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Original Research Article

Neonatal Intestinal Obstruction – A Retrospective Study in A Newly Established Tertiary Care Centre

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Abstract:
Neonatal intestinal obstruction is a common surgical emergency and occurs in approximately 1 in 2,000 live births. This retrospective study aimed to investigate the etiological spectrum of neonatal intestinal obstruction and analyze factors influencing the outcome of surgical management. The study included 26 newborns with a male-female ratio of 1.16:1 and a mean gestational age of 37.5 weeks. The most common cause of neonatal intestinal obstruction was found to be intestinal atresia (30.7%) and anorectal malformation (30.7%), followed by Hirschsprung disease (15.3%), Malrotation gut (7.6%). The mean age of presentation was 4 days, and the mortality rate was 19.2%. The study highlights the importance of antenatal detection, early intervention, meticulous resuscitation, and effective NICU care in improving the morbidity and mortality associated with neonatal intestinal obstruction over recent years.

Keywords: neonate, intestinal obstruction, atresia, malrotation, meconium ileus, anorectal malformation.

Introduction

Surgery in neonates presents a significant challenge, particularly in developing countries. Until 1950, successful treatments for neonatal intestinal obstructions were rare, but advancements in neonatal surgery since then have significantly improved survival rates for newborns with previously lethal congenital malformations. Neonatal intestinal obstruction, occurring in approximately 1 in 2000 births, is a common reason for pediatric surgical consultation.

Early and accurate diagnosis is crucial, categorized as high or low based on dilated bowel loops observed on initial abdominal radiographs. Neonatal intestinal obstruction typically presents with several key indicators, such as maternal polyhydramnios, bilious emesis, abdominal distention, and the failure to pass meconium within the first 24 hours of life.

While none of these observations are pathognomonic of obstruction, they collectively suggest an obstructive phenomenon and warrant thorough evaluation to determine the underlying cause. High obstructions involve the proximal ileum, causing various dilatations, while low obstructions affect the distal ileum or colon, leading to diffuse dilatation. Classic signs include bilious vomiting, abdominal distention, and failure to pass meconium. The clinical presentation varies by the level of obstruction, with foregut obstruction causing difficulty swallowing and regurgitation, high obstruction leading to bilious vomiting and a scaphoid abdomen, and distal obstruction resulting in feeding intolerance and abdominal distention. Timely diagnosis and intervention are essential for optimal patient management.

Aim

The aim of this study was to detect pattern of neonatal intestinal obstruction and to find out problem and outcome of surgical treatment in the Paediatric Surgery Department of a tertiary care centre.

Material and Methods

A retrospective study over two years (2022-23) since the establishment of Department of Pediatric Surgery, at Government General Hospital, Siddhartha Medical College, Vijayawada. All the newborns that underwent surgery for neonatal intestinal obstruction were included in the study. The outcome of initial surgery has been included. Patients who were inoperable due to septic shock, pneumonia, very low birth weight and extreme

prematurity were excluded from the study. The data regarding the demography, clinical presentation, investigations, and management were retrieved from the medical record section and analyzed.

Results

A total of 26 neonates with neonatal intestinal obstruction were operated in our department during the study period. All were put on intravenous fluids, antibiotics and nasogastric decompression was done. Routine blood investigations like complete blood picture, serum electrolytes, renal function tests, and viral markers were done.

Diagnostic imaging like abdominal X-ray, ultrasound and in some cases contrast studies were done. After dehydration and electrolyte imbalance was corrected, exploratory laparotomy was done in all the cases and type of surgical intervention was carried as per the cause. In postoperative period, patients were managed by nasogastric aspiration, fluids and antibiotics, feeds were allowed on POD-1 for ihps, arm, POD-2 for HD and on POD-5 for atresia. The patients were discharged after 7-10 days. In this study only initial surgical procedure and its outcome was included.

Out of 26 patients, 14were males and 12 were females. Male: female ratio was 1.16:1. Gestational age was variable from 32 to 42 weeks (mean = 37.5 weeks), 4/24 were preterm (PT). The birth weight ranged from 1.8 to 3.2 kg (mean =2.25 kg).The most common presentation was vomiting, abdomen distension and non-passage of stools. Most common cause of intestinal obstruction was anorectal malformation (ARM) followed by intestinal atresia followed by Hirschsprung, Malrotation gut and Meconium ileus.

