Epidemiology and In-Hospital Clinical Outcome of Post Traumatic Limb Amputations in Lady Reading Hospital Peshawar

Mian Amjad Ali, Faaiz Ali Shah, Naeemullah, Afsar Khan, Abdul Rehman Qureshi

ABSTRACT

Objective: To find out the epidemiology and in-hospital clinical outcome of post traumatic major limb amputations.

Methods: This descriptive case series study was carried from February 2014 to June 2016. Life saving major limb amputations were performed in Accident and emergency Department (A & E) in patients of both gender and any age fulfilling the inclusion criteria. The demographic data and clinical data of mechanism of injury, level of amputation, associated injuries, Mangled Extremity Severity Score (MESS), postoperative stump wound infection, length of hospital stay and mortality were recorded. Patients were followed up till discharge from hospital.

Results: A total of 82 patients(87 major limb amputations) with mean age 29 years (range 7 to 48 years) were enrolled in this study. Male patients were 77(93.9%) while female patients were 5(6%). Motor bike accident was accounted for the highest number of limb amputations (n=21, 24.1%) followed by sugar cane crusher machine (n=13, 14.9%). Upper limb amputations were 59.7% while 40% were of lower limb.Below elbow amputations were 39% while above elbow were 20.6%. Below knee amputations were 29.8% while above knee were 10.3%. Stump wound infection was reported in 16%. Stump refaschioning or revision was done in 28.7%. Five (6%) patients died in hospital. In hospital mortality was 6%.

Conclusion: Upper limb amputations were more frequent than lower limb. Below elbow amputations were more common than above elbow or below knee amputations.Younger male patients(15 to 20 years) with motorbike injury was the most commonly affected group.Stump wound infection was the most common post operative complication.

Key words: Trauma, Amputation, Mangled Extremity Severity Score(MESS).

INTRODUCTION

Amputation is defined as the removal of the whole or part of a limb by cutting through bone or joint [1]. Limb amputations have been done since time immemorial and the evidence of amputation as a medical treatment for trauma or disease comes from ancient Egypt [2,3], while the the first surgical description of a leg amputation was reported by Hippocrates (460-377 BC) [4]. There is significant geographical variation in amputation rates, mortality rates and below knee to above knee amputation ratios [5]. In the developing countries trauma is the leading cause of amputation, whereas in developed countries peripheral arterial limb amputations [6,7]. Traumatic amputations accounts for nearly 57% of all global amputations while it appears to be the primary cause of 13% of United Kingdom and European amputations [8,9]. It is estimated that each year soliders fighting wars sustained about 3500 traumatic amputations [10]. Lower limb amputations are much more frequent than upper limb amputations and young adult males predominantly from motorcycle accidents are the victims [6,11]. Unlike surgical amputation which is a planned procedure for the removel of diseased limb due to vascular insufficiency, tumour or infection,traumatic amputation is the separation of a limb and can be sharp (guillotine), crushed, avulsion type or in combination [12]. The decision to amputate has significant repercussions medically, economically, socially and medicolegally [13]. However, when life saving amputation is the only option left, then performing early surgery decreases morbidity and mortality, decreases pain, disability and shortens patient hospitalization [14].

Department of Orthopaedics & Traumatology Unit "B" Medical Teaching Institution (MTI) & Lady Reading Hospital (LRH) Peshawar
Correspondence: Faaiz Ali Shah
E-mail: faaizalishah@yahoo.com

Traumatic amputations, like all open fractures, require surgical debridement as early as possible (usually within six hours of the injury) to prvent further soft tissue ischemia and infection [15].

