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ANAESTHETIC OUTCOMES IN NEONATAL SURGICAL CARE IN A TERTIARY HEALTH FACILITY IN NIGERIA

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ABSTRACT

There is always a concern about the survival of new-borns undergoing corrective surgical procedure early in life. Perioperative care, especially in sick babies, is challenging, and this makes ascribing outcomes to care given difficult.

This study is aimed at determining and evaluate factors associated with poor outcomes in new-borns undergoing surgery and anaesthesia. This is a retrospective case notes review of 37 neonates who received general anaesthesia during surgical care over a three-year period. After ethical approval for the study, the demographic data, indications for surgery, ASA classifications, preoperative, intraoperative and postoperative challenges present in these neonates as well as their outcome were extracted. Out of a total of 48 neonates were operated over a three-year period, only 37(77.1%) case files were available for review. Male: Female ratio was about 2:1, the two most common procedures performed were bowel resection and anastomosis in 7(18.9%) and colostomy 7(18.9%). Overall mortality was 29.7%. Neonatal mortality was significantly higher in patients with postoperative sepsis (p=0.006) and respiratory challenge (p=0.035). The median time to death was 9 days. Only one (9.1%) patient died within 24hours postoperative. Mortality in neonates undergoing surgical procedure early in life is very high in this study. However, it is difficult to implicate anaesthesia in our study as the cause of mortality as most occurred very late after many days of surgery. Availability of postoperative elective ventilation for selected patients may improve outcome

Keywords: Neonatal Anaesthesia; Outcome; Neonatal mortality; Respiratory challenges; Anaesthesia challenges.

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INTRODUCTION

Anaesthetizing a neonate requires the services of a paediatric anaesthesiologist or an experienced anaesthetist in handling this vulnerable group of patients who are still transiting and adapting to the new environment after the delivery from the intrauterine live. Most of the time, this group of patients present with critical conditions that will require emergency surgical intervention. Anaesthesia management may, in fact, exert a number of effects on postoperative outcome. Several clinical risk factors have been established to predict poor outcome in surgical neonates in the developed world (Catre et al.,2013; OECD 2011; Wardlaw 2004). Despite improvement in anaesthesia delivery and surgical techniques, neonatal surgery continues to be a major cause of morbidity and mortality, especially in settings with limited facilities (Horbar et al., 2012; Tome et al., 2009; Catre et al., 2013).

Several studies have stratified surgical neonates into different risk strata soon after delivery or admission (Cockburn and Cooke 1993, Parry et al., 2003).
Surgeries in babies with low gestational age, low birth weight with potentially correctable malformations always provoked dilemmas of survival (Cockburn and Cooke 1993). With a better understanding of the severity and risk factors for the development of postoperative complications among operated neonates, effort can be targeted towards the prevention of a bad outcome.

This study was aimed at evaluating the anaesthetic outcomes of neonates that underwent surgery in our hospital.

MATERIALS AND METHODS

This was a retrospective study of all neonates that underwent surgeries in the University of Ilorin Teaching Hospital between year January 2014 - December 2016 (3years). Circumcision and Neonates operated for neurosurgical conditions were excluded. After approval by the Hospital Ethical Review Committee, records of patients were reviewed for demographic information, surgical diagnosis, ASA physical status, type of anaesthesia given, pre, intra and postoperative details and outcome. The primary outcome measure was 30-day operative mortality.

Statistical analyses were performed using SPSS Software Version 20.0 for Windows (SPSS Inc., Chicago, IL, USA). Data were expressed as a proportion, means± standard deviation (SD), median. Continuous variables were compared with student's t-test and categorical variables were analysed with Chi-square test and Fisher's exact test where appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 48 neonates met the selection criteria over the study period, but only 37(77.1%) case files were available for review. Out of these cases, 24(64.9%) were males and 13(35.1%) were females. Twenty-five (67.6%) were outborn and 9(24.3%) were inborn. The place of birth was not documented for 3 patients.

Table 1: Sex distribution and outcome

		Outcome Dead or Alive		Total
		alive	Dead	
Sex	Male	16	8	24
	Female	10	3	13
Total		**26**	**11**	**37**

Table 1 shows the clinical characteristics of the patients. Anorectal malformation accounted for 10 (27%) of the patients, Intestinal malrotation and bands 8(21.6%), intestinal atresia 6(16.2%), abdominal wall defect 5(13.5%) and others 8(21.6%) [Table 2]. Ten (27.0%) patients had associated congenital anomalies. The American Society of Anesthesiologists' Physical status of patients were ASA IE 11(29.7%), IIE 15(40.5%), IIIE 10(27.0%) and IVE 1(2.7%). The most common procedures performed were bowel resection and anastomosis in 7(18.9%) and colostomy 7(18.9%) as shown in Table 2.

