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Patterns and Management Outcomes of Neonatal Acute Surgical Conditions in Alexandria, Egypt.

H.L. Wella[1], S.M.M. Farahat[2],
[1]Currently a paediatric surgery trainee Department of Paediatric Surgery-Alexandria University
[2]House officer- Alexandria University Hospitals.
Correspondence to: Dr. Herman Landolin Wella, Email: her_w2002@yahoo.com

Background: ***Neonatal acute surgical conditions significantly contribute to high morbidity and mortality among neonates particularly in low resource settings.The main objective of this study was to determine the pattern and management outcomes of acute surgical conditions in neonates.***
Methods: ***A one year prospective study was conducted at El Shatby hospital, Alexandria, Egypt between February 2014 and January 2015. Only neonates who were operated for acute surgical conditions were included in the study.***
Results: ***A total of 156 neonates were studied. The males accounted for 103 (66.0%) for the cases. The M: F sex ratio was 1.9:1(P=0.02). The ages ranged from 5 hours to 30 days. The median age was 6 days. The majority had normal birth weight (≥ 2.5 kg), 84.0% (131) (mean 2.9 (± 0.5SD) kg), P=0.03. The most common conditions were oesophageal atresia 15.4% (24), anorectal malformation 13.5% (21) and intestinal atresia 12.8% (20). Overall 17.9 % (28) of neonates had postoperative complications with wound sepsis being the commonest postoperative complication. The mortality was 20.5% (32) with high mortality seen among low birth weight neonates, P= 0.00, and in those with other medical conditions, P=0.04.***
Conclusion: ***High morbidity and mortality occur among neonates with acute surgical conditions and so adequate maternal health care, facilities and personnel are essential for the best out comes.***
Key words: Neonates, Acute surgical conditions, Management, Outcomes.

Introduction

Newborns acute surgical pathologies occur in 1 in 5000 live births and contribute considerably to high morbidity and mortality among neonates [1–3]. When compared to older children, neonates have a wide divergence in physiology, anatomy, immunity and response to stress and when they have surgical illness they are further compromised by the condition itself which predisposes them to electrolyte derangement, respiratory distress, sepsis and unpleasant effects of anaesthesia and surgery[1,4,5]. The ultimate goal in newborns surgical care is every neonate undergoing surgery should live and therefore effective and close interdisciplinary collaboration between community health workers, paediatric surgeons, paediatricians, anaesthesiologists, nurses, radiologists, pathologists, biochemists and technicians is essential for the best outcomes[1,6,7]. This analysis was conducted to find out the pattern and outcomes of emergency newborns surgeries and provide baseline data for future studies.

Patients and Methods.

This one year prospective study was conducted at the paediatric surgery department, El Shatby hospital in Alexandria Egypt from February 2014 to January 2015. Only neonates (newborns ≤ 30 days of age) who undergone emergency Surgery were recruited into the study after obtaining verbal consent from parents. Data collection was done by using a structured questionnaire during admission, surgery, postoperative care in the ICU/ward and the out patients clinic visits after discharge. Mobile phone communication was used to get maternal information and follow up of patients while at home. Information collected included age, sex, birth weight, gestational age at birth, associated maternal co morbidities, mode of delivery, type

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of gestation, maternal age, status of parents consanguinity, duration of symptoms, clinical features, diagnosis, other associated anomalies and medical conditions, time interval between admission and surgery, surgical treatment, pre and post operative treatments, post operative complications and outcomes at discharge. Data collected were cleaned and analysed using the SPSS version 20. Categorical data were analyzed using fisher`s exact and chi-square tests and a P value ≤ 0.05 was considered as significant. Continuous data were expressed in mean and median. Permission to carry out this study was obtained from the hospital management.

