



## A 3 years' Experience of Operated Surgical Neonates Outcome in a Tertiary Hospital of Ain Shams University (Neonatal Intensive Care Unit)

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### ABSTRACT

**Background:** Surgery on a newborn has been one of the most challenging subjects in medical science. A neonate is born with its unique physiological features of very narrow normal ranges, beyond which it is helpless to cope with the adverse situations. Added to this, it has to be able to respond to life-threatening surgical conditions for its survival. **Objectives:** We aimed in this piece of work to assess the outcome of different neonatal surgical conditions and factors responsible for mortality in surgical neonates. **Patients and Methods:** The present retrospective study was conducted in the NICU of Ain Shams University Children's Hospital using the records from the beginning of year 2011 till the end of year 2013. The recorded data included gestational age, postnatal age at admission, sex of neonates, maternal age, mode of delivery, surgical diagnosis, surgery outcome, risk factors for occurrence of sepsis, classification of type of sepsis if present (Early-onset sepsis, Late-onset, or nosocomial), blood culture results, antimicrobials used, length of hospital stay, need for ventilation, risk factors for occurrence of sepsis, cause of death. **Results:** The study included 69 patients with surgical problems who were admitted to the NICU. They were 45 males (65.22%) and 24 females (34.78%) with a male to female ratio of 1.8: 1. They were 10 preterms (14.49%) and 59 full-terms (85.51%); with mean gestational age range from 32-40 weeks, mean  $\pm$  SD: 36.91 $\pm$ 1.98 weeks. 37 (53.62%) were delivered by LSCS and 32 (46.38%) by SVD. 33.33% of neonates were admitted between 1 and 2 days postnatal, 42.9% were more than 1 week old, with mean age of admission 9.49  $\pm$ 10.37 days. The most common surgical problems were Tracheo-oesophageal fistula (9 cases), followed by imperforate anus low anomaly 5 cases, imperforate anus high anomaly 5 cases, then Hirshsprung disease 4 cases. Also, hydrocephalus and Arnold Chiari malformation each 4 cases. Diaphragmatic hernia 4 cases. 61 cases had sepsis, 50 cases were discharged, 19 died and 8 had no complications. The most common causes of death were; sepsis (16 cases), heart failure (9 cases), respiratory failure (5 cases), cardio – pulmonary failure (3 cases) and pneumonia and pulmonary hypertension each one case. **Conclusion:** Most of cases were full term babies and had late presentation to our hospital which led to delayed operations. Most common surgical problem was trachea-oesophageal fistula.

**Keywords:** *Gastrointestinal tract- Surgical- Congenital diaphragmatic hernia- Neonatal*

## 1. INTRODUCTION

In the context of gestational age at birth, birth weight and neonatal pathological conditions, certain adverse early variables - such as decreasing gestational age, decreasing birth weight and critically compromised neonatal health status, specifically in the presence of surgical life-threatening conditions mainly related to immaturity and low birth weight have been recognized for increasing risk of poorer health outcomes for neonatal and infant morbidity and mortality<sup>(1)</sup>.

Among several other factors, infections and sepsis remain as persistent and significant causes of mortality and morbidity among neonates. Newborns suffering from sepsis have increased mortality rate and have higher mortality from sepsis. This remains as a challenge to neonatal surgical care. Survival following neonatal surgery has made a significant improvement in the developed countries because of better understanding of neonatal physiology, introduction of sophisticated devices, availability of trained personnel and of course antibiotics treating infections effectively<sup>(2)</sup>.

On the other hand, in developing countries, due to the burden of other childhood diseases, neonatal surgery is of low priority to health-care budget holders, thus outcomes expectedly differ from that obtainable in developed countries<sup>(3)</sup>.

## 2. METHODS

This study is a retrospective study that was carried out in the Neonatal Intensive Care Unit (NICU), Children's Hospital; Ain Shams University.

**Study population:** The study included 69 patients with surgical problems who were admitted to the NICU from beginning of 2011 till end of 2013.

