Original Article

Clinical Pattern and Outcome of Neonates with Surgical Problems in Dhaka Medical College Hospital

MA Rouf[1], Tanvirul Hasan[2], Shafiqul Alam[3], Abdul Hanif Tablu[4], Kaniz Hasina[5], ABM Moniruddin[6].

Abstract

Background: *Although the global number of newborn deaths declined from 5 million (1990) to 2.4 million (2020), children face the greatest risk of death within their first 28 days of life. Dhaka Medical College Hospital (DMCH) is the biggest tertiary hospital in Bangladesh serving all incoming patients free of cost.* ***Objectives:*** *We studied here the clinical patterns and outcomes of neonatal surgeries in DMCH from July 2014 to June 2016.* ***Materials and Methods:*** *This prospective descriptive study included 500 neonates with surgical problems who had attended from July 2014 to June 2016. Data were collected at admission and thereafter by predesigned data collection sheet.* ***Results:*** *Male female ratio was 1.5: 1. Majority of the neonates (346) presented during the first week of life (69.2%). Presented within 1 hour to 28 days (mean 7.1 days ± SD 8.8), weighing 1.5 - 5.0 kilogram (mean 2.6 in kg ± SD 0.5). Surgical indications in order of sequences were Neonatal Intestinal Obstruction (NIO), gastroschisis, omphalocele, abscess/cellulitis, hydronephrosis, congenital diaphragmatic hernia, Tracheo esophageal atresia or fistula (TEF), bladder exstrophy, malignancy, Infantile Hypertrophic Pyloric Stenosis (IHPS), cloacal exstrophy, neonatal injury, patent urachus, prune belly syndrome, amniotic band syndrome. NIO was in the form of Anorectal Malformations (ARM), Hirschsprung disease, septicemia, intestinal atresia, meconium ileus, volvulus neonatorum, multiple congenital anomalies, obstructed inguinal hernia. Total 384 patients were managed surgically. 125 (25.0%). 33 (6.6%) died preoperatively and 92 (18.4%) died postoperatively.* ***Conclusion:*** *Early diagnosis, resuscitation, skilled staff, ICU facilities etc. are crucial for the best outcomes of neonatal surgical problems.*

Key words: *Congenital Anomalies (CAs), Neonatal Surgery, Neonatal Intestinal Obstruction (NIO), Sustainable Development Goal (SDG).*

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Introduction

Globally, 2.4 million children died in the first month of life in 2020. That is, approximately 6,500 neonatal died every day.[1] Most of which occurred in the first week, with about 1 million dying in the first day of life. Sustainable Development Goal 3 (SDG 3), as it regards to good health and well-being out of 17 SDGs was formulated by the United Nations in 2015 to entrust healthy lives and to promote well-being for all at all age groups. Thus, it is essential to reduce neonatal mortality to 12/1000 and under-5 mortality to 25/1000 live birth by the year of 2030.[2,3] The neonatal period is defined as the first 28 days after birth. In Bangladesh, the neonatal mortality rate is approximately 20/1000 live births.[4] Majority of the neonatal deaths are from preventable causes (like birth asphyxia, prematurity, severe infection which together account for almost 75 percent of neonatal deaths). About 80 percent of these deaths occur during the first week of life, 50 percent within the first 24 hours. Congenital anomalies have become the fourth cause of neonatal deaths and many of these are curable.[5] Among maternal and fetal risk factors, parental consanguinity, maternal under nutrition and obesity, positive family history of an anomaly, low birth weight and prematurity are significantly associated with higher frequency of congenital anomalies. Birth defects are a diverse group of disorders of prenatal origin that can be caused by single gene defect, chromosomal disorders, multifactorial inheritance, environmental teratogens and micronutrient deficiencies.[6,7] In developed countries, outcome of neonatal surgical cases is favorable because of availability of antenatal

1. Associate Professor of Surgery, Khwaja Yunus Ali Medical College, Enayetpur, Sirajganj, Bangladesh.
2. Medical Officer, Institute of Nuclear Medicine & Allied Sciences, Bangladesh Atomic Energy Commission, Dinajpur, Bangladesh.
3. Associate Professor, Department of Anaesthesiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
4. Professor of Neonatal Surgery, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
5. Professor, Department of Pediatric Surgical Oncology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
6. Professor & HOD, Department of Surgery, Khwaja Yunus Ali Medical College, Enayetpur, Sirajganj, Bangladesh.

