The Professional Medical Journal
www.theprofesional.com

https://doi.org/10.29309/TPMJ/2021.28.03.5795

ORIGINAL PROF-0-5795

Pattern and outcome of neonatal gastrointestinal surgical emergencies: A prospective analysis.

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Article received on:
25/07/2020
Accepted for publication:
13/11/2020

ABSTRACT… Objectives: This study is aimed at determing the pattern and treatment outcome of neonatal gastrointestinal surgical emergencies. **Study Design:** Prospective Descriptive study. **Setting:** DHQ Teaching Hospital Sahiwal. **Period:** January 2018 to December 2019. **Material & Methods:** All neonates (<28 days old) who underwent surgery for acute gastrointestinal emergency during the study period were included. Newborns more than 28 days and diseases such as esophageal atresia, esophageal atresia with trachea-esophageal fistula, diaphragmatic hernia, omphalocele, gastroschisis and infantile hypertophic pyloric stenosis were not included in the study. **Results:** A total of 104 cases of neonatal gastrointestinal surgical emergency were included in the study. The most common cause was anorectal malformation 37(35.57%), followed by intestinal atresia 26(25.0%), Hirschsprung disease 13(12.50%), necrotizing enterocolitis 9(8.65%), intestinal malrotation 8(7.69%), meconium ileus 7(6.73%) and others 4(3.84%). Males were 59(56.73%), females 45(43.26%) and male to female ratio 1.3:1. Mean weight was 2.62kg, ranging from 1.5 to 4.4kg. Post-operative complications were septicemia 26(25.0%), wound infection 17(16.34%), respiratory problems 19(18.26%). Mortality rate in necrotizing enterocolitis was 55.55%, meconium ileus 42.85% and intestinal atresia 38.46%. Mortality rate in premature neonates was 48.0% and mature 12.65%. Overall mortality rate was 21.15%. **Conclusions:** Anorectal malformation is the commonest cause of neonatal gastrointestinal surgical emergency. Necrotizing enterocolitis, intestinal atresia and meconium ileus are the neonatal surgical diseases with high mortality rate. Surgical outcome depends on the complexity of the disease. Sepsis, late presentation, prematurity and low birth weight are significant contributory factors for high morbidity and mortality.

Key words: Anorectal Malformation, Neonatal Surgery, Neonatal Gastrointestinal Obstruction, Necrotizing Enterocolitis.

Article Citation: Shafiq ur Rehman, Makki Y, Fazal Z, Babar TSN, Ishtiaq F, Fazal S. Pattern and outcome of neonatal gastrointestinal surgical emergencies: A prospective analysis. Professional Med J 2021; 28(3):415-421. https://doi.org/10.29309/TPMJ/2021.28.03.5795

INTRODUCTION

The neonatal period is defined as the first 28 days after birth.[1] Newborn babies have unique anatomic, physiologic, phathologic and psycholsogic existence. Operative stress and anesthesia during this period evokes responses that are unique. Surgery in neonates is a challenging issue in developing countries, especially in emergency settings. However morbidity and mortality of neonatal surgical emergencies has decreased in developed countries. This has been attributed to improvement in specialist surgical and anaesthetic management, improved diagnostic facilities and neonatal intensive care and better insight of neonatal physiology. The incidence of surgical emergency in neonates ranges from 1 to 4 per 100 births. Neonatal intestinal obstruction is the most common newborn surgical emergency.[2] Gastrointestinal obstruction in the newborn was almost always fatal in the past. Until 1950 there were only 125 successfully treated cases recorded in the literature.[3] The outcome of neonatal gastrointestinal surgical emergencies is poor in the low and middle income countries, as compared to the results from developed countries. The attributing factors to the high morbidity and mortality in developing countries are prematurity, low birth weight, late presentation, associated congenital anomalies, complications of surgery and lack of neonatal intensive care facilities.[4,5,6]

In our country some other factors like ignorance and poor socioeconomic conditions also share the responsibility of high morbidity and mortality in neonatal intestinal obstruction. Failure to recognize neonatal bowel obstruction can result in aspiration of vomit, sepsis, midgut infarction or entrocolitis.[7] Early presentation, timely diagnosis and management in a specialized setup are key features for success and good outcome of surgery in neonatal intestinal obstruction.[8]

There are so many causes of neonatal intestinal obstruction with variable presentation and outcome. The cardinal features of neonatal intestinal obstruction are maternal polyhydramnios, bilious vomiting, abdominal distention and failure to pass meconium in 24 hours of life. None of these features are pathognomic. All are consistent with an obstructive phenonmenon and should be carefully evaluated. The common causes are anorectal malformations, atresia of small and large intestine, Hirschsprung's disease, malrotation, meconium ileus and congenital bands.

