Original Article

Indications and Challenges of Limb Amputation in Children; Experience in a Tertiary Hospital in Enugu Nigeria

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Abstract

Background: Limb amputations in children are generally an uncommon procedure and are usually associated with significant emotional implications for the patients and their caregivers. Apart from emotional issues, this surgical procedure, which is often life-saving is fraught with challenges in a developing country. The aim of the study was to review indications and challenges posed by presentation and consent time in managing children who need amputation. It is hoped that highlighting the challenges will be helpful in improving care for children who may be involved. **Patients and Methods:** This was a retrospective study of all children 16 years and below who had limb amputation in Enugu State University of Technology Teaching hospital between January 2015 and December 2019. **Results:** They were 22 amputations involving 13 (59.0%) males and 9 (41.0%) females, giving a ratio of 1.4:1. Amputations of the lower limb occurred in 15 (68.2%) cases, while the upper limb was involved in 7 (31.8%) cases. Road traffic accident (RTA) 6 (27.3%) and sequalae of Traditional bone setter's (TBS) intervention 6 (27.3%) after trauma were the most common indications for amputation. Delayed wound healing was the most common complication seen. No mortality was recorded, and consent for surgery was the most common challenge encountered. None of the patients was able to acquire prosthesis due to financial constraints. **Conclusion:** RTA and bone setter's intervention in trauma management leading to gangrene are the most common indications for amputation in children. Comprehensive Child health care plan addressing observed challenges could bring a better outcome in children who may need amputation.

Keywords: Challenges, children, limb amputation

Introduction

Amputation is the removal or severance of a limb through a bone.[1] Often, this is done as a way of treating one pathology or another and not as a form of punishment for a misdemeanor as may be prescribed by some religious sects.[1] Amputation could be said to be major if the limb removal is at or proximal to the wrist or the ankle[2] or minor if it is below the wrist or the ankle.

The loss of a whole limb or part thereof is always a significant event and is usually associated with enormous emotional stress. When the loss is in a child, it tends to elicit a lot of sentiments due to the perceived limitations the child is to be exposed for reasons possibly not due to the child.

Indications for amputations vary between countries and even within countries.[3] Trauma has been noted to be the most common indication for amputation in some studies[3,4] while some other studies have implicated diabetic foot gangrene as the most common indication for amputation[5,6] in adults. Misguided intervention by traditional bone setters (TBS) who have no formal training in trauma and orthopedic treatment is a top indication for amputation in children.[7,8] Lawnmower injuries have been noted to be a common cause of childhood amputation in the United States.[9]

Irrespective of the indication for amputation, this surgical procedure is offered as the last option to save a life. The procedure though life-saving is usually difficult to accept by patients and their families. Many parents withhold consent for surgery, and this often creates an ethical dilemma for the surgeon who, in our environment, cannot override their

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decision in managing children who need that life-saving and life-changing surgical intervention.[10] The socioeconomic and financial demands on the family are usually enormous, that some of the children who get amputations may end up as street beggars and social misfits. Prolonged hospital stay, disability, and psychological consequences are burdens seen in child amputees,[11,12] and they may complicate the recovery process of the child with the possible affectation of the child's future goals.[13]

This study was aimed to review indications for amputations in children who presented to Enugu State University of Technology Teaching hospital, as well as highlight challenges are commonly seen in the child who may have had or may have the need for amputation to survive. It is envisaged that knowledge of these challenges will go a long way in improving care and ultimately improve the developmental process of the child involved.

