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## Incidence and type of complications following traumatic extremity amputations: preliminary report from a teaching hospital

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### Abstract

Amputation is one of the oldest surgical procedure and a good amputation results in optimal functional outcome by providing healthy residual limb. Advances in prosthetics has enabled amputee with diverse options and better functionality. There is also decrease in the overall burden of amputation as a result of better treatment of causative disorders and proper limb salvage techniques. Complications, however, pose challenges in regain of necessary functions and include an array of disorders related to the procedure, technique and other factors. An understanding of common and practical complications is helpful in their anticipation and relevant prohibitive measures. Apart from it, a comprehensive study that highlights pattern of amputations and related complications provides database for preventive and management strategy. A total of 69 cases of extremity amputations were included within a defined period of Jan 2011 to June 2016. Relevant demographic data were noted along with other details amputation and complications. An attempt is also made for co-morbidities associated in cases with complications. Males (88.40%) and lower extremity (66.66%) were involved more commonly than females and upper extremity. Below knee was commonest (50.72%) lower and below elbow along with digital amputations were commonest (15.94% each) upper extremity amputations. The significant complication that required increased hospital stay or additional procedures were noted in 34 (49.27%) cases. Delayed wound healing, wound dehiscence, painful neuroma, stiffness, exposed bone and phantom pain were some of major complication noted in the study. A brief notes on patient characteristics has been attributed to the nature of trauma, co-morbidities and substance abuse among the complicated cases. The early recognition of complication and prompt management goes a long way in abatement of agony and discomfort of patient affecting overall outcome.

**Keywords:** Amputations, complication, trauma, injury, lower extremity, upper extremity, management, outcome

### Introduction

Amputation is one of the oldest surgical intervention and staged procedure for variety of indications compromising the vitality of limb and at times life <sup>[1]</sup>. It is to be considered as a reconstructive procedure and is not mere removal of useless body part. The level and underlying culprit causes are of little concern now as advances in prosthetics has given us diversity and functionality that was akin to fiction in the past. Amputation aims to restore function and better results are met with team efforts. Apart from patient, doctor and prosthetist, moral support of family and close ones and at times psychological support is also critical for the optimal outcome <sup>[2]</sup>. The knowledge of common risk factor and types of amputations as well as complications helps clinician better anticipate and prevent those.

### Material and Methods

The study was done as retrospective analysis of cases of amputations in a teaching hospital attached to a medical college during the period between Feb 2011 and June 2016. All consecutive cases of amputations of upper and lower extremities related to trauma or other etiology were noted during the aforementioned period through operation theatre register and register for documentation of receipt of amputated part to patient's attendants.

Exclusion criteria was amputations related to peripheral vascular diseases or those following chronic systemic or neoplastic etiology. Amputations following congenital or developmental anomalies were also excluded. A detailed history of affected extremity, side, laterality, diagnosis and relevant demographic data were noted for each case. The type and level of amputation was noted and then related complications were recorded. The complications were categorized into early and late and also under heading of technique related or those related to post-operative factors like prosthesis use. Amputations related to causes other than trauma were noted separately but were excluded from final study. Mangled extremity severity score (MESS) was used for its simplicity as predicting factor of early amputations. Amputations related to diabetic complication were excluded as these were largely managed by surgery or plastic surgery department. The cases had at least four months follow up (range 4 months to four years).

## Result

A total of 69 cases of upper and lower limb amputations were noted from collected data during the described period. Most of the cases were of traumatic origin and were either primary or delayed amputation. Two cases were sequelae of old trauma rendering traumatic painful deformity of the great toe and trophic ulceration of foot. One case of painful extra digit (pre-axial polydactyly) following localized infection was included as we assumed local frictional trauma as contributing factor. All cases were categorized in sections of below the elbow or knee or above it, along with bilateral and those related to digital or toe amputation (Table- 1). Lower extremity was involved in most cases (46 cases, 66.66%) and upper extremity was involved in 23 cases (33.33%). Below knee amputation (BKA) was most common procedure (35 cases, 50.72% of all cases and 76.08% of total lower extremity amputations. Upper extremity amputation was dominated by digital amputations (DE) and below elbow amputations in 11 cases each (15.94% of total and 47.82% of upper extremity amputations). Eight cases were bilateral with six and one case each of below knee and below elbow respectively. One case of bilateral AKA was also noted. Above knee amputations (AKA) were more than above elbow amputation (AEA) in 09 and 01 cases respectively. Males were involved in 42 cases of upper (32 BKA, 08 AKA, 02 toe amputation) and 19 cases of lower extremity amputations (09 BEA and 10 DE), thus making 61 cases (88.40%) of overall case burden. Females were involved in 8 cases (4 each for upper and lower extremity group). The most common age bracket involved was 21-30 years with 20 cases (16 male and 04 female) followed by 31-40 years with 15 cases (13 male and 02 female). The youngest case was 3 year old and oldest being 83 year old including 05 cases above 70 year age group (Graph- 1). The wound related complications like delayed healing or dehiscence constituted largest share of complications (15, 44.11%) followed by others like stiffness of adjacent joints, complex regional pain syndrome among others (Table-2). An attempt was done to link the complications to underlying co-morbidities or related risk factors and in 13 cases (38.23%) major contributing factors could be isolated. Key contributing factors were identified as diabetes mellitus in 04 cases (11.76%) and smoking in 03 cases (8.82%) followed by presence of head injury, massage and sero-positivity to viral markers (Table-3).