Results

A total of 156 newborns were studied. The males contributed 103 (66.0 %) of the cases with a Male to Female ratio of 1.9:1(P=0.02).Their ages ranged from 5 hours to 30 days with the overall median being 6.0 days. The majority had birth weight greater than 2.5 kilograms (Kg), 131 (84.0%), (P=0.03). Birth weight ranged between 1.5 Kg and 5.5 Kg with the overall average being 2.9(±0.5 SD) Kg. The majority were delivered at term (≥ 37 weeks of gestation), 87.8% (137/156), P=0.44.

Table 1. Distribution of patients by demographic characteristics and sex

Patients` characteristics	Sex		Total (%)
	Male (%)	Female (%)	
Age (days)			
0-7	60(67.4)	29(32.6)	89(57.1)
8-14	9(39.1)	14(60.9)	23(14.7)
15-21	14(82.4)	3(17.6)	17(10.9)
22-30	20(74.1)	7(25.9)	27(17.3)
Total	**103(66.0)**	**53(34.0)**	**156(100.0)**
Birth weight(kilograms)			
1.5-1.9	3(33.3)	6(66.7)	9(5.8)
2.0-2.4	7(43.8)	9(56.2)	16(10.2)
2.5-2.9	30(68.2)	14(31.8)	44(28.2)
≥3	63(72.4)	24(27.6)	87(55.8)
Total	**103(66.0)**	**53(34.0)**	**156(100.0)**
Gestational age at birth(weeks)			
<37	11(57.9)	8(42.1)	19(12.2)
≥37	92(67.2)	45(32.8)	137(87.8)
Total	**103(66.0)**	**53(34.0)**	**156(100.0)**
Maternal age (years)			
<20	5(83.3)	1 (16.7)	6(3.8)
20-30	92(68.7)	42(31.3)	134(85.9)
31-40	8(57.1)	6(42.9)	14(9.0)
>40	1(50.0)	1(50.0)	2(1.3)
Total	**103(66.0)**	**53(34.0)**	**156(100.0)**
Presence of consanguinity			
Not present	82(67.8)	39(32.2)	121(77.6)
Present	21 (60.0)	14(40.0)	35(22.4)
Total	**103(66.0)**	**53(34.0)**	**156(100.0)**

Fisher`s exact test, P=0.02 for the age, Fisher`s exact test, P=0.03 for the birth weight, Chi-square Value 0.60, df=1, P=0.44 for gestational age, Fisher`s exact test, P= 0.68 for the maternal age, Fisher`s exact test, P= 0.68 for consanguinity

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The gestational age ranged from 32-41 weeks and the overall mean was 38.0 (±1.6 SD) weeks. Fifty (32.1%) and 49 (31.4%) of neonates were second or third born respectively, followed by 27 (17.3%) first born group, P=0.43. Ninety two (58.9%) of the newborn were delivered by caesarean section. The overwhelming majority (96.8%) were single tons.

The ages of the mothers ranged from 16 to 41 years with a mean of 24.9 (±4.3 SD) years. A total of 134 (85.9%) of the mothers were in the 20-30years age group. Consanguinity was present in 35 (22.4%) of couples (Table 1). Twenty (12.8 %) of the neonates were delivered from mothers with other maternal co morbidities (P= 0.49), which included premature rupture of membranes occurring in 7 (4.5%) of the mothers, pre-eclampsia in 6 (3.8 %), anaemia in 5 (3.2 %), gestational diabetes in 3 (1.9 %) and cardiomyopathy in 1 (0.6%) of the 156 mothers.

Associated maternal morbid conditions were common in neonates aged below 7 days at admission, P= 0.28, in females, P=0.29, in low birth weights (<2.5 Kg), P=0.09, and in preterm deliveries, P=0.46. A half of cases, 50.0% (78/156) presented late to hospital (> 2 days of symptoms). Most of males, 51.5% (53/103), normal birth weight neonates (≥ 2.5 Kg birth weight), 52.7% (69/131) and most of those born at term, 51.8% (71/137), presented late to hospital. The overall median duration of symptoms was 2.0 days (range 4hours-29 days). The most frequent reason for delay was misdiagnosis, 60.3% (47/78), followed by delayed investigations at the initial health centre, 33.3% (26/78).

