

## Factors influencing the outcome of elective paediatric orthopaedic operations in Ile-Ife, Nigeria

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**Abstract:** There is a paucity of published data on the types of paediatric orthopaedic conditions that require surgery and factors influencing their outcome in most parts of Sub-Saharan Africa. This is a necessary audit to improve paediatric orthopaedic practice. We carried out an audit of all elective orthopaedic operations performed in children at Awolowo University Teaching Hospitals Complex in Ile-Ife, Nigeria from January 2000 through December 2005. The aim was to document the clinical outcomes and the factors that influence them. This is with a view to instituting necessary measures to improve paediatric orthopaedic practice in the area. A total of 146 children who had elective operations on 210 limbs were included in the study. Their mean age was 75.6±66.8 months (range 0.3-396 months). The commonest indications for surgery were angular knee deformities (from Blount's disease and rickets) and club foot. The mean hospital stay before surgery was 12±8.8 days (range 1-38days). The mean duration of operation was 78.4±36min. (range 30-195 min). The total length of hospitalization was 34.97±19.91 days in males and 41.97±25.15 days in females. Wound infection was the commonest postoperative complication (8.2%). The patient's age ( $P=0.002$ ), indication for surgery ( $P=0.008$ ), length of preoperative hospital stay ( $P=0.048$ ), length of operation ( $P<0.001$ ) and intraoperative blood loss above 200ml ( $P<0.001$ ) were found to be statistically significant factors adversely affecting the surgical wound outcome. We conclude that most of the factors that predicted poor outcome in this study were patient and environment-related and are preventable. There is need to upgrade facilities in health institutions in Nigeria.

**Key words:** paediatric, orthopaedic, operations, prognosis, Nigeria

### Introduction

The subspecialty of paediatric orthopaedic surgery is relatively new in most parts of sub-Saharan Africa. There is therefore a paucity of published data on the type of orthopaedic conditions that require surgery among children in our environment. Furthermore in contrast to numerous reports in adults little information is available on postoperative complications and risk factors in paediatric orthopaedic operations (Duke-Estrada *et al.*, 2003; Horwitz *et al.*, 1998; Kaabachi *et al.*, 2005). Operative procedures are the most definitive mode of treatment in paediatric orthopaedics (Staheli, 2006). It is a well known fact that children have greater healing potential and fewer complications than adults, thereby increasing the chance of a successful outcome, all things being equal (Bhattacharyya & Kosloske, 1990; Staheli, 2006). To avoid complications the risk must be identified preoperatively and preventive measures taken (Staheli, 2006).

The management and outcome of paediatric orthopaedic operations vary considerably between the developed and developing countries (Ekenze *et al.*, 2006). Delay in presentation, shortage of personnel

and inadequate facilities are major limitations in the management of children in our environment (Ekenze *et al.*, 2006). All the elective paediatric orthopaedic operations carried out, over a 6-year period, in the department of Orthopaedic Surgery and Traumatology of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria, were studied. The aim of the study was to identify the common indications for elective paediatric orthopaedic operations, postoperative complications and factors contributing to their prevalence. This is with a view to instituting necessary preventive measures.

### Materials and Methods

#### Study area and patients

This is a retrospective audit of all elective paediatric orthopaedic operations carried out between January 2000 and December 2005 inclusive. The study setting was the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria. The hospital is a 554-bed facility in the south western Nigeria. The bio-data of each patient, pre-surgery hospital stay (days), pre-operative haemogram, diagnosis (indication for

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surgery), surgical operation performed, duration of operation (minutes), intra operative blood loss and duration of tourniquet application (when used) were recorded. Intravenous cefuroxime (Zinacef by Glaxo Limited, UK) was the preoperative antibiotic of choice where indicated. Excluded were patients older than 16 years, American Society of Anesthesiology class greater than 2, bone and joint infections, malignancies, open fractures, sickle cell disease (HbSS and Hb SC) patients and patients with HIV/AIDS. All the surgeries were performed by the consultant staff and senior registrars. The operating room environment was similar for all the patients. A surgical wound was expected to heal in each patient within 14 days. A pre-surgical hospital stay beyond 72 hours and a post operative hospital stay beyond 14 days were defined abnormal.

The outcomes that were measured were post-operative complications, the wound status (presence or absence of infection and duration of wound healing), length of post operative hospital stay (days), and microbiology of the surgical wound site (if infected). Wound infection was defined as a purulent discharge from the wound either spontaneously or on removal of sutures. A patient with wound infection, recurrence of deformity or abnormal post operative hospital stay was considered to have unsatisfactory outcome.

