Section: Orthopedics

Original Research Article

EPIDEMIOLOGY OF ACUTE TRAUMATIC LIMB AMPUTATIONS AT RURALTERTIARY CARE CENTRE IN HARYANA

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ABSTRACT

Background: Traumatic limb amputation is the leading cause of limb loss in developing countries compared to non-traumatic causes like diabetes, peripheral vascular disease being the main etiology in developed countries. Knowledge about the causes and patterns of trauma related amputations help in formulation of prevention strategies for limb salvage, timely management and effective rehabilitation. This study was performed to investigate the profile of acute traumatic limb amputations presenting at rural tertiary care centre in Haryana. **Materials and Methods:** A hospital based cross sectional observational study was conducted involving 125 patients presenting with traumatic limb amputation within 7 days of occurance. Data regarding sociodemographic profile, mechanism of injury, level of amputations, and outcomes were collected and analysed using SPSS version 25.**Result:** The study found that male constituted the majority of cases and most affected age group 21-40 years, farmers and farm related workers constituted the largest group, and agriculture machinery injuries were the leading mode of injury with upper limb extremities being the most involved in the study group. **Conclusion:** Overall, the findings of this study emphasize that traumatic limb amputations in rural Haryana are largely preventable through improved occupational safety, timely access to trauma care, and effective emergency response systems. Strengthening preventive strategies, enhancing community awareness, and improving trauma infrastructure are essential to reduce the burden of traumatic amputations and improve long-term outcomes. This study provides valuable baseline data that can guide policymakers, healthcare providers, and public health initiatives in developing targeted interventions for injury prevention and rehabilitation in rural populations.

INTRODUCTION

The incidences of different pathologies leading to limb amputation have been reported to vary in different populations. In developed countries peripheral vascular disease is the major cause whereas, trauma, infections, uncontrolled diabetes mellitus and malignancies are the leading causes for amputation in developing countries. Most amputees in developed countries elderly patients with vascular problems. However, in the developing countries, most patients with amputation are young and the major cause of limb amputation varies from one hospital to another.[1]

Trauma related amputations are more in the developing world. Road traffic accidents and work accidents claim the most number of limbs in the absence of war. The number of road traffic accidents in India has shown a sharp increase due to the rapidly growing population, expanding vehicle density on the roads, and disproportionately slow growth in the road networks. Limb loss statistics are not well documented in developing countries, including India in contrast to developed countries. A nationwide report in 1981 estimated the prevalence rate of amputees at 0.62 per 1000 population in India but there is no data available in the published literature after that. Upper limb amputations are usually related to machine injury and workplace accidents. However, any formal data related to it's incidence and change over the last decade are unavailable online and in published literature. Similarly, data related to other causes of amputation like falls from height, railway accidents and blast

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injury are also not available. Today, many developed countries regularly update limb loss statistics and carry out extensive research in this field, which helps formulate strategies to prevent limb loss and implement rehabilitation. Due to lack of significant data on this problem and less number of studies conducted in India, leading to a knowledge gap in the epidemiology of amputation in the country. Thus, it is needed to conceptualize more number of studies to investigate the demographic profile, epidemiology of the patients undergoing amputation after trauma.[2]

This investigation characterizes the epidemiological profile of acute traumatic limb amputees in rural Haryana.

MATERIALSANDMETHODS

A hospital based prospective observational cross-sectional study carried out in the Department of Orthopaedics, Maharaja Agrasen Medical College and Hospital, Agroha (Hisar), Haryana. The study spanned from the May 2024 to September 2025.

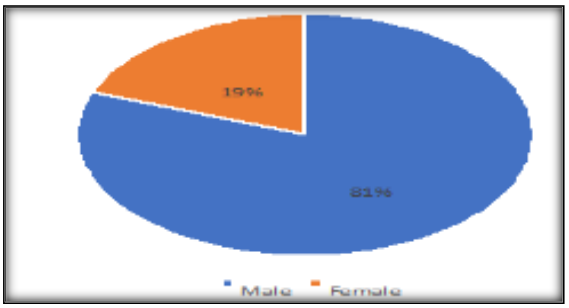
Total 125 traumatic limb amputees presented to the Emergency Department or Outpatient Department of Orthopaedics were enrolled in the study. Eligibility criteria encompassed all age groups and both sexes presenting within 7 days of injury. Exclusion criteria ruled out other nontraumatic vascular causes such as peripheral vascular disease, Buerger's disease, Raynaud's disease,neurological causes of limb loss, metabolic causes such as diabetes mellitus, burn injuries, patients who did not provide consent. Data regarding sociodemographic profile, mechanism of injury, level of amputations, and outcomes were collected using preformed questionnaire and analysed using SPSS version 25.

RESULTS

The present study analysed 125 patients with acute traumatic limb amputations treated at a rural tertiary care centre in Haryana.