Corresponding author: M Abdur Rouf, Associate Professor of Surgery, Khwaja Yunus Ali Medical College, Enayetpur, Sirajganj, Bangladesh. E-mail: abdurroufdr@gmail.com, Mobile: +8801718910341.

diagnosis, improved surgical skills and technologies, sophisticated neonatal intensive care unit, availability of total parenteral nutrition and adequate staff.[8] The introduction of new antibiotics and advances made in the field of preventive medicine and immunology has changed this. Recently death of infancy was due to congenital anomalies than infectious disease.

A preterm birth is a live birth that occurs before 37 completed weeks of pregnancy. Approximately 15 million babies are born preterm annually worldwide, indicating a global preterm birth rate of about 11%. Preterm birth is the leading cause of death among children, accounting for 18% of all deaths among children aged under-5 years and as much as 35% of all deaths among newborns (aged </=28 days). There are significant variations in preterm birth rates and mortality between countries and within countries. However, the burden of preterm birth is particularly high in low- and middle-income countries. Preterm birth rates are rising in many countries.[9]

Birth weight is one of the most important determinants of neonatal survival.[10] Low-birth weight (LBW) babies constitute only about 14% of children born, accounting for 60% to 80% of neonatal deaths. Low birth weight arises through short gestation (preterm birth) or in-utero growth restriction, or both.[11] The WHO had set a goal of a 30% reduction in the rate of LBW worldwide to be achieved by 2025 in order to meet its SDGs.[12] It has been estimated that almost half of all infant deaths in Bangladesh are from diarrhea and pneumonia that could be prevented if LBW was eliminated.[13]

Late presentation is another major challenge facing the delivery of neonatal surgical services to children in Bangladesh. Many of these neonates are brought to hospital several days or sometimes weeks after the onset of illness with severe fluid and electrolyte imbalances, anemia, sepsis, and malnourishment. Frequently, even the neonates who are delivered in the hospitals are referred late to specialist centers, often not well resuscitated and transported in suboptimal conditions from remote locations. These babies are usually hypothermic, septic, and hemodynamically unstable and frail on arrival at the referral centers, further compounding the problems. Coupled with inadequate manpower and poor facilities with often lack of neonatal intensive care even at the major tertiary health institutions, the majority of these babies eventually die. Besides, surgical intervention in such babies often leads to high postoperative morbidity and mortality. [14,15]

Dhaka Medical College Hospital (DMCH) is the biggest tertiary hospital in Bangladesh serving all incoming patients free of cost, where we studied the outcome of neonatal surgeries. We studied here the clinical patterns and outcome of neonatal surgeries in DMCH from July, 2014 to June, 2016.

Materials and Methods

This was a prospective descriptive study. Neonates (aging from birth to 28 days of life) who were admitted into the Department of Pediatric Surgery in Dhaka Medical College and Hospital were considered as the study population from July 2014 to June 2016. Data were collected from primary source in a predesigned data collection sheet. Detailed history was collected and recorded from the parent of each patient. Detailed history included age, sex, date of delivery, mode of delivery, birth weight, weight during admission, presenting complaints, that was followed by thorough examination of the baby including abdomen, perineum, head neck region and limbs. Neonates were resuscitated by such IV (Intravenous) fluid like 10% baby saline followed by if required administration of board spectrum antibiotics, injectable vitamin k, gastric decompression by nasogastric tube, catheterization and oxygen inhalation. After resuscitation, we ensured adequate urinary output, correction of dehydration, correction of electrolyte imbalance and cyanosis etc. Then neonates were prepared for surgical intervention.