No doubt, the morbidity and mortality associated with gastrointestinal surgical emergencies is still a significant health problem in neonates. The specific objectives of this study are to determine the pattern and treatment outcome of neonatal gastrointestinal surgical emergencies in the department of pediatric surgery at DHQ teaching hospital Sahiwal. This is a newly created unit with limited human and material resources and poor infrastructure. This study is a way of assessing the quality of neonatal surgical care in this department and would provide the baseline data for future reviews.

MATERIAL & METHODS

It is a prospective descriptive study conducted during the period of two years from January 2018 to December 2019, in the department of pediatric surgery at DHQ teaching hospital Sahiwal.

Inclusion criteria. All neonates (<28days old) who underwent surgery for acute gastrointestinal emergencies in the department of pediatric surgery at DHQ teaching hospital Sahiwal, were included in the study.

Exclusion criteria. Newborns more than 28 days and diseases such as esophageal atresia, esophageal atresia with trachea-esophageal fistula, diaphragmatic hernia, omphalocele, gastroschisis and infantile hypertophic pyloric stenosis were not included in the study. Cases of meconium ileus, necrotizing enterocolitis, meconium plug syndrome and small left colon syndrome which settled conservatively were also excluded.

Formal approval of the study was obtained from ethical review committee of Sahiwal medical college and allied hospital, Sahiwal. The informed consent was taken from parents of all neonates. A preformed proforma was filled for every patient. Demographics like age, sex and weight of neonate were recorded. A detailed clinical history/antenatal history was obtained from the parents/attendants of all neonates. Complaints with duration and their onset were recorded. In antenatal history special care was taken to identify gestational age, polyhydramnios and maternal diabetes mellitus. A thorough physical examination including the perineal examination was performed in each case. All the neonates were evaluated for signs of prematurity, dehydration, hypothermia and septicemia. A special consideration was given to antenatal maternal-fetal ultrasonography, if available. Routine laboratory tests such as complete blood count, serum electrolytes, blood glucose, blood urea, serum creatinine, C-reactive protein etc and abdominal sonography done in every patient. Other investigations like x-ray chest, upright x-ray abdomen, cross-table lateral radiograph, barium follow through and barium/gastrografin enema were requested in specific indications. All patients were properly optimized/resuscitated before surgery. Standard post-operative care was provided to every patient in neonatal intensive care unit. All the patients were followed for one month after discharge. Survival for one month after discharge from hospital was taken as end point for data analysis. Data was analysed for age, sex, weight, causes of neonatal intestinal obstruction, symptomatology, treatment, postoperative complications and outcome. Statistical analysis was performed through SPSS version- 20. Frequencies and

percentages calculated for descriptive variables. Mean and standard deviation calculated for quantitative variables.

RESULTS

A total of 104 cases of neonatal gastrointestinal surgical emergency were evaluated during the study period. Anorectal malformation 37(35.57%) was the most common cause of neonatal gastrointestinal obstruction. Followed by intestinal atresia 26(25.00%) and Hirschsprung disease 13(12.50%). Etiological detail of total cases is shown in Table-I. Age of neonates at presentation ranged from 1-28 days with mean age 5.12 days. The mean weight of neonates was 2.62kg, ranging from 1.5 to 4.4kg. There were 59(56.73%) male and 45(43.26%) female with male to female ratio 1.3:1. Out of total 104 cases of neonatal gastrointestinal obstruction, 79(75.96%) were mature and 25(24.03%) premature. Highest no of prematurity was seen in necrotizing enterocolitis 9(100%), followed by intestinal atresia 9(34.61%). Cause wise distribution 0f mature and premature neonates is shown in Table-II. Mean hospital stay was 3.06 days, ranging from 1 to 14 days. Detail of symptomology is given in Table-III. The commonly observed symptoms were abdominal distension 94(90.38%), bilious vomiting 93(89.42%) and constipation 85(81.73%). Palliative operative procedures were performed in 55(52.88%) patients and definite procedures in 49(47.11%) patients. The commonly performed operative procedures were laparotomy and end to end anastomosis 20(19.23%), anoplasty 20(19.23%), laparotomy and double barrel ileostomy 15(14.42%), sigmoid colostomy 15(14.42%), laparotomy and Bishop Koop enterostomy 10(9.61%) and colostomy and biopsies 10(9.61%). (Table-IV). Most common post-operative complication was septicemia/ multi organ dysfunction (MODS) 26(25.0%), followed by respiratory problems 19(18.26%) and wound infection 17(16.34%). (Table-V). Out of total 104 patients, 82 survived and 22 died and overall survival rate was 78.84% and mortality rate was 21.15%. Mortality in premature was much higher than in mature neonates with gastrointestinal surgical emergencies. (Table-VI). Similarly high mortality was observed in low weight neonates. Characteristics of weight shown in Table-VII. Among 22 deaths, highest mortality was observed in necrotizing enterocolitis and lowest in anorectal malformation. Outcome of patients is shown in Table-VIII.