Anorectal malformations were seen in 8/26(30.7%) neonates, out of which one female neonate had rectal atresia and underwent ascending colostomy, 2 with low arm underwent V-Y anoplasty, 5 had high ARM and underwent loop sigmoid colostomy. Two female ARMs, with one cloaca and the other with cloacal exstrophy were seen. Loop sigmoid colostomy was done for cloaca and the neonate with cloacal exstrophy underwent primary pull through with closure of the hemi bladder. One case of high ARM, expired at 7 months of age with severe gastroenteritis and dehydration. Atresia was also seen in 8/26 (30.7%) neonates with ileal atresia 3/26 (11.5%) and jejunal atresia (11.5%) being more common than duodenal atresia (7%).One neonate with duodenal atresia was managed for respiratory distress, early onset sepsis, with on and off feed intolerance was diagnosed at 40 days of life with duodenal atresia. Surprisingly the baby was on orogastric feeds and on contrast study, the stomach was grossly dilated upto the urinary bladder.

However, the neonate had fungal sepsis and succumbed to gastric perforation in postoperative period. Hirschsprung's' disease (HD) was seen in 4/26 (15.3%) out of which 1 neonate had long segment HD with transition zone at splenic flexure. One neonate with HD had white forelocks, heterochromia, hypopigmented patches over the skin which were all suggested of Shah-Waardenburg syndrome, succumbed to sepsis. Malrotation was seen in 1 neonate and underwent Ladd's procedure. 3/26 neonates presented after 2 weeks of life with non-bilious vomiting and were diagnosed with infantile hypertrophic pyloric stenosis (IHPS).

One IHPS neonate had to be ventilated preoperatively because of aspiration from recurrent vomiting. Meconium ileus was seen in 2/26 neonates, presented with respiratory distress, abdomen distension and non-passage of stool. Both the cases had associated bad obstetric history with abortions, and death of a sibling with similar complaints just after birth.

Genetic study for cystic fibrosis transmembrane conductance regulator (CFTR) gene was positive in one neonate and it was positive for cystic fibrosis. Both the neonates with meconium succumbed to death with prolong ventilation and respiratory failure. Overall mortality rate was 19.2 % (5/26). The cases have been summarized in Table 1.

Discussion

Intestinal obstruction in neonates is predominantly congenital, with an incidence of 1 in 2000 live births, often attributed to various pathologies such as intestinal atresia, malrotation of the gut, Hirschsprung's disease, anorectal malformation, and meconium ileus [1]. Common clinical presentations include bilious vomiting, abdominal distension, and a lack of stool passage, with the sequence of symptoms contingent on the site of obstruction [2]. Early diagnosis is paramount for successful management, and antenatal ultrasonography may reveal dilated bowel loops and maternal polyhydramnios [3]. A comprehensive approach involving a thorough history, clinical examination, and abdominal X-ray typically proves adequate for diagnosing neonatal intestinal obstruction [4, 5]. Surgical intervention stands as the gold standard for management regardless of the specific pathology or location, initial management protocols encompass gastric decompression, intravenous fluid resuscitation, hemodynamic stabilization, radiographic evaluation, and a thorough workup to identify any associated anomaly [6].

Intestinal atresiais the most common cause of neonatal intestinal obstruction. Atresia is due to failure of recanalization or due to intrauterine vascular catastrophe due to volvulus, duplication

and intrauterine intussusception resulting in atresia of different types. Our study revealed that atresia is the most common cause of neonatal intestinal obstruction, aligning with findings from similar studies by Annigeri et al [7]. Notably, the incidence of atresia in our study (30.7%) was equal to that reported in other studies conducted in Bangladesh, Nigeria, and elsewhere. Among atresia cases, jejunoileal atresia was predominant, consistent with findings in Zaria, Nigeria [8]. The male-to-female ratio in our atresia cases was 3:1, unlike the literature that often reports an equal incidence in both sexes. Atresia typically presented early within 7 days, possibly attributed to the rapid onset of symptoms and deterioration in patients with intestinal atresia and meconium ileus. Gestational age and birth weight, essential determinants of neonatal surgical outcomes, were comparable to findings in other studies.