Lady Reading Hospital is a referral centre for a large number of orthopaedic and trauma patients and provides orthopaedic, vascular and plastic surgical service to the entire population of Khyber Pakhtunkhwa province and Afghanistan. In our set up patients reach the hospital late.Replantation facilities are not available in our hospital or nearby. Mostly, traumatic patients have an element of crush and avulsion while the ideal case for replantation is a sharp cut injury. The lack of pre-hospital care and optimum care of amputated part is another factor favouring early amputation. Moreover, patients with multiple system involvement due to trauma often simply cannot withstand prolonged surgery without complications. Early amputation therefore is part of life-saving process that must be considered even though the limb may be potentially salvageable in some of the cases.At the time of writing this study, there was no previous published data on traumatic amputations from this hospital. We conducted this descriptive study to find out the epidemiology and in-hospital clinical outcome of post traumatic limb amputations in our set up and to make recommendations towards reducing the incidence. Our study results may be used in establishing national traumatic extremity amputation rates that would help in planning for preventing traumatic amputations.

METHODS

This descriptive case series study of patients of all ages and both gender with traumatic major limb amputations(proximal to wrist and ankle joint) partial, complete, crushed and sharp with Mangled Extremity Severity Score (MESS) [16] of ≥7 and high voltage electrocuted limbs presenting to Accident and Emergency (A & E) Department were included in the study. Amputations due to peripheral vascular disease, diabetes, minor traumatic limb amputations (amputations distal to the wrist and ankle), arterial injuries requiring amputation after failed attempts at revascularization and patients received dead were excluded from the study. The study was approved by the Ethical Committee of the hospital. Informed written consent for life saving amputation and data publication was taken from near relatives of the patient. All the patients were received and given adequate resuscitation in the Accident and Emergency Department according to the ATLS protocol. Complete history was taken, associated life threatening head injury, thoracic, abdominal and pelvic injuries were treated initially by the concerned units.Xray chest,pelvis and affected limbs were taken in every polytrauma patient. CT scan brain and ultrasound abdomen were done in patients where indicated. The demographic data of patient age, gender, education level, occupational status and clinical data of mechanism of injury, injury site, duration of injury before presentation, level of amputation, associated injuries, Glasgow Coma Scale (GCS) and Mangled Extremity Severity Score (MESS), postoperative surgical site infection, wound dehiscence, stump revision, length of hospital stay,care in intensive care unit (ICU) and mortality were recorded for these patients. Patients were followed up till discharge from hospital. All patients had wound debridement, blood transfusion (where needed) normal saline lavage, anti-tetanus and antibiotic cover. As a general guiding principle for amputation, every effort was made to preserve as much residual limb length as possible. The stump was either left open or closed primarily depending upon the condition of soft tissues. Under tourniquet control extensive debridement of stump was done in each case. Bony ends were smoothend and covered with soft tissues as much as possible with creful separation of nerves to prevent neuroma formation. Patients who developed post-op complications were managed appropriately. Data collected were analysed using the Statistical Package for Social Sciences (SPSS version 18). Frequency and percentages were used for categorical variables like gender while mean was used for numerical variables like age. Data were presented in the form of a table.

RESULTS

A total of 87 major limb amputations were performed in 82 patients. The mean age of the patients were 29 years (range 7 to 48 years). Male patients were 77 (93.9%) while female patients were 5(6%). The aetiology, frequency and distribution of traumatic major limb amputations is shown in table 1.

Majority of amputations were of upper limb (59.7%,n=52) while 40% (n=35) were of lower limb. Right side was involved in 78.8% (n=41) while left side was involved in 21.1% (n=11). Below elbow amputations were 39% (n=34) while above elbow were 20.6%(n=18). Below knee amputations were 29.8% (n=26) while above knee were 10.3%(n= 9). Three patients (3.6%) had shoulder disarticulations, high voltage electrical injury

was the cause in two patients and motor bike accident in one patient. Two patients (2.2%) had hip disarticulations due to motor bike accident. Five patients (6%) had more than one major amputation. Two (2.4%) of them had bilateral below elbow amputations due to high voltage electrical injury, while three patients (3.6%) had ipsilateral below elbow amputations and below knee amputations due to motor bike accident. Majority (59.7%, n=52) of amputations were of the crushing type while sharp (guillotine) amputations were reported in 40.2% (n=35). Complete amputations were 48.2% (n=42) while incomplete or partial amputations were 51.7% (n=45). The mean Mangled Extremity Severity Score (MESS) score was 9. High voltage electrical injury was responsible for 12.6% (n=11) of amputations.

