77**: 417- 421.
20. Alabi, Z.O. The pattern of tibial fractures in Ilesa, Nigeria. *Nig Med J*. 1981; **11** (1): 22- 29.
21. Oguachuba, H.N. The pattern of tibia and fibula fractures in Jos, Plateau State, Nigeria. *Nig Med J*. 1981; **11**(1):22-29.
22. Helmkamp, J.C., Furbee, P.M., Cohen, J.H. and Tadros, A. All terrain vehicle- related hospitalizations in the United States, 2000- 2004. *Am J Prev Med*. 2008; **34**(1): 39- 45.
23. Melvin, J.S., Dombroski, D.G., Torbert, J.T., Kovach, S.J., Esterhai, J.L. and Mehta, S. Open tibial shaft fractures: I Evaluation and initial wound management. *J Am Acad Orthop Surg*. 2010; **18**(1): 10- 19.
24. Court-Brown, C.M., Cross, A.T., Hahn, D.M., Marsh, D.R., Willett, K., *et al*. British Orthopaedic Association of Plastic Surgeons working party. The management of open tibial fractures. *Br J Plast Surg*, 1997; **50**(8): 570- 583.
25. Fujita, M., Yokoyama, K., Tsukamoto, T., Aoki, S., Noumi, T., *et al*. Type III open tibia fractures in children. *European J Orthop Surg Traumatology*, 2001; **11**(3): 169- 175.