

Determinants of Upper Limb Amputations in a Tertiary Care Center, Pakistan

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ABSTRACT

Objective: To determine the frequency and causes of accidental upper limb amputations seeking rehabilitation (prosthesis) care in a tertiary care center

Study Design: Observational Descriptive Study

Place and Duration of Study: This study was carried out at outpatients Department of Institute of Physical Medicine and Rehabilitation at Dow University of Health Sciences, Karachi from Jan 2007 to Dec 2010.

Materials and Methods: The Sampling Technique was non Probability Purposive sampling. A study specific Performa was prepared which included patient age, stump complications, level of amputation and associated risk factors. The data was analyzed in SPSS version 15.

Results: The Mean $\pm$ SD age of ULA was 28.56 $\pm$ SD 11.97 (years). Most ULA were reported from Karachi 65 (67.7%). Labourers were the most commonly affected groups 33(34.4 %). Accidents leading to ULA were reported in 89(92.70) and machine injury (chaff cutting) was responsible in one third of the ULA. Quarter of the ULA had leading cause electric injury. Only, 16 (16.7%) amputees had road traffic accidents.

Conclusion: The study concluded that majority of upper limb amputation were caused by machine accidents affecting mostly labourers. Therefore, machine safety protocols for labourers, farmers and workers should be implemented in their local language and through pictorial messages and inbuilt safety measures machines should be sold by company representatives

Key Words: Amputees, Upper limb, amputation (ULA) Accidental, Prosthesis, Machine injury, Education

INTRODUCTION

Amputation is defined as the loss of a limb often resulting in physical, psychological, emotional and vocational consequences¹. Limb amputation has been one of the most ancient of all surgical treatments in human race study. Currently the increased rate of upper limb amputees has been linked to the development of mechanical civilization in rural setups with prolongation of life². The trauma accounts for 68.6%-89 % of upper limb amputations.^{3,4} NARANG from Pune, India also reported trauma as the leading cause approximately 76%, involving machine, electrical and explosive accidents, fire arm & train injuries accounting for 36%⁵. The type of upper limb amputations reported were trans-radial (39.8%), followed by partial hand amputees (25.4%) and trans-humeral(24.9%).

There has been scarce data in Pakistan regarding upper limb amputation (ULA) and its consequences. A study of 76 cases was conducted at the Department of Plastic Surgery, Services Hospital Lahore that showed mechanical trauma in 25%⁶. The National Bureau of Pakistan 2008-2009 statistics showed skilled agricultural and fishery workers as the top group suffering occupational injuries, particularly in the rural areas.⁷ Sindh has the highest rate (54.23%) followed by Punjab (39.56%), NWFP (25.63%) and Baluchistan

(14.16%).⁸ Since this permanent disability is associated with economic, social and psychological trauma to individuals and community therefore analysis of determinants is needed.

The objective of this study was to determine the frequency and causes of accidental upper limb amputations seeking rehabilitation (prosthesis) in a tertiary care center.

MATERIALS AND METHODS

This study was an observational, descriptive study conducted at Outpatients Department of Institute of Physical Medicine and Rehabilitation (IPMR), at Dow University of Health Sciences, Karachi, Pakistan from Jan 2007 to Dec 2010. All patients seeking Prosthetic fitting after accidental upper limb amputation were included in the study through non probability purposive sampling. A detailed history was taken along with, physical examination, laboratory tests and radiological examinations. A Performa was prepared to collect all possible amputee information including Patient age, occupation, stump complications, side of amputation, level of amputation and associated risk factors of amputation. Patients were given pre prosthesis counseling prosthesis and physiotherapy in outpatients department. All patients were followed for their prosthesis and prognosis. The upper limb amputees included both male and female from all over Sindh. The

frequency and determinants were recorded to evaluate causes of accidental upper limb amputations. Data was entered and analyzed on SPSS version window version 15.

RESULTS

A total of 96 amputees were analyzed. Table 1 shows characteristics of study subjects, causes, Level and site of amputation. The Mean $\pm$ SD age of ULA was 28.56 $\pm$ SD 11.97. Most ULA were reported from Karachi 65 (67.7%). At IPMR medical rehabilitative care of prosthesis and follow-up was provided to these upper limb amputees. Labourers were the most commonly affected group 33 (34.4 %). Accident causes of ULA were observed in 82(85.4%). Below elbow and right sided amputations were reported in half of the amputees. Among upper limb amputees trans radial amputees were 32(33.3 %), trans humeral 25(26.04%), trans metacarpal 13(3.12%), transcarpal 16 (16.6%) and miscellaneous 12(12.5%). The last groups include 3 or 4 finger amputations of upper limb which were ipsilateral and bilateral and also wrist and shoulder disarticulations.