## Discussion

The aim of amputation is to develop a good residual limb as the residual limb functioning as an end organ is key element of good function<sup>[3]</sup>. Apart from good surgery and prosthesis, rehabilitation is paramount in maximal return of pre-injury level of function. Our centre is referral hospital to a large catchment area of hilly region which is prone for road traffic accidents due to rough terrain and unfavorable natural elements. The cases that underwent amputations were those with severe mangled extremities not amenable to salvage and were planned accordingly after due consultation through multiple relevant disciplines like plastic and reconstructive unit. The volume of amputations in a hospital has been linked to various factors including, rural setting, non-teaching status and low revascularization procedures resulting in high lower extremity amputation rates in the long term<sup>[4]</sup>. In the west, most of these amputations follow peripheral vascular diseases and identification of risk factors has been advocated.<sup>[5]</sup> Traumatic amputations is common procedure in developed world with the road traffic accidents involving high velocity trauma a major contributor. Recent times has shown armed conflicts with use of land mines and explosives as a key contributor of war time injuries leading to amputations in affected regions<sup>[6]</sup>. We had no instances of amputation related to use of firearm related injury.

Most of our cases followed road traffic accidents with severe crush injuries leading to limb not salvaged subjected to amputation either primarily or after failed attempt of salvage. Previous studies have acknowledged that salvaged limbs have more operation and late return to work than properly amputated cases of mangled extremity<sup>[7, 8]</sup>. Recent studies have insisted on reconstruction attempts of the limb and deferred amputations<sup>[9]</sup>. As we used MESS as primary screening to predict the requirement of limb salvage, the literature however suggests that no single parameter or score is predictive of outcome<sup>[10]</sup>. Rehabilitation, prosthesis expenditure and psychological trauma are another issues worth consideration that were not covered in our study and require another study. Amputation in our cases lead to a shorter hospital stay and limited complication, decrease healthcare cost and early return of function. The objective or outcome was to gain a good stump for effective prosthetic placement and usage. Most cases achieved these objective, however, some of them had complications related to the procedure and were managed accordingly (Table -2). The shortcoming of the study was to additional identification of causes and factors responsible for complications or bad outcome described in the study. Underlining the effects of bad prognostic factors other than smoking or nicotine use, local co morbid conditions like peripheral vascular diseases or trophic conditions on overall complication rate would have rendered the study more comprehensive. The delayed wound healing and wound dehiscence were common complications involving seventeen cases in total that resulted in increased hospital stay and required repeated debridement leading to secondary healing (Fig.1c). Two cases required skin grafting procedures to expedite the healing. Phantom limb pain was noted in three cases and was improved with mirror visual feedback therapy. Two cases of neuroma (Fig.2, a) required surgical intervention and one case of exposed bone (Fig.1, b) was managed by bone drilling to encourage medullary granulation tissue and subsequent healing. Complex regional pain syndrome (Fig.1, a), stiffness and heterotopic ossification (Fig.2, b) were nagging complications and were believed to arise from patient related factors including massage and non-

compliance to proper physiotherapy protocol. One case in an adolescent male had bone growth out of stump that required excision (Fig.3). Many of the complications were avoidable with proper selection of cases, technique and good rehabilitation. The study, a linear data based, is about acknowledging the patterns of amputation in a teaching tertiary care hospital catering a particular geographic region

and is important for its data and further research in that area. It is required to document the pattern of a common yet underreported procedure and its complications. The study highlights the nature of surgery in a tertiary care setting and advocates mastery over theory and practice of common amputation procedures and knowledge of complications for better management of the patient.

