Original Article

Pattern and Mode of Trauma for Child Amputation at Tertiary Care Hospital

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Abstract

Background: Limb loss and limb deficiency are potentially disabling conditions affecting the health and well being of persons worldwide. There are multiple pathways to the loss of a limb. Acquired limb deficiencies as a result of disease or physical trauma, are less ordinary. Similar to other types of trauma, determination of the patterns of these injuries is necessary for establishment of preventive strategies. Thus, the patterns of these injuries has not yet been well defined in our set up. So the epidemiological evidence is needed to define and understand the patterns of these injuries which results in amputation in children.

Objective: To determine the pattern, mode of injury and body part involvement in children with amputation.

Methodology: Study was carried out at Department of Pediatrics Surgery, Mayo Hospital Lahore. All patients (children) with amputation during the Year 2009-2011 were included in the study. Data regarding amputation injuries to children treated in Department of Pediatric Surgery from 2009 to 2011 were obtained from the Admission registers. This data includes demographics details, body part involved, and type of amputation. Data entry and analysis was done with the help of SPSS 15.0. Chi-square was used to see the association between different modes of trauma with amputation. P-value ≤ 0.05 was taken as significant.

Results: Among these 65 children 46 were male and 19 were females. Mean age of male and female children was 7.61 ± 3.29 and 6.92 ± 3.11 years. There were 41 children who got injury at their home while the remaining 24 children suffered from injury on high way. Most frequent cause of injury was electric burn, road traffic accident, injury due to Tokka (Grass cutting machine in rural areas) and upper limb injury was high as compared to lower limb injury. There were 21 children who had partial amputation, 22 children had near complete and complete amputation done as a result of injury.

Conclusion: Male children were more prone towards imputation, most frequent injury and cause of amputation was RTA and electric burn. Upper extremity in-

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jury was more prevalent as compared to lower extremity injury in children who had undergone imputation.
Key Words: Amputation, Children, Upper Extremity, Lower Extremity, Traumatic.

Introduction

Limb loss and limb deficiency are potentially disabling conditions affecting the health and well being of persons worldwide. There are multiple pathways to the loss of a limb, including diabetes mellitus, peripheral vascular disease, trauma, and malignancy. Congenital limb deficiency, on the other hand, may be caused by genetic variation, may be acquired from exposure to an environmental teratogen, or may be because of a gene environment interaction. Limb deficiency disorders are heterogeneous, chronic physical conditions with a reported prevalence across different countries of 2–7 in 10.000 births.[1] Most limb deficiencies in children are congenital in origin; acquired limb deficiencies as a result of disease or physical trauma, are less ordinary.[2] Almost all children with lower limb deficiencies are fitted with prosthetic components to enhance their ability to participate in activities of daily living. The use of prosthetic devices in children with upper limb deficiencies is less evident, depending on the level of deficiency and functional gain.[3] For children and youth, involvement in life situations includes participation in recreational and leisure activities as well as school and work activities.[4] After amputation, persons frequently follow a rehabilitation program aimed at optimal functioning with a prosthesis during normal daily life. An important consequence of an amputation is that walking with a prosthesis is less energy efficient, which may result in increased physical strain (expressed as heart rate response or oxygen consumption) during walking. Another adaptation strategy may be that strenuous activities such as walking are avoided[10,11] or that the performance of activities is changed to decrease physical strain.[12-14] In our set up no proper data is available for amputation among children which describes the mode, extent and type of injury which results in amputation. This study will help out to define the pattern, mode of injury and other associated characteristics resulting in child amputation. There is a need in our set up to assess these major factors resulting in child amputation so that in future better management and understanding will be developed for preventive measures in this issue.