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Table 2: Pattern of surgical Diagnosis in Neonates Presenting for Surgical Emergency

Diagnosis	Total
Abdominal wall defect	5(13.5%)
Intestinal malrotation and congenital band	8(21.6%)
Anorectal malformation	10(27%)
Hernia	2(5.4%)
Hirschsprung	2(5.4%)
Hypertrophic pyloric disease	1(2.7%)
Intestinal atresia	6(16.2%)
Oesophageal atresia	2(5.4%)
NEC	1(2.7%)
Total	37(100%)

Preoperative challenges included sepsis in 8(21.6%) patients, respiratory challenges 8(21.6%) patients, oliguria 4(10.8%) patients while cardiovascular challenges were present in 3(8.1%) patients [Table 3]. One (2.7%) and 2(5.4%) patients had convulsion and hypotonia, respectively. The temperature patterns were normal in 26(70.3%), intermittent in 6(16.2%) patients while there were no documented temperature in 5(13.5%) patients. Thirteen (36.1%) out of 36 neonates anaesthetised were consultant-led while the remaining 23(63.9%) neonates were led by the senior registrar anaesthetists [Table 3].

Table 3: Risk factors and outcome

RISK FACTORS	OUTCOME			
	ALIVE	DEAD	Total	P values
Place of birth				0.068
Inborn	7	2	9	
Outborn	16	9	25	
Total	23	11	34	
ASA Classification				0.434
I	9	2	11	
II	11	4	15	
III	5	5	10	
IV	1	0	1	
Total	26	11	37	
Rank of Anaesthetist				0.057
Consultant	12	1	13	
Senior Registrar	14	10	24	
Total	26	11	37	
Preoperative CVS challenges				0.162
Present	1	2	3	
Absent	25	9	34	
Total	26	11	37	
Preoperative Respiratory challenges				0.035
	3	5	8	
Present	23	6	29	
Absent	26	11	37	
Total				
Preoperative sepsis				0.678
Present	5	3	8	
Absent	20	8	28	
Total	27	10	37	
Neonatal Sepsis				
Present	4	7	11	0.006
Absent	22	4	26	
Total	26	11	37	
Required ICU admission				0.001
Yes	2	7	9	
No	24	4	27	
Total	26	11	37	

Sixteen (43.2%) neonates had blood transfusion while 20(54.1%) patients did not receive a blood transfusion and 1(2.7%) patient's record of need for transfusion was missing. Postoperative challenges were respiratory challenges in 8 (21.6%) patients, delayed awakening in 2(5.4%) patients and difficult extubation due to inability to maintain a patent airway following extubation and reintubation occurred in 1(2.7%) patient.

Overall, 11 patients died giving percentage mortality of 29.7%. Death was more common among patients with oesophageal atresia 2(100%), necrotizing enterocolitis 1(100%), intestinal malrotation 4(50%), followed by intestinal atresia 2(50%) and anorectal malformation 2(20%), p=0.073. ASA score, p=0.43; preoperative cardiovascular challenges, p=0.21; and rank of anaesthetists, p=0.057 were not significantly associated with death (Table:3). Mortality was significantly more in patients with preoperative respiratory challenge 62.5% (5/8) compared to 20.7% (6/29) among those without respiratory challenges, p=0.035 and mortality was also higher in neonates with postoperative sepsis 7(63.6%) out of 11 compared with those without postoperative sepsis 4(14.3%) out of 28, p=0.006. The median time to death was 9 days and range was between 10hours to 24days. Only one (9.1%) died within 24hours.

DISCUSSION

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In our study, 11 out of 37 neonates died postoperatively giving neonatal surgical mortality of 29.7%. Preoperative respiratory challenges and postoperative sepsis were major factors contributing to mortality and morbidity among neonates with surgical conditions. Although other factors like surgical diagnosis could be risk factors associated with higher mortality as found in oesophageal atresia and necrotizing enterocolitis with 100% mortality. However, this is difficult to prove as most of the case files that we were not able to retrieve included oesophageal atresia. During the study period, seven (7) cases of oesophageal atresia were managed and three (3) survived but the case files were not available for data collection. Our two major factors, respiratory challenges and postoperative sepsis were risk factors in these mortalities.

Neonates presenting for surgery early in life constitute higher anaesthetic risks than other patients because of their peculiar anatomic, physiologic and pharmacologic characteristics that differentiate them from adults. Surgical interventions in the neonate with congenital anomalies becomes imperative because they are unlikely to resolve without surgery early in life. Paediatric patients in the developing countries have perioperative mortality rates ranging from 3.0 to 15.9 per 10,000 anaesthetics (Gonzalez et al., 2012; Bhattacharya et al., 2016).

There is paucity of data describing the burden of paediatric surgical disease in Sub-Saharan Africa. The pattern of diagnoses at admission in our institution was related to the gastrointestinal tract which is similar to the finding by Faponle et al., 2004. The mortality rate in our study was 29.7% which is similar to that reported by Ameh et al., 2001 in Nigeria but lower than what was reported by Manchanda et al., 2012 in India. When we compared our study to that done by Faponle et al., 2004 we discovered that mortality occurred within 24days (9.74day±6.96days) after surgery in our study while it occurred within 14days in their study. Only one patient (9.1%) died within 24hours in our study while in Faponle et al., 2004; 38.5% of their patients died within 24hours. Therefore, our neonates lived longer postoperatively than in the study by Faponle et al., 2004. The disparity may be a reflection of the improvement in surgical care with the upgrading of training facilities and the provision of equipment that has taken place in Nigeria within the last 10years.