Table 1: Summary of clinical presentation, diagnosis, and management of neonates with intestinal obstruction

S. No.	1	2*	3	4	5	6	7
Age (days)	3	40	15	4	3	3	2
Sex	m	m	f	m	m	f	m
Antenatal diagnosis	N	Y	N	N	N	N	N
Gestational age	PT	T	T	T	T	PT	T
Clinical presentation	Bilious vomiting	Respiratory distress, non-bilious vomiting	Altered OG aspirates, sepsis, abdomen distension, not passing stool	Bilious vomiting, abdomen distension, not passing stool	Bilious vomiting	Bilious vomiting, abdomen distension, passing scanty stool	Bilious vomiting, abdomen distension, passing scanty stool
Associated anomalies	Small PFO		Small VSD				
Diagnosis	Duodenal atresia	Duodenal atresia	Jejunal atresia	Ileal atresia type 2	Ileal atresia type 3b	Ileal atresia type 1	Jejunal atresia
Surgery	Kimura duodenoduodenostomy	Kimura duodenodu odenostomy	End to side anastomosis	Resection and end to end anastomosis	End to side anastomosis	End to side anastomosis	Side to side
Remarks		Delayed diagnosis grossly					
Follow-up	stable				seizures		

16	15	14	13	12	11	10	9	8
14	21	4	3	2	2	3	5	4
m	f	m	f	f	f	m	f	m
N	N	N	Y	N	N	N	N	N
T	T	T	T	T	T	T	T	T
Respiratory distress, non-bilious vomiting	Non bilious vomiting	Abdomen distension, not passing stools	Visible viscera over the lower abdomen, no anal orifice	Abdomen distension, not passing stools	Abdomen distension, not passing stools	Abdomen distension, not passing stools	Bilious vomiting	Bilious vomiting, abdomen distension, passing scanty stool
		Left HDUN	Small PFO, absent right kidney, absent hemi vagina			VSD, Absent Right kidney		
IHPS	IHPS	Anorectal malformation	Cloacal exstrophy	Cloaca	Anorectal malformation	Anorectal malformation	Malrotation	Jejunal atreisa
Pyloromyotomy	Pyloromyotomy	Loop sigmoid colostomy	Primary pull through with closure of hemi bladder	Loop sigmoid colostomy	Loop sigmoid colostomy	Loop sigmoid colostomy	Ladds procedure	End to side anastomosis
	Some dehydration	Wound infection					Wound infection	
						7m - severe Gastroenteritis		

25	24	23*	22	21*	20*	19*	18	17
4	4	6	4	4	4	14	3	50
f	f	m	f	f	m	f	m	m
N	N	N	N	N	N	N	N	N
T	T	T	T	T	T	PT	T	PT
Abdomen distension, respiratory distress and not passing stools	Abdomen distension, not passing stool	Abdomen distension, not passing stools	Abdomen distension, not passing stools	Respiratory distress, bilious aspirates, abdomen distension, not passing stool	Respiratory distress, bilious aspirates, abdomen distension, not passing stool	Respiratory distress, bilious aspirates, abdomen distension, not passing stool	Not passing stool, abdomen distension	Non bilious vomiting
		VSD, left HDN						
Rectal atresia	Hirschsprungs' disease	Hirschsprungs' disease	Hirschsprungs' disease	Hirschsrpungs' disease	Meconium ileus	Meconium ileus	Anorectal malformation	IHPS
Ascending colostomy	Loop sigmoid colostomy	Divided sigmoid colostomy	Divided sigmoid colostomy	Transverse colostomy	Loop ileostomy + milking of bowel	Double barrel ileostomy + milking of meconium pearls	V-Y anoplasty	Pyloromyotomy
Sepsis		Sepsis		Sepsis	Respiratory failure, stoma functioning, CFTR gene positive	Sepsis, non-functional stoma, worsening		Severe dehydration
		Shah-waardenburg syndrome		two abortions	death in sibling	poor obstetric history		burst abdomen

26	3	m	N	T	Abdomen distension, respiratory distress and not passing stools		Anorectal malfromation	V-Y anoplasty		

f- female, m- male, Y – yes, N – no, T- term, PT- preterm, HDN – hydronephrosis, HDUN – hydroureteronephrosis, VSD- ventricular septal defect, PFO- patent foramen ovale, IHPS- Infantile hypertrophic pyloric stenosis, OG – orogastric, CFTR- cystic fibrosis transmembrane conductance regulator, * - expired