Motor bike accident was accounted for the highest number of limb amputations (24.1%, n=21) followed by sugar cane crusher machine (14.9%, n=13). Paediatric limb amputations were reported in 9(10.9%) children, three (3.4%) had below elbow amputations due to high voltage electrical injury, three (3.4%) had below knee amputations due to motor bike accidents, one (1.1%) had below elbow amputation due to earthquake while two children (2.2%) had below elbow amputations caused by cattle feed cutting machine injury. The average time of arrival to the hospital since injury was 4.5 hours (range 2 to 10 hours). Per operatively amputated stumps were left open in 74.7% (n=65) and primarily closed in 25.2% (n=22) amputations depending upon the soft tissue status and contamination.

Post operatively, 30 (36.5%) patients were shifted to ICU for immediate care while the remaining 63.4% (n=52) were shifted to orthopaedic ward. The average stay in the hospital was 8 days (range 4 to 21 days). Lower limb amputees had a longer in hospital stay than upper limb amputees. Stump wound infection was reported in 16% (n=14) and culture yielded no growth in 4.5% (n=4), Staphylococus aurus in 5.7% (n=5), E.coli in 3%(n=3), Pseudomonas in 1.1%(n=1) and mixed micro-organism in 1.1%(n=1). Stump wound dehiscence was noted in 19.5%(n=17). Stump refaschioning or revision was required in 28.7%(n=25). Split skin grafting was done in 4.5%(n=4) stumps. Few (3.4%,n=3) patients were referred to plastic surgeon for flap coverage.

Additional surgical procedures include intramedullary femur nailing in 2.2% (n=2), tibial interlocking in 1.1% (n=1) and k-wire fixations of hand and feet in 5.7% (n=5). In hospital mortality in our study was 6%(n=5) and was attributed to haemorregic shock (1.2%,n=1), acute renal failure (1.2%,n=1), sepsis (1.2%, n=1) and associated brain injuries (2.4%,n=2).

Table 1: The aetiology,frequency and distribution of traumatic major limb amputations.

AETIOLOGY	**UPPER BLIMB**				**LOWER LIMB**			
	ABOVE ELBOW		BELOW ELBOW		ABOVE KNEE		BELOW KNEE	
	Right	Left	Right	Left	Right	Left	Right	Left
Motor Bike	01	-	02	01	05	02	07	03
Sugar Cane Crusher	03	01	07	02	-	-	-	-
High voltage electrical injury	04	02	03	02	-	-	-	-
Wheat Threshing machine								
Motor Vehicle	02	01	05	01	-	-	-	-
Fire cracker/Bomb blast								
Gas cylinder blast	-	-	01	01	01	-	03	01
Cattle feed cutting	-	-	02	-	01	-	02	-

machine								
Heavy object fall	01	-	01	-	-	-	02	-
Earthquake	02	-	02	-	-	-	-	-
Paedestrian injury								
Gunshot	-	-	-	-	-	-	02	01
Industrial machine injury	-	-	01	-	-	-	01	01
	-	-	01	-	-	-	02	-
	01	-	-	-	-	-	-	01
	-	-	02	-	-	-	-	-
TOTAL	**14**	**04**	**27**	**07**	**07**	**02**	**19**	**07**
	18(20.6%)		**34(39%)**		**09(10.3%)**		**26(29.8%)**	
	52(59.7%)				**35(40.2%)**			

DISCUSSION

Traumatic extremity amputations are responsible for a higher morbidity and mortality in developing nations although it is under reported. The unexpected, sudden and without pre surgical planning and counselling, loss of a limb due to trauma is unbearable for the patient and family. The aetiology and mechanism of limb amputation is different in countries due to different socioeconomic and cultural traditions [17].

