Neonatal Surgery: Demand and Survival Both are on Increase- an Experience of Seventeen Years in Dhaka Medical College Hospital, Bangladesh

Hanif A[1], Hasina K[2], Rouf MA[3], Islam KMS[4], Ferdous NS[4], Khan JG[1], Huq A[4]

[1]Department of Neonatal Surgery, Dhaka Medical College and Hospital, Dhaka, Bangladesh; [2]Department of Paediatric Surgical Oncology, Dhaka Medical College and Hospital, Dhaka, Bangladesh; [3]Department of Surgery, North Bengal Medical College and Hospital, Sirajganj, Bangladesh; [4]Department of Paediatric Surgery, Dhaka Medical College and Hospital, Dhaka, Bangladesh

Abstract

Background: In order to achieve the Sustainable Development Goal (SDG) 3 target of reduction in under-five mortality below 25 per thousand live births by the year of 2030, major reductions are going to be required in neonatal mortality. Congenital anomalies have become the fourth cause of neonatal deaths and most of these are curable. The largest public hospital of Bangladesh is serving the poor and lower middle class people where surgery and medical facilities are mostly free of cost.

Objective: This study was done to assess the types of neonatal surgical patients admitted in this hospital and their management outcome with limited facilities and explore new ideas and information and the ways to improve the scenario to contribute in achieving the SDG 3.

Methods: This was a descriptive study with retrospective record review of all admitted neonates done over a period of 17 years from July 2001 to June 2018 and carried out in the Department of Paediatric Surgery. A total of 2492 neonates were admitted during this period and it was the 16.16% of total number of 15414 paediatric surgical admission upto 12 years of age. Data were collected from hospital records and analysed retrospectively. Detail history of each patient was collected and recorded in a pre-designed, semi-structured questionnaire. Statistical analyses were done by SPSS version 22.

Results: Out of these 2492 neonates, 1932 (77.53%) were admitted for Neonatal Intestinal Obstruction (NIO) and intestinal atresia 246 (09.87%), omphalocele 163 (06.54%), meconium ileus 154 (06.18%), volvulous neonatoram 125 (05.02%), septicemia 114 (04.57%), posterior urethral valve 78 (03.13%), gastroschisis 75 (03.01%), abscess 57 (02.29%), congenital Diaphragmatic Hernia 54 (02.17%), ectopia vesicae 50 (02.01%), infantile pyloric stenosis 42 (01.68%), tracheo-oesophageal fistula 24 (0.96%), prune belly syndrome 8 (0.32%), neonatal injury 5 (0.20%), conjoint twin 4 (0.16%). The most common cause of NIO was anorectal malformation (ARM) 806 (32.34%). And / of them 516 (64.02%) patients had high variety and 290 (35.98%) patients had low variety ARM. Next was Hirschsprungs disease and 487 (19.54%) neonates presented with this. One hundred and forteen (4.57%) patients presented with septicemia and 246 (9.87%) presented with intestinal atresia, 154 (6.18%) neonates had meconium ileus and 125 (5.02%) patients presented with volvulus neonatorum. Total 1791 (71.86%) patients were managed surgically. Most of the surgerical procedures were pelvic colostomy 541 (21.71%), transverse colostomy and biopsies 376 (15.09%), resection and anastomosis 261(10.47%), anoplasty 239 (9.59%), primary repair 135 (5.42%) and ileostomy 104(4.17%). Out of 2492 patients, 351 died, so mortality rate was 14.09%, before surgery 127 (5.10%) and after surgery was 224 (14.85%).

Conclusion: Paediatric surgeons by their skills and teamwork greatly improved the neonatal surgical service and contributing significantly in reducing infant mortality rate to achieve SDG 3. But to improve further, neonatal intensive care unit (NICU) and other support systems are essential as well as support from UNICEF and World Health Organization (WHO) to include paediatric surgery and surgeons in their activities especially in developing countries. Due to socio-political and economic reasons of the developing countries the roll of paediatric surgeons are multidimensional.

Keywords: Neonatal surgery, Neonatal intestinal obstruction, Anorectal malformation, Sustainable development goal

Introduction

The neonatal period is the most vulnerable time for a child. Over one third of the global 10.8 million deaths of children under age 5 in the year 2000 occurred in the neonatal period.[1] Globally, 2.5 million children died in the first month of life in 2017 alone – approximately 7,000 neonatal deaths every day – most of which occurred in the first week, with about 1 million dying on the first day and close to 1 million dying within the next six days.[2] Declines in neonatal mortality over the