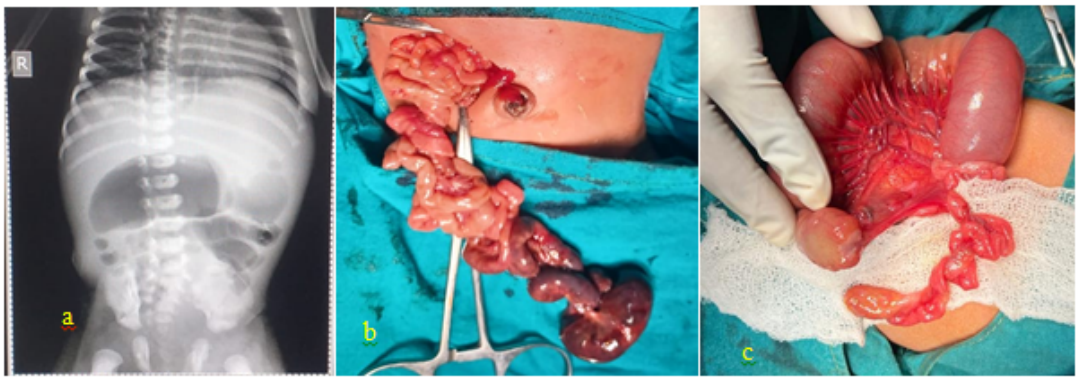

Fig 1 a: Abdominal x-ray showing triple bubble sign – suggestive of jejunal atresia, b- jejunal atresia with volvulus of ileum, c- apple peel ileal atresia

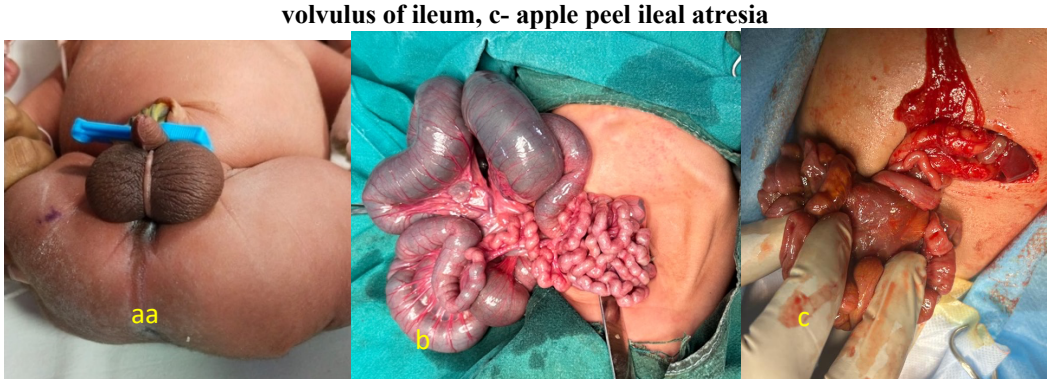

Fig 2 a: Clinical image of Anorectal malformation, b- Meconium ileus with meconium pearls, c- Malrotation with volvulus

Anorectal malformations encompass a spectrum from imperforate anus to complex cloacal malformations, involving a common channel between the genitourinary system and rectum. Around 80% of cases exhibit associated genitourinary anomalies, and various congenital anomalies, including spinal, cardiac, gastrointestinal, and limb abnormalities, are common, with VACTERL syndrome being a prevalent association [9]. The multifactorial etiology, likely involving genetic factors, contributes to an incidence of 1–4 in 5,000 newborns, with slight male preponderance [10]. Neonates with anorectal malformations typically present with abdominal distention, failure to pass meconium, and the absence of a normal anal opening. Diagnosis involves various examinations and imaging techniques, such as ultrasound and MRI. Management varies based on lesion type, with high lesions initially treated with colostomy as a temporary measure followed by definitive surgical repair, while low lesions are addressed with procedures like anoplasty or dilation. Preoperative assessment for associated life-threatening anomalies is crucial. The prognosis is generally good unless complicated by sepsis and severe congenital anomalies. ARM patients can have potential urinary and fecal incontinence based on the severity of the malformation.

Hirschsprung disease (HD) results from an interruption in the migration of neuronal (ganglion) cells to the distal bowel before the 12th week of gestational age, most commonly affecting the rectosigmoid region. It is seen in 15-20% of all neonatal intestinal obstruction [11]. Our study reveals a lower incidence of Hirschsprung

compared to intestinal atresia, contrasting with findings from Dhaka and Zaria, where Hirschsprung's incidence slightly surpassed or equaled that of intestinal atresia, respectively. The male-to-female ratio of 1:3is different from the established literature, and the median age at diagnosis in our study was 4 days, like our study. HD is characterized by aganglionosis, often involving the rectum and part of the sigmoid colon, with short and long segment variations. Clinical presentation in newborns typically includes delayed meconium passage and abdominal distention. Contrast enema aids in diagnosis by showcasing characteristic findings such as abnormal rectosigmoid ratio, transition zone of rectal narrowing, irregular rectal contractions, and retained contrast material [12]. While the contrast enema study may be normal, rectal biopsy is crucial for definitive diagnosis in neonates with clinical signs of persistent low intestinal obstruction.