Diagnosis	No. of Patients	Percentage
Anorectal Malformation	37	35.57%
Intestinal Atresia	26	25.00%
Hirschsprung Disease	13	12.50%
Necrotizing Enterocolitis	09	8.65%
Intestinal Malrotation	08	7.69%
Meconium Ileus	07	6.73
Intestinal Duplication	01	0.96%
Spontaneous Perforation of stomach	01	0.96%
Mesenteric Cyst	01	0.96%
Obstruction from mesenteric duct remnants	01	0.96%
Total	104	100%

Table-I. Etiology of neonatal gastrointestinal surgical emergencies (n=104)

Diagnosis	Total n(%)	Mature n(%)	Premature n(%)
Anorectal malformation	37(100)	32(86.48)	5(13.51)
Intestinal atresia	26(100)	17(65.38)	9(34.61)
Hirschsprung disease	13(100)	13(100)	0(0)
Necrotizing Enterocolitis	9(100)	0(0)	9(100)
Intestinal malrotation	8(100)	8(100)	0(0)
Meconium ileus	7(100)	7(100)	0(0)
Others	4(100)	2(50)	2(50)
Total	104(100)	79(75.96)	25(24.03)

Table-II. Etiology wise distribution of premature and mature Neonates (n=104)

Symptom	Frequency	Percentage
Reluctant to feed	42	40.38%
Feed intolerance	77	74.03%
Bilious Vomiting	93	89.42%
Abdominal distention	94	90.38%
Constipation	85	81.73%
Delayed passage of meconium	12	11.53%
Others	44	42.30%

Table-III. Frequency distribution of symptomatology (n=104)

Procedure	Frequency	Percentage
Anoplasity	20	19.23 %
Sigmoid colostomy	15	14.42 %
Laparotomy + Colostomy+Biopsies	10	9.61 %
Laparotomy + Double Barrel Ileostomy	15	14.42 %
Laparotomy + Resection + End to end anastomosis	20	19.23 %
Laparotomy + Bishop Koop enterostomy	10	9.61 %
Laparotomy + duodeno- duodenostomy	3	2.88 %
Laparotomy + Ladd Procedure	7	6.73 %
Laparotomy+ Excision of omphalomesenteric duct remnants	1	0.96 %
Laparotomy+ Repair of stomach perforation	1	0.96 %
Laparotomy + colostomy+ Anoplasty	1	0.96 %
Laparotomy + Colostomy + vesicoplasity	1	0.96 %
Total	104	100 %

Table-IV. Frequency distribution of operations performed (n=104)

Complications	Frequency	Percentage
Septicemia/ MODS	26	25.00%
Wound Infection	17	16.34%
Wound dehiscence	3	2.88%
Anastomotic leak	5	4.80%
Respiratory problems	19	18.26%
Peri-stoma excoriations	16	15.38%
Colostomy/ileostomy prolapse	7	6.73%
Para Stoma Hernia	3	2.88%
Others	**4**	**3.84%**

Table-V. Post-operative complications (n=104)

	No. of Patients	Survived n(%)	Died n(%)
Preterm	25	13(52.00)	12(48.00)
Term	79	69(87.34)	10(12.65)
Total	104	82(78.84)	22(21.15)

Table-VI. Distibution of outcome among term preterm Neonates (n=104)

	No. of Patients	Range	Mean
Survived	82	1.5-4.4 Kg	2.50 Kg
Died	22	1.6-3.5 Kg	2.06 Kg
Total	104	1.5-4.4 Kg	2.62 Kg

Table-VII. Characteristics of weight (n=104)

Aetiology	No. of Patients	Survived n(%)	Died n(%)
Anorectal Malformation	37	36(97.29)	1(2.70)
Intestinal atresia	26	16(61.53)	10(38.48)
Hirschsprung disease	13	12(92.30)	1(7.69)
Necrotizing enterocolitis	9	4(44.44)	5(55.55)
Intestinal Malrotation	8	6(75.00)	2(25.00)
Meconium ileum	7	4(57.14)	3(42.85)
Others	4	4(100)	0(0)
Total	104	82(78.84)	22(21.15)

Table-VIII. Aetiology wise Distribution of outcome (n=104)