Table 2. Distribution of neonates by surgical conditions and sex

Primary Diagnosis	**Sex**		**Total (%)**
	Male (%)	**Female (%)**	
Oesophageal atresia	15(62.5)	9(37.5)	24(15.4)
Anorectal malformation	17(81.0)	4(19.0)	21(13.5)
Intestinal atresia	9(45.0)	11(55.0)	20(12.8)
Hypertrophic pyloric stenosis	14(87.5)	2(12.5)	16(10.2)
Peritonitis	9(60.0)	6(40.0)	15(9.6)
Hirschsprung`s Disease	10(76.9)	3(23.1)	13(8.3)
Intestinal malrotation	5(50.0)	5(50.0)	10(6.4)
Diaphragmatic hernia	5(55.6)	4(44.4)	9(5.8)
Obstructed inguinal hernia	4(100.0)	0(0.0)	4(2.6)
Exomphalos minor	1(25.0)	3(75.0)	4(2.6)
Intestinal web	2(50.0)	2(50.0)	4(2.6)
Gastroschisis	3(100.0)	0(0.0)	3(1.9)
Meconium ileus	2(100.0)	0(0.0)	2(1.3)
Midgut volvulus	1(50.0)	1(50.0)	2(1.3)
Ileal duplication cyst	2(100.0)	0(0.0)	2(1.3)
Intestinal obstruction secondary to primary adhesions	1(50.0)	1(50.0)	2(1.3)
Annular pancreas	2(100.0)	0(0.0)	2(1.3)
Others	1(33.3)	2(66.7)	3(1.9)
Total	**103(66.0)**	**53(34.0)**	**156(100.0)**

Fisher`s exact test, Value 25.188, P=0.08

**Others included: intestinal obstruction secondary to twisted Meckle`s diverticulum (1), Intestinal obstruction secondary to colonic tumour (1), eventration (1).*

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Table 3. Distribution of Cases by Associated Anomalies and Sex

Associated Anomalies		Sex		Total (%)
		Male (%)	Female (%)	
Absent		90(66.2)	46(33.8)	136(87.2)
Present		13(65.0)	7(35.0)	20(12.8)
Total		**103(66.0)**	**53(34.0)**	**156(100.0)**
Musculoskeletal anomalies	Dactyl anomalies	2(50.0)	2(50.0)	4(11.4)
	Club foot	2(66.6)	1(33.3)	3(8.6)
	scoliosis	1(100.0)	0(0.0)	1(2.9)
	Hemivertebral	1(100.0)	0(0.0)	1(2.9)
Cardiac anomalies	ASD&VSD	6(85.7)	1(14.3)	7(20.0)
Genital urinary anomalies	Undescended testis	3(100.0)	-	3(8.6)
	Hypospadias	1(100.0)	-	1(2.9)
	Abnormal labia majora	-	1(100.0)	1(2.9)
	hydrocoele	1(100.0)	0(0.0)	1(2.9)
Anorectal anomalies		3(75.0)	1(25.0)	4(11.4)
Gastrointestinal anomalies	Situsinversus	1(50.0)	1(50.0)	2(5.7)
	Intestinal malrotation	1(50.0)	1(50.0)	2(5.7)
Renal anomalies	Hypoplastic kidney	1(100.0)	0(0.0)	1(2.9)
	Aplastic kidney	1(100.0)	0(0.0)	1(2.9)
Cranial facial anomalies	Microcephaly	1(50.0)	1(50.0)	2(5.7)
Down syndrome		1(100.0)	0(0.0)	1(2.9)
Total		**26(74.3)**	**9(25.7)**	**35(100.0)**

Chi-square Value 0.007, df=1, P=0.93

Table 4. Distribution of Surgical Conditions and Status of Postoperative Complications