Table No.1: Characteristics of study population n=96

Characteristics	Frequency	Percentage
Age(Years)		
Mean $\pm$ SD		
28.56 $\pm$ SD 11.97		
Gender		
1.Male	81	84.4
2.Female	15	15.6
Residence		
1.Karachi	65	67.7
2.Outside Karachi	31	32.3
Occupation		
1.Students	14	14.59
2.Labour	33	34.37
3.Office worker	6	6.25
4.Housewife	15	15.62
5.Unemployed	16	16.67
6. Not related to occupation (Road traffic accidents)	12	12.5
Causes		
1.Accidental	89	93.6
2.Congenital	4	4.0
3.Infection	3	2.4
Level of amputation		
1.above elbow	30	31.3
2.below elbow	49	51.0
3.fingers	11	11.5
4.wrist	6	6.2
Side of amputation		
1.right	53	55.2
2.left	41	42.7
3.bilateral	02	2.1

Table No.2: Causes of upper limb amputations in the study population n=96

Cause	Frequency	Percent
Machine injury	34	35.4
Electric Injury	24	25.0
Road Traffic Accidents	16	16.7
Railway Accident	8	8.3
Congenital	4	4.2
Others	10	10.4
Total	96	100
Others include: (10)		
Gunshot	2	
Infection	2	
Bomb blast	1	
Diabetes	1	
Earthquake	1	
Firework explosion	1	
Gas cylinder	1	
Glass injury	1	

Table 2 showed determinants of ULA in the study. Machine injury was responsible in one third of the total study population. These machine injuries were caused by chaff cutting machines used in farms for different types of crops in urban and rural Sindh. Out of 34 machine injuries 12 had amputations of upper limb involving 3-4 fingers at various levels by chaff cutter. Machinery used in farms do not have any inbuilt safety measures and the affected farmers were not trained at all for machine safety protocols.

The electric burns were common among students, peons and office salesman. Only 16 (16.7%) amputees had Road traffic accident. A miscellaneous group reported ULA and is shown in the category of others.

DISCUSSION

Globally with the mechanical advancement in rural areas of developing countries the incidence of limb amputations has increased. This study conducted from 2007-2010 at Institute of Physical Medicine & Rehabilitation, Pakistan focuses on the determinants of upper limb amputations in view of developing preventive strategies to reduce it.

The Center for Disease control and Prevention Work Health chart 2004, showed that amputation accounts for 80.6% in males and 19.4% in females. Highest amputation rates occurred in the 20-40 year age group⁹ and this is consistent with this study. Farming, forestry and fishing leads ULA rate of 5.4% whereas operators, fabricators and Labourers have a rate of 55.1%.

In the present study majority residing in Karachi, the younger population with a Mean $\pm$ SD age of 28.56 $\pm$ SD 11.97years had ULAs, this is similar to studies in Burma¹⁰, eastern Turkey¹¹, Korea², India⁵, Iran¹², Taiwan¹³ 8 and Saudi Arabia where males predominate with a ratio of 5:1.³

This study also analyzed the vocational status of amputees dividing them into 5 groups: students, laborer, Office worker, housewives and un-employed. Labourers were the most commonly affected group 34.4%, comprising 33 out of 96 cases. Al-Turaiqi and Al-falahi have also reported Labourers as the major upper limb amputation group at 28.8%.³ Another study conducted on Burmese amputees reported Labourers as the most affected around 20.83%.⁹ However, several other studies show different results. In Iran¹² industrial workers were the dominant upper limb amputees. Taiwan⁸ and United states⁶ conclude that Manufacturing industries account for majority of upper limb amputations followed by agriculture, forestry, fisheries and mining. The National Bureau of Statistics Pakistan 2008-2009 showed similar results for Pakistan rural areas. Bureau of Labor Statistics (BLS) United States, 1977 showed machines causing 54% of work-related amputations involving the fingers, hand and wrist.⁶ A prospective observational study carried at the Dhaka Medical College Hospital revealed road traffic accidents as the major cause of injury (42.9%) followed by machine injury 34.86%.⁷ In Taiwan, a study reported 85% of upper limb amputations occurring as a result of powered machines.⁸ Trauma remained the leading cause of amputation involving upper limb (87.16%) in a 15-year retrospective study conducted at Burma, with farming, domestic and industrial group.⁹

