

Changing Trends in Aetiology of Amputations: A 12-year Retrospective Cross-sectional Study

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ABSTRACT

Introduction: The Kashmir valley, which has experienced political instability since 1989, has witnessed a rise in amputations and a different aetiology compared to other parts of India. Limited data exists on the changing patterns of various causes of amputations before and after 1989 in the Kashmir valley, India.

Aim: To analyse the demographic characteristics, amputation patterns, and different causes among amputees.

Materials and Methods: A retrospective cross-sectional study was conducted at the Artificial Limb Centre (ALC) of Bone and Joint Hospital Barzulla, Srinagar, India. The study included 504 patients whose medical records were reviewed from 2006 to 2018 to identify the aetiology, geographical distribution, and level

of amputation. Descriptive analysis was performed to determine the frequencies of various causes and levels of amputation.

Results: The study found that the most common traumatic causes of amputation were Road Traffic Accidents (RTAs), firearm injuries, and blasts. Non-traumatic amputations (vascular disease and malignancies) accounted for 30% of cases. Lower limb amputations (91.5%) were more prevalent than upper limb amputations (8.5%).

Conclusion: Prior to 1989, RTA accidents were the major cause of amputations, but there was a surge in amputations caused by firearm injuries and blasts. Additionally, there has been an increase in amputations caused by malignancies and dysvascular ischaemia in non-traumatic causes.

Keywords: Demography, Diabetic foot, Lower extremity, Peripheral vascular disease, Prosthesis and implants, Upper extremity, Wounds and injuries

INTRODUCTION

Amputation, a surgical procedure dating back to Hippocrates over 2500 years ago, is considered a last resort when limb salvage is not feasible [1]. It is a catastrophic and irreversible act emotionally for patients and poses a significant burden on families, society, and medical services [2-5]. The incidence of limb amputation varies among different populations, with affluent nations primarily attributing it to Diabetes Mellitus and peripheral vascular disease, while trauma, infections, and malignancies are less common causes [6-8]. Globally, peripheral vascular disease is the leading cause of amputation, with diabetes [6] accounting for approximately 80% of cases [6]. Most amputations occur after the age of 60 years [7]. In India (Kolkata), RTA was the primary cause of amputations in the age group below 40 years, while peripheral vascular disease was more prevalent in the age group above 40 years [7,8]. Male patients had a higher incidence of amputations compared to females. The aetiological causes of amputations exhibit significant global variations [7]. Lower limb amputations account for over 90% of all amputations [8], with elbow and knee amputations being the most common within this category. Amputation trends have been observed to change globally and regionally, including in the Kashmir division where political turmoil began in 1989. Therefore, this study aimed to analyse and compare the demographic characteristics, amputation patterns, and changes in the aetiological causes among amputees, with 1989 serving as a benchmark for assessing the impact of political instability in the region.

MATERIALS AND METHODS

This retrospective cross-sectional study was conducted at the Artificial Limb Centre (ALC) of Bone and Joint Hospital Barzulla, Srinagar, India. The study reviewed the records of patients over a period of 12 years, from January 2006 to December 2018. All data was organised in an Excel sheet in February 2019, and data analysis was performed in June 2021. Informed consent was obtained from

all patients for prosthetic treatment at the centre, and confidentiality was strictly maintained throughout the study.

Inclusion criteria: A total of 504 subjects, aged between 2 and 80 years, who received various types of prostheses at the ALC within the study duration, were included in the study.

Exclusion criteria: Patients with missing entries in their records were excluded from the study.

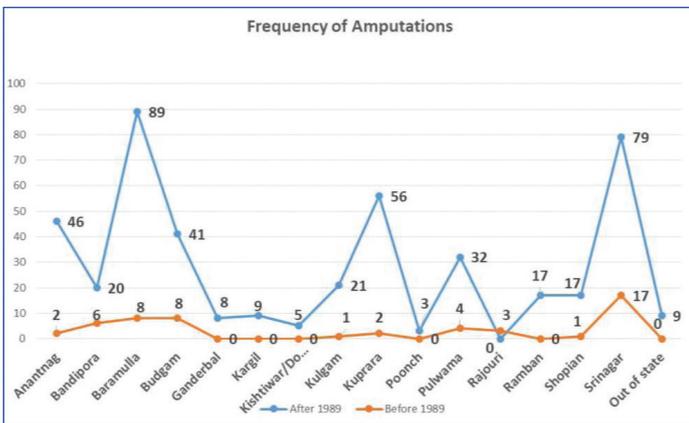
Data collection: Patient data were assessed from the medical records of amputees at the ALC. Detailed information including the year of amputation, age, gender, residence, level of amputation, and cause of amputation were thoroughly examined. The data were analysed to identify any variations in the aetiology of amputations over the decades and variations in aetiology across different districts of the state.