Patients and Methods

This was a retrospective study of children who were admitted and had amputation of the limb at Enugu State University Teaching Hospital (ESUTH) Enugu southeast Nigeria from January 2015 to December 2019. Medical records of the patients in the accident and emergency unit, the theatre, wards, and orthopedic outpatient clinics were used in data collection. The study was approved by the Institutional review board of ESUTH. Data were collected using designed pro-forma, and it included age, gender, indication for amputation as well as the limb and side affected. Associated injuries and complications were recorded. Challenges/impediments to prompt surgical intervention and rehabilitation like presentation time after injury/pathology, time-lapse from the decision to intervene surgically and obtaining consent to intervene, as well as the acquisition or not of rehabilitation facilities, were recorded. Only patients with complete hospital records were included, while those with incomplete records like those who signed against medical advice and those who had no follow-up visit to the outpatient clinic were excluded. Analysis of data collected was performed using IBM SPSS version 20 (Armonk, NY, USA. IBM Corp) software and presented in tables and figures.

Results

The study noted 22 amputations involving 13 (59.0%) males and 9 (41.0%) females. The male:Female ratio was 1.4:1. The age ranged from 1 to 16 years, with a mean of 10.1 years (standard deviation) 1.4 years.

Table 1 shows that the most common indication for amputations was trauma from road traffic accidents (RTA) 6 (27.3%) and limb gangrene resulting from bone setter's intervention 6 (27.3%). In one case of bone setter's intervention, the radiological examination did not reveal any bone pathology or fracture, and hence the child ended with an above elbow amputation as a life-saving procedure from wet gangrene resulting from tight splinting by the bonesetter. The cases of industrial accidents 2 (9.1%) occurred when the children were caught by the conveyor belt of industrial palm kernel cracking and cassava grating machines leading to mangled extremities. Neoplasia 4 (18.2%) is the third most common indication for amputation. Three (75.0%) of the 4 cases of neoplasia were due to osteogenic sarcoma, while one (25.0%) was due to dermatofibrosarcoma. Civil violence accounted for 3 (16.6%) cases and crush injury from collapsed building wall was responsible for 1 (4.5%) case.

The right lower limb was the most affected in 9 (40.9%) patients. This was followed by left lower limb 6 (27.3%), right upper limb 5 (22.7%) and the left upper limb 2 (9.1%). In all, the lower limb was involved in 15 (68.2%) cases and upper limb in 7 (31.8%) cases.

As shown in Figure 1, the most common level of amputation was below knee 11 (50.0%). Above elbow, amputation occurred in 5 (22.7%) patients and was the second most common amputation level. Above-knee amputation was offered to 4 (18.2%) children and below the elbow was done on 2 (9.1%) patients. Two cases of below-knee amputation presented 2 years after the primary amputation with stump overgrowth and had re-amputation.

Head injury and blunt abdominal injuries were noted to be the most common associated injuries in children who had trauma. They were all managed conservatively with good results.

Delayed wound healing was most common complication seen and it was followed closely by joint stiffness and stump overgrowth [Table 2]. There was partial wound breakdown of three lower limb (1 above knee and 2 below knee) wounds after removal of sutures 14 days post definitive wound closure. The wounds healed eventually after daily wound dressing with appropriate agents (Honey, Normal saline, tule grass). Joint stiffness was treated by physiotherapy and stump overgrowth had stump revision.

Consent for amputation was given by the fathers of the patients or the oldest paternal male relation around 18 (81.8%) cases. The grandfathers of 4 (18.2%) patients were the ones who gave consent for their surgery. Mothers who, in most cases, brought the children to the hospital did not give consent for surgical intervention. In trauma-related cases, it took an average of 36 h to obtain consent after the decision to amputate was made.

No patient was able to acquire prosthesis due to financial constraints, but all lower limb amputees were trained and mobilised on axillary crutches.

Sixteen patients came from the countryside approximately 35 km from the hospital, while the remaining two patients live within the city, and the abode of two patients was not stated.