Primary diagnosis	Status of Postoperative complications		Total (%)
	Present (%)	Absent (%)	
Oesophageal atresia	3(12.5)	21(87.5)	24(15.4)
Anorectal malformation	2(9.5)	19(90.5)	21(13.5)
Intestinal atresia	4(20.0)	16(80.0)	20(12.8)
Hypertrophic pyloric stenosis	1(6.2)	15(93.8)	16(10.2)
Peritonitis	7(46.7)	8(53.3)	15(9.6)
Hirschsprung`s disease	2(15.4)	11(84.6)	13(8.3)
Intestinal malrotation	1(10.0)	9(90.0)	10(6.4)
Diaphragmatic hernia	2(22.2)	7(77.8)	9(5.8)
Obstructed inguinal hernia	0(0.0)	4(100.0)	4(2.6)
Exomphalos minor	0(0.0)	4(100.0)	4(2.6)
Intestinal web	1(25.0)	3(75.0)	4(2.6)
Gastroschisis	0(0.0)	3(100.0)	3(1.9)
Meconium ileus	2(100.0)	0(0.0)	2(1.3)
Midgut volvulus	1(50.0)	1(50.0)	2(1.3)
Ileal duplication cyst	1(50.0)	1(50.0)	2(1.3)
Intestinal obstruction secondary to primary adhesions	0(0.0)	2(100.0)	2(1.3)
Annular pancreas	1(50.0)	1(50.0)	2(1.3)
Others	0(0.0)	3(100.0)	3(1.9)
Total	**28(17.9)**	**128(82.1)**	**156(100.0)**

Fisher`s exact test, Value 36.172, P= 0.02

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Table 5. Distribution of Surgical Conditions by Postoperative Complications

Primary diagnosis	Postoperative complications				Total (%)
	Wound sepsis (%)	Wound dehiscence (%)	Burst abdomen (%)	Anastomosis leak/breakdown (%)	
Oesophageal atresia	3(60.0)	1(20.0)	0(0.0)	1(20.0)	5(9.6)
Anorectal malformation	2(50.0)	2(50.0)	0(0.0)	0(0.0)	4(7.7)
Intestinal atresia	4(44.4)	4(44.4)	0(0.0)	1(11.1)	9(17.3)
Hypertrophic pyloric stenosis	1(50.0)	0(0.0)	1(50.0)	0(0.0)	2(3.8)
Peritonitis	7(53.8)	4(30.8)	2(15.4)	0(0.0)	13(25.0)
Hirschsprung`s Disease	2(66.7)	0(0.0)	1(33.3)	0(0.0)	3(5.8)
Intestinal malrotation	1(50.0)	1(50.0)	0(0.0)	0(0.0)	2(3.8)
Diaphragmatic hernia	2(100.0)	0(0.0)	0(0.0)	0(0.0)	2(3.8)
Intestinal web	1(100.0)	0(0.0)	0(0.0)	0(0.0)	1(1.9)
Meconium ileus	2(66.7)	1(33.3)	0(0.0)	0(0.0)	3(5.8)
Midgut volvulus	1(33.3)	0(0.0)	1(33.3)	1(33.3)	3(5.8)
Ileal duplication cyst	1(33.3)	1(33.3)	0(0.0)	1(33.3)	3(5.8)
Annular pancreas	1(50.0)	0(0.0)	1(50.0)	0(0.0)	2(3.8)
Total	**28(53.8)**	**14(26.9)**	**6(11.5)**	**4(7.7)**	**52(100.0)**

The most common surgical conditions were Oesophageal atresia, 15.4% (24/156), followed by Anorectal malformation, 13.5% (21/156) and intestinal atresia, 12.8% (20/156), (Table 2). Most of neonates (≥50.0%) in each condition weighed ≥2.5 Kg birth weight, P=0.001 and also (≥66.0%) were delivered at term, P=0.19. High consanguinity was seen in cases with hirschsprung`s disease, 46.2% (6/13) and intestinal malrotation, 40.0% (4/10), P=0.58. Most of maternal co morbid conditions occurred in Oesophageal atresia, 25.0% (5/20) and Intestinal atresia, 18.8 %(3/16), P= 0.21. Associated anomalies were found in 12.8% (20/156) of newborns, P=0.93.