STATISTICAL ANALYSIS

Descriptive analysis was conducted to examine the frequencies of various aetiologies of amputation, levels of amputation, and variations in aetiology across different districts.

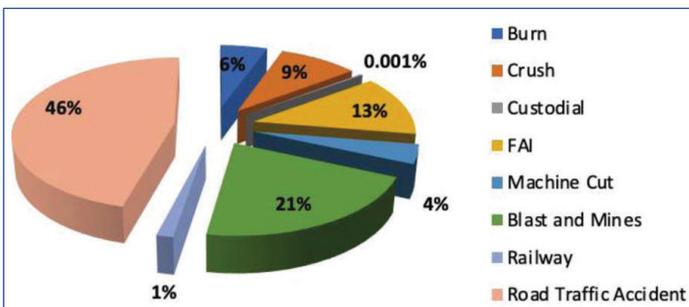
RESULTS

The study included a total of 504 newly registered patients at the ALC from 2006 to 2018. Among them, 52 (10.32%) patients underwent amputation before 1989, while 452 (89.68%) underwent amputation post-1989. Of the 504 subjects, 383 (76%) were men and 121 (44%) were women. The mean age was 38.12 ± 14.33 years. The distribution of amputations varied geographically before and after 1989. Before 1989, District Srinagar had the highest number of amputees. After 1989, there was a tremendous increase in amputees in Baramulla and Srinagar Districts, likely due to heightened militancy in those districts during the first decade post-1989. Districts Anantnag, Kupwara, and Pulwama also had an increase in amputations in later decades [Table/Fig-1].

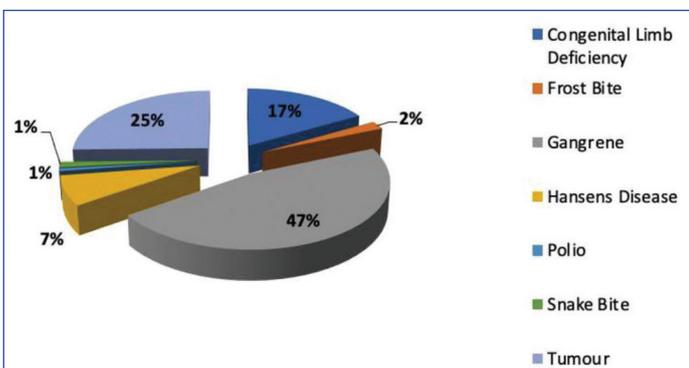


[Table/Fig-1]: District wise distribution of amputations.

Trauma accounted for 70% of amputations, while non traumatic causes accounted for 30%. Road Traffic Accidents (RTAs) were the major cause of post-traumatic amputations (46%), followed by blast and mine injuries (21%) [Table/Fig-2]. Among non traumatic causes, gangrene (47%) was the most common cause of amputation, followed by tumours (25%) and congenital limb deficiency (17%) [Table/Fig-3].

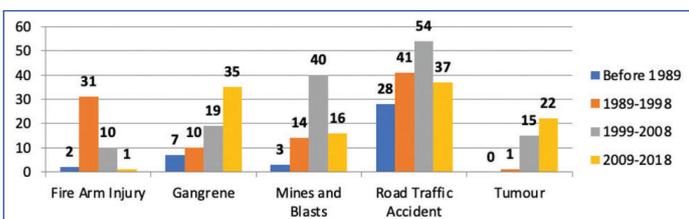


[Table/Fig-2]: Post-traumatic amputations percentage of the various causative agent.



[Table/Fig-3]: Showing distribution of non traumatic amputations.

