PATTERN OF UPPER AND LOWER LIMB AMPUTATIONS AMONG PATIENTS PRESENTING TO EMERGENCY DEPARTMENT OF MAYO HOSPITAL, LAHORE

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ABSTRACT

Background & Objective: Limb amputation is a surgery performed for the removal of a limb. It is indicated when the recovery of limb is impossible due to certain conditions. There are different types of amputations, and their causes, pattern, and levels can vary from one area to the other. The objective of this study was to assess the pattern of upper and lower limb amputations among patients presenting to Emergency Department of Mayo Hospital, Lahore.

Methods: This retrospective study was executed at the Mayo Hospital, Lahore, from 2018 to 2020. A total of 100 patients were included in the study. These individuals had undergone upper or lower limb amputations due to trauma or mechanical injuries. Data was taken from hospital records and entered in SPSS version 25. Descriptive statistics were used to assess the pattern of amputations. Chi-square test was used to see the association between gender and limb involvement, and $p \leq 0.05$ was considered significant.

Results: The mean age of participants was 42.7 ± 9.5 years. 75% patients were male and 25% female. 78% cases of amputations were performed because of road traffic accidents, whereas, 22% were due to mechanical injuries. Lower limb amputations were more common (60%) than upper limb amputations (40%). The most frequent levels of amputations were below-knee (58.3%) and below-elbow (62.5%). The mean Mangled Extremity Severity Score (MESS) was 7.8 ± 0.57. There was no statistically significant association between gender and type of limb amputated ($p = 0.34$).

Conclusion: Trauma remains the leading cause of limb amputation in emergency settings in Pakistan, with young to middle-aged males most affected. Lower limb amputations are more prevalent, and below-joint amputations are more common due to efforts to preserve limb function. These findings highlight the need for improved trauma prevention, early intervention, and development of a national amputation registry to inform healthcare planning and rehabilitation services.

Keywords: Limb amputation, trauma, emergency department, upper limb, lower limb, road traffic accident, Mangled Extremity Severity Score, Pakistan

Upper and lower limb amputations are associated with significant physical disability and psychosocial consequences, affecting quality of life and functional independence of patients.[1] Globally, it remains a major health concern, with millions affected and new cases occurring every year. The incidence and prevalence of traumatic amputation have significantly increased, rising from 11.37 million and 370.25 million cases in 1990 to 13.23 million and 552.45 million cases in 2019, representing a 16.4% and 49.2% increase, respectively.[2] However, the distribution of causes and incidence rates vary significantly across different regions and healthcare settings.[3,5]

Amputation can result from various causes such as frostbite, burns, peripheral vascular disease, severe infections, trauma, diabetes, malignancies, and congenital deformities.[3,4] While amputation is sometimes necessary to save a life, the decision to amputate is always challenging for doctors, patients, and their families.[6] Therefore, a more compassionate and care-

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fully guided approach is essential.

Amputations are commonly classified as major or minor. Major amputations include those at the transhumeral, transradial, transfemoral, or transtibial levels, while minor amputations involve the hand, fingers, toes, or midfoot.[7] Surgeons must consider various patterns and levels of amputation to ensure the best possible functional and clinical outcomes.[8] The level and technique of amputation are influenced by multiple factors.[9] Host-related factors include the presence of other injuries, the patient's preoperative functional status, and individual expectations. Limb-specific factors involve the level and type of injury, contamination or infection, vascular supply, and the availability of soft tissue coverage[9]. These considerations play a crucial role in determining the most appropriate surgical approach and rehabilitation potential.