Observations from our study revealed that the three major risk factors for traumatic amputations were younger age,male gender and motor bike accidents. The patients in our study were predominantly males and below the age of 30. This is similar to the findings of traumatic amputations in others studies [5,18,19]. This was due to the fact that males are more prone to traumatic events than females because they travel more frequently and are more likely to engage in risky behavior, are more adventurous and are involved more in physical exertions and fast driving. A high percentage of patients in our study were young people, who were actively involved in the economic and production sectors of society. Since our society is composed of young people in a higher percentage,the disabilities of young people were a serious economic loss to the families and community.

The results of one local study are however, interesting as it reported that the total number of body parts amputated at the time of 2005 earthquake of Pakistan was 112 and most of the victims were adult women (>18 years) because at the time of earthquake majority of females were inside their homes and received seriouss injuries due to roof and walls collapse on them at the time of earthquake [20].

In our study motor bike accident was accounted for the highest number of limb amputations (24.1%, n=21) followed by sugar cane crusher machine (14.9%, n=13). Omoke [17] documented that 50% of traumatic amputation were due to motor bike accidents in his study while Obalum [11] claimed that 61.9% of the amputations were due to motor bike accidents. We proposed special attention to training the young people about driving, prohibiting underage driving, produce safer vehicles and ensuring that roads and streets that are prone to accidents are modified and implementation of stringent road safety regulations.

We noted that 59.7% of amputations were of the crushing type while sharp (guillotine) amputations were 27.5%. Omoke [17] observed crush type of amputation

in 64.2% patients whereas guillotine type was observed in 35.8% patients. Crushed type of amputations were reported by Moini [19] in 31.7% and Rotter [21] in 50% of their patients.In our study occupational or work related accidents resulting in major limb amputations were due to sugar cane crusher injury (14.9%), wheat threshing machine injury (10.3%), cattle feed cutting machine injury (4.5%), gas cylinder blast(4.5%) and industrial machine injury (2.2%). Omoke [17] documented such amputations in 28.3%, Moini [19] 63.4% and Rotter [21] 89%. The mechanism of amputation injury we observed in all these amputations suggested lack of stringent adherence to safety precautions. Major limb amputations due to high voltage electrical burn injuries are uncommonly reported in literature.In most most cases amputation is done with extensive tissue necrosis or on those complicated by infection. Limb amputation is considered one of the most devastating consequences of electrical injury. In our study 12.6 % amputations (including two shoulder disarticulations) were due to high voltage electrical injury mostly due to non occupational accidents outdoor in children and young men. Ghavami [22] reported 23.7% while Hsueh [23] reported 19.1% major limb amputations due to high voltage electrical injury. Educating the population about the dangers and hazards associated with handling high voltage wires and use of electrical devices and instruments is imperative.

Contrary to the findings of other studies [5, 20, 24] where traumatic lower limb amputations were more frequent than upper limb, we documented that upper limb amputations were 59.7% while lower limb amputations were 40.2%. This was due to the fact that road traffic accidents more likely caused a lower limb amputation whereas the upper extremity amputation was more likely in work-related accidents. Furthermore, patients with lower extremity amputations were more severely injured, stump revision and infection was more than upper limb amputation and had prolonged hospital stay.

Paediatric limb amputations were reported in 9(10.9%) children, three (3.4%) had below elbow amputations due to high voltage electrical injury, three (3.4%) had below knee amputations due to motor bike accidents, one (1.1%) had below elbow amputation due to earthquake while two children (2.2%) had below elbow amputations caused by cattle feed cutting machine injury. Loder [25] reported 256 amputations in 235 children in the upper Midwestern United States over 20 years. Of the 256, 193 were major amputations, occurring above the ankle or wrist. Lawnmower was responsible for 69 (35.7%) amputations followed by farm machinery (29.5%,n=57) and motor vehicle accidents (19.6 %, n=38). Majority were below knee amputations (46.1%,n=89) and below elbow amputations (15%, n=29).