Musculoskeletal associated anomalies were the commonest accounting for 25.7% (9/35), followed by cardiac anomalies, 20.0% (7/35) and genital urinary system anomalies, 17.1% (6/35), (Table 3). Most of the associated anomalies were seen in oesophageal atresia cases, 34.3% (12/35), Diaphragmatic hernia neonates, 14.3% (5/35) and Anorectal malformation cases, 11.4% (4/35). Most of cases, 51.9% (81/156), had other associated preoperative medical conditions and these included: septicaemia occurring in 35.9% (56/156), Pneumonia, 22.4% (35/156), neonatal jaundice, 17.9% (28/156) and hypothermia in 16.7% (26/156) of the neonates. These were common in females, 58.3% (31/53), P=0.26, among newborns aged less than a week, 55.1% (49/89), P=0.72, in low birth weight (<2.5kg) neonates, 84.0% (21/25), P= 0.04, and in preterm babies (<37 weeks of gestation), 68.4% (13/19), P= 0.14. Most of other

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medical conditions were more frequent in Oesophageal atresia cases, 31.9% (38/119), Intestinal atresia neonates, (15.1%) 18/119, Diaphragmatic hernia, 13.4% (16/119) and 8.4 %(10/119) in peritonitis and also in intestinal malrotation babies. The overall median duration between time of admission and time at the start of surgery was 1.0 day (range 4hours-21 days). About 79.5% (124/156) of babies used incubators, 26.3% (41/156) used neonatal ventilators in which most were cases involved thoracic surgery like Oesophageal atresia, 70.8% (17/24) and Diaphragmatic hernias, 66.7% (6/9).Twelve cases, 7.7% (12/156) used parenteral nutrition.

Postoperative complications were observed in 17.9% (28/156) of newborns, P=0.02, (Table 4). The most frequent postoperative complication was wound sepsis, 53.8% (28/52), followed by wound dehiscence, 26.9 (14/52) and burst abdomen 11, 5% (6/52), (Table 5). Overall postoperative complications were common in females, 22.6% (12/53), P=0.27, in neonates with less than 2.5 Kg birth weight, 20.0% (5/25), P= 0.726, in preterm neonates, 21.1% (4/19), P= 0.65, and in neonates aged above one week, 20.9% (14/67), P=0.68. Postoperative complications also occurred frequently among neonates with associated maternal co morbidities, 35.0% (7/20), P=0.36, in those from consanguineous couples, 25.7% (9/35), P=0.19, among those with associated anomalies, 20.0% (4/20), P=0.75, in those who presented late to hospital, 32.1% (25/78), P=0.76, among survivors, 18. 5% (23/124), P=0.70 and in those with other preoperative medical conditions, 18.5% (15/81), P=0.71.

Table 6. Distribution of neonates by surgical conditions and outcomes

Primary diagnosis	**Outcomes**		**Total (%)**
	Survived (%)	**Died (%)**	
Oesophageal atresia	15(62.5)	9(37.5)	24(15.4)
Anorectal malformation	19(90.5)	2(9.5)	21(13.5)
Intestinal atresia	13(65.0)	7(35.0)	20(12.8)
Hypertrophic pyloric stenosis	16(100.0)	0(0.0)	16(10.2)
Peritonitis	11(73.3)	4(26.7)	15(9.6)
Hirschsprung`s Disease	11(84.6)	2(15.4)	13(8.3)
Intestinal malrotation	9(90.0)	1(10.0)	10(6.4)
Diaphragmatic hernia	6(66.7)	3(33.3)	9(5.8)
Obstructed inguinal hernia	4(100.0)	0(0.0)	4(2.6)
Exomphalos minor	4(100.0)	0(0.0)	4(2.6)
Intestinal web	3(75.0)	1(25.0)	4(2.6)
Gastroschisis	2(66.7)	1(33.3)	3(1.9)
Meconium ileus	1(50.0)	1(50.0)	2(1.3)
Midgut volvulus	2(100.0)	0(0.0)	2(1.3)
Ileal duplication cyst	2(100.0)	0(0.0)	2(1.3)
Intestinal obstruction secondary to primary adhesions	2(100.0)	0(0.0)	2(1.3)
Annular pancreas	2(100.0)	0(0.0)	2(1.3)
Others	2(66.7)	1(33.3)	3(1.9)
Total	**124(79.5)**	**32(20.5)**	**156(100.0)**