In Pakistan, where emergency services often face high patient loads and resource limitations, the patterns of limb amputation may differ from those reported in other countries.[10,11] A large retrospective study found that the most common type of amputation was transtibial (61.6%), followed by transfemoral (25.7%). Trauma was the leading cause (61.9%), with bomb blast injuries (21.6%) and road traffic accidents (14.6%) being the major contributors. Among disease-related causes, diabetes mellitus was most common (4.6%), while reconstructive surgeries and congenital conditions accounted for 15.4% and 2.1% of cases, respectively.[3] Another study focusing on traumatic limb amputations (TLA) estimated the prevalence at 10.98 per 1,000 individuals (0.011%). TLAs predominantly involved upper limbs with transphalangeal amputations being most frequent, followed by amputations involving the arm and leg. Agricultural tools emerged as the leading cause of trauma in TLA cases (47%).[5]

Despite these alarming trends, Pakistan lacks a centralized amputation registry or comprehensive national data that could inform policy and improve trauma care and rehabilitation services. Understanding the current patterns of upper and lower limb amputations is essential for developing targeted prevention strategies, improving patient outcomes, and allocating healthcare resources effectively. This study aims to analyze the pattern and level of upper and lower limb amputations in the emergency department of Mayo Hospital, Lahore.

METHODS

A retrospective cross-sectional study was carried out at the Accident and Emergency Department, Mayo Hospital, Lahore, over a period of 2 years from 2018 to 2020. The study involved 100 patients with upper and lower limb amputations. Data was collected using consecutive sampling technique. Both male and female patients, aged 10 to 60 years, who underwent auto-amputation or amputation following traumatic injury were included. Patients younger than 10 or older than 60 years with amputations caused by diabetic foot complications, gangrene, or tumors were excluded.

Data was taken from hospital records after obtaining institutional approval. Demographic and clinical information including age, gender, mode of injury, limb involved, and level of amputation were noted in a pre-designed questionnaire. The Mangled Extremity Severity Score (MESS) was also recorded for each patient.[12]

Data was entered and analyzed using SPSS version 25. Continuous variables such as age and Mangled Extremity Severity Score were presented as mean ± standard deviation, while categorical variables including gender, mode of injury, limb involvement, and amputation level were expressed as frequencies and percentages. Comparative analysis between upper and lower limb amputations by gender was conducted using the Chi-square test to determine any statistically significant association, with a p-value less than 0.05 considered significant.

RESULTS

The study included 100 patients. Table 1 presents the demographic and clinical characteristics of the study participants. The study population consisted predominantly of males (75%), with females representing 25%. The mean age of the patients was 42.7 ± 9.5 years, suggesting that middle-aged adults were the most commonly affected. Road traffic accidents (RTA) were the leading mode of injury, accounting for 78% of cases, followed by machine-related injuries at 22%. Regarding the limb involved, lower limb amputations were more frequent (60%) compared to upper limb amputations (40%). The mean Mangled Extremity Severity Score was 7.8 ± 0.57, reflecting the severity of injuries sustained.

In the upper limb group, the majority of amputations were performed below the elbow, accounting for 62.5% of upper limb amputations. Above elbow amputations were less common, observed in 13 patients (32.5%), while shoulder disarticulations were rare, comprising only 2 cases (5%). For the lower limb amputations, below knee amputations were the most frequent, seen

Table 1: *Demographic and Clinical Characteristics of Patients (n = 100)*

Variables		n	%
Gender	Male	75	75%
	Female	25	25%
Mean Age (years)			42.7±9.5
Mode of injury	Road traffic accident	78	78%
	Machine injury	22	22%
Limb involved	Upper	40	40%
	Lower	60	60%
Mean Mangled Extremity Severity Score			7.8 ± 0.57

in 35 patients, representing 58.3% of lower limb cases. Above knee amputations were observed in 21 patients (35%), and hip disarticulations were the least common at 4 cases (6.6%), as explained in table 2.

Statistical analysis showed no significant difference in the distribution of limb involvement between genders (p=0.34), suggesting that both males and females were similarly affected in terms of which limb was

Table 2: *Levels of Amputation in Upper and Lower Limbs*

Variables		N	%
Upper limb	Above elbow	13	32.5%
	Below elbow	25	62.5%
	Shoulder disarticulation	2	5.0%
Lower limb	Above knee	21	35.0%
	Below knee	35	58.3%
	Hip disarticulation	4	6.7%

amputated, as shown in table 3.