In our study in-hospital stump wound infection was reported in 16% (n=14) and culture yielded Staphylococus aurus in (5.7%,n=5) majority. Stump wound dehiscence was noted in 19.5% (n=17). Ajibade [1] reported 17.8% wound infection and 3.5% wound dehiscence in his study while Omoke [17] reported 56.6% (30) stump wound infection. We observed that infection and wound healing disturbance occurred in patients who had some predisposing factors like crush injury and higher degree of contamination because these traumatic amputations were not planned and occurred outside the hospital setting. One-stage amputation also appeared to be associated with increased risk of wound infection and wound dehiscence. Late presentation was also a factor that contributed to wound infections and its sequel, septic shock, observed in our study.

Stump refashioning or revision and split skin grafting was done in 25 (28.7%) and 4 (4.5%) stumps respectively in our study. Ajibada [1] did 79 (59.8%) traumatic amputations in one stage while 53 (40.2%) were done in two stages while Odatuwa-Omagbemi [24] reported that 28 (60.9%) amputation wounds healed primarily and re-amputation was done in 2(4.3%). In hospital mortality in our study was 6%(n=5) and was attributed to haemorregic shock (1.2%,n=1), acute renal failure (1.2%, n=1), sepsis (1.2%, n=1) and associated brain injuries (2.4%, n=2). Ajibade [1] reported a mortality rate of 2.3% due to septicemia and tetanus, Omoke [17] reported 7.5% due to haemorrhagic shock, septic shock, pulmonary embolism and acute renal failure while Odatuwa-Omagbemi [24] reported a mortality of 6.5%. The low mortality rate in our study was due to meticulous surgical technique and good post-operative nursing care.

CONCLUSION

Upper limb amputations were more frequent than lower limb. Below elbow amputations were more common than above elbow or below knee amputations.Younger male patients with motorbike injury was the most commonly affected group.Stump

wound infection was the most common post operative complication.

Expertise in limb salvage procedures, an increasing number of surgeons with vascular and microsurgical skills and availability of appropriate equipments may make it possible to salvage more limbs and may reduce the number of amputations.However, when amputation is inevitable then surgical goals must be to produce a painless and useful stump. All patients with amputations should be followed regulary and rehabilitated optimally. To reduce the complications of wound infection and or dehiscence, consideration should be given to performing amputation in two stages in the presence of infection. Educational campaigns for accident prevention on roads and at workplace should be intensified.

REFERENCES

1. Ajibade A. Akinniyi OT. Okoye CS. Indications and complications of major limb amputations in Kano,Nigeria.Gana Med J 2013 Dec;47(4):185-8.
2. Birch R. A history of limb amputation. J Bone Joint Surg (Br) 2008;90:1276-7.
3. Dupras TL. Williams LJ.. Meyer M. Peeters C. Depraetere D. Vanthuyne B. et al.

Evidence of amputation as medical treatment in ancient Egypt. Int J Osteoarchaeol 2009 Mar;20:405-23.

