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A 10-year retrospective review of perioperative mortality in pediatric general surgery at Ile-Ife Hospital, Nigeria

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ABSTRACT

Background/Purpose: The analysis of perioperative mortality as well as surgery- and anesthesia-related death in pediatric patients may serve as a potential tool to improve outcome. The aim of this study is to report the 24-h and 30-day overall, and surgery and anesthesia-related, mortality in a tertiary hospital.
Methods: This is a retrospective review of perioperative mortality in children ≤15 years at a general pediatric surgery unit. All pediatric general surgery cases operated under general anesthesia between January 2007 and December 2016 were included in the study and data analyzed.
Results: A total of 4108 surgical procedures were performed in 4040 patients. The age was 1 day to 15 years with a median age of 2 years. The all cause 24-h mortality was 34 per 10,000 procedures and the all cause 30-day mortality was 156 per 10,000 procedures. Septicemia was the most common cause of death. The determinants of mortality were neonatal age group (Adjusted Odd Ratio (AOR) = 0.033, 95% CI = 0.015–0.070, p = 0.001), emergency surgery (AOR = 90.91, 95% CI = 27.78–333.33, p = 0.001), higher ASA status (AOR = 0.014, 95% CI = 0.005–0.041, p = 0.001) and multiple operative procedures (AOR = 38.46, 95% CI = 10.64–142.85, p = 0.001).
Conclusions: Neonatal age group, children with poorer ASA status, emergency and multiple surgeries were predictors of perioperative mortality.
Level of evidence: Retrospective study.

Perioperative mortality is defined as death occurring within 30 days of a surgical procedure. Most perioperative mortality is attributable to complications from the operations (such as excessive hemorrhage, sepsis, and failure of vital organs) or preexisting medical or surgical conditions [1–3].

Pignaton et al. [4] observed that there is a higher percentage of perioperative death in children compared with adults. Among pediatric age groups, perioperative mortality is higher in neonates and infants compared with older children [5].

A comprehensive evaluation of the rates and pattern of death after surgery may help surgeons and anesthetists to identify children at higher risk, and may also assist to draw protocols for proper planning, distribution of resources and provision of expert staffing for these higher risk children so as to stem the spate of perioperative death [6,7].

The incidence of mortality in children especially neonates and infants with surgical conditions is higher in sub-Saharan Africa [8,9] compared to developed countries. Ilori et al. [10] as well as Osifo and associates [11] observed that late presentation is a risk factor contributing to high mortality among neonates in our subregion. Other risk factors include ignorance, poverty, poor transportation, late diagnosis, delay in the provision of care and dearth of modern facilities [8,9]. Owing to improvement in pediatric anesthesia, intensive care, blood and blood product transfusion, and introduction of parenteral nutrition in the past decades, perioperative mortality as well as surgery- and anesthesia-related death has become infrequent in developed countries unlike sub-Saharan Africa [2,4,5,9].

Bruin et al. [5] in a study reported a 24 h hospital mortality of 13.1 per 10,000 procedures and a 30 day in hospital mortality of 41.6 per 10,000 procedures. They also found that the overall surgery- and anesthesia-related deaths were 0.9 per 10,000 procedures and 1.1 per 10,000 procedures respectively. Other studies have reported that

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anesthesia related death ranges from 0.19 to 0.98 per 10,000 procedures requiring anesthesia [4,7,12].

These studies on perioperative mortality as well as surgery- and anesthesia-related death are from developed countries. There are few reports to date on this subject in our subregion [4,5,7].

The aim of this study is to describe the prevalence and causes of overall perioperative mortality including surgery- and anesthesia-related mortality in pediatric patients in our hospital.

1. Methods

1.1. Setting

Our hospital is a tertiary medical college facility situated in a semiurban area of south west, Nigeria. The institution has six health care units through which it provides integrated health care delivery to people who are predominantly farmers, artisans and civil servants.

1.2. Study design

The Ethics and Research Committee of our institution approved the study protocol. The medical records including the anesthetic and clinical charts of children aged ≤15 years operated within January 1, 2007 and December 31, 2016 were reviewed. Criterion for inclusion was; patients with general pediatric surgery conditions who had complete records up to 30 days after surgery requiring general anesthesia. The biodata, diagnosis, elective or emergency surgery, congenital or acquired, American Society of Anesthesia Physical Status (ASA PS), type of operation (major, or minor), time, and cause of death were retrieved. Children were classified into five groups according to their age: neonates up to 30 days of age, infants from 31 days to 12 months of age, preschool children of one to three years of age, children aged four to nine years and 10 to 15 years. The medical records of the children who died within 30 days after anesthesia were examined by 2 pediatric surgeons, and 1 consultant anesthetist and 2 pediatric surgical registrars. Patients were discussed and anesthesia- and surgery-related death was reached by the entire team. The panel agreed to classify the principal causes of death according to a previous study [5]. The principal causes of death were examined and tabulated into four major categories.