#### Data analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 11.0 for win-

## Results

A total of 489 children were admitted and treated for different kinds of elective paediatric orthopaedic disorders during the study period. A total of 146 patients, who had elective orthopaedic operations on 210 limbs, constituting 42.9% of all elective paediatric orthopaedic surgery cases, fulfilled the study inclusion criteria. Sixty three patients (males=52.1%; females= 47.9%) had bilateral pathology, mainly knee deformities (including Blount's disease and rickets) and club foot (Table 1). Congenital limb deformities (absent radius, absent tibia, tibia pseudarthrosis and polydactyl) accounted for 27.6% of the diagnoses. The mean age was 75.6±66.8 months (range: 0.3-396 months). Children in the under-five (years) age group constituted 57.5% of the study population while 82.2% of the patients were in the first decade of life. Ninety patients (61.6%) had bone operations while 56 (38.4%) had soft tissue surgery (Table 2).

The mean hospital stay before surgery was 12±8.8 days (range 1-38 days, 2-tailed test  $P=0.048$ , CI=-5.733 -0.029). The mean total hospital stay for males was 34.97± 19.91 days and for females was 41.97±25.15 days (2-tailed test  $P=0.063$ , CI=-14.39 ±0.395). The mean packed cell volume PCV) at surgery was 34.7±3.8% (range 26-42%). A total of 122 patients (83.6%) had haemoglobin genotype AA while 24 (16.4%) had AS. The mean duration of surgery was

**Table 1: Patients' diagnosis at surgery**

Diagnosis	No. of limbs	%
Angular knee deformities	120	57.1
Club foot	58	27.6
Congenital limb deformities	16	7.6
Post traumatic deformities	10	4.8
Polio deformities	4	1.9
Baker's cyst	2	1.0
Total	210	100

dows. Transformation of variables was done where necessary, in particular quantitative variables. Test of significance was calculated by the use of Analysis of Variance (ANOVA), chi-square tests with Fischer's exact test where numbers were small and Yates correction when indicated. Student *t*-test was used to compare the means. Bivariate correlation was carried out to determine the relationship between variables and the correlation between outcome, wound status and other variables using binary logistic regression analysis.

78.4±36 minutes (range: 30-195 minutes). The mean duration of tourniquet application (where it was used) was 20.5±25.7 minutes (range 15 to 125minutes).

The surgical wound status, duration of wound healing and determinants of outcome are summarised in Table 3. Wound infection was the commonest post operative complication. The patient's age ( $\chi^2 = 12.792, df = 2, P=0.002$ ), pre-operative diagnosis (indication for surgery) ( $\chi^2 = 15.701, df = 5, P=0.008$ ),

**Table 2: Types of surgical operations performed**

Operation	No of patients	Percentage
Corrective osteotomy	80	54.8
Soft tissue release	44	30.1
Open reduction and internal fixation of fractures	4	5.4
Centralization (carpus & ankle)	4	5.4
Excision (Extra digits, Baker's cyst)	10	13.6
Triple arthrodesis	4	5.4
Total operations	146	100

length of preoperative hospital stay ( $P=0.048$ ), length of operation ( $\chi^2=42.160$ ,  $df=2$ ,  $P=0.000$ ) and intraoperative blood loss above 200ml ( $\chi^2=18.667$ ,  $df=2$ ,  $P=0.000$ ) were found to be statistically significant factors affecting the surgical wound outcome. Gender ( $\chi^2=0.625$ ,  $df=1$ ,  $P=0.429$ ), type of operation performed -bone or soft tissue surgery ( $\chi^2=1.530$ ,  $df=1$ ,  $P=0.216$ ) and haemoglobin genotype ( $\chi^2=$

(2 tailed test + 0.568,  $P=0.000$ ). Seventeen (8.1%) wounds developed infections (10 superficial - 4.8%, 7 deep - 3.3%) (Table 4).

When the patients were stratified into age groups, 95.2% of the patients under the age of 5 years had satisfactory outcome. Sixty percent of overall unsatisfactory outcome was accounted for by those in the age group 5-10 years. There was thus a statistically

**Table 3: Surgical wound status, duration of wound healing, post-operative complication**

Clinical outcome	Frequency	Percentage
Surgical wound status		
No wound infection	193	91.9
Superficial wound infection	10	4.8
Deep wound infection	7	3.3
Duration of wound healing(days)		
within 14 days	46	21.9
>14 days	164	78.1
Post operative complications		
Wound infection	17	8.1
Malaria	6	4.1
Anaemia	4	2.7