Patients and Methods

Study Design: Retrospective study design was used.
Setting: Study was carried out at Department of Pediatrics Surgery, Mayo Hospital Lahore.
Sample Size: All patients (children) with amputation during the Year 2009 – 2011 were included in the study to meet the objective of the study.
Population: Population for this study was defined as children with amputee limbs. (Congenital or as a result of Trauma).
Data Collection: Data regarding amputation injuries to children treated in Department of Pediatric Surgery from 2009 to 2011 were obtained from the Admission registers. Data included demographics, body part involved, and type of amputation.
Data Analysis: Data entry and analysis was done with the help of SPSS 15.0. Quantitative variables were presented in the form of Mean ± SD. Chi-square was used to see the association between different modes of trauma with amputation its type and other factors leading to child amputation. p-value ≤ 0.05 was taken as significant.

Results

After retrieving the data total 65 children were identified who had undergone amputation due to certain accidental injuries. Among these 65 children 46 were male and 19 were females. Mean age of male and female children was 7.61 ± 3.29 and 6.92 ± 3.11 years respectively. In terms of p-value mean age of male and females children was same. i.e. (**p-value = 0.433)** There were 41 children who were injured at their home while the remaining 24 children were injured on high way. Out of these 65 children 48 were resident of urban area and 17 children were resident of rural area. Most frequent cause of injury was electric burn 26 children suffered from electric burn, 24 children had road traffic accident, 8 children had injury due to Tokka (Grass cutting machine in rural areas) and 4 children had machine injury. Upper limb injury was observed in 37 children while in remaining 28 children lower limb injury was observed. There were 37 children whose upper limb suffered due to injury (Hand = 20 and Arm = 17) the remaining 28 children suffered from lower limb injuries (Legs = 14 and Foot = 14).

There were 45 children whose right side of the body was effected as a result of injury, 15 children's left side was effected and 5 children suffered from

injury on both sides of their body. There were 21 children who had partial amputation, 22 children had near complete and complete amputation done as a result of injury **(Table 1).** According to p-value no significant association was seen between cause of injury and gender of the child. i.e. **(p-value = 0.273)** No significant association was seen between gender of the child and body part involved due to injury i.e. **(p-value = 0.243)** Side of body part effected due to injury was insignificantly associated with the gender of the child .i.e. **(p-value = 0.848)** Significant association was observed between effected body part due to injury with respect to place of occurrence of injury. Those children who had injury in their home they suffered more from upper limb injury as compared to lower limb injury. Out of 65 children who had under gone amputation among them 41 (Partial and near complete amputation = 13, Complete amputation = 15) children had the injury at their homes and the remaining 24 children (Partial amputation = 8, Near complete amputation = 9, Complete amputation = 7) had injury at high way **(Table 2).**

Table 1: Characteristics of Children with Amputation.

		Frequency	Percent
Gender	Male	46 (7.61 ± 3.29)	70.76%
	Female	19 (6.92 ± 3.11)	29.24%
Place of Injury	Home	41	63.1%
	High Way	24	36.9%
Residence	Urban	48	73.8%
	Rural	17	26.2%
External Cause of Injury	Tokka	8	12.3%
	RTA	24	36.9%
	Osteomyelitis	1	1.5%
	Machine Injury	4	6.2%
	Fall	1	1.5%
	Electric Burn	26	40.0%
	Blast Injury	1	1.5%
Body Part Involved	Upper extremity	37	58.5%
	Lower extremity	28	41.5%
Body Part Involved	Hand	20	30.8%
	Arm	17	26.2%
	Legs	14	21.5%
	Foot	14	21.5%
Effected side of the Body	Right Side	45	69.2%
	Left Side	15	23.1%
	Bilateral	5	7.7%
Type of amputation	Partial	21	32.3%
	Near Complete	22	33.8%
	Complete	22	33.8%

Discussion

General indications for amputation include Trauma, tumor, and transplantation; Infection; Peripheral vas-

Table 2: Amputation related Characteristics with respect to gender of the Children.