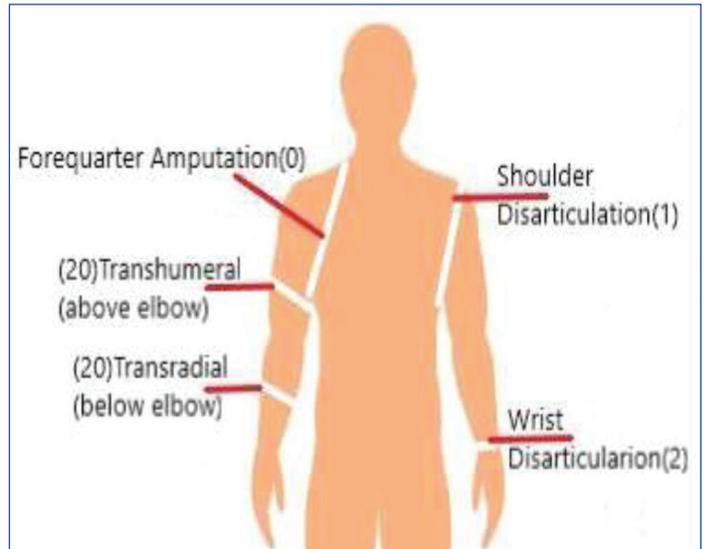
The total number of amputations due to RTAs was 160, with a higher incidence observed from 1999 to 2008, followed by a decreasing trend from 2009 to 2018. Firearm injuries caused 44 amputations, mostly happening between 1989 and 2018 [Table/Fig-4].



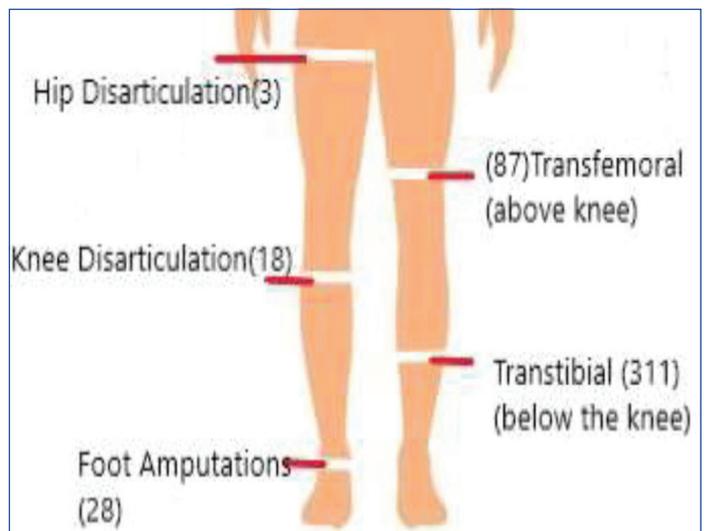
[Table/Fig-4]: Trends of major causes of amputations over four decades.

Among the amputations, 43 (8.5%) were upper limb amputations, while 461 (91.5%) were lower limb amputations. Left-sided amputations were performed in 253 patients, right-sided in 235 patients, and 16 patients had bilateral amputations. Transhumeral

and transradial amputations were the most common for upper limb amputations, while transtibial amputations were the most common for lower limb amputations [Table/Fig-5,6].



[Table/Fig-5]: Levels of Upper limb amputations.



[Table/Fig-6]: Levels of Lower limb amputations.

Baramulla, Kupwara, and Srinagar had the highest number of blast victims due to increased militant activity. Srinagar also had the highest number of firearm injuries, followed by Baramulla. Anantnag had the highest number of amputations due to tumours, followed by Baramulla and Kupwara. Band-saw injuries were most frequent in Baramulla, while amputations due to leprosy were primarily seen in Srinagar [Table/Fig-7].

Burns accounted for 19 amputations, with a higher incidence in Baramulla, followed by Srinagar. Congenital limb deficiency or short limbs were present in 25 patients, with Baramulla and Kulgam contributing the highest numbers. Frostbite caused amputations in three patients, while crush injuries accounted for 40 amputations, primarily involving transtibial amputations. Other rare causes included railway accidents, polio, and snakebite. The majority of amputations (363) were performed at Bone and Joint Hospital, Barzulla. Other amputations were performed at various hospitals, including SKIMS Soura, GMC Srinagar, JVC Bemina, Delhi hospitals, Army Hospital Badami Bagh, and Kargil.

DISCUSSION

The prevalence rate of amputees in Jammu and Kashmir was found to be 50-75 per lac people in 1982 [8], with a total of 3,000 amputees in the region. In the present study, traumatic causes