Analysis of presentation time of 18 trauma-related cases shows that 2 (11.1%) patients presented within 12 h of injury, 4 (22.2%) patients presented between 13 and 24 h of injury, 5 (27.8%) presented 25–36 h after injury, 1 (5.6%) patient presented between 37 and 48 h after injury and 6 (33.3%)

Table 1: Indications for amputation

Indications	Right lower limb	Left lower limb	Right upper limb	Left upper limb	Total
Industrial accidents	-	-	2	-	2 (9.1)
Neoplasia	1	2	-	1	4 (18.2)
Civil violence	2	-	1	-	3 (13.6)
Bone setters intervention	2	1	2	1	6 (27.3)
Home accidents	1	-	-	-	1 (4.5)
Road traffic accident	3	3	-	-	6 (27.3)
Total	9 (40.9)	6 (27.3)	5 (22.7)	2 (9.1)	22 (100)

Table 2: Complications

Complication	Frequency (%)
Delayed wound healing	3 (13.6)
Sepsis	1 (4.5)
Joint stiffness	1 (4.5)
Phantom pain	2 (9.1)
Stump overgrowth	2 (9.1)
Stump wound infection	2 (9.1)

patients presented after 48 h of injury. The average presentation time of patients who had bone setters intervention was two and a half days after the primary injury.

Discussion

Amputation is an ancient surgical procedure which still has relevance in modern times, recent technological advances notwithstanding. Our study revealed 22amputations in children out of a total of 167 amputations. This gives children an amputation rate of 13.2%, which is <19.6% rate of amputation in children reported by Nwosu *et al*.[4] in Northern Nigeria and 32.7% reported by Akinyoola *et al*.[7] in Ile Ife southwest Nigeria. The difference between our report and the other reports may be related to the number of years their studies covered. Our study covered only 5 years while theirs covered 7 years. It could also be that there is a change in attitude towards preventive behavior or practices leading to a reduction in rate in our study.

The study found a male preponderance, which is in keeping with other studies.[3,4,6] The commonest indication for amputation in children in our study was RTA associated, and this was equaled by TBS intervention induced gangrene. Other studies in Nigeria with children in focus also had similar finding.[4,7,8] However, Trautwein *et al*.[14] in their study found that lawnmower injuries, resulting in amputation in children were more common than RTA injuries giving rise to amputation in children. Post-burn contractures, followed by congenital limb malformations were ranked first and second respectively in the study by Paudel *et al*.,[15] further laying credence to the fact that indications for amputations in children vary from country to country possibly depending on the prevailing circumstance in the area. The overall contribution of TBS is thought to be under-reported when it is included in traumatic causes of amputation but may be over reported when it is reported as a separate indication for amputation.[2] The negative contribution of TBS toward amputation in Nigerian children has been documented by some authors.[16,17] Neoplasia was ranked third commonest indication for amputation in children in the study by Akinyoola *et al*.[7] in Ile-Ife southwest Nigeria. In this study, neoplasia was the indication for amputation in 18.2% of cases while Seid *et al*.[18] working in Tikur Anbessa, Ethiopia recorded that neoplasia was the indication for amputation in 29.2% of patients in their study.

This study found that the lower limbs were amputated more than upper limbs. This is in keeping with the findings of other studies.[8,12,19] Akinyoola *et al*.[7] and Seid *et al*.[18] however, noted that there were more upper limb amputations in children than there were lower limb amputations in their work. Our finding of more lower limb amputations could be linked to the finding that the lower limbs are usually more involved in trauma,[4] which happened to be the most common indication for amputation in our series. Further consideration of lower limb amputations shows that below-knee amputation accounted for 50.0% of all amputations in this series, and that is as much as all the other amputations put together. The level of amputation largely depends on the indication as the attending surgeon basically chooses a level of amputation that gives the best chance of survival. However, every effort is usually made to limit the amputation to below knee level as it is known that preservation of the knee mechanism reduces postoperative energy expenditure, makes rehabilitation faster and effective with better proprioception than above knee amputation.[20] A study in Sokoto, Nigeria however, found that above elbow amputation was predominant among children in the study.[21]