Data were analyzed with the help of SPSS Inc (Statistical package for social sciences). Chicago, IL, version 22.0 for Windows and expressed in table with appropriate statistical test results. All quantitative variables were estimated using measures of central location (mean, median) and measures of dispersion (standard deviation and standard error). Quantitative data were presented as mean and standard deviation, whereas qualitative data were presented as frequency and percentage. Comparison was carried out between groups by Pearson Chi-square ($\chi 2$) test. Statistical analysis was done by ANOVA test (F) and multiple comparison test and probability value (p) of <0.05 was considered statistically significant.

Result

Majority of the neonates with surgical problems presented during first week of life (346; i.e., 69.2%). Gender distribution of neonates: male was 297, female was 203, ratio (m: f) was 1.5: 1. 358 were term babies and 142 were preterm babies. (Table I).

Table I: Neonates presenting time (age in weeks/term/preterm) & gender distribution.

Presenting time	Male	Female	Term	Preterm
1st week	197	149	229	117
2nd week	34	21	42	13
3rd week	31	20	42	9
4th week	35	13	45	3
Total	297	203	358	142

Table II: Weight pattern of neonates (N = 500)

Weight of neonates (kg)	Frequency (%)	Mean ± SD (kg)
1.5 – 2.5	167 (33.4)	
2.5 – 3.5	317 (63.4)	
>3.5	16 (3.2)	2.6 ± 0.5
Total	500 (100)	

Presenting weight of neonates ranged from 1.5 to 5.0 in kilogram (mean 2.6 in kg ± standard deviation 0.5). 63.4% of presenting neonates were 2.5 – 3.5 kg weight, 33.4% were 1.5 – 2.5 kg and 3.2% were >3.5 kg. Mean weight of neonates was 2.6 kg with ± 0.5. (Table II)

Table III: Clinical presentation among neonates (N = 500)

Presentation/symptoms	Frequency (%)
Abdominal distension	387 (77.4)
Failure to pass meconium	371 (74.2)
Bilious vomiting	296 (59.2)
Dehydration	103 (20.6)
Fever	83 (16.6)
Abdominal wall defects	66 (13.2)
Swelling/mass (different parts of body)	31 (6.2)
Respiratory distress	25 (5.0)
Dribbling of urine	22 (4.4)

77.4% of neonates presented with abdominal distension. Other presenting features were: failure to pass meconium 74.2%, bilious vomiting 59.2%, dehydration 20.6%, fever 16.6%, abdominal wall defects 13.2%, mass or swelling 6.2%, respiratory distress 5.0% and dribbling of urine 4.4%. (Table III)

Table IV: Disease pattern of neonates (N = 500).

Diagnosis	Frequency	Percentage (%)
ARM- High variety 91 - Low variety 27	118	23.6
HPD	86	17.2
NIO with sepsis	50	10.0
Intestinal atresia	44	8.8
Gastroschisis	35	7.0
Omphalocele major	29	5.8
Abscess/cellulitis (different pa of body)	20	4.0
Hydronephrosis	14	2.8
CDH	13	2.6
Meconium ileus	12	2.4
TEF	12	2.4
Volvulus neonatorum	12	2.4
Bladder exstrophy	9	1.8
Mass (different parts of body)	9	1.8
Multiple congenital anomalies	8	1.6
Hypertrophic pyloric stenosis	8	1.6
Cloacal exstrophy	6	1.2
Others***	15	3.0
Total	500	100

*** Inguinal hernia 6, neonatal injury 4, patent urachus 2, prune belly syndrome 2 and amniotic band syndrome 1 cases.

118 (23.6%) neonates were diagnosed as Anorectal Malformation (ARM). The rest were Hirschsprung Disease 86 (17.2%), NIO with sepsis 50 (10.0%), intestinal atresia 44 (8.8%), gastroschisis 35 (7.0%), omphalocele 29 (05.8%), abscess and cellulitis 20 (4.0%), hydronephrosis due to posterior urethral valve or unilateral or bilateral 14 (2.8%), CDH 13 (2.6%), TEF with atresia, meconium ileus and volvulus neonatorum 12 (2.4%) in each. (Table IV)

Table V: Types of surgical intervention of neonates (N = 500).