Aetiology district	Burn	CA	Crush	Custodial	FAI	Frost bite	Gangrene	Hansen's	Machine cut	Blast	Polio	Railway accident	RTA	Snake bite	Tumour	Unknown cause	Total
Anantnag	1	2	4	0	3	0	8	0	3	5	0	0	14	0	8	0	48
Bandipora	2	0	0	0	3	0	1	0	1	7	0	0	9	0	3	0	26
Baramulla	5	5	4	0	6	0	10	0	5	27	0	1	28	0	6	0	97
Budgam	1	3	7	0	3	0	6	0	1	3	0	1	21	0	3	0	49
Ganderbal	0	1	2	0	1	0	1	0	0	1	0	0	2	0	0	0	8
Kargil	0	0	1	0	1	1	2	0	1	1	0	0	1	0	1	0	9
Kishtiwar/ Doda	1	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	5
Kulgam	1	4	1	0	3	1	2	1	1	0	0	0	5	0	3	0	22
Kuprara	2	1	3	0	4	0	13	0	0	13	0	0	16	0	6	0	58
Poonch	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	3
Pulwama	1	2	4	0	1	0	6	0	0	2	0	0	18	0	2	0	36
Rajouri	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3
Ramban	1	2	3	0	0	0	1	1	0	2	0	1	5	0	1	0	17
Shopian	1	1	4	0	1	0	6	0	0	0	1	0	4	0	0	0	18
Srinagar	3	3	4	0	17	0	14	9	1	9	0	0	31	0	5	0	96
Out of state	0	1	2	0	0	1	0	0	0	1	0	2	2	0	0	0	9
Total	19	25	40	0	44	3	71	11	13	73	1	5	160	1	38	0	504

[Table/Fig-7]: Aetiology wise distribution of amputees in different districts.

CA: Congenital anomaly/Amptation; FAI: Firearm injury; RTA: Road traffic accident

accounted for 70% of amputations, with RTAs and ballistic injuries being the major contributors. Vascular diseases and malignancy were responsible for 30% of the amputations. Lower limb amputations accounted for 91.5% of the cases, while upper limb amputations made up 8.5%.

A study conducted in the Jammu division of the Union Territory (UT) found a male-to-female ratio of 7:1, whereas in the present study, it was 3:1 [1]. In the Jammu study, 30% of amputations were traumatic, while 70% were non traumatic. RTAs were the most common cause of trauma. In Kashmir, in addition to RTAs, mine and blast injuries, and firearm injuries were major causes of traumatic amputation. Non traumatic causes such as Peripheral Vascular Disease (PVD), diabetes, tumours, and infections were also major contributors to amputations in the Kashmir division.

The major causes of amputation in India have shown a changing trend over the years. In 1983, leprosy, RTA injuries, and agricultural injuries were the major causes [8]. However, by 2013, trauma, peripheral vascular disease, and malignancy became the new major causes of amputations [9]. In a study conducted in South India in 2017, diabetic foot and vascular insufficiency accounted for 84% of cases, with trauma being the most important indication for amputation in younger individuals. The incidence of amputations was higher in men compared to women [2]. In a study conducted in Pakistan, complications of diabetes were the most common cause of non traumatic limb amputations, while trauma was the leading cause overall [3]. An Iranian study found that trauma was the most common cause of amputation, followed by diabetes and dysvascular causes [10].

In the United States, dysvascular causes were implicated in 82% of limb loss, while trauma and malignancy showed a decreasing trend [6,11]. In England, a study found that diabetes and peripheral vascular disease were the leading causes of major lower limb amputations, followed by trauma, neoplasms, and unclassified causes [5,12]. Overall, the causes of amputation vary across different regions and countries. Trauma, diabetes, and dysvascular causes are consistently identified as major contributors to amputations. Understanding the specific causes and trends in each region can help inform preventive measures and improve treatment options for amputees. Another study conducted in England from 2003-2009 by

Ahmad N et al., aimed to examine the prevalence, regional variation, and relationship with revascularisation, social deprivation, and risk factors [13]. The study looked at the prevalence of major lower limb amputation and revascularisation in different regions of England. It was found that the prevalence was higher in men than women and higher in the North region than in the South. Amputees in Northern England were more likely to experience social deprivation, cigarette smoking, CVD's but astonishingly had lower levels of diabetes, hypertension, and hypercholesterolemia. Amputations following revascularisation procedures were more common in the North than in Midlands and Southern England.