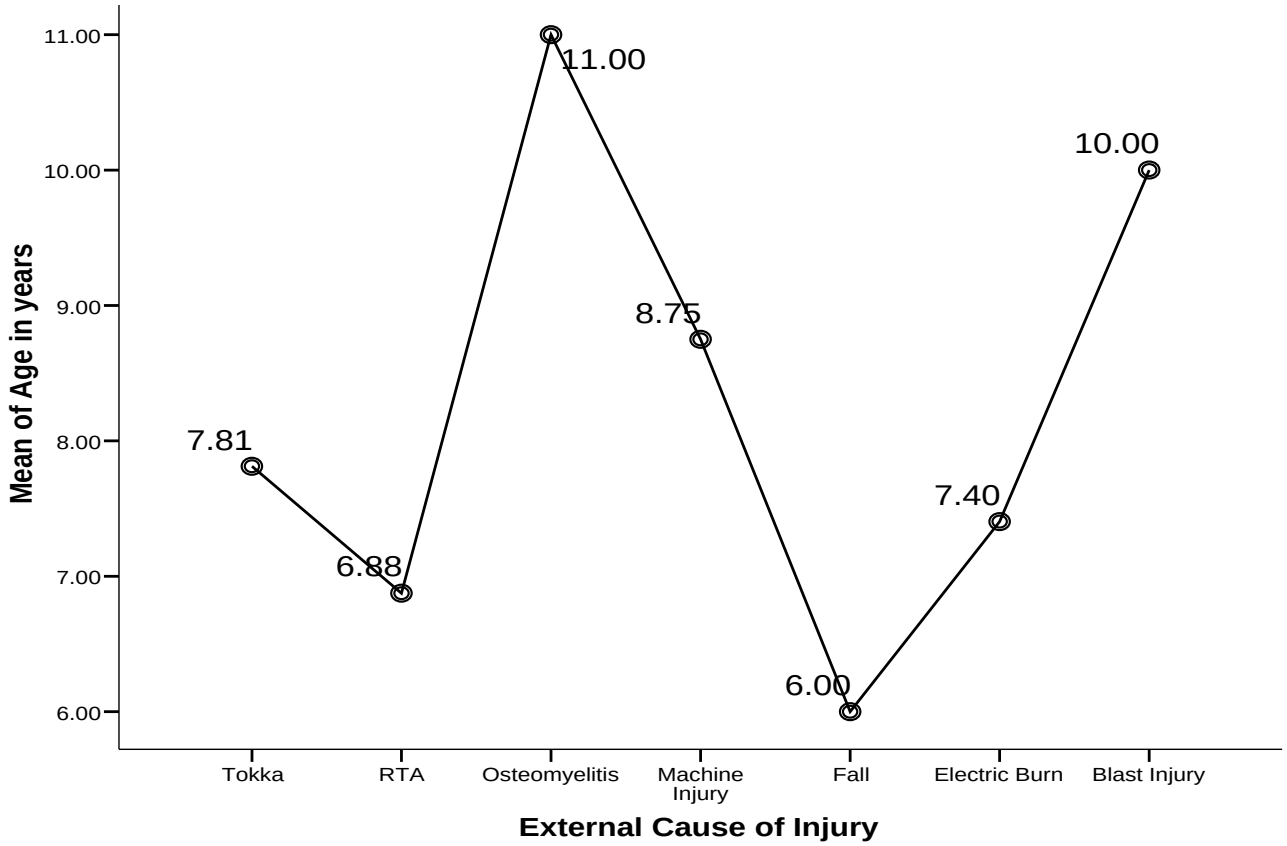
		Gender		p-value
		Male	Female	
External Cause of Injury	Tokka	5	3	0.273
	RTA	15	9	
	Osteomyelitis	0	1	
	Machine Injury	2	2	
	Fall	1	0	
	Electric Burn	22	4	
	Blast Injury	1	0	
Body Part Involved	Upper Limb	29	9	0.243
	Lower Limb	17	10	
Effected side of the Body	Right	32	13	0.848
	Left	11	4	
	Bilateral	3	2	
Type of Amputation	Partial	13	8	0.338
	Near Complete	15	74	
	Complete	18		
		Body Part		p-value
		Upper Limb	Lower Limb	
Place of Occurrence	Home	33	8	0.000
	High Way	5	19	

cular disease; Congenital deformities (TIPC); chronic pain; electively for deformities in the elderly population; and in growing toenails.[15] Trauma is the second-leading cause of amputation and the most common cause in the young patient. The most common traumatic causes of amputation are electric burns and road traffic accidents.