Table 3: *Comparison of Upper and Lower Limb Amputations by Gender*

Gender	Pattern			p-value
	Upper Limb	**Lower Limb**	**Total**	
Male	28 (28.0%)	47 (47.0%)	75 (75.0%)	0.34
Female	12 (12.0%)	13 (13.0%)	25 (25.0%)	
Total	40 (40.0%)	60 (60.0%)	100(100.0%)	

DISCUSSION

Limb amputation is a significant cause of morbidity, mortality, and economic burden on healthcare systems across the globe[2,13,14]. The impact is even more pronounced in Pakistan[14,15]. The present study assessed the patterns, levels, and causes of upper and lower limb

amputations among patients presented to the emergency department of Mayo Hospital, Lahore, Pakistan. The majority of amputees were males (75%). Their mean age was 42.7±9.5 years. These findings are consistent with previous national and international studies.[3,10,16] A retrospective study conducted at King Fahad Medical City, Riyadh, Saudi Arabia, also reported a predominance of male patients (75%). Age distribution was also similar (45.6±19.9).[10] Another research, conducted in Malawi, revealed that the median age of the patients was 39 (25, 55) years. Majority (70.5%) of the participants were males[16]. A Pakistani study also documented a similar trend where 87.9% amputees were males, with the mean age of 37±19 years.[3] This gender difference is due to men being more frequently involved in high-risk occupations, thereby increasing their exposure to trauma-related injuries.

Road traffic accidents (78%) and machine-related injuries (22%) were the causes behind limb amputations in the present study. This is consistent with data from Pakistan, where a study involving 564 amputees reported trauma as the leading cause of amputation (74%). Among the traumatic cases, road traffic accidents were the most common (33.2%), followed by injuries sustained during earthquakes (28.1%) and mechanical injuries (10.1%).[17] Similarly, another study from Pakistan identified road traffic accidents as the second most common cause of lower limb amputation, accounting for 20% of cases.[18] In contrast, studies from Western countries showed a shift toward vascular-related amputations, particularly those caused by diabetes and peripheral vascular disease.[19,20] Rivera et al. estimated that approximately 94% of limb amputations in the U.S. were related to diabetes and peripheral vascular conditions.[20] These differences highlight the significant role of socioeconomic and healthcare systems in determining the causes of amputation across various regions.

In our study, lower limb amputations (60%) were more common than upper limb amputations (40%). Similar findings were reported in the American study examining amputation rates, which found that lower limb amputations were predominant (~91%).[20] A Saudi study also reported a similar trend (69.7% vs. 20.9%), although with a trend toward more distal amputations such as partial foot amputations (16.8%) due to improved medical management of chronic diseases.[10] In our population, below-knee amputations accounted for the majority of lower limb cases (58.3%), while below-elbow amputations were the most frequent among upper limb cases (62.5%). Similarly, a previous study conducted in Pakistan also identified below-knee amputations as the most common type among

lower limb amputations (42.5%).[21] These trends are in line with international preferences for limb-sparing procedures when feasible[22], as more distal amputations are associated with better rehabilitation outcomes and prosthetic functionality.

Shoulder (5%) and hip (6.7%) disarticulations were among the least performed amputations in this study. This aligns with previous findings due to the rare and extreme nature of injuries that require such procedures.[10,21] These high-level amputations are typically only performed when there is severe tissue destruction, uncontrollable infection, or malignancy. A Nigerian study also indicated trauma as the most common cause of limb amputations (23.5%), particularly in the younger age group, supporting the demographic pattern found in our study[23]. It was also reported in the same study that 42.9% of the amputations were above knee, followed by below knee amputations in 37%, above elbow in 13.4%, and below elbow in 1.8% of cases.[23]

The average Mangled Extremity Severity Score (MESS) in our study was 7.8±0.57, suggesting that most patients had irreversibly damaged limbs at presentation. The MESS is a valuable tool in guiding amputation decisions in emergency trauma settings.[24] Previous literature has shown that a MESS above 7 is highly predictive of the need for amputation[25], and our findings reaffirm its clinical utility in such scenarios. Interestingly, gender-wise comparison of limb involvement did not show a statistically significant difference ($p = 0.34$), suggesting that although males are more frequently injured overall, the pattern of upper vs. lower limb involvement is not gender-dependent.