2.112,  $df=1$ ,  $P=0.146$ ) did not significantly affect the outcome of surgery. There was a positive correlation between age and duration of wound healing (2 tailed test, +0.231,  $P=0.006$ ). There was also a significant correlation between length of hospital stay before operation and length of post operative hospital stay

significant difference in the surgical outcome between the under 5 age group and those between 5 and 10 years ( $\chi^2=12.792$ ,  $df=2$ ,  $P=0.002$ ). All the 26 patients (17.8%) above the age of 10 had satisfactory outcome. There was no significant difference in the outcome of surgery between the age group 10 to 15 years and those under 5 years. The reason for this is not clear

**Table 4: Determinants of surgical outcome**

Determinant	Mean	P-value
Age(months)	75.6±66.8	0.002
Gender	-	0.429
Haemoglobin genotype	-	0.146
Indication for surgery(diagnosis)	-	0.008
Type of operation(bone or soft tissue)	-	0.216
Preoperative hospitalization(days)	12±8.8 (range 1-38)	0.048
Duration of surgery(minutes)	78.4±36 (range 30-195)	0.000
Intraoperative blood loss above 200mls	-	0.000

from this study.

### Discussion

This audit of elective paediatric orthopaedic operations has revealed some predictors of outcome in Ile-Ife, Nigeria. There was a positive correlation between age and duration of wound healing. Surgical wound infection is a significant source of postoperative morbidity in orthopaedics surgery (Duque-Estrada *et al.*, 2003; Horwitz *et al.*, 1998; Kaabachi *et al.*, 2005). Such infections prolong wound healing and thus the length of hospital stay and overall cost of treatment. The wound site infection rate in our study was higher than that reported for clean paediatric surgery by other workers (Duque-Estrada *et al.*, 2003; Horwitz *et al.*, 1998; Kaabachi *et al.*, 2005) but similar to the rate in a series of paediatric orthopaedic operations (Kaabachi *et al.*, 2005). Further studies are necessary to establish whether surgical site infection rate is higher in clean paediatric orthopaedic operations than in non-orthopaedic paediatric surgery cases.

We found the indication for surgery to be a determinant of postoperative surgical site infection. Patients with club foot and knee deformity (especially Blount's disease) had worse prognosis. *Talipes equino varus* deformity has been found to be a significant risk factor for postoperative wound infection in a study conducted in Tunisia (Kaabachi *et al.*, 2005).

The length of preoperative hospitalization was a risk factor for surgical site infection in this study. The mean hospital stay before surgery of  $12 \pm 8.8$  days was rather too long. This is due to logistic problems like poor power (electricity) supply and inadequate facilities necessitating frequent cancellation of operation lists in most of our hospitals in Nigeria. The length of preoperative hospital stay has been reported to be an important risk factor for surgical site infection in nosocomial infections surveillance in Dutch orthopaedic patients (de Boer *et al.*, 1999). However some studies could not demonstrate any significant association between the length of preoperative hospitalization and wound infection (Duque-Estrada *et al.*, 2003; Horwitz *et al.*, 1998; Bhattacharyya & Kosloske, 1990). The surgical site infection rates among patients undergoing elective surgery on the same day of their hospitalization was found not to be significantly lower than that of other patients that required preoperative hospitalization (Manian & Meyer, 1998). Another factor that significantly correlated with poor wound status was the length of operation. The longer the operation time the worse the wound status. Increasing duration of operation more than 1 hour has been generally found to increase the rate of surgical site infection in most

studies (Duque-Estrada *et al.*, 2003; Horwitz *et al.*, 1998; Kaabachi *et al.*, 2005; Bhattacharyya & Kosloske, 1990; Al-Habdan & Sadat-Ali, 2003; Uludag *et al.*, 2000). This is due to higher chance of wound contamination, especially from glove perforation (Al-Habdan *et al.*, 2003). The amount of intra operative blood loss, especially if more than 200ml, also significantly affected the outcome of surgery. This, if not replaced adequately, may lead to postoperative anaemia (2.7% in this study). This delays wound healing and thus the outcome.

This study has shown that most of the factors that predict poor outcome by increasing the rate of surgical site infection and prolonging the post operative hospitalization are related to both the patient and the environment. The length of pre-operative hospitalization should be shortened because it increases the rate of surgical site infection and overall cost of treatment. Infrastructural facilities in hospitals in Nigeria should be upgraded. More paediatric orthopaedic surgeons need to be trained. All these would shorten the waiting time before patients have their operations. Paediatric orthopaedic practice, being relatively new in most parts of Africa, is a fertile and very challenging subspecialty of orthopaedic surgery. There is need for more prospective studies to highlight these challenges with a view to improving the outcome of paediatric orthopaedic operations.

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