Treatment	Frequency	Percentage (%)
Conservative	116	23.2
Surgery	384	76.8
• Pelvic colostomy	81	21.1
• Transverse colostomy, biopsy	60	15.6
• Primary repair	54	14.6
• Laparotomy, resection & anastomosis	41	10.7
• Ileostomy	37	9.6
• Anoplasty	27	7.0
• laparotomy & repair	26	6.7
• Incision & drainage	15	3.9
• Transverse colostomy	12	3.1
• Excision of mass	11	2.9
• Ramstedt's operation	5	1.3
• Cystoscopic fulguration	5	1.3
• Others***	10	2.6
Total	500	

*** Herniotomy 6 cases, wound closure 3 cases and amputation 1 case.

Emergency surgical procedures were done on 384 (76.8%) and conservative management was done on 116 (23.2%). 81 (21.1%) were pelvic colostomy. Other procedures were: transverse colostomy with biopsy 60 (15.6%), primary repair of the defect 54 (14.6%), laparotomy with resection and anastomosis 41 (10.07%), ileostomy 37 (9.6%), anoplasty 27 (7.0%), laparotomy and repair 26 (6.7%), incision and drainage 15 (3.9%), transverse colostomy 12 (3.1%), excision of growth or mass 11 (2.9%), Ramstedt's operation 5 (1.3%), cystoscopic fulguration 5 (1.3%) and others 10 (2.6%). (Table V)

Table VI: Patterns of disease according to presenting time in weeks with mortality (N = 500).

	1st week	Mortality (%)	2nd week	Mortality (%)	3rd week	Mortality (%)	4th week	Mortality (%)
Anorectal malformation (ARM)	109	14 (12.84)	6	2 (33.33)	0	0	3	0
Hirschsprung disease	31	7 (22.58)	13	1 (7.69)	16	1 (6.25)	26	0
NIO with sepsis	33	8 (24.24)	5	2 (40.0)	8	0	4	0
Intestinal atresia	34	15 (41.18)	9	2 (22.22)	1	1 (100)	0	0
Gastroschisis	35	23 (65.71)	0	0	0	0	0	0
Omphalocele	23	3 (13.04)	2	1 (50.0)	3	0	1	1 (100)
Abscess/cellulitis	1	0	6	0	12	1 (8.33)	1	0
Hydronephrosis	7	4 (51.14)	3	2 (66.67)	3	1(33.33)	1	0
Congenital diaphragmatic hernia	9	2 (22.22)	3	0	0	0	1	0
Tracheo - esophageal fistula	8	7 (87.5)	4	3 (75.0)	0	0	0	0
Meconium ileus	10	1 (10.0)	0	0	2	0	0	0
Volvulus neonatorum	9	4 (44.44)	3	3 (100)	0	0	0	0
Hypertrophic pyloric stenosis	1	0	0	0	1	0	6	1(16.7)
Bladder exstrophy	7	2 (28.57)	0	0	1	0	1	0
Malignancy/mass	8	1 (12.5)	0	0	1	1(100)	0	0
Multiple congenital anomalies	8	6 (75.0)	0	0	0	0	0	0
Inguinal hernia	2	0	1	0	2	0	1	0
Cloacal exstrophy	6	3 (50.0)	0	0	0	0	0	0
Neonatal injury	2	0	0	0	1	0	1	0
Patent urachus	0	0	0	0	0	0	2	0
Prune belly syndrome	2	2 (100)	0	0	0	0	0	0
Amniotic band syndrome	1	0	0	0	0	0	0	0
Total	346	102 (29.4)	55	16 (29.1)	51	5 (9.8)	48	2 (4.2)

Majority of neonates presented at first week of life. Among them 109 (21.2%) were ARM, gastroschisis 35 (6.79%), intestinal atresia 34 (6.6%) and NIO with sepsis 33 (6.4%), Hirschsprung disease 31 (6.01%) and omphalocele 23 (4.5%). (Table VI)

Table VII: Outcome related to weight of neonates (N = 500).