Taken together, these findings provide important insights into the burden and characteristics of limb amputations in emergency departments and point to the need for national-level preventive, rehabilitative, and reporting systems to better manage this growing challenge. However, our findings do highlight the absence of national data registries in Pakistan for amputees, a gap that hampers large-scale public health planning. These databases are necessary to guide prevention, rehabilitation, and prosthetic services.

CONCLUSION

Trauma remains the leading cause of limb amputation in emergency settings in Pakistan, with young to middle-aged males most affected. Lower limb amputations are more prevalent, and below-joint amputations are more common due to efforts to preserve limb function. These findings highlight the need for improved trauma prevention, early intervention, and development of a national amputation registry to inform healthcare planning and rehabilitation services.

Author's Contribution

Conceptualization study design	AHS, AA, AA, KUI, FM, AH
Data Acquisition	FM, AH, AA, KUI, AHS
Data Analysis/ interpretation	KUI, AA, AHS, AH, FM
Manuscript drafting	FM, AHS, AA, AA
Manuscript review	AHS, FM, AA, KUI, AH

All authors read and approved the final draft.

REFERENCES

1. Roşca AC, Baciu CC, Burtăverde V, Mateizer A. Psychological Consequences in Patients With Amputation of a Limb. An Interpretative-Phenomenological Analysis. Front Psychol. 2021;12:537493. 10.3389/fpsyg.2021.537493

2. Yuan B, Hu D, Gu S, Xiao S, Song F. The global burden of traumatic amputation in 204 countries and territories. Front Public Health. 2023;11:1258853. 10.3389/ fpubh. 2023.1258853

3. Ahmad A, Ashfaq O, Akhtar N, Rana T, Gul M. Causes of Lower Limb Amputation in Patients Registered at Pakistan Institute of Prosthetic and Orthotic Sciences Peshawar-Pakistan. Khyber Med Univ J. 2019;11(1):41-4. 10.35845/kmuj-.2019.18096

4. McDonald CL, Westcott-McCoy S, Weaver MR, Haagsma J, Kartin D. Global prevalence of traumatic non-fatal limb amputation. Prosthet Orthot Int. 2021; 45(2):105-14. 10.1177/0309364620972258

5. Jabeen N, Malik S. Prevalence and pattern of traumatic limb amputations in female population of Bhimber District, Azad Jammu and Kashmir, Pakistan. Pak J Med Sci. 2015;31(1):54-9. 10.12669/ pjms. 311. 6423

6. Monaro S, West S, Gullick J. Making decisions about amputation for chronic limb threatening ischaemia. J Vasc Nurs. 2024;42(1):65-73. https://doi.org/10.1016/j.jvn.2023.11.011

7. Varma P, Stineman MG, Dillingham TR. Epidemiology of limb loss. Phys Med Rehabil Clin N Am. 2014; 25 (1):1-8. 10.1016/j.pmr.2013.09.001

8. Shelmerdine L, Stansby G. Lower limb amputation and rehabilitation. Surgery (Oxford). 2022; 40(7): 445-9. https://doi.org/10.1016/j.mpsur.2022.05.015

9. Baumfeld D, Baumfeld T, Macedo B, Zambelli R, Lopes F, Nery C. Factors Related to Amputation Level and Wound Healing in Diabetic Patients. Acta Ortop Bras. 2018; 26(5): 342-5.10.1590/1413-785220182605173445

10. Alshehri FM, Ahmed SA, Ullah S, Ghazal H, Nawaz S, Alzahrani AS. The Patterns of Acquired Upper and Lower Extremity Amputation at a Tertiary Centre in Saudi Arabia. Cureus. 2022;14(4):e24026. 10.7759/cureus.24026

11. Guilcher SJT, Mayo AL, Swayze S, de Mestral C, Viana R, Payne MW, et al. Patterns of inpatient acute care and emergency department utilization within one year post-initial amputation among individuals with dysvascular major lower extremity amputation in Ontario, Canada: A population-based retrospective cohort study. PLoS One. 2024;19(7):e0305381. 10.1371/journal.pone.0305381