**Study methods:** The data was collected retrospectively from the admission register and examination of admission files and records.

The data collected from all studied neonates included: Gestational age, postnatal age at admission, neonatal sex, maternal age, mode of delivery, surgical diagnosis, operative findings, surgery outcome, risk factors for occurrence of sepsis, including devices and procedures, type of sepsis if present (early-onset, late-onset, or nosocomial), blood culture results (initial and subsequent, if any), including the isolated pathogen and the antimicrobial susceptibility and resistance. Antimicrobials used initially and subsequently with their prescription patterns (e.g. normal or meningitic doses, prophylactic or definitive treatment

antibiotics....etc.), length of hospital stay, need for ventilation, cause of death.

**Statistical Analysis:** Data were analyzed using Statistical Program for Social Science (SPSS) version 20.2. Quantitative data were expressed as mean  $\pm$  SD. Qualitative data were expressed as frequency and percentage.

## 3. RESULTS

This study included 69 neonates; 45 males and 24 females. According to gestational age; there were 59 fullterms (85.51%) and 10 preterms (14.49%) as shown in table (1).

37 (53.62%) were delivered by LSCS and 32 (46.38%) by SVD. 23 cases (33.33% of neonates) were admitted between 1 and 2 days postnatal, 29 cases (42.9%) were more than 1 week old, with mean age of admission  $9.49 \pm 10.37$  days as evident in table (1).

The most common surgical problems were Tracheo-oesophageal fistula (9 cases), followed by imperforate anus low anomaly 5 cases, imperforate anus high anomaly 5 cases, then Hirshsprung disease 4 cases. Also hydrocephalus and Arnold Chiari malformation each 4 cases. Diaphragmatic hernia 4 cases. 61 cases had sepsis, 50 cases were discharged, 19 died and 8 had no complications as in table (2). The most common causes of death were; sepsis (16 cases), heart failure (9 cases), respiratory failure (5 cases), cardio – pulmonary failure (3 cases) and pneumonia and pulmonary hypertension each one case as in table (4). Table (3) shows the outcome of neonates in the study; where 61 cases had sepsis, 50 cases were discharged, 19 cases died, 8 cases had no complications and 2 cases had short bowel syndrome.

Table (1): Demographic characteristics of studied neonates

GA (wks)	No.	%
<b>Preterm</b>	10	14.49
<b>Full-term</b>	59	85.51
<b>Age of Admission</b>		
<b>1-2 days</b>	23	33.33
<b>3-4 days</b>	14	20.29
<b>5-7 days</b>	3	4.35
<b>&gt;7 days</b>	29	42.03
<b>Hospital stay</b>		
	No.	%
<b>1wks</b>	19	27.54
<b>2wks</b>	18	26.09
<b>3wks</b>	12	17.39
<b>4wks</b>	7	10.14
<b>&gt;4wks</b>	13	18.84

Table (2): Diagnosis of surgical cases in the study

<b>Gastrointestinal</b>	<b>No.</b>	<b>%</b>
Tracheo-esophageal fistula	9	13.0
Imperforate anus (low anomaly)	5	7.25
Imperforate anus (High anomaly)	5	7.25
Hirschsprung	4	5.80
Jejunal Atresia	3	4.35
Gastroschiasis	3	4.35
Examploos minor	3	4.35
Esophageal atresia without fistula	2	2.90
NEC + perforation	2	2.90
Malrotation	2	2.90
Dudenal atresia	2	2.90
Ileal atresia	1	1.45
Gastric duplication cyst	1	1.45
<b>Central nervous system</b>	<b>No.</b>	<b>%</b>
Hydrocephalus (one infected shunt)	4	5.80
Arnold chiari	4	5.80
Meningocele	3	4.35
Meningocele + hydrocephalus (2ry hydrocephalus after repair of meningocele)	2	2.90
Subdural hemorrhage	1	1.45
<b>Respiratory</b>	<b>No.</b>	<b>%</b>
Diaphragmatic hernia	4	5.80
Bilateral choanal atresia	2	2.90
Congenital lobar emphysema	1	1.45
<b>Cardiovascular</b>	<b>No.</b>	<b>%</b>
Transposition of great vessels	2	2.90
Parent ductus arteriosus	1	1.45
Ventricular septal defect	1	1.45
Coarctation of aorta	1	1.45
<b>Others</b>	<b>No.</b>	<b>%</b>
Septic arthritis	2	2.90
Bladder exstrophy	1	1.45