The majority of patients belonged to the 21–40 years' age group (61 cases, 48.8%), followed by 41–60 years (40 cases, 32.0%), while patients below 20 years and above 60 years accounted for 12 cases each (9.6%). A marked male predominance was observed, with 101 males (80.8%) and 24 females (19.2%) affected Occupational analysis revealed that farmers and farm-related workers constituted the largest group (44 cases, 35.2%), followed by labourers and daily wage workers (20 cases, 16.0%), and skilled workers (18 cases, 14.4%). Regarding educational status, primary-level education was most common (46 cases, 36.8%), followed by secondary education (28 cases, 22.4%), while illiteracy was present in 8 cases (6.4%). Agricultural machinery injuries were the leading mode of injury, accounting for 47 cases (37.6%), followed by sharp tool injuries (25 cases, 20.0%) and road traffic accidents (19 cases, 15.2%). Upper limb amputations predominated, involving 98 patients (78.4%), while lower limb involvement was seen in 24 patients (19.2%), and multiple limb involvement in 3 patients (2.4%). The right side was more commonly involved (70 cases, 56.0%) compared to the left side (52 cases, 41. 6%).Complete amputations were most frequent, occurring in 94 patients (75.2%), followed by near total amputations in 31 patients (24.8%).

Most patients reached the hospital within 3 hours of injury (51 cases, 40.8%), while 31 patients (24.8%) presented after more than 6 hours.



Graph 1: Sex distribution

Table 1: Age group distribution

Age group (years)	Frequency (n)	Percentage (%)
< 20	12	9.6
21–40	61	48.8
41–60	40	32.0
> 60	12	9.6
Total	125	100

Table 2: Occupation distribution

Occupation category	Frequency (n)	Percentage (%)
Farmers / farm workers	44	35.2
Labourers / daily wage workers	20	16.0
Homemakers	14	11.2
Students	14	11.2
Skilled workers	18	14.4
Others	15	12.0
Total	125	100

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Table 3: Mode of injury distribution

Mode of injury	Frequency (n)	Percentage (%)
Agricultural machinery	47	37.6
Sharp weapon injuries	25	20.0
Road traffic accidents	19	15.2
Mechanical / industrial	18	14.4
Railway track injuries	7	5.6
Physical assault	9	7.2
Total	125	100

Levels of Amputation

Figure 1: Mid hand level Figure 2: Mid hand level

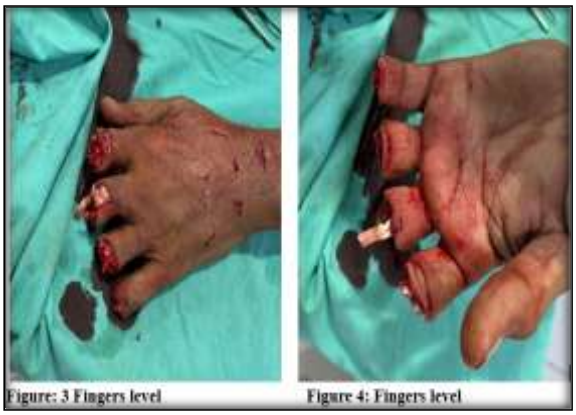

Figure: 3 Fingers level Figure 4: Fingers level

Figure 6: Below knee level Figure 7: Mid forearm and below knee level

Figure 8: Forearm level Figure 9: Forearm level

Figure 10: Fingers level Figure 11: Fingers level

Figure 12: Finger level Figure 13: Finger level

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Figure 14: Mid arm level

DISCUSSION

The present study demonstrated that acute traumatic limb amputations predominantly affected individuals in the economically productive age groups. Patients aged 21–40 years constituted the largest proportion, accounting for 61 cases.

The predominance of young and middle-aged adults in the present study aligns with trauma epidemiology reported in multiple Indian studies, Saini et al. observed a mean age of 37.2 years among patients undergoing amputations following road traffic accidents.[3] Dhillon et al. reported a mean age of 35.6 years among traumatic amputees at a level-I trauma centre, reinforcing that limb loss commonly occurs during peak working years.[4]

Present study confirms that traumatic limb amputations predominantly affect economically productive adults, consistent with trauma-based studies from India, while differing significantly from studies dominated by diabetic and vascular etiologies. In contrast, Unnikrishnan et al. reported a significantly higher mean age of 59.23 ± 14.79 years among amputees, largely attributable to diabetic and vascular causes rather than trauma.11 Garg et al. also noted a wider age range (23–85 years) with diabetes mellitus as the dominant etiology for lower limb amputations.[12]

The present study revealed a striking male predominance among patients with acute traumatic limb amputations. Of the 125 patients studied, 101 were males (80.8%), while females accounted for only 24 cases (19.2%). This marked gender disparity highlights the differential exposure to high-risk environments between males and females in rural settings, where men are more frequently engaged in physically demanding and hazardous occupations. Comparable findings have been consistently reported in Indian trauma literature. Saini et al. observed that

97.5% of patients undergoing amputations following road traffic accidents were male, underscoring the extreme gender skew associated with trauma related limb loss.3 Dhillon et al. similarly reported a male predominance of 83.5% among traumatic amputees, closely aligning with the proportion observed in the present study.[2]

The gender distribution observed in the present study underscores the importance of gender specific injury prevention strategies Farmers and farm-related workers constituted the largest occupational group, accounting for 44 cases (35.2%). Labourers and daily wage workers formed the second largest group with 20 cases (16.0%). Skilled workers, including drivers, electricians, mechanics, and factory workers, accounted for 18 cases (14.4%), while homemakers and students each contributed 14 cases (11.2%).The predominance of agricultural workers in the present study is consistent with findings reported by Singh et al., who analysed agricultural orthopaedic injuries and found that males from rural backgrounds constituted over 90% of cases, with agricultural machinery responsible for 56.6% of injuries.[7] Notably, amputations were recorded in 47.2% of their cohort, highlighting the severe nature of agricultural trauma. The occupational profile observed in the present study reflects systemic gaps in occupational safety, including lack of machinery guards, absence of safety training, informal work environments, and poor regulatory oversight.