Outcome	Weight in kg			Total	χ^2, p
	<2.5	2.53.5	>3.5		
Good	92 (55.1%	269 (84.9%	14 (87.5%	375 (75%	
Dead	75 (44.9%	48 (15.1%	2 (12.5%)	125 (25%	54.9, <0.001
Total	167 (100.0%)	317 (100.0%)	16 (100.0%	500 (100.0%)	

The outcome of treatment was assessed with the weight of neonates. It was found that 44.1% of lowest weight (<2.5 kg) babies were dead compared to 15.1% in 2.5-3.5 kg birth weight and only 12.5% dead in better weight (>3.5 kg) babies. This difference was statistically significant (2= 54.9, P <0.001). (Table VII)

Table VIII: Cause of death of neonates. (n = 125).

Treatment approach	Cause of death		Total
	Sepsis	Anesthetic hazar	
Conservative	33 (100.0%)	0	33 (100.0%)
Surgery	71 (77.1%)	21 (22.9%)	92 (100.0%)
Total	104 (83.2%)	21 (16.8%)	125 (100.0%)

83.2% of neonatal death occurred due to sepsis. Among them 77.1% were after surgical intervention and all 33 (100%) cases were death after conservative treatment. Death due to anesthetic hazard was 16.8%. (Table VIII)

Table IX: ANOVA (F) test of presenting time in the 1st week.

Presenting time in 1st week	No.	Mean ± SD	F, p
Meconium ileus	10	3.90 ± 1.52	
Intestinal atresia	34	3.69 ± 1.94	
Volvulus neonatorum	9	3.62 ± 1.75	
NIO with sepsis	33	3.29 ± 1.94	
HPD	31	3.29 ± 1.62	
TEF	8	3.12 ± 1.73	
CDH	9	3.11 ± 1.69	7.0 <0.001
Hypertrophic pyloric stenosis	1	3.00 ± 00	
Hydronephrosis	7	2.85 ± 1.34	
Mass (different parts of body)	8	2.65 ± 2.09	
Cloacal exstrophy	6	2.50 ± 1.63	
Bladder exstrophy	7	2.45 ± 2.41	
ARM	109	2.29 ± 1.37	
Abscess	1	2.00 ± 00	
Others***	7	2.00 ± 1.15	
Multiple congenital anomalies	8	1.87 ± 0.83	
Omphalocele major	23	1.31 ± 0.70	
Gastroschisis	35	0.82 ± 0.41	
Total	346	2.53 ± 1.70	

*** Inguinal hernia 2, neonatal injury 2, prune belly syndrome 2, amniotic band syndrome 1 cases.

Presenting time in the 1st week of neonates with surgical problems was shown that gastroschisis, omphalocele major and multiple congenital anomalies came with on an average in the first day of birth, while ARM, CDH and exstrophy presented within a mean of less than 3 days. HPD, meconium ileus, and intestinal atresia usually presented on an average of more than 3 days. This difference of presenting time was statistically significant (P <0.001). (Table IX)