Table (3): Outcome of studied neonates

<b>Short term outcome</b>	<b>No.</b>	<b>%</b>
<b>Sepsis</b>	61	88.4
<b>Discharged</b>	50	72.46
<b>Died</b>	19	27.54
<b>Short bowel syndrome</b>	2	2.90
<b>No complications</b>	8	11.59

Table (4): Causes of death among the study group (Died, N=19).

<b>Cause of Death</b>	<b>No.</b>	<b>%</b>
<b>Sepsis</b>	16	84.21
<b>Heart failure</b>	9	47.37
<b>Respiratory failure</b>	5	26.32
<b>Cardio-pulmonary failure</b>	3	15.79
<b>Pneumonia</b>	1	5.26
<b>Pulmonary hypertension</b>	1	5.26

Sepsis in the studied neonates was classified into: Early-onset sepsis; 21 cases and late-onset sepsis; 40 cases and nosocomial infection in 8 cases as shown in table (5).

Table (6) demonstrates the blood culture results in the study, where Klebsiella (8.7%) was the most common organism detected in blood culture.

Table (5): Types of sepsis of the study group

<b>Sepsis</b>	<b>No.</b>	<b>%</b>
<b>Early- onset sepsis</b>	21	30.43
<b>Late-onset sepsis</b>	40	57.97
<b>None</b>	8	11.59
<b>Total</b>	69	100

Table (6): Blood culture results of the study group

<b>Blood culture</b>	<b>No.</b>	<b>%</b>
<b>Organism</b>	13	18.84
<b>Acetobacter</b>	3	4.35
<b>E coli</b>	1	1.45
<b>Klebsiella</b>	6	8.70
<b>Non hemolytic streptococci</b>	1	1.45
<b>Pseudomonas</b>	1	1.45
<b>Staphylococcus aureus (coag. negative )</b>	1	1.45
<b>No growth</b>	56	81.16

#### **4. DISCUSSION**

The surgical neonate requires care in specialized centers offering high-risk neonatal support, with neonatology and pediatric surgical specialties. These patients are often immature and very ill, presenting associations of several risk factors such as preterm birth, low birth weight, chromosomal defects, genetic syndromes or serious illness with multiple organ

dysfunction, and thus require management in highly dedicated neonatal intensive care units<sup>(4)</sup>.

The neonatal period is a highly vulnerable time for an infant, who is completing many of the physiologic adjustments required for extra-uterine existence. If the neonate suffered a problem which needs surgery, this challenge is magnified.

Our study included 69 surgical neonates admitted at different postnatal ages; neonates aged from 1-2 days (33.33%), from 3-4 days (20.29%), from 5-7 days (4.35%) and >7 days (42.03%) with mean  $\pm$  SD 9.49 $\pm$ 10.37 days. They were 45 males (65.22%) and 24 females (34.78%) with male to female ratio 1.8:1. (10 cases) 14.49% were preterm and (59 cases) 85.51% were full-term; with mean gestational age 36.91 $\pm$ 1.98 weeks.

Most of them were late admission after being admitted in other neonatal intensive care units, then referred to our hospital being a referral centre.

This was in accordance with Abdalla and Karsani (2014) in Sinnar Hospital (2013-2014) in Sudan who found that 145 neonates were operated. 83 out of them were males (57.2%), 61 (42.1%) were females while one neonate was intersex (0.7%).with male to female ratio 1.4:1<sup>(5)</sup>.