*Correspondence: Dr. Abdul Hanif (Tablu), Department of Paediatric Surgery, Dhaka Medical College and Hospital, Dhaka, Bangladesh;
e-mail: ahaniftablu@hotmail.com; ORCID: 0000-0002-0466-9858

last three decades have been slower than declines in post neonatal or early child (1 to 5 years) mortality. In order to achieve the Sustainable Development Goal (SDG) 3 target of reduction in under-five mortality below 25 per thousand livebirths by the year of 2030, major reductions are going to be required in neonatal mortality.[3]

Congenital anomalies have become the 4th cause of neonatal death and most of these are curable.[4] Among maternal and fetal risk factors; parental consanguinity, maternal under nutrition and obesity, positive history of an anomaly in family, low birth weight and prematurity were 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 micronutrients deficiencies.[5,6]

Population of Bangladesh is approximately 163.05 million and about 20.628 million people live in Dhaka.[7] The largest public hospital in Bangladesh is serving these poor and lower middle class people where surgery and medical facilities are mostly free of cost. The congenital anomalies treated in this hospital are anorectal malformation (ARM), Hirschsprung's disease, gastroschisis, omphalocele, intestinal atresia, meconium ileus, volvulous neonatoram, septicemia, posterior urethral valve, abscess, infantile pyloric stenosis, prune belly syndrome, neonatal injury, congenital diaphragmatic hernia, ectopia vesicae, oesophageal atresia, tracheo-oesophageal fistula, conjoint twin,etc. NIO is the most common form of neonatal emergencies in neonatal surgical patients. It is caused by a group of congenital anomalies and some other acquired conditions.[8] Neonatal surgeries require surgical management by pediatric surgeons in medical centers with facilities for pediatric anesthesia, radiology and the specialized nursing care for successful survival.[9] Maternal polyhydramnios, dilated fluid filled loops of gut at maternal ultrasonography and family history of cystic fibrosis or Hirschsprung disease are the antenatal diagnostic tool for NIO. It is an urgent condition that requires immediate involvement of a team of pediatric surgeon and neonatologist for peri-operative management. Fluid loss, electrolyte imbalance, metabolic acidosis, hypoglycemia, hypothermia, respiratory distress and sepsis lead to high morbidity and mortality due to intestinal obstruction.[10] Among urological cases, hydronephrosis may result from obstruction or reflux of urine which needs careful evaluation. The most common cause of fetal hydronephrosis is ureteropelvic junction (UPJ) obstruction.[11]

In the developed countries, intrauterine diagnosis, fetal intervention, planned delivery, better paediatric anaesthetic support, improved neonatal intensive care, ventilator support and prompt surgical management of relatively clinically stable neonates are possible.[12-14] These were not so in this country where a majority of surgical neonates present very late.[15] 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 deficits, 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 far locations. These babies are usually hypothermic, septic, and haemo-dynamically unstable and frail on arrival at the referral centres, 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.[16]

By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortalities to at least as low as 25 per 1,000 live births.[3] Bangladesh has a stable, growing economy, but living standards have yet to improve for the poor and vulnerable segments of the population.[5] This study is done to see the types of neonatal surgical patients admitted in this hospital and their management, outcome with limited facilities and find out the ways to improve the scenario to contribute in achieving SDG 3.

Materials and Methods

This was a descriptive study with retrospective record review of all admitted neonates done over a period of 17 years from July 2001 to June 2018 and carried out in the Department of Paediatric Surgery of Dhaka Medical College Hospital. A total of 2492 neonates were admitted during this period and it was the 16.16% of total number of 15414 paediatric surgical admission upto 12 years of age. Parameters of clinical presentations at the time of admission, measures of resuscitation and peri-operative measures were

taken and recorded. Diagnoses of the patients were based on detailed history, complete physical examination and laboratory and radiological findings. A pre-designed, semi-structured questionnaire was used to collect data. Detail history of each patient was collected and recorded from previous record. Age, sex, date of delivery, mode of delivery, weight during admission, detail history of presenting complaints, history of consanguinity and family history of birth defects were taken. Thorough examination history of baby including abdomen, perineum, head neck region and limbs were recorded. History of resuscitation, types of antibiotics, surgical interventions, morbidity and mortality were also recorded. Statistical assessments were done by SPSS version 22 was obtained from the Ethical Committee of the Dhaka Medical College.

Results

Total number of neonates admitted during the study period was 2492 surgical problems. The age of the neonates ranged from birth to 28 days with the mean age of 7.9 ± 4 days, weight ranged from 1.0 to 3.9 kg. Majority of the patients came from poor and lower middle class socioeconomic condition. Male: female ratio was 3:2.

The major clinical presentations of the patients included abdominal distension (29.17%), bilious vomiting (22.51% and failure to pass meconium (28.0%) (table I). Some patients exhibited dehydration (8.71%) and fever (7.78%), abdominal wall defects (4.29%), dribbling of urine (2.97%) and respiratory distress (0.88%).