1. Attributable to preoperative condition or disease (when comorbidities were the only or the major contributory factor);
2. Attributable to a preoperative trauma event (with subsequent surgery);
3. Anesthesia either fully or partially contributed to the death (when the child's disease or condition were primary factors but anesthesia-related problems represented an additional factor;
4. The surgical procedure either fully or partially contributed to the death (when the child's disease or condition were primary factors but surgery-related death represented an additional factor);

Categories 1 and 2 include all deaths in which the panel agreed that neither surgery nor the anesthesia contributed to death. Deaths attributable to anesthesia were defined using the definition by Griend et al. [7]. The panel was not blinded to the rank of surgeons and anesthetists that were involved in all the procedures. The operative procedures and anesthesia were performed by consultants and senior residents in anesthesia and pediatric surgery units of the hospital. We also looked at mortality rate over time by comparing the mean mortality between the first 5 years of the study with the latter half. We define major surgery as an invasive surgical procedure in which there is extensive tissue dissection and/or resection or a body cavity is entered while a minor procedure is one in which neither a body cavity is entered nor extensive tissue dissection or resection is performed.

1.3. Statistical methods

Mortality prevalence is expressed per 10,000 procedures. Data collected were analyzed for frequencies and percentages using SPSS software version 20 (IBM, Chicago, IL, USA). The results were presented as tables and graph. Initially, all variables potentially associated with 30-day perioperative mortality were subjected to Chi square analysis or Fisher's exact test. Variables with p value <0.2 were included in the regression model. Univariate and multivariate analyses using logistic regression model were performed to determine predictors of mortality. A p value of <0.05 was accepted as significant.

2. Results

During the study period, there were 4056 patients with 4126 procedures requiring anesthesia. Of this, the records of4040 patients with 4108 procedures were available for analysis. Their ages ranged from 1 day to 15 years with a median age of 2 years. Perioperative mortality was 34 per 10,000 procedures within 24 h and 156 per 10,000 procedures within 30 days.

Sixty eight percent of those who died were neonates. Mortality in children older than 1 month was 116 per 10,000 procedures which was much lower than in children younger than one month, 508 per 10,000 procedures. Generally, mortality seem to increase with decreasing age of patients and this difference was statistically significant, p = 0.001 (Table 1).

The sex of patients had no influence on the outcome of surgeries, p = 0.792 (Table 1). Male patients constituted 723 (52.8%) of the major surgeries performed. Similarly, majority (1782; 65.1%) of the minor procedures were also performed in male children. Emergency surgery and higher ASA status statistically influenced mortality as shown in Table 1. Most patients (98.3%) underwent a single operation. Those that had multiple surgeries had more mortalities of 1180 per 10,000 procedures compared to those that had single surgeries, 140 per 10,000 procedures. The difference was statistically significant, p = 0.001, Table 2.

Univariate logistic regression analysis identified younger age, emergency surgery, higher ASA status, and multiple surgical procedures as factors determining higher mortality (Table 3). On multivariate regression analysis, the determinants of mortality were neonatal age group (Adjusted Odd Ratio (AOR) = 0.033, 95% CI = 0.015–0.070, p = 0.001), emergency surgery (AOR = 90.91, 95% CI = 27.78–333.33,

Table 1
Patients' characteristics and procedures. Mortality is per 10,000 procedures.

Variables	Number of procedures, n	Death over 30 days, N (%)	Mortality Rate/10,000 procedures	P-value
Total	4108	64	156	
Sex				0.792
Male	2502	40 (62.5)	159.9	
Female	1606	24 (37.5)	149.3	
Age in months				0.0001
≤1	767	39 (61.0)	508	
>1–12	948	11 (17.2)	11.6	
13–60	1015	5 (7.8)	49.3	
61–120	773	7 (10.9)	90.5	
121–180	605	2 (3.1)	33.1	
Type of surgery				0.0001
Emergency	701	60 (93.8)	855.9	
Elective	3407	4 (6.2)	11.7	
Time of death				
≤24 h		14 (21.9)	34.1	
>24 h–30 days		50 (78.1)	121.7	
ASA status				0.0001
I	2092	5 (7.8)	23.9	
II	1338	16 (25.0)	119.5	
III	601	28 (43.8)	465.9	
IV	77	15 (23.4)	1948.1	

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