4. Van der Meij KN. No leg to stand on. Historical relation between amputations. Surgery and Prostheseology 1995;1:1-256.
5. Akiode O. Shonubi AM. Musa A. Sule G. Major limb amputations: An audit of indications in a suburban surgical practice. J Natl Med Assoc 2005 Jan;97:74-8.
6. Perkins ZB. De'ath HD. Sharp G. Tai NR. Factors affecting outcome after traumatic limb amputation. Br J Surg 2012 Jan;99(1):75-86.
7. Bisseriex H. Rogez D. Thomas M. Truffaut S. Compere S. Mercier H. et al. Amputation in low-income countries: particularities in epidemiological features and management practices. Med Trop (Mars) 2011 Dec;71:565-571.
8. Heikkinen M. Saarinen J. Suominen VP. Virkkunen J. Salenius J. Lower limb amputations: Differences between the genders and long-term survival. Prosthet Orthot Int 2007 Sep;31(3):277-86.
9. Moxey PW. Hofman D. Hinchliffe RJ. Jones K. Thompson MM. Holt JE. Epidemiological study of lower limb amputation in England between 2003 and 2008. Br J Surg 2010 Sep;97:1348-53.
10. Starnes. Benjamin W. Beekley. Alec C. Sebesta. James A. et al Extremity vascular injuries on the battlefield: tips for surgeons deploying to war. J Trauma 2006 Feb;60:432-42.
11. Obalum DC. Okeke GC. Lower limb amputations at a Nigerian private tertiary hospital.West Afr J Med 2009 Jan;28(1):24-7.
12. Trauturein LC. Smith DG. Rivara FP. Paediatric amputation injuries: aetiology, cost, and outcome. J Trauma 1996 Nov;41(5):831–38.
13. Hansen ST Jr. The type IIIc tibial fractures. Salvage or amputation. J Bone Joint Surg Am 1987 Jul;69-A:799-800.
14. Bondurant F. Colter HV. Buckle R. Cortchett PM. Browner BD. The medical and economic impact of severely injured lower extremities. J Trauma 1988 Aug;28:1270-73.
15. Khan MA. Javed AA. Rao DC. Corner JA. Rosenfield P. Pediatric traumatic limb amputation: The principles of management and optimal residual limb lengths.World J Plast Surg 2016 Jan;5(1):7-14.
16. Gregory RT. Gould RJ. Peclet M. Wagner JS. Gilbert DA. Wheeler JR. et al. The mangled extremity syndrome (M.E.S.): A severity grading system for multisystem injury of the extremity. J Trauma 1985 Dec;25(12):1147-1150.
17. Omoke NJ. Chukwu CO. Madubueze CC. Nanchi A. Traumatic extremity amputation in a Nigerian setting: patterns and challenges of care. Int Orthop 2012 Mar;36(3):613-618.
18. Umaru RH. Gali BM. Ali N. Role of inappropriate splintage in limb amputation in Maiduguri, Nigeria. Ann Afr Med 2004;3(3):138-140.
19. Moini M. Rasouli MR. Khaji A. Farshidfar F. Heidari P. Patterns of extremity traumas leading to amputation in Iran: Results of Iranian National Trauma Project. Chinese Journal of Traumatology (English edition) 2009 Apr;12(2):77-80.
20. Awais SM. Dar UZ. Saeed A. Amputations of limbs during the 2005 earthquake in Pakistan: A firsthand experience of the author. Int Orthop 2012 Nov;36(11):2323-2326.
21. Rotter K. Sanhueza R. Robles K. Godoy M. A descriptive study of traumatic lower limb amputees from the Hospital Hel Trabajador: Clinical evolution from the accident until rehabilitation discharge. Prosthet Orthot Int 2006 Apr;30(1):81-6.

22. Ghavami Y. Mobayen MR. Vaghardoost R. Electrical burn injury:A five year survey of 682 patients. Trauma Mon 2014 Nov;19(4):187-190.
23. Hsueh YY. Chen CL. Pan SC. Analysis of factors influencing limb amputation in high voltage electrically injured patients. Burn 2011 Jun;37(4):673-7.
24. Odatuwa-Omagbemi DO. Adiki OT. Extremity amputations in Warri,South-South Nigeria. J West Afr Coll Surg 2012 jan-Mar;2(1):14-24.
25. Loder RT. Demographics of traumatic amputations in children. Implications for prevention strategies. J Bone Joint Surg Am 2004 May; 86-A:923-928.