According to the results of Iranian Trauma project the second highest incidence of amputation was seen in the age group of 11 – 20 years.[16] In view of current study mean age of children who had amputation as a result of injury their mean age was 7.41 ± 3.23 with maximum age 12 years and minimum age 1 year. These results regarding age were consistent with the result of Iranian Trauma project.[16]

According to the results of study conducted by Judith that children younger than 5 years had the highest rate of finger amputations treated in hospital EDs.[17] Almost 3 out of 4 of these amputations in young children resulted from their finger(s) getting caught, jammed, or crushed in a doorway during the opening or closing of a door. Another study describes similar findings about the vulnerability of small children's fingers.[18] Some prevention measures for the home have been suggested: placing rubber stoppers on the door or taking other measures to prevent the door from fully closing in the home.[18] However, these measures have not been evaluated for their effectiveness in preventing finger amputations. Some amputations occur in locations other than the home, such as in a motor vehicle when a child is boarding or alighting.

It has been shown that hand and fingers are the most frequent parts of body affected in these injuries[19,20] and it is consistent with our results that showed high rate of hand and arm amputation. Regarding the age and sex of victims, our results are consistent with previous reports which show most of the traumatic limb amputations occur in young males.[21-24]



Graph 1: Age distribution of children with respect to external cause of Injury.

Regarding the level of amputation in upper extremity, our results are similar to the study conducted by Liang et al that shows most of the amputations occur at upper extremity part of the body.[25] According to the results of current study, amputation at the level of ankle and foot was the most frequent in lower extremity trauma, which was not similar to the study conducted by Abbas and Musa which showed below knee amputation was the most frequent procedure.[26] The difference may be explained by different patterns of traumas in two countries.

Regarding the mechanism of injury, our results showed electric burn was more frequent than RTA that was in contrast with the report from Nigeria.[27] Moreover, our study showed that blunt trauma resulted in amputation were more common than penetrating ones. It may confirm that blunt trauma carries worse prognosis than penetrating injuries as previously described and are more likely resulted in amputation.[28,29] Because most blunt trauma results from falls and motor vehicle accidents and higher energy injuries are more likely to result in vascular injury.

Conclusion

In conclusion, this study shows the pattern and mode of Trauma for Child Amputation at a Tertiary Care Hospital. Results of this study may be used for precautionary strategic planning of these injuries.

References

1. Ephraim PL, Dillingham TR, Sector M, Pezzin LE, MacKenzie EJ. Epidemiology of limb loss and congenital limb deficiency: A review of the literature. Arch Phys Med Rehabil 2003; 84 (5): 747–761.
2. Setoguchi Y, Rosenfelder R. The limb deficient child. Springfield, IL: Thomas; 1982.
3. Kuyper MA, Breedijk M, Mulders AH, Post MW, Prevo AJ. Prosthetic management of children in The Netherlands with upper limb deficiencies. Prosthet Orthot Int 2001; 25 (3): 228–234.
4. World Health Organization. International classification of functioning, disability and health. Geneva, Switzerland: WHO; 2001.