Table X: Multiple comparison test of multiple means at the 1st week

Diagnosis	Significant multiple comparison test
Gastroschisis	ARM (p=0.0001), HPD (p=0.0001), NIO with sepsis (p=0.0001), intestinal atresia (p=0.0001) and meconium ileus (p=0.0001)
Omphalocele	ARM (p=0.005), HPD (p=0.0001) , intestinal atresia (p=0.0001), NIO with sepsis (p=0.0001) and CDH (p=0.003)
Intestinal atresia	ARM (p=0.0001), gastro schisis (p=0.0001), multiple congenital anomalies (p=0.002), and omphalocele (p=0.0001)
NIO with sepsis	Omphalocele (p=0.0001), ARM (p= 0.001) and gastroschisis (p=0.0001)
ARM	Omphalocele (p=0.005), HPD (p=0.001), gastroschisis (p=0.0001) and intestinal atresia (p=0.0001)
HPD	Omphalocele (p=0.005), ARM (p=0.001), gastroschisis (p=0.0001) and meconium ileus (p=0.001)

Multiple comparison tests were done of multiple means at the 1st week. The post hoc revealed that mean presentation of gastroschisis was earlier, which is statistically significant compared to ARM, HPD, NIO with sepsis and intestinal atresia as disease specificity. In case of omphalocele, presentation was earlier, which were significant compared to ARM, HPD, gastroschisis and NIO with sepsis. In case of intestinal atresia, presentation was significant compared to ARM, gastroschisis, multiple congenital anomalies and omphalocele. In case of ARM, presentation was significantly different compared to omphalocele, HPD, gastroschisis and intestinal atresia. (Table X)

Discussion

Congenital abnormalities accounted for over 82% of all neonatal surgical conditions. This finding was similar to other studies.[15-17] The most common surgical conditions in the newborn involve the gastrointestinal tract 355 (71.0%). This finding was similar to other studies.[18] Boys were predominant group in this study, similar finding was noted in other studies.[19-21] Majority of neonates had normal birth weight (mean 2.6 kg ± standard deviation 0.5) same as seen in other studies.[22-24]

Majority of neonates presented at first week of life, mean presenting time 7.1 days with ± standard deviation 8.8. This was similar to other study but lower age at presentation was

observed in other studies.[22,24-26] In this study, early presentation was observed among ARM, gastroschisis, omphalocele and meconium ileus. Early onset of symptom and rapid deterioration of patients' condition in intestinal obstruction and easy approach to diagnosis in ARM was probably the cause of early presentation. On the other hand, presentation was later in Hirschsprung disease, late onset of sepsis (LOS) and malrotation because of variability in onset of symptom and lack of specificity.

In the present study, the commonest congenital abnormalities requiring surgical intervention were anorectal malformations, Hirschsprung disease, small intestinal obstruction, omphalocele and gastroschisis. Similar finding was noted by other studies.[15,18] Neonatal intestinal obstruction (NIO) was the most common form of neonatal emergencies 355 (71.0%), similar finding to other studies.[26,27] This study was dissimilar to other study where esophageal atresia with fistula were common presentation.[28]

In this study, various modalities of management were used. Sigmoid colostomy was done for 81 high variety ARM and anoplasty done for 27 low variety ARM. Transverse colostomy and multiple biopsies were done for 60 Hirschsprung disease and rest cases improved by per rectal normal saline irrigation, laxatives. Primary repair was done for gastroschisis, esophageal atresia and bladder exstrophy. Definitive surgery was done in remaining cases as resection and anastomosis was done for intestinal atresia and midgut volvulus cases. In this study, the mortality was 25.0%, in India it was 20% and other authors noted higher mortalities ranging from 30% to more than 42%.[15,29]

Significantly, more deaths occurred in preterm, low birth weight babies and overwhelming sepsis.[30] Death occurred during resuscitation or surgical interventions, blood culture could not be done in emergency setting. Physical examination for signs of sepsis would be helped the diagnosis. Mortality was higher in preterm babies because of the immaturity of all physiologic functions. Higher mortality was observed in laparotomy for intestinal resection and anastomosis (either for small intestinal obstruction or ruptured necrotizing enterocolitis), closure of ruptured omphalocele, colostomy, thoracostomy with esophageal anastomosis, and associated with multiple congenital abnormalities, this finding was similar to another study.[25]