Table I: Clinical presentations of neonatal surgical patients (n = 2492)

Presentation	Frequency	(%)
Abdominal distension	727	29.17
Failure to pass meconium	698	28.0
Bilious vomiting	561	22.51
Dehydration	217	8.707
Fever	194	7.78
Dribbling of Urine	74	2.969
Abdominal Wall Defects	107	4.29
Respiratory Distress	22	0.88

The most common variety of neonatal surgical patients was ARM (806). Among these 516 (64.02%) patients had high variety and 290 (35.98%) patients had low variety ARM. This was followed next by Hirschsprung disease, 487 (19.54%) of the total cases. Intestinal atresia 246 (09.87%), omphalocele 163 (06.54%), meconium ileus 154 (06.18%), volvulous neonatoram 125 (05.02%), septicemia 114 (04.57%), posterior urethral valve 78 (03.13%), gastroschisis 75 (03.01%), abscess 57 (02.29%), congenital diaphragmatic hernia 54 (02.17%), ectopia vesicae 50 (02.01%), infantile pyloric stenosis 42 (01.68%), tracheo-oesophageal fistula 24 (0.96%), prune belly syndrome 8 (0.32%), neonatal injury 5 (0.20%), conjoint twin 4 (0.16%) were the patients (table II).

Table II: Varity of Neonatal Surgical Patients (n = 2492)

Cause	Frequency	(%)
Anorectal malformation (ARM)	806	32.34
Hirschsprung's disease	487	19.54
Intestinal atresia	246	09.87
Omphalocele	163	06.54
Meconium ileus	154	06.18
Volvulous neonatoram	125	05.02
Septicemia	114	04.57
Posterior Urethral Valve	78	03.13
Gastroschisis	75	03.01
Abscess	57	02.29
Congenital Diaphragmatic Hernia	54	02.17
Ectopia Vesicae	50	02.01
Infantile pyloric stenosis	42	01.68
Tracheo-oesophageal fistula	24	0.96
Prune belly syndrome	8	0.32
Neonatal injury	5	0.20
Conjoint twin	4	0.16

One thousand seven hundred and ninety-one patients (71.86%) were managed surgically (table III).

Table III: Treatment modalities of the patients (n = 2492)

Treatment modalities	Frequency	(%)
Conservative	701	28.13
Pelvic colostomy	541	21.71
Laparotomy, labelling biopsy and colostomy	376	15.09
Laparotomy, resection and primary anastomosis	261	10.47
Anoplasty	239	9.59
Laparotomy and Repair	135	5.42
Ileostomy	104	4.17
Drainage	45	1.82
Primary Repair	38	1.52
Fulgaration	28	1.12
Cutaneous Vesicostomy	24	0.96

Out of 2492 patients, wound infection developed in 160 (6.42%) patients and total 351 died, 127 (5.10%) before surgery and 224 (8.99 %) after surgery (table IV). The mortality rate was 14.09%.

Table IV: Morbidity and mortality of the patients (n = 2492)

Morbidity and mortality	**Frequency**	**(%)**
After surgical intervention		
Wound infection	160	6.42
Death	224	8.99
After conservative treatment		
Death	127	5.10
Total death	351	14.09

Discussion

The first 28 days of life – the neonatal period – is the most vulnerable time for a child's survival. Children face the highest risk of dying in their first month of life at an average global rate of 18 deaths per 1,000 live births in 2017. Comparatively, the probability of dying after the first month but before reaching age 1 was 12 and after age 1 but before age 5 was 10. Globally, 2.5 million children died in the first month of life in 2017 alone – approximately 7,000 neonatal deaths every day – most of which occurred in the first week, with about 1 million dying on the first day and close to 1 million dying within the next six days.[2] A child born in a least developed country is almost 14 times more likely to die during the first 28 days of life than a child born in an industrialized country. And these burdens of death are heavy for Africa and Asia, accounts for 95 per cent maternal and 90 per cent newborn deaths.[17]

Congenital abnormalities accounted for over 82.0% of all neonatal surgical conditions. This finding was similar to other studies.[15,18] The most common surgical conditions in the newborn involve the gastrointestinal tract. This finding was similar to other studies.[19,20] Boys were predominant group in this study, similar finding was noted in other studies.[21-23]

In this study, early presentation was observed among ARM, gastroschisis, omphalocele major 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, sepsis 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.[15,19] Neonatal intestinal obstruction (NIO) was the most common form of neonatal emergencies 1932 (77.53%), similar finding to other studies.[24,25]

