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Challenges and Outcome of Neonatal Surgeries in a Teaching Hospital in Enugu, Nigeria

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ABSTRACT

BACKGROUND: Outcome of neonatal surgery is a measure of the quality of pediatric surgery services in any center. The outcome of treatment is still relatively poor in developing countries. This study aimed to evaluate our experience and the challenges we encountered in the management of surgical neonates.

METHODS: This was a retrospective study of neonates that had surgery at the pediatric surgery unit of Enugu State University Hospital, Enugu, Nigeria. Medical records of neonates that had surgery over a 5-year period were evaluated.

RESULTS: There were 30 cases of neonatal surgeries with an age range of 2-20 days (median 10.8 days) at presentation and male to female ratio of 2.3:1. The median duration of symptoms prior to presentation to the hospital was 3 days (range: 1–12). Most of the neonates were delivered in a health center. Necrotizing enterocolitis was the most common diagnosis in the neonates. Colostomy creation and insertion of peritoneal drain were the most performed surgical procedures in the neonates. Surgical site infection was the most common postoperative complication. Mortality was 36.7%.

CONCLUSION: Outcome of neonatal surgeries in our center is still poor and is fraught with several challenges. Early presentation, provision of well-equipped neonatal intensive care unit and availability of parenteral nutrition are required to improve outcome.

Keywords: Neonatal, Surgery, Teaching Hospital, Challenges

INTRODUCTION

Neonates are still adapting to extrauterine life and the stress of anesthesia/surgery affects their fragile homeostasis. Newborns who require surgery present a challenge to the pediatric surgical team and the ancillary support medical staff [1]. The indications for neonatal surgeries range from congenital anomalies to acquired pathologies. However, neonatal surgeries are mostly performed for congenital malformations or birth defect [2]. Neonatal surgery's complexity requires in-depth knowledge of neonatal physiology/anatomy and advanced surgical skills and neonatal care pre and post-operatively [3]. In developing countries like Nigeria, there are several challenges and the outcome is far from what is achieved in developed countries [4]. The high burden of childhood diseases in developing countries has taken away neonatal surgery's attention [4]. A better

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understanding of neonatal physiology, technology improvements, and advances in neonatal intensive care have improved outcomes in developed countries [5,6]. Some of the challenges identified by studies included a late presentation, delayed referral, poor transportation, lack of appropriate personnel, absence of intensive care facilities and lack of total parenteral nutrition (TPN) [4,5]. The purpose of this study was to evaluate neonates who have surgical pathologies, identify challenges of management and assess the outcome of treatment.

METHODS

Study design: This was a retrospective study of neonates who had surgery between January 2014 and December 2018.

Study setting and location: Pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria. ESUTH is a tertiary hospital located in Enugu, South-East Nigeria. The hospital serves the whole of Enugu State, which according to the 2016 estimates of the National Population Commission and Nigerian National Bureau of Statistics, has a population of about 4 million people and a population density of 616.0/km2. The hospital also receives referrals from its neighboring states.

Participants/subjects: Neonates who had a surgical diagnosis at presentation and those who developed surgical problems in the course of medical treatment were included in the study. Only neonates operated on and managed by the pediatric surgery unit were included. Neonates managed by other surgery subspecialties were excluded from this study.

Enrolment of participants: Neonates managed during the study period were recruited into the study. Recruitment of the neonates followed each other continuously.

Variables and outcomes: The information extracted include the age, gender, duration of symptoms before presentation, the time interval between presentation and intervention, surgical diagnosis, a definitive operative procedure done, complications of treatment, duration of hospital stay and outcome of treatment.

Sample size: A sample size of 34 was determined using Altman's formula based on our population size of 4 million and a prevalence of 8.9% found in Ameh et al. [9].

How were outcomes measured: Information was extracted from the case notes, operation notes, operation register, and admission-discharge records. Survival was the primary outcome measure, while post-operative complications and mortality (or survival) were the secondary outcome measure.

Data collection tools employed: A proforma designed by the investigator was used for data collection. A proforma was used for orderly and proper patient's data retrieval with each proforma for each patient.

Data Management and statistical analysis: The Statistical Package for Social Science (SPSS) version 21 was used for data entry and analysis. Data were expressed as percentages, median, mean, and range.

Ethical consideration: Ethics of medical research were strictly followed. Parents/caregivers were counselled about the purpose of the study and informed consent was obtained. Confidentiality was ensured by not revealing any features of patients that may identify them.

This study followed the principle of the Declaration of Helsinki. The research protocol was reviewed and approved by the hospital ethics and research committee. (Ref: ESUTHP/RA /044/ VOL 12/276) on 7/11/19.

RESULTS

Patients' demographics: Out of the 357 neonates admitted into the hospital's newborn unit during the period of the study, 34 (9.5%) of them had surgery. However, only 30 neonates had complete case records and formed the basis of this report. There were 21 (70%) males and 9 (30%) female, which correspond to a male to female ratio of 2.3:1. The patients' ages at presentation ranged from 2 to 20 days, with a median of 10.8 days. The median duration of symptoms prior to presentation to the hospital was 3 days (range: 1–12). The median duration from presentation to surgery was 2 days (range: 1-5). The mean duration of hospital stay was 15 days (range: 7-22) Table 1.