Fisher`s exact test, Value 21.455, P= 0.20

The overall mortality was 20.5% (32/156) with highest mortality seen in oesophageal atresia neonates, 37.5% (9/24), in intestinal atresia babies, 35.0% (7/20), and in one meconium ileus case, P=0.20 Table 6. Mortality was higher in girls, 26.4% (14/53), P=0.20, among those in the first week of life, 30.3% (27/89), P=0.01, in low birth weight children (< 2.5 Kg), 56.0% (14/25)

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and it was decreasing with increasing birth weight, P=0.00, also it was high in preterm children, 31.6% (6/19), P=0.18, among early presenters (≤2 days of symptoms), 25.6% (20/78), P= 0.17, in newborns with associated anomalies, 35.0% (7/20), P=0.09, and in the group of patients with other preoperative medical conditions, 27.5% (22/71), P= 0.04. Mortality was lower in neonates delivered from consanguineous marriage, 6.6 %(2/30) than in the counterpart group, 11.3 % (12/106), P= 0.00. Mortality was almost equal among neonates with associate maternal morbid conditions and those without, 11.8 %(2/17) versus 10.9 %(13/119), P= 0.00.The overall median duration of hospitalization was 8.0 days (range 1-25 days) with ileoduplication cyst and Meconium ileus conditions having prolonged hospitalization, median of 47.5 days and mean of 28.0 (±0.00 SD) days respectively.

Discussion

Neonatal surgical emergency conditions contribute considerably to mortality among newborns as they are still in the transition of physiologic adjustments needed for extra uterine life [8]. In the current study boys formed a predominant group comparably to the results obtained by other authors [9–11] possibly because Y-chromosome provides less protection against genetic susceptibility for developing congenital anomalies and also probably due to males embryos being highly vulnerable to teratogenic agents. The overall median age at presentation in this survey was almost one week as similarly reported by Sowende *et al* [12]. Lower age at presentation was observed in other studies [2,13,14]. However, Osifo *et al* [15] found the mean age at presentation to be more than a week. Early presentation age may denote good clinical acumen among health personnel in the initial hospitals and early referral or possibly due to the tertiary centres being the only reliable facilities for stabilizing a newborn, investigating and providing surgical care in those environments so once diagnosed neonates are referred there. Delayed age of presentation for a week or more including in this study may be due to high misdiagnosis or due to presence of many other centres that can provide early stabilisation and diagnostic investigations to a neonate before referral for a specific surgical care. The majority of newborns had normal birth weight as same as it was seen in other settings[3,6] illustrating low birth weight not to be directly a risk for developing surgical anomalies. Nonetheless Singh *et al* [16] reported a higher prevalence of congenital anomalies in low birth weight children. The finding of mean birth weight more than 2.5kg corresponded to the results in other reports[10,13,14]. But Gangopadhyay *et al* [17] obtained low average birth weight probably reflecting inadequate maternal nutrition status and health care in their environments.