5. Law M. Participation in the occupations of everyday life. Am J Occup Ther 2002; 56 (6): 640–649.
6. Brown M, Gordon WA. Impact of impairment on activity patterns of children. Arch Phys Med Rehabil 1987; 68 (12): 828–832.
7. Forsyth R, Jarvis S. Participation in childhood. Child Care Health Dev 2002; 28 (4): 277–279.
8. King G, Law M, King S, Rosenbaum P, Kertoy MK, Young NL. A conceptual model of the factors affecting the recreation and leisure participation of children with disabilities. Phys Occup Ther Pediatr 2003; 23 (1): 63–90.
9. Law M, Finkelman S, Hurley P, Rosenbaum P, King S, King G, et al. Participation of children with physical disabilities: Relationship with diagnosis, physical function, and demographic variables. Scand J Occup Ther 2004; 11 (4): 156–162.
10. Pernot HF, Winnubst GM, Cluitmans JJ, De Witte LP. Amputees in Limburg: incidence, morbidity and mortality, prosthetic supply, care utilisation and functional level after one year. Prosthet Orthot Int 2000; 24: 90-6.
11. Collin C, Collin J. Mobility after lower-limb amputation [editorial]. Br J Surg 1995; 82: 1010-1.
12. Fisher SV, Gullickson G. Energy cost of ambulation in health and disability: a literature review. Arch Phys Med Rehabil 1978; 59: 124-33.
13. Engsberg JR, Herbert LM, Grimston SK, Fung TS, Harder JA. Relation among indices of effort and oxygen uptake in below-knee amputee and able – bodied children. Arch Phys Med Rehabil 1994; 75: 1335-41.
14. Gonzalez EG, Corcoran PJ, Reyes RL. Energy expenditure in below-knee amputees: correlation with stump length. Arch Phys Med Rehabil 1974; 55: 111-9.
15. Kominsky S. Medical and surgical management of the diabetic foot. St Louis (MO) 7 C.V. Mosby; 1994.
16. Moini M, Rasouli MR, Khaji A, Farshidfar F and Heidari P. Patterns of extremity traumas leading to amputation in Iran: results of Iranian National Trauma Project. CJOT. 2009; 12 (1): 77-80.
17. Conn JM, Annest Jl, Bossarte RM, Gilchrist J. Nonfatal sports and recreational violent injuries among children and teenagers, United States, 2001 – 2003. J Sci Med Sport. 2006; 9 (6): 479-89.
18. Doraiswamy NV. Childhood finger injuries and safeguards. Inj Prev. 1999; 5: 298-300.
19. Al-Dawood K. Non-fatal occupational injuries requiring admission to hospitals in Al-Khobar City, Saudi Arabia: prospective cohort study. Croat Med J 2000; 41 (3): 323-326.
20. Boyle D, Parker D, Larson C, et al. Nature, incidence, and cause of work-related amputations in Minnesota. Am J Ind Med 2000; 37 (5): 542-550.
21. McCall BP, Horwitz IB. An assessment and quantification of the rates, costs, and risk factors of occupational amputations: analysis of Kentucky workers' compensation claims, 1994-2003. Am J Ind Med 2006; 49 (12): 1031-1038.
22. Atroshi I, Rosberg HE. Epidemiology of amputations and severe injuries of the hand. Hand Clin 2001; 17 (3): 343-350.
23. Olson DK, Gerberich SG. Traumatic amputations in the workplace. J Occup Med 1986; 28 (7): 480-485.
24. Pozo JL, Powell B, Andrews BG, et al. The timing of amputation for lower limb trauma. J Bone Joint Surg Br 1990; 72 (2): 288-292.
25. Liang HW, Chen SY, Hsu JH, et al. Work – related upper limb amputations in Taiwan, 1999-2001. Am J Ind Med 2004; 46 (6): 649-655.
26. Abbas AD, Musa AM. Changing pattern for extremity amputations in University of Maiduguri Teaching Hospital, Nigeria. Niger J Med 2007; 16 (4): 330-333.
27. Olasinde AA, Oginni LM, Bankole JO, et al. Indications for amputations in Ile – Ife, Nigeria. Niger J Med 2002; 11 (3): 118-121.
28. Dueck AD, Kucey D. The management of vascular injuries in extremity trauma. Curr Orthoped 2003; 17 (4): 287-291.
29. Fitridge RA, Raptis S, Miller JH, et al. Upper extremity arterial injuries: experience at the Royal Adelaide Hospital, 1969 to 1991. J Vasc Surg 1994; 20 (6): 941-946.