In an extended study by Ahmad N et al., covering a total of 10 years from 2003 to 2013, the prevalence of major limb amputations in diabetics versus non diabetics was examined [4]. The study found that a total of 42,294 amputations were performed, with 54% being above-knee and 46% below-knee amputations. The rate of major amputations in diabetics was six times higher than in those without diabetes. Men were twice as likely to undergo major amputation procedures compared to women. A study conducted in Canada by Kayssi A et al., found that diabetic complications accounted for 81% of amputations, followed by cardiovascular diseases at 6% and malignancy at 3% [14]. The majority of amputations in the study were below-knee amputations. A global study by McDonald CL et al., estimated that approximately 57.7 million people worldwide had undergone limb amputations for traumatic causes [15]. Falls were the most common cause of amputations, and conflict and terrorism played a significant role in unilateral lower limb amputations in adults. In children aged 5-14 years, conflict and terrorism accounted for one-third of all unilateral lower limb amputations globally. South Asia was found to have the second-highest prevalence of traumatic amputations. A comparison of the findings in the present study with other studies is shown in [Table/Fig-8] [1-6,10,13,14].

These studies highlight the prevalence and causes of amputations in different regions and populations. Factors such as diabetes, cardiovascular diseases, and traumatic events play significant roles in the occurrence of amputations. Understanding these trends and risk factors is crucial in developing preventive strategies and improving treatment outcomes for amputees.

Authors name	Year and place of study	Sample size	Findings (Causes of amputations)
Mehreen M et al., [1]	December 2012 to October 2013 in Government Medical College Jammu	30	30% (RTA).
Unnikrishnan EP et al., [2]	2017 Government Medical College, Kozhikode, Kerala	81	Diabetic foot and vascular insufficiency constituted upto 84% of the cases.
Jawaid M et al., [3]	Civil Hospital, Karachi March 2007 to August 2007	53	Diabetes 29 (54.7%) patients, and the traumatic amputations 22 (45.3%) patients.
Sarvestani AS and Azam AT [10]	Two major teaching and referral hospitals of Zahedan. April 2002 to December 2011	216	The most common cause was found to be trauma. On the other hand, diabetes caused 26% of amputations, and dysvascular causes led to 10% of amputations. The minor causes were malignancy, infections, and congenital anomalies (0.46%).
Dillingham TR et al., [6]	Department of PMR JohnHopkins University 1988 to 1996	1,199,111	The dysvascular causes were implicated for 82% of the limb loss.
Moxey PW et al., [5]	England Hospital Episode Statistics (HES) data were acquired for the years 2003-2008	57,193	39.4% diabetes, 43.1%, 13.9% had trauma, 2.2% had neoplasms, and 6.9% were unclassified.
Ahmad N et al., [4]	England in 2003-2009	42,294 major and 52,525 minor amputations and 355, 545 revascularisations	The prevalence was double in men than women; in the North region than in the South of England.
Ahmad N et al., [13]	England 2003 to 2013	25,312	The rate of major amputations in diabetics was found to be 6 times more than those without diabetes.
Kayssi A et al., [14]	Canadian Institute for Health Information's 2016	5,342	Diabetes 81%, 6% and 3% were due to malignancy.
Present study	January 2006 to December 2018, ALC Srinagar	504	70% (RTA, Mines, Blasts, FAI).

[Table/Fig-8]: Comparison of causes of amputation in different regions of world [1-6,10,13,14].

FAI: Firearm injury; RTA: Road traffic accident; DM: Diabetes mellitus

Limitation(s)

One limitation of this study is that the Assisted Limb Centre (ALC) only provides basic types of prostheses to patients. This means that patients who were seeking high-end prostheses were not included in the study. This could potentially skew the results and limit the generalisability of the findings. Another limitation was that the study only focused on patients who were using prostheses post-amputation. Patients who chose not to use prostheses were not included in the study. This could introduce a bias in the results and overlook important insights into the experiences and needs of this particular group of patients. These limitations should be considered when interpreting the findings of the study and may impact the overall understanding of the prevalence, causes, and outcomes of amputations in the population. Future research should aim to include a more diverse range of patients, including those seeking high-end prostheses and those who do not use prostheses, to provide a more comprehensive understanding of the topic.

CONCLUSION(S)

In contrast to the rest of the world and India, the causes of amputations in the Kashmir Valley differ. RTAs, mines and blasts, diabetes, peripheral vascular disease, firearm injuries, and tumours were identified as the major causes of amputations in this region. Traumatic amputations are primarily preventable injuries, and understanding the common injury mechanisms can help inform preventive measures. Non traumatic causes, such as diabetes, peripheral vascular disease, and tumours, can be prevented through early screening, lifestyle modifications, and the prevention of complications. By focusing on these preventive measures, the incidence of amputations in the Kashmir Valley can potentially be reduced. It is important to consider these findings and implement appropriate strategies to address the specific causes of amputations in this region. By doing so, it may be possible to decrease the burden of amputations and improve the overall well-being of individuals in the Kashmir Valley.

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