Neonates born at term accounted for the majority comparably to the findings given by other authors [3,11] denoting preterm delivery not to be directly associated with development of congenital surgical anomalies. On the other hand Singh *et al* [16] found a high prevalence of congenital anomalies among preterm babies. Term mean gestational age was found in this survey likewise the results of others[(10,13)]. On the contrary, Bhatti *et al* [14] obtained preterm mean gestational age due to having a considerable proportion (32.6%) of preterm neonates in their surveys and so probably indicating a considerable preterm birth rate in that area. Majority of neonates were second parity and more, similar observation was reported in one prevalence study[16] whereby a high prevalence of congenital anomalies was seen among newborns of multiparous women signifying increased risk for congenital surgical anomalies after first delivery/pregnant. Yet this observation was statistically insignificant in this study. Majority of mothers were under 30 years of age the same as it was reported by Singh *et al* [16] reflecting this to be the age period of maximum delivery in these areas and high maternal age not to be a direct risk of developing a surgical anomaly in a newborn. However,

High prevalence of congenital anomalies had been reported to be among deliveries at above 30 years of maternal age[16]. Consanguinity is a known risk for developing congenital malformations. In this study consanguinity was 22.4%, lower than 45.8% obtained in one study in Egypt [18]. This

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reveals consanguinity generally to have relatively low risk for delivering a child with congenital surgical anomalies. But this observation was not statistically significant in this study. However, the prevalence of congenital anomalies is high among consanguineous marriages[19]. They were fewer cases with maternal co-morbidities in this study when compared to a study done by Bhatti *et al* [14] indicating the difference in maternal wellbeing in different environments. However, this observation was not statistically significant in this study. Half of neonates presented early in this survey unlike Ugwu *et al* [2] who reported a lower proportion of early presenters possibly due to a better clinical acumen among clinicians and adequate use of antenatal ultrasound in the diagnosis and early referral of cases in the environments of this study. Misdiagnosis and delayed investigations were the major reasons for delayed presentation, in contrast to the findings in another study [15] where ignorance, superstition beliefs and financial constraints were the predominant reasons. This indicates good heath seeking behaviours and accessibility to health care services in the setting of the current study. Oesophageal atresia was the most common condition in this study as same as it was found in India [13], Oman [14], and Iran [19]. Unlike in other studies done in Portugal [10] and Saudi Arabia [11] where Diaphragmatic hernias was the commonest condition and Anorectal malformation was the most frequent condition in Kenya [6], Korea[7] and India[17].

The variability in the occurrence of conditions signifies the difference in risk factors of congenital surgical anomalies in different societies and environments. About one eighth of cases had associated anomalies and musculoskeletal anomalies were the frequently associated anomalies; however, Homa et al[3] and Cho Y et al[7] in their studies observed cardiac anomalies to be the commonest associated anomalies. In this study a high frequency of associated anomalies was noted in among neonates with Oesophageal atresia contrary to the findings in another study in Korea[7] whereby associated anomalies were commonest among anorectal malformations babies. This inconsistence implies the difference in types of risks of exposure between different locations and societies. A considerable proportion of neonates presented with sepsis in this survey the same as it was reported in other studies[2,12,15] indicating the importance preoperative adequate assessment and appropriate medication as most of neonates are liable to have sepsis due to their existing acute surgical conditions and weak body immunity. There was a shorter interval between admission and surgical intervention in this study than in others studies [9,11] may be due to active resuscitation, fast investigations results availability, and neonates reporting relatively in less severe ill conditions due to early presentation and adequate resuscitation in the initial health care facilities in this area. Postoperative complications occurred in 17.9% of newborns in this survey. Other authors[7,11] reported very low occurrence of postoperative complications. However, Ugwu *et al* [2] observed high post operative complications rate. This dissimilarity may be explained by difference in length of time of illness before presentation to hospital, adherence to aseptic techniques and in type and adequacy of medications given.

Postoperative complications in this study were mainly wound complications which were common among survivors indicating that wound complications are not directly related to mortality. Wound sepsis was the commonest post operative complication likewise in other studies [2,7]. But very low wound sepsis rate compared to that in this study was observed by Sherif *et al* [11] and Bhatti *et al* [14] and the higher rate was reported by Ugwu *et al* [2]. The difference may be due to difference in types of surgical cases commonly seen and their conditions at admission and may be indicating the difference in quality of medications and adherence to aseptic techniques in different settings. Low birth weight, preterm delivery, and delayed presentation were associated with high complications rate as similarly reported by others[10,12,15] stressing these to be major risk factors for developing postoperative complications as babies in these conditions have immature organs functions, low body immunity, and are in severe septic condition due to late presentation.