A common challenge experienced in the management of children who had amputation was that of obtaining consent. It was noted that only male relations gave consent when there was a need for surgical intervention. Waiting for the male relation to arrive for consent to be given the lead to loss of valuable time which may impact the surgical outcome. The paternal family heritage in our environment made it that mothers and female caregivers could not give consent for fear of possible consequences or backlash that could follow. There is no clear-cut consent law that allows medical personnel to proceed with surgery when the patient's relation is not forthcoming with consent. The process of obtaining legal authority to circumvent parental authority is quite cumbersome and time consuming that it may well be late when and if it is obtained.[9] The

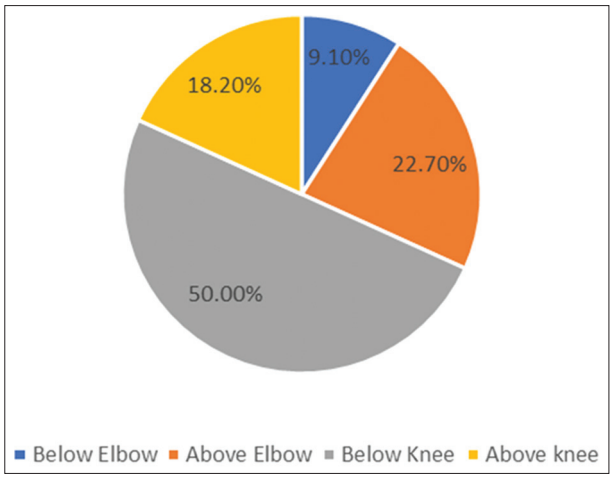

Figure 1: Amputation levels

unnecessary delay usually compounds the child's condition, predisposing the child to more postoperative complications, and make surgical expectations when orthodox treatment is applied to be low.[22] Parents are known to only give consent when there is an obvious threat to the life of the child[21] and that creates a difficult management challenge to the attending surgeon.

Two-thirds of the patients in this study who had trauma and that includes all cases of TBS intervention cases presented after 48 h of the primary injury. Late presentation has remained an intractable issue, and it was seen in all pathologies that ended up in amputation. All cases of neoplasia in this study presented when the mitotic cells had infiltrated beyond the compartment and metastasised to distant organs making any form of limb salvage an unnecessary exercise.[21] The reason for late presentation includes but is not limited to financial difficulty, ignorance, and lack of access to a health facility where initial first aid could make a difference. Most of the patients in this study came from the rural area where there was no standard health facility and access road to the urban area was poor, all culminating into late arrival to the hospital. A study in Kaolack Senegal has noted that children from rural areas have the challenge of limited access to health-care facilities.[13] Post amputation rehabilitation was noted to be almost nonexistent in this study due mainly to financial reasons. None of the patients in the series procured prosthesis. A similar finding was also noted in other studies in Northern Nigeria.[7,8] This contrasted sharply with the report of Kejlaa in county Funen in Denmark, where all amputees had prosthesis and none of the amputees were required to pay for rehabilitation or prosthetics supply.[23] The inability to procure prosthesis is understandable. In an environment where the minimum wage is less than USD 100 a month, procuring a prosthesis of about USD 900 is a tall order. Replacing prosthesis overgrown by the child if it was procured earlier pose added challenge to the overall rehabilitation of the child. Without prosthesis, moving around could be quite a task for children, especially where there is no special provision for disabled persons in many public buildings. If these children are not properly rehabilitated, they may end up not achieving their potentials.

Conclusion

Amputation in children in our environment is largely due to preventable causes. Better parental care to prevent trauma will go a long way in keeping these causes at bay. Whenever there is trauma, the use of orthodox Medicare should be the only line of action to ensure optimal care. Laws that are streamlined to give attending physicians the opportunity to intervene accordingly instead of waiting for the minors' relation who may not be informed to give the needed consent, is hereby advocated. Subsidizing Medicare for children will go a long way in ensuring adequate care and rehabilitation to give proper social integration for the victim of inevitable limb amputation.

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Conflicts of interest

There are no conflicts of interest.

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