Place of birth of the patients: Majority of the patients 9 (30%) were delivered at a health center. Details are shown in Table 2.

Specific diagnosis: Necrotizing enterocolitis (NEC) was the most common diagnosis in our patients

Table 1: Patients' demographics

Parameter	Number of patients (%)
Gender	
Male	21 (70)
Female	9 (30)
Median age of the patients	10.8 days (2-20)
Median duration of symptoms prior to presentation	3 days (1-12)
Median duration from presentation to surgery	2 days (1-3)
Mean duration of hospital stay	15 days (7-22)

(Table 3). Two-third (66.7%) of the patients with NEC were pre-terms and their mothers had prolonged labor. Two (22.2%) of the neonates had birth asphyxia and were fed artificial milk (formula) preceding NEC's onset of symptoms.

Table 2: Place of birth of the patients

Place of birth	Number of patients (%)
Health center	9 (30)
Hospital	8 (26.7)
Home	7 (23.3)
Maternity home	6 (20)

No predisposing factor to NEC was found in 1 (11.1%) neonate. NEC's diagnosis was confirmed radiologically by air within the bowel wall (pneumatosis intestinalis) and pneumoperitoneum.

Table 3: Patients' diagnosis

Diagnosis	Number (%)
Necrotizing enterocolitis	9 (30)
Anorectal malformation	7 (23.4)
Ruptured omphalocele	4 (13.3)
Obstructed inguinal hernia	4 (13.3)
Intestinal atresia	3 (10)
Gastroschisis	3 (10)

A peritoneal drain was inserted in 8 patients while 1 neonate had a colostomy. Four (4/9; 44.4%) neonates died postoperatively. Mortality was due to overwhelming sepsis.

Anorectal malformation was the second most common in the current series. All the neonates were males: Six (6/7; 85.7%) had a rectourethral fistula while 1 had no fistula. Diagnosis of anorectal malformation was clinical and confirmed by cross-table lateral radiograph. Defunctiong colostomy was offered the patients. There was no mortality.

Ruptured omphalocele was the third most common diagnosis in our patients. Diagnosis of omphalocele was clinical and investigations such as blood glucose and echocardiography were performed for associated anomalies. Operative reduction and repair of the anterior abdominal wall was indicated in ruptured omphalocele. Three (¾; 75%) expired post-operatively from congenital cardiac defects and absence of intensive care monitoring facilities.

Obstructed inguinal hernia occurred in males and presented after 21 days of postnatal life. The diagnosis was made clinically and treatment was herniotomy/herniorrhaphy. However, one neonate (1/4; 25%) had gangrenous bowel and required intestinal resection and anastomosis due to late presentation. There was no mortality.

Intestinal atresia was present in 3 neonates and they all presented within the first 7 days of postnatal life. The diagnosis was made clinically (bilious vomiting, failure to pass meconium) and supported by radiological findings. All the neonates had intestinal resection and anastomosis. Mortality occurred in 2 (2/3; 66.7%) neonates due to sepsis from an anastomotic leak.

Gastroschisis present as eviscerated bowel that

is inflamed, matted together and edematous. The operative treatment entails returning the eviscerated bowel into the abdominal cavity and repairing the defect in the abdominal wall. Two (2/3; 66.7%) neonates died due to prolonged ileus and lack of parenteral nutrition that was required to sustain them.

Operation performed: Colostomy and insertion of peritoneal drain were performed in 8 (26.7%) patients, each. They were the most common performed operative procedures. Other surgeries performed are shown in Table 4.

Table 4: Operation performed

Operation performed	Number (%)
Colostomy	8 (26.7)
Insertion of peritoneal drain	8 (26.7)
Closure of anterior abdominal wall	7 (23.3)
Intestinal resection and anastomosis	4 (13.3)
Herniotomy/Herniorrrhaphy	3 (10)

Post-operative complications: The most common postoperative complication was surgical site infection (SSI) (Table 5).

Outcome: Sixteen (53.3%) patients did well and were discharged home. The parents of 3 (10%) patients signed out against medical advice and 11 (36.7%) patients expired. The neonates whose parents signed out against medical advice could not be categorized as mortalities because they may have survived by seeking medical care in a peripheral hospital or another teaching hospital. The mortalities with respect to the respective diagnosis are described in the section on the specific diagnosis.

DISCUSSION

Neonates are not small adults and their physiologic features are different from those of older children and adults. There is a wide difference in neonatal surgery outcomes between developing and developed countries [7]. Neonatal surgery in developing countries is fraught with challenges which include a late presentation (due to poverty and ignorance), paucity of trained support staff, lack of neonatal intensive care and other facilities for peri-operative care [7,8].