Postoperative complications were frequently observed among neonates from consanguineous couples and in those with associated maternal co morbid conditions, but these findings were not statistically significant. Late presentation was associated with high post operative complications rate as similarly noted by others[12,15] indicating the importance of early diagnosis and referral to tertiary centres as delay exacerbate sepsis and delay resuscitation causing a neonate to present in moribund state. Mortality was 20.5% in this analysis, but Abdalla *et al* [8], Sharif *et al* [11] and Bhatti *et al* [14] obtained lower mortality. On contrary Ilori *et al* [9], Manchanda *et al* [13] and Gangopadhyay *et al* [17] reported a higher mortality than in this study. Lack or inadequate facilities for neonatal surgical care like neonatal ICU, neonatal ventilators, incubators, parenteral nutrition and shortage of skilled personnel contribute to high mortality.

Mortality was high among children aged less than a week due to more serious conditions being in this group. A high mortality occurred in low birth weight, preterm babies, and neonates with associated anomalies as equally observed in the earlier studies [10,12,13]showing these to be important contributors of mortality in an acute surgical neonate as most of these neonates cannot withstand the stress of surgery, have immature organs systems and low body immunity. However, high mortality was observed in early presenters in this survey different from previous study findings[8,9,15] probably because most of them were under weight, preterm with multiple associated anomalies and also had high risk types of conditions like oesophageal atresia and intestinal atresia. But in this analysis this finding was not statistically significant.

Mortality was low among newborns from consanguineous marriages and this finding was statistically significant indicating consanguinity to have no risk for death in acute surgical neonates. Associated maternal morbidity occurred less frequently in this survey than in one previous study [14] and mortality was the same between babies from mothers with co morbid conditions and those without. This observation was statistically significant. This reflects the difference in maternal health status between different societies and maternal co morbidities not to be direct risks of mortality in acute surgical neonates.

Presence of associated anomalies was associated with high mortality as reported by Cantre *et al* [10] and Manchanda *et al* [13]. These anomalies particularly cardiac anomalies can lead to death unrelated to the actual surgical anomaly under treatment and also can be precipitated by anaesthesia and surgical stress leading to death [13]. But in this survey this observation was not statistically significant. Other associated medical conditions did not increase the risk of developing postoperative complications, however, contributed significantly to mortality the same as it was reported by Homa *et al* [3], Abdalla *et al* [8], Sharif *et al* [11], indicating the importance of adequate preoperative evaluation and appropriate medical treatment of neonates. The duration of hospitalization was shorter than in other preceding reports probably in this study most of cases were in relatively less ill conditions.

Conclusion

Acute neonatal surgical conditions are common in males. The majorities of newborns with acute surgical emergencies are delivered at term, had normal birth weight and were from maltiparous mothers. Oesophageal atresia was the commonest acute surgical condition and musculoskeletal anomalies were the most common associated anomalies. A considerable proportion of neonates had other associated medical conditions. Misdiagnosis was the most frequent reason for delay and wound sepsis was the most common postoperative complication. Post operative complications are common in surgical neonates. Mortality was also high mainly in low birth weight babies and in those with other preoperative medical conditions.

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Recommendation

It is recommended that a special attention to be paid to multigravida/ multiparous mothers during antenatal obstetric ultrasound session and first neonatal screening for surgical anomalies for early diagnosis and referral. Adequate assessment and management of other associated medical conditions is important for better outcome. Special attention should be considered for low birth weight babies, and those with other associated medical conditions as they are at a higher risk of mortality. It is important to improve community maternal health to reduce incidence of preterm and low birth weight deliveries as they are risk factors for poor outcomes in acute surgical neonates.

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