The typical approach for surgical management of Hirschsprung disease involves a staged procedure, commonly starting with Hartmann or loop colostomy, followed by a subsequent Duhamel pull-through. However, there is a growing trend towards primary pull-through or transanal procedures in recent practice [13]. These alternative approaches aim to streamline the surgical process, potentially reducing the need for a colostomy and minimizing the overall number of interventions. The choice between staged and primary procedures often depends on the specific characteristics of the case, surgeon preference, and the institution's protocols. Advances in surgical techniques continue to shape the landscape of Hirschsprung disease management, offering more options and individualized approaches for patients.

Meconium ileus presents with abdomen distension and inability to pass meconium, x-ray abdomen shows dilated small bowel loops, with micro colon. This condition is assumed to be an early manifestation of cystic fibrosis (CF)and occurs in 20% of patients with CF [14]. It is associated with mutation in CFTR gene and we have proved association in one of our patients [15].Initially, it can be managed with warm saline wash or N-acetyl cysteine wash or gastrograffin enema [16]. In unresponsive cases, exploratory laparotomy with ileostomy is done. It was associated with 100% mortality in our series which is higher than reported 80%, due to respiratory failure [17].

Malrotation manifests in approximately 1 in 2500 live-born infants, though as an anatomic entity, it is more prevalent, occurring in 0.2%–1% of the normal population. The condition poses a risk of midgut volvulus, resulting in both mechanical obstruction and arterial occlusion of mesenteric vessels. Untreated midgut volvulus can progress to bowel ischemia and eventual infarction. Diagnosis often involves contrast studies, revealing a characteristic corkscrew appearance. Many individuals remain asymptomatic until volvulus develops. The Ladd's procedure stands as the definitive treatment, with an increasing trend towards laparoscopic interventions at various centers. The prognosis for malrotation is generally favorable, unless complicated by volvulus and bowel gangrene. Timely intervention has shown to improve outcomes in our series and numerous other cases.

Infantile hypertrophic pyloric stenosis usually presents in males after 4 weeks; however, we have early presentation at 12-14 days in our series. The incidence of pyloric stenosis is 2 to 5 in 1000 live births per year [18]. The neonates present with non-bilious projectile vomiting visible gastric peristalsis and dehydration. Ultrasonography is the diagnostic modality with pyloric wall thickness 3 mm or greater and pyloric channel length 15 mm or greater with associated abnormal findings like target signs and lack of gastric emptying. Correction of electrolyte imbalance and metabolic alkalosis plays a crucial role in outcome [19].One patient in our series, though diagnosed within a month, came for surgery at 50 days of life with dehydration, and had burst abdomen postoperatively. Ramstedtpyloromyotomy is the gold standard surgical treatment. It is associated with an excellent prognosis and has a mortality rate of 0.1%. Prematurity and apnea can increase the morbidity and mortality [20].

The mortality associated with neonatal intestinal obstruction ranges between 21% and 45% in developing countries, in our study it was 19.2% [21]. In this report, sepsis emerged as a significant contributor to mortality, mirroring findings in other studies. Mitigating postoperative sepsis and complications such as anastomotic dehiscence and burst abdomen, which may necessitate repeat surgery, is crucial for enhancing survival rates.

The considerable improvement in newborn survival after surgery in recent years is attributed to advanced surgical techniques, enhanced pediatric anesthesia support, and improved neonatal intensive care. However, infants with risk factors such as prematurity, low birth weight, late presentation, and severe associated congenital anomalies remain prone to a poor prognosis even after surgery [8]. While factors like prematurity and associated anomalies are challenging to address, the delay in diagnosis and treatment, a modifiable factor, warrants attention. The type of surgical condition and the specific surgical procedure performed also significantly influence patient outcomes within an institution. Additionally, certain concealed factors like motivation for surgical treatment, socioeconomic conditions, and

infrastructure quality, which are challenging to quantify and report, play pivotal roles in shaping outcomes.

Conclusion

Our retrospective study highlights that to enhance outcomes and reduce mortality in newborn babies with intestinal obstruction in developing countries, collaborative efforts involving paediatricians, paediatric surgeons, and investments in the subspecialty of neonatal surgery are imperative. Antenatal diagnosis, early referral, advancements in surgical skills and technologies, an adequate workforce, and comprehensive postoperative care are crucial components of this collaborative approach. By addressing these factors collectively, it is possible to improve the management of neonatal intestinal obstruction and achieve better results in developing nations.

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