Evaluating the causes of upper limb amputation, accidental causes account for 93.6%, followed by congenital 4.0% and infection 2.4% of the total population. Table 2 provides a detailed categorization of the upper limb amputation causes. In our study population, machine injury chaff cutting was the most common cause of amputation 34 (35.4%). Other causes include electrical injury (25.0%), road traffic accidents (16.7%) railway accident (8.3%), congenital (4.2%). There was also 1 reported case of amputation due to diabetes, 2 cases of gunshot injury and 1 case each of upper limb amputation as a result of bomb blast, earthquake, firework explosion, and burst of gas cylinder and glass injury.

In developing countries such as Pakistan, India and Bangladesh trauma is the leading factor particularly in upper limb amputations. The most commonly involved machines are reported to be electrically powered saws, Chaff cutting machines and press machines. Another study conducted at services hospital Lahore reciprocates these findings. In Rawalpindi, a study was conducted particularly to evaluate the outcome of patients with hand trauma and results showed majority males had road traffic accidents, followed by workplace accidents.¹⁷

In India, a retrospective analysis of 14,400 disabled civilians showed that upper limb amputees were 37% as compared to lower limb with trauma. The causes of amputation vary depending on the social status of a

country. In Iran¹⁵ and Turkey¹⁴ the most common reasons of amputation were gunshot injuries, landmine injuries, hand grenade, stabbing and crush injuries.

Two studies conducted in Saudi Arabia show contrasting results to each other. Al-turaiqi and Al-falahi stated trauma as the leading cause whereas a study at Al-Noor specialist hospital, Makkah reported Diabetes Mellitus with peripheral vascular disease as the leading cause 86% followed by trauma 12%.¹⁸

This study has the strength to show that the traumatic injuries due to machines were doubled 66(68.75%) in the general population compared to the case series carried out at Pakistan Institute of Medical Sciences hospital, Islamabad in 2009 which reported that 38.4% of traumatic hand amputees were machine operators and 12.3% labourers.

In our study, there were 49 below-elbow amputations, 30 above elbow amputations, 11 finger amputations and 6 involving wrist with half of the amputations occurred on the dominant right side. A retrospective analysis in Amman, Jordan showed trauma as the leading cause 50.17% followed by diabetes mellitus 29%. In the upper limb they reported transhumeral amputations as most common followed by trans-radial.¹⁸ Hand-tools are commonly used on Indian farms and 1700 injuries were reported related to hand tools per hundred thousand farm workers in rural India.¹⁹ The farmers buy these machines from the market with a flyer of English instructions which they cannot read and follow. All the chaff cutters injuries 15(43%) were observed mostly in women. Women have no training in using these chaff cutter machines. The chaff cutting machines have been manual and electric both. These machines and cutters are sold by company representatives without counseling and safety instructions and trainings in their regional language. This study found that 20 years' experienced farmer also had upper limb accidental injuries. Therefore chaff cutter injuries were not directly related to experience of work. Quarter of the ULA reported electric injury. The electric burns were observed accidentally due to mismanagement by trained and untrained patients. An electrician had burn with an experience of 25 years work in the field. These electrical injuries have been inflicted by untrained staff with no knowledge on electric equipment and safety measures. These patients suffered due to lack of optimum knowledge and training regarding electric machines.

The data obtained was from the general population residing in urban Karachi but permanently belonging to rural Sindh. The population main source of income was from the agriculture farming of different crops seasonally and they have not been supervised by the public sector departments for safety use of these machines. However, these farmers have been taught traditionally by their parents and grandparents. There has been no record of deaths caused by these injuries.

The study was conducted to develop strategies and guide policy makers for development of safety measures. The training programs for all those working with manual, electrical machines and chaff cutters are also needed on priority. This will reduce the economic crisis at micro level. The data from industries have not been collected since machines and staff mostly are trained and supervised by the employees, as the health care support has been provided by their management.

The determinants of upper limb amputation have been analyzed with other studies and varying factors have been explored according to the economical, social, mechanical and educational status of the rural population in a developing country, like Pakistan.

CONCLUSION

The study concluded that majority of upper limb amputation were caused by machine accidents affecting mostly labourers. Therefore, machine safety protocols for labourers, farmers and workers should be implemented in their local language and through pictorial messages and inbuilt safety measures machines should be sold by company representatives.

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