**Table 1:** The types and other relevant details of extremity amputation cases.

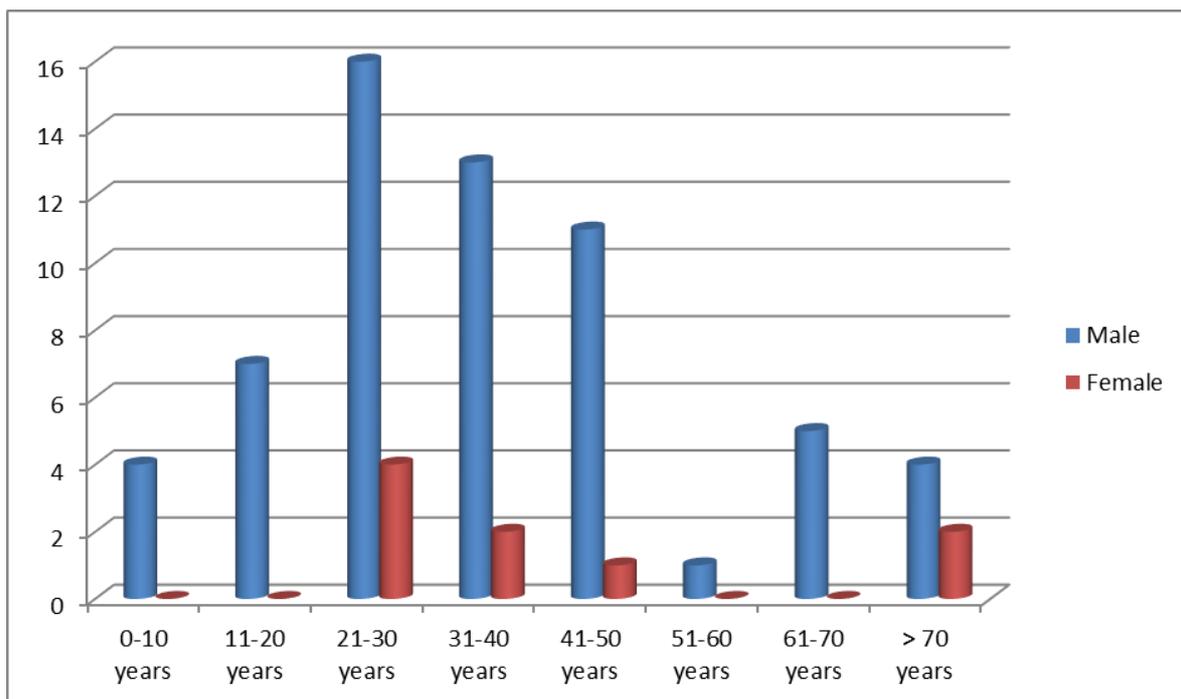
Sex(M/F)	Lower Limb Amputations							
	Below Knee Amputation (BKA)			Above Knee Amputation (AKA)			Toe Amputations	
	Left	Right	Bilateral	Left	Right	Bilateral	Left	Right
Male(=42)	16	11	05	01	06	01	01	01
Female(=04)	01	01	01	01	-	-	-	-
Total= 46	17	12	06	01	06	01	01	01
	Upper Limb Amputations							
	Below Elbow Amputation (BEA)			Above Elbow Amputation (AEA)			Digital Amputation (DE)	
	Left	Right	Bilateral	Left	Right	Bilateral	Left	Right
Male(=19)	02	06	01	-	-	-	03	07
Female(=04)	02	-	-	01	-	-	01	-
Total= 23	04	06	01	01	-	-	04	07

**Table 2:** The major post-operative complication noted in the follow up.

Complications	Number of cases
Wound dehiscence	05
Delayed wound healing	10
Phantom pain	03
Painful neuroma	02
Revision with change of level of amputation	02
Stiffness of adjacent joint	04
Exposed bone requiring cover	02
Growth of bone out of stump in juvenile case	01
Complex regional pain syndrome (CRPS) Type 1	03
Heterotopic ossification within stump	01
Bone overgrowth out of stump	01

**Table 3:** Leading associated conditions with complicated cases.

S.N.	Co- morbidities or associated conditions	Number of cases attributed
1	Diabetes	3 cases with delayed healing and 1 with dehiscence requiring further surgery
2	Smoking	Delayed healing and revision in 3 cases
3	Corticosteroid use for medical problems	1 case with delayed healing requiring further surgery
4	Massage and alternative treatment	Two CRPS cases and one with heterotopic ossification
5	Head injury	Heterotopic ossification in 1 case
6	Hepatitis B Seropositive	Delayed healing with exposed bone in 1 case
7	Bad surgical technique	02 Neuromas and bone overgrowth in 1 adolescent case.



**Graph 1:** Age wise distribution of the cases.



**Fig 1:** The radiological features of complex regional pain syndrome in a residual limb with patchy osteoporosis (a). The exposed bone (b) and wound dehiscence (c) noted in other cases.



**Fig 3:** The growing bone out of stump in an adolescent before and after excision

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**Conflict of interest** – None.

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**Fig 2:** Painful neuroma (site indicated by arrow) undergoing surgical management in an above knee stump (a) and heterotopic ossification in another case (b).