In our study, 60% of surgical conditions were gastrointestinal; 20% both central nervous system and respiratory, and cardiovascular 7% and other anomalies represented 3%. From Gastrointestinal lesions; intestinal atresia represented 26.1% , TOF 13% , abdominal wall defects 8.7%, Hirshsprung disease 5.8%, perforated NEC 2.9%, malrotation 2.9% and gastric duplication cyst represented 1.45%.

Shah et al. (2016) study done at tertiary care neonatal intensive care unit of Saurashtra region; India<sup>(6)</sup>. Agreeing with us that the most common system involved in neonates presenting with congenital surgical conditions was gastrointestinal tract( 56.9%). The commonest GIT anomalies were tracheo-oesophageal fistula (28.6%), intestinal obstruction (23.7%), anorectal malformation (17.9%), and omphalocele (7%). Central nervous system anomalies represented 4.5% and genitourinary system anomalies 1.5%.

According to a study done in NICU of the Coimbra's Pediatric Hospital in Portugal<sup>(7)</sup>. Upon comparing their study with ours; GIT anomalies were higher in ASU Hospital in Egypt and Coimbra's Hospital in Portugal but Esophageal atresia/ TOF and Anorectal malformation are higher in Egypt. But NEC/intestinal perforation, small bowel obstruction or atresia and gastroschisis are higher in Portugal. Also Portugal had

higher rates in congenital diaphragmatic hernia and hydrocephalus.

Our study found that the total mortality rate was 27.54%. Sepsis was the major cause of death; 84.21% of all deaths either alone or with another causes of death. Sepsis also was the major surgical complication 88.4% (58% is due to late sepsis and 30.4 due to early sepsis).

In agreement with our study, a study in Nnewi, Nigeria<sup>(8,9)</sup> demonstrated that the overall mortality rate was 27.9%, although comparable with several other reports from the country.

But Rowe and Rowe (2000); Matsuda and Tamura (2011) proved that this rates are still high compared with the rates from developed countries, which is currently less than 10%<sup>(10,11)</sup>.

Osifo and Ovuenu (2009)<sup>(9)</sup> agreed that neonates are at an increased risk of infection because of their compromised immune system. Sepsis is a common complication among surgical neonates. Late presentation, intubations and invasive procedures increase the risk of sepsis. They documented established sepsis in 55.3% of neonates presenting late in their series. Apart from the delayed presentation as in our study, we can attribute this high figure to the overcrowded nature and poor ventilation of the special care baby room (resuscitaire).

On the other hand, the study done in Intensive Care Unit of the Coimbra's Pediatric Hospital Portugal; Europe by Catré et al. (2014)<sup>(7)</sup> found that there was an overall mortality of 6.4% and according to (Taguchi, 2008)<sup>(12)</sup> this mortality relating to a surgical NICU population of risk, is within the prevalence reported for developed countries, which is usually below 10% the most common cause of death in Portugal is Peritonitis/Abdominal sepsis 42% while sepsis represented 7%.

In the current study, (18.84%) of neonates had positive blood cultures while (81.16%) had no growth and the most common organism was Klebsiella 46% then Acetobacter 23% then E coli 7%, and non- hemolytic streptococci 7%, Pseudomonas 7% and Staphylococcus aureus (coagulase negative ) 7%.

In contrast to us Sadowska-Krawczenko et al. (2012)<sup>(13)</sup> study demonstrated that the most common hospital acquired pathogens in all neonates were Coagulase-Negative Staphylococcus (36.1%) and K. pneumoniae (29.3%).

One of the limitations of our study is that it was a retrospective case based study, and not all the detailed information pertaining to cases could be extracted from the records.

## **5. CONCLUSION**

The results of this study show that the male to female ratio in surgical emergencies is 1.8:1. Most of cases

were gastrointestinal anomalies mainly atresia or obstructions. The mortality rate is higher than in developed countries and sepsis is the most common complication and cause of death.

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