DISCUSSION

Intestinal obstructions are very common surgical emergencies encountered in neonates. Dedicated neonatal surgical care, early diagnosis and timely intervention are crucial factors in improving management outcome in neonatal surgery. Early presentation and early intervention have a significant impact on survival of these patients.[9]

The male preponderance was observed in this study. There were 59(56.73%) males and 45(43.26%) females, with male to female ratio 1.3:1. This finding was almost similar to many published studies.[10,11,12,13]

In this study anorectal malformation 37(35.57%) was the most common cause of neonatal intestinal obstruction. Similar observation was reported by Seth et al 12(48%), Saha et al 73(35.60%), Ali et al 30(25.0%), Ekpemo et al 32(53.3%) and Yadav et al 39(63.5%).[14,15,16,17,18]

Intestinal atresia 26(25.0%) was the second common cause of neonatal intestinal obstruction. This finding is at variance with findings in some published studies in which intestinal atresia was reported as the most cause of neonatal intestinal obstruction.[10,12,13,19] But in these series anorectal malformation was not included in the study. Hirschsprung disease 13 (12.50%) is the third common cause of neonatal obstruction in our study. This finding varies from the study conducted at Rajshahi Medical College where Hirschsprung disease was the commonest cause of intestinal obstruction in neonates.[20] Numerous studies on the causes of neonatal gastrointestinal surgical emergencies are more or less consistent with the findings of this study. However some studies have had different results.

Sepsis is a common complication in surgical neonates. Neonates show increased vulnerability to bacterial infection and sepsis due to immaturity of immune system. Late presentation, malnutrition and invasive procedures also increase the risk of sepsis. Sepsis/MODS 26(25.0%) was the commonest post-operative complication reported in our study. The post-operative complications noted in our patients were similar to those reported by other authors.[12,16,21]

The overall mortality revealed in our study was 22(21.15%). The reported mortality associated with neonatal intestinal obstruction ranges from 21% to 45% in developing countries and less than 15% in developed countries. Different mortality rates have been reported in different series, Nasir et al 22%, Reddy et al 16%, M et al 20.40%, Ekpemo et al 13.3%, and Verma et al 16.4%.[4,10,12,17,19] Mortality rate noted in this study was within the range reported in international published literature.

In our study the presence of prematurity and low birth weight revealed as risk factors for high mortality in surgical neonates. The mortality rate was high in premature babies 48.0% and low in mature babies 12.65%. Weight characteristics of neonates included in this study showed high mean weight in survived and low mean weight in died patients High mortality in low birth weight and premature neonates has been reported in numerous studies.[2,6,12,15,17,19] However surprisingly, according to some studies weight at presentation

and gestational age do not affect the survival outcome.[16,22]

In the present study maximum number of deaths observed in necrotizing enterocolitis 55.55%, followed by meconium ileus 42.85%, Intestinal atresia 38.46%, intestinal malrotation 25.0%, Hirschsprung disease 7.69% and anorectal malformation 2.70%. Highest survival rate was seen in anorectal malformations 97.29% and lowest in necrotizing enterocolitis 44.44%. In a study conducted by Saha et al highest survival was noted in anorectal malformations 94% and lowest in intestinal atresia 55%.[15] Verma et al reported highest mortality in intestinal atresia and lowest in Hirschsprung disease.[19] In a study conducted by Ravi et al maximum number of deaths noted in meconium ileus 66%, followed by ileal atresia 62.5%, jejunal atresia 54.5%, duodenal atresia 50% and malrotation 42.5%.[13] The finidings of these different studies suggest that the etiology of intestinal obstruction is most important determinant of outcome of surgical neonates.

Delayed referral, late presentation, prematurity, low birth weight, complexity of disease, associated anomalies and sepsis contribute to the high morbidity and mortality of surgical neonates. However better infrastructure, advanced surgical skills, advanced pediatric anaesthesia, skilled nursing care, and judicious pre and post-operative management can give a better chance of survival to these infants.

CONCLUSION

Anorectal malformation is the commonest cause of neonatal gastrointestinal surgical emergency. Necrotizing enterocolitis, intestinal atresia and meconium ileus are the neonatal surgical diseases with high mortality rate. Surgical outcome depends on the complexity of the disease. Sepsis, late presentation, prematurity and low birth weight are significant contributory factors for high morbidity and mortality.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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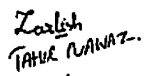
2	Yasir Makki	Data collection, Literature review.	
3	Zarlish Fazal	Data entry, Literature review.	
4	Tahir Shahzad Nawaz Babar	Biostatistics.	
5	Fareena Ishtiaq	Data collection, Literature review, Proof reading.	
6	Saad Fazal	Literature review, Data entry.