There are still few anesthetists who subspecialize in neonatal anesthesia. However, there have been reports of slight improvements in neonatal surgery outcomes in developing countries due to coordinated interdisciplinary collaboration [9,10]. The outcome of neonatal surgery depends on

Table 5: Operation performed

Diagnosis	Complications						
	None	SSI	Burst abdomen	AIO	Recurrence	Anastomotic leak	Total
Necrotizing enterocolitis	6	3	-	-	-	-	9
Anorectal malformation	7	-	-	-	-	-	7
Ruptured omphalocele	2	1	1	-	-	-	4
Obstructed inguinal hernia	-	1	2	-	1	-	4
Intestinal atresia	-	1	-	1	-	1	3
Gastroschisis	1	1	1	-	-	-	3

SSI=Surgical site infection; AIO=Adhesive intestinal obstruction

the operative procedure and the type of initial care received at the referral hospital and during transport [11].

Our neonatal surgery incidence rate of 9.5% is similar to the report from Nigeria's south-south region [8]. However, a study carried out in Cuba reported a surgery incidence in neonates of 12.7% while another study conducted in Port Harcourt Nigeria reported 6.2% [1,12]. The differences in neonatal surgery incidence could be explained by the fact that the number of neonates operated on varies from place to place and from year to year [1]. Specialized neonatal surgical centers are more likely to perform more neonatal surgeries. The male predominance recorded in the current study is consistently observed in other studies, too [1, 8]. The reason for the male predominance is not known. The median age of the patients of 10.8 days recorded in the present study is at variance with another researchers' report [7,8]. The dominant pathology in the neonates may explain the differences in the median ages of the patients. For instance, neonates with congenital anomalies such as intestinal atresia will present earlier than neonates who have acquired abnormalities such as necrotizing enterocolitis. Late presentation of our patients is manifested in the 3-day lag period. This finding agrees with the observation of other authors [5,9,13]. This is unlike what is obtainable in Europe and America.

A significant number of neonates were not delivered in the hospital in the current study. A study done in Port Harcourt Nigeria reported that most neonates were delivered in maternity homes [8]. However, a study done in Lagos Nigeria reported the hospital as the most commonplace of birth of the neonates [14]. The place of birth of surgical neonates may be dependent on the health facility available in a locality. Family finances may also be an important consideration.

Necrotizing enterocolitis (NEC) was the most common indication for neonatal surgery in this series. Other studies also reported necrotizing enterocolitis as a common indication for neonatal surgery [15,16]. Necrotizing enterocolitis is a multifactorial disease process of the gastrointestinal tract of neonates (especially premature neonates) resulting in inflammation and bacterial invasion of the bowel wall [17]. Two-third of our patients who had NEC were preterm babies. This finding is in line with the report of Rose et al. [18]. NEC is regarded as a disease of prematurity and has also been associated with formula feeds [18]. We offered our patients peritoneal drainage and this line of management is supported by studies that have not shown any difference in outcome between laparotomy and peritoneal drain insertion in neonates with NEC [19]. As we found in the index study, NEC is leading cause of death among pre-term babies [20].

Some researchers have reported anorectal malformation and intestinal atresia as the most common neonatal surgery indications [10,21]. The anorectal malformation is wide spectrum of congenital disorder of the anorectum. There is male predominance in anorectal malformation and this is consistent with the report of one study from Texas, USA [22]. Treatment of anorectal malformation is usually staged with colostomy as the initial surgery.
Intestinal atresia results from a vascular accident that occurs during intrauterine life and treatment are resection and anastomosis through a laparotomy. The challenge in managing these neonates with intestinal atresia is the absence of parenteral nutrition because of the prolonged nil by mouth in the post-operative period.

Ruptured omphalocele and gastroschisis constitute anterior abdominal defects. Return of the eviscerated bowel and repair of the abdominal wall is the treatment modality. Delayed return of bowel function in these neonates with anterior abdominal wall defects requires nutritional support which is not available in my centre.
Complications from inguinal hernia are quite common in neonates and early elective repair is advised. Emergency repair of inguinal hernia is associated with a higher risk of surgical and anesthetic complications [23].

Colostomy was the most common procedure performed in this series. Neonates who had anorectal malformation and one of the neonates that had necrotizing enterocolitis had a creation of colostomy as a temporizing measure. Colostomy was also the most commonly performed procedure in other studies [24,25].

The present study's mortality rate is consistent with the observation of most series on neonatal surgery [7,10,13]. Absence of surgical neonatal intensive

care unit, non-availability of parenteral nutrition and late presentation may have contributed to the high mortality recorded in the current study. However, in developed countries, the reported mortality rate is about 6.4% [26]. The differences in mortality between developing countries and developing countries lie in developing countries' challenges as already enumerated.

This is a descriptive study of a single surgical center. Therefore, the pathologies are dependent on the referral practices of regional hospitals. The small number of participants should be noted. A number of patients self-discharged and thus, their ultimate outcomes are unknown.

CONCLUSION

Neonatal surgery is associated with significant morbidity and mortality, especially in developing countries like Nigeria. Several challenges are encountered in the surgical neonate's management, including late presentation, lack of total parenteral nutrition, lack of neonatal intensive care and other facilities for peri-operative care.

There is a need for the provision of neonatal intensive care unit, parenteral nutrition and early presentation of the surgical neonate which will make for an improvement in survival.

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