Mortality was high among children aged less than a week due to more serious conditions being in this group. Higher mortality was observed in early presenters in this survey probably because most of them were under weight, preterm with multiple associated anomalies and also had high risk types of conditions like gastroschisis, esophageal atresia and intestinal atresia, this was similar to other study.[19] Presence of associated anomalies was associated with high mortality as reported by other studies.[24,29]

In this study, mortality related to anesthesia was 16.8%. This was similar to other studies.[18] The Baltemore Anesthesia Study Commission found that 20% of pediatric anesthesia death occurred in the first week of life.[31] Higher rate of cardiac arrest occurred when non-pediatric anesthesiologists delivered anesthesia to infants. These deaths could result from lack of facilities required for intra-operative monitor, aspiration, respiratory compromise or drug related complications.[32] The anesthetic considerations in the preterm neonate are based on the physiological immaturity of the various body systems, associated congenital disorders, poor tolerance of anesthetic drugs and considerations regarding use of high concentrations of oxygen.[33,34]

When risk factors were subjected to statistical analysis, the only significant factors calculated as prematurity, weight of babies ($\chi 2 = 54.9$, $p=0.001$) and ANOVA test (F) for presenting time in 1st week ($p<0.001$), it was significant. The post hoc revealed that mean presentation of gastroschisis was earlier statistically significant compared to ARM, HPD, NIO with sepsis and intestinal atresia due to disease specificity. In case of omphalocele, presentation was earlier significantly compared to ARM, HPD, gastroschisis and NIO with sepsis. In case of intestinal atresia, presentation was significant compared to ARM, gastroschisis, multiple congenital anomalies and omphalocele. In case of ARM, presentation was significantly different compared to omphalocele, HPD, gastroschisis and intestinal atresia and also ANOVA test for 2nd, 3rd and 4th weeks were 0.6, 0.8 and 0.8 respectively, but those were not significant.

The disease process of neonates with surgical problems varies day to day, even start in intrauterine life. In present study, anorectal malformation was the most common presentation among surgical neonates (23.6% of all neonates) and the disease process start just after birth. It was to be showed that late presentation of neonates was a risk factor for surgical outcome. Babies delivered outside the hospital need to travel several hours to get to a specialist hospital that offers neonatal surgical services during which time the baby's condition may detoriate, leading to increased operative risk and mortality.[15]

In the developed countries, intrauterine diagnosis, fetal intervention, planned delivery, better pediatric anesthetic support, improved neonatal intensive care, ventilator support and prompt surgical management of relatively clinically stable neonates are possible.[26] These were not so in our country where a majority of surgical neonates present very late.[15]

Conclusion

Although substantial progress has been made in reducing neonatal mortality by the WHO and the UNICEF, increased efforts to improve progress are still needed to achieve the SDG 3 (Good Health and Well-being) of 17 SDGs as set by the UNO in 2015. Early diagnosis, early intervention, meticulous resuscitation, dedicated skilled staff, good neonatal intensive care facilities as well as proper post-operative care are crucial for improving outcome in surgical neonates. In Bangladesh, pediatric surgeons play an important vital role to achieving the target of SDG 3 to reduce surgical neonatal mortality in conjunction with the programs of the UNICEF and the WHO.

Recommendations

It is recommended that a special attention is to be paid to gravid mothers during antenatal care, obstetric ultrasound sessions and the first neonatal screening for surgical anomalies for early diagnosis. Antenatal diagnosis with early referral, improved

surgical skills and technologies, competent adequate staff, better pediatric anesthetic support, improved neonatal intensive care and post-operative care units as well as adequate investment in developing neonatal surgery as a subspecialty are all required to reduce mortality and to ensure a better outcome for surgical neonates in developing countries in the years to come.

Limitations

1. The study was conducted in a single hospital so the study population may not necessarily represent the whole country.
2. Neonatal surgical conditions with or without co-morbidity were not well defined here.
3. Lack of modern medical support is rampant here.

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