The educational profile of patients in the present study revealed that lower levels of formal education were common among individuals sustaining traumatic limb amputations, limited educational attainment may contribute to increased vulnerability to severe trauma.

In the present study, agricultural machinery-related injuries emerged as the leading cause of acute traumatic limb amputations this was followed by sharp tools injuries, including gandasa and similar implements, which contributed to 25 cases (20.0%). Road traffic accidents were responsible for 19 cases (15.2%), while mechanical and industrial injuries accounted for 18 cases (14.4%). Railway track injuries (5.6%) and physical assaults (7.2%) constituted smaller but clinically significant proportions. These findings highlight that the majority of traumatic amputations in this rural population were caused by preventable, occupation-related mechanisms. Saini et al. reported that 85.3% of amputations were attributable to road traffic accidents, reflecting the urban and highway dominated catchment of their level-1 trauma centre.[3] Similarly, Dhillon et al. found that road traffic accidents were responsible for 77.4% of traumatic amputations.[4] The comparatively lower contribution of road traffic accidents in the present study highlights the rural agricultural context, where occupational injuries outweigh vehicular trauma. Badgurjar et al. similarly emphasized the role of occupational trauma and poor safety infrastructure in rural regions, where delayed presentation and severe injury patterns are common.[5]Gopinathan et

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al. highlighted that delayed presentation and associated vascular injuries significantly increased amputation rates, irrespective of injury mechanism.[6]Unsafe agricultural practices, lack of machinery guarding, poor occupational safety enforcement, and limited awareness are central contributors. These findings reinforce the urgent need for targeted preventive strategies focusing on agricultural safety education, safer machinery design, enforcement of occupational regulations, and community-based injury prevention programs.

The present study demonstrated a marked predominance of upper limb involvement in traumatic amputations, fingers being the most frequently involved. The high frequency of upper limb amputations observed in the present study is consistent with findings reported by Singh et al., who noted predominately upper limb involvement in agricultural injuries, with amputations being the most common outcome.[7] Compared to the study conducted bySadoma BR et al.(2023) fingers were most frequently amputated followed by toes.[8] Similarly, Sorbello CCJ et al reported traumatic amputations in Brazil between 2008 and 2023 mainly involving fingers.[9] This similarity reinforces the concept that upper extremities are at greatest risk during manual handling of machinery, tools, and agricultural equipment. Hands are often directly exposed to cutting, crushing, and entanglement injuries, particularly in unguarded machines.

Loss of hand function can severely impair earning capacity, self-care, and social participation. Sharma et al. highlighted the profound psychosocial impact of limb loss, including perceived social isolation and dependence, underscoring that functional loss extends beyond physical disability.[10]The findings of the present study emphasize the need for preventive interventions specifically targeting hand safety, including machine guards, emergency shut-off mechanisms, use of protective gloves, and safety training focused on upper limb protection.[11]

Based on the study findings, several recommendations can be proposed to reduce the burden of traumatic limb amputations. Strengthening occupational safety measures in agriculture and manual labor sectors is essential, including the promotion of machine guards, safe tool design, and use of personal protective equipment. Community-based safety education programs should be implemented to raise awareness about injury prevention, safe machinery handling, and early hospital presentation following trauma. Improving emergency medical services through better ambulance availability, trained first responders, and streamlined referral pathways can help reduce delays in care. Peripheral healthcare facilities should be equipped and trained to provide initial trauma stabilization and early referral to tertiary centres. At the policy level, enforcement of safety regulations in agricultural and industrial settings should be strengthened. Rehabilitation services, including physiotherapy, prosthetic fitting, and vocational training, should be integrated into post-amputation care to facilitate functional recovery and social reintegration. Psychological counselling and family support services should be incorporated to address the emotional and mental health challenges faced by amputees. Collectively, these measures can contribute to reducing preventable amputations and improving long-term outcomes for affected individuals.

CONCLUSION

The findings of this study emphasize that traumatic limb amputations in rural Haryana are largely preventable through improved occupational safety, timely access to trauma care, and effective emergency response systems. Strengthening preventive strategies, enhancing community awareness, and improving trauma infrastructure are essential to reduce the burden of traumatic amputations and improve long-term outcomes. This study provides valuable baseline data that can guide policymakers, healthcare providers, and public health initiatives in developing targeted interventions for injury prevention and rehabilitation in rural populations.

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