Defining anaesthesia-related mortality is very difficult and most often subjective (Gonzalez et al., 2012; Deshpande et al., 2011). The North American Perioperative Cardiac Arrest (POCA) Registry classified cardiac arrest as anaesthesia-related if anaesthesia personnel or the anaesthetic processes played at least some role in the cause of cardiac arrest (Bharti et al., 2009). The perioperative period has varied definitions which included intraoperative only (Ahmed et al.,2009), intraoperative through the recovery from anaesthesia (Flick et al., 2007; Braz et al., 2006), the first 12 postoperative hours (Biboulet et al., 2001), the first 24 postoperative hours (Van der Griend et al., 2011; Bunchungmongkol et al., 2009), two post-operative days (Ahmed et al., 2009) and 7-8 postoperative days (Morita et al., 2002).

Neonatal death in our study was more related to the presenting surgical condition than to anaesthesia with oesophageal fistula and enterocolitis carrying the highest risk. Intestinal malrotation and intestinal atresia had a 50% risk of mortality while anorectal anomaly was associated with the least mortality. Sepsis is the commonest problems among neonates presenting for surgery, followed by respiratory and cardiovascular problems (Ameh et al., 2001). In this study significant number of neonates were out-born because home delivery occurs more in rural area where deliveries are supervised by traditional birth attendants and late presentation of the newborn to clinics and hospital is the norm in developing world. In this study, the out-born babies had more complications like anastomotic leak and wound dehiscence. Postoperative mortality was also higher in the out-born than in the inborn neonates {9 out 16 (56.25%)} and 2 out of 7(28.57%) respectively [Table 3]. However, these were not statistically significant. Neonatal sepsis is a systemic infection that occurs in new-borns up to 28 days of age and it is a major cause of morbidity and mortality in new-borns. The surgical neonate has the added burdens of invasive procedures and exposure to pathogenic bacteria prior to the hospital environment. This may

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further worsen the outcome especially where health care facility is inadequate. Sepsis in the hospital-born (in-born) babies in the developing world are increased because of poor intrapartum and postnatal infection-control practices (Machanda et al., 2012). Although ASA physical status has been implicated as a risk factor in the paediatric perioperative mortality (Van der Griend et al., 2011), our study also shows poor outcome with increase in ASA but surprisingly the only ASA IV patient that had surgery survived (Table3)

Among those that died, the preoperative respiratory challenge was a significant determinant of neonatal mortality(p=0.035) in our study. This challenge was also compounded by non-availability of neonatal ventilator to give elective respiratory support to these neonates with respiratory insufficiency. All the five neonates who had preoperative respiratory insufficiency had delayed awakening from anaesthesia and eventually died. Two (5.4%) patients without preoperative respiratory challenge also developed postoperative respiratory insufficiency. The effect of sepsis on respiratory, cardiac and renal function is evident and related directly to the pre-mortality incidents in our study. Some of the neonates in our study needing respiratory support had to be ventilated manually postoperatively because our facility does not have mechanical ventilators for neonates.

In this study, mortality was lower amongst neonates anaesthetized by consultant anaesthetists compared to those by senior registrars although this was not statistically significant. In our centre, the paediatric surgical team comprising 3 Paediatric Surgeons, one paediatric Anaesthetist, 3 paediatric perioperative nurses and more than 10 paediatric trained ward nurses have contributed a lot to improved outcome of our neonatal surgeries. We also enjoy support from neonatologist in the Neonatal Intensive Care Unit of the hospital

Only one patient died within 24 hours while others died many days after surgery which is an indicator of improved anaesthesia services in the immediate perioperative period. Postoperative neonatal intensive care is a challenge for surgical neonates in our study in terms of respiratory support. Mitul AR,2015; identified reasons why developed world have a great reduction in neonatal surgical mortality most of which are lacking in developing countries. These are availability of experienced neonatal surgeons and paediatric anaesthetists with good knowledge of neonatal physiology, development of sophisticated medical devices to monitor changes in neonatal physiology. Also, provision of neonatal ventilators and respiratory support system, total parenteral nutrition, effective antibiotics and establishment of neonatal intensive care unit with trained personnel.

In this study 9(24.3%) neonates required ICU admission and only 2(22.2) survived given percentage mortality of 77.8% among those managed in intensive care, which is very high. This constituted about 19% of overall mortality. This indicates that outcome of surgical intensive neonatal care was poor due to lack of needed equipment and facility to support these critically ill neonates.

CONCLUSION

Our study showed no direct anaesthesia related to neonatal surgical mortality. However, postoperative sepsis and respiratory challenges constituted major risk factors to neonatal death in our study. Provision of critical and elective ventilation to selected patients may improve outcome of neonatal surgery and anaesthesia in our setting.

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