Neonatal intestinal obstruction (NIO) was the most common form of neonatal emergencies. It was caused by a group of congenital anomalies and some other acquired conditions. NIO presented with a triad of bile stained vomiting, abdominal distension and failure to pass meconium. 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 (32.34 % 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 this study, various modalities of management were used. Sigmoid colostomy was done for 541 ARM patients. Transverse colostomy and multiple biopsies were done for 376 Hirschsprung disease and rest cases improved by per rectal normal saline irrigation, laxatives. Primary repair was done for gastroschisis, oesophageal 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 case of neonate diaphragm is the only respiratory muscle for respiration, which is abdomino-thoracic. After laparotomy wound closure abdominal movement becomes restricted during reversal and postoperative period due to pain in incision line. In this study, all cases were given pre-emptive analgesia with 0.5-1 ml/kg local anesthetic (both lignocaine and bupivacaine) in incision line before the incision was made. So for this simple but good pain management technique recovery from anesthesia was good as well as postoperative period was uneventful without any ventilatory support - which this hospital could not provide due to absence of NICU. Thus, this technique helps in reducing mortality. Similar finding was found by Landsman et al.

Total 163 patients with omphalocele were admitted during the study period. 42 patients were treated surgically. Out of them 12 patients were died preoperatively and 16 patients were died postoperatively due to infection, membrane rupture & other congenital anomalies. 109 patients were managed conservatively with 0.5% mercurochrome, alcohol, povidone iodine.

Number of patients with posterior urethral valve were 78. Cutaneous vesicostomy was done on 29 patients and catheterizations were done on 16

patients for temporary relief of symptoms. Fulgaration was done on 33 cases.

Total 54 patients with Congenital Diaphragmatic Hernia were admitted. Out of them 10 patients were died preoperatively during resuscitation. Forty-four neonates were treated surgically and 6 patients were died postoperatively due to unsuccessful recovery from anesthesia & lack of NICU support. Outcome of other patients were good. Survival rate was 70.37%. The largest multicenter report on CDH mortality to date is that of the CDH Study Group, which has reported an overall survival of 68% which is similar to current study.[26, 27]

Seventy-five patients with Gastroschisis were visited as emergency basis & referred from other centres. Out of them18 were died preoperatively during resuscitation & 20 patients were died postoperatively due to inadequate reversal from anesthesia & lack of NICU support. Total 50 Ectopia Vesicae patients were treated during study period. All of them were treated surgically by primary closure of anterior urinary bladder wall & anterior abdominal wall. 12 patients were developed postoperative wound dehiscence. Outcome of other neonates were uneventful.

In case of conjoint twin & esophageal atresia, total 24 patients were treated during study period for esophageal atresia with distal tracheo-oesophageal fistula. All cases were treated surgically and reversal were good but unfortunately babies were died on postoperative period due to lack of NICU support and septicaemia. One pygopagus twin was successfully separated by multidisciplinary team approach. Department's surgical team on emergency basis also separated 2 conjoint twin from its dead sibling but the baby died two hours after operation in the way for NICU support.

Out of 2492 patients, wound infection developed in 160 (6.42%) patients and total 351 died, 127 (5.10%) before surgery and 224 (8.99%) after surgery. The mortality rate was 14.09%. In India, it was 20% and other authors noted higher mortalities ranging from 30% to more than 42%.[15, 28]

Significantly, more deaths occurred in preterm babies and low birth weight babies. 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 NEC), closure of ruptured omphalocele, colostomy, thoracostomy with esophageal anastomosis, and associated with multiple congenital abnormalities, this finding was similar to another study.[24]

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.[22] Presence of associated anomalies was associated with high mortality as reported by other studies.[28, 29]

Presentation, diagnosis and treatment modalities of this study are more or less consistent with the other studies.[30-32] Fluid loss and electrolyte imbalance, metabolic acidosis, hypoglycemia, hypothermia results from inadequate warming during examination and/or negligence, respiratory distress and septicemia are the leading factors for high morbidity and mortality of intestinal obstruction.[33]

Many of these neonates are brought to hospital several days or sometimes weeks after the onset of illness with severe fluid and electrolyte deficits, anemia, sepsis, and malnourishment. Frequently, even the neonates who are delivered in the hospitals are referred late to specialist centres, often not well resuscitated and transported in suboptimal conditions from far locations on bad roads. These babies are usually hypothermic, septic, and hemodynamically unstable and frail on arrival at the referral centers, further compounding the problems Previously mortality was decreased but in the recent year it was increasing, mostly due to more admission occurs in neonatal emergencies.

Conclusion

In developing countries, the role of paediatric surgeons is multidimensional due to socio-political and economic reasons. Paediatric surgeons by their skill and teamwork greatly improved the neonatal surgical services and contributing significantly in reducing infant as well as neonatal mortality rate and thus help in achieving SDG3. But to improve further NICU and other support systems are very essential. It is advisable that UNICEF and WHO should include paediatric surgery in their activities including training and infrastructure development especially in developing countries to design the future for the children.

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