12. Abdo E, Farouk N, Eiimam S, Elshinawy W, Abdel-hafez A, Hamza M, et al. Mangled Extremity Severity Score in the Assessment of Extremity Injuries – Is it Reliable? Vasc Endovasc Surg. 2023;57:445-50. 10.1177/15385744231152024

13. Qaarie MY. Life Expectancy and Mortality After Lower Extremity Amputation: Overview and Analysis of Literature. Cureus. 2023;15(5):e38944.10.7759/ cureus. 38944

14. Zakriya M, Rehman ZU, Anees M, Shaikh H, Memon AQ, Siddiqui NA, et al. Predictors of 30-day mortality in major lower limb amputations: insights from a five-year retrospective study in a South Asian LMIC. BMC Surg. 2025;25(1):300. 10.1186/s12893-025-03013-5

15. Labeeq M, Tariq MA, Tung SA, Yar MA, Rehman W, Ehsan SB. The economic impact of lower extremity amputations in diabetics. A retrospective study from a tertiary care hospital of Faisalabad, Pakistan. Pak J Surg Med. 2020;1(1):18-22. 10.5281/zenodo. 3595029.

16. Grudziak J. Etiology of major limb amputations at a tertiary care centre in Malawi. Malawi Med J. 2019; 31(4):244-8. https://dx.doi.org/10.4314/mmj.v31i4.5

17. Keramat K, Shahzad M, Tariq J, Bhutta AH. Etiology of Amputation among Patients Presented At Helping Hand Institute of Rehabilitation Sciences Mansehra. J Riphah Coll Rehab Sci. 2021;9(1):18-21. 10. 53389/JRCRS.2021090104

18. Kamran M, Rasool A, Ahsan Z, Tahir M, Rehman S, Ahmed A, et al. A Retospective Study on Causes of Lower Limb Amputation in Peshawar, Khyber Pukhtun-khwa Orthotist at Paraplegic Centre Peshawar. Pak J Med Health Sci. 2024;18:3. 10.53350/ pjmhs020241837

19. Walicka M, Raczyńska M, Marcinkowska K, Lisicka I, Czaicki A, Wierzba W, et al. Amputations of Lower Limb in Subjects with Diabetes Mellitus: Reasons and 30-Day Mortality. J Diabetes Res. 2021; 2021: 8866126. 10.1155/2021/8866126

20. Rivera JA, Churovich K, Anderson AB, Potter BK. Estimating Recent US Limb Loss Prevalence and Updating Future Projections. Arch Rehab Res Clin Transl. 2024;6(4):100376. https://doi.org/10.1016/j.arrct.2024.100376

21. Khatoon MA, Karim SMK, Khan L, Karimi S, Abro UF. Exploring the Indications, Levels, and Outcomes of Lower Extremity Amputation at a Tertiary Care Hospital in Pakistan. Cureus. 2023;15(11):e48856. 10.7759/cureus.48856

22. Raj M, Arnav A, Pal AK, Mondal S. Global Research Trends in Limb Salvage Surgery for Osteosarcoma: Findings from a Bibliometric and Visualized Analysis over 15 Years. Indian J Orthop. 2023;57(12):1927-48. 10.1007/s43465-023-01005-2

23. Nwosu C, Babalola MO, Ibrahim MH, Suleiman SI. Major limb amputations in a tertiary hospital in North Western Nigeria. Afr Health Sci. 2017;17(2):508-12. 10.4314/ahs.v17i2.26

24. Koshy DI, Koshy D, Ishaku Z. Assessment and Decision-Making in Complex Limb Fracture Management. Cureus. 2025;17(5):e83877. 10.7759/cureus.83877

25. Dradjat R, Sananta P, Savitri G, Pribadi A. The Relevance of Mangled Extremity Severity Score to Predict Amputation: A Systematic Review. Macedonian J Med Sci. 2023;11:53-7. 10.3889/ oamjms. 2023. 11324