Section: Paediatrics

Original Research Article

GASTROINTESTINAL OBSTRUCTION IN NEONATES AND CHILDREN- AN ANALYSIS OF THE ETIOLOGY, MANAGEMENT AND SURGICAL OUTCOME

Athiya Perveen K[1], Shirbin Joe Mathews[2], Divya Davis[3]

[1]Associate Professor, Department of Paediatric Surgery, Government Medical College, Kottayam, India.
[2]Assistant Professor, Department of Paediatric Surgery, Government Medical College, Kottayam, India.
[3]Assistant Professor, Department of Paediatrics, Government Medical College, Kottayam, India.

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Corresponding Author:
Dr. Divya Davis C
Email: drdivyajoby@gmail.com

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Abstract

Background: Gastrointestinal obstruction is one of the most common emergencies encountered in the paediatric age group which needs immediate diagnosis, resuscitation, and appropriate management. Its incidence and etiology vary from place to place. Our aim is to study the prevalence of the common causes of intestinal obstruction in our geographical area and compare it to national and international data and to highlight those rare conditions which we have encountered in our clinical practice. **Materials and Methods:** The study was a retrospective descriptive study including all children from birth to 12 years of age who were operated at the Department of Paediatric surgery for gastro intestinal obstruction from January 2017 to December 2022. The hospital inpatient records, the outpatient records and theatre records will be used for data collection. **Results:** This was a retrospective descriptive study in which 348 children from birth to 12 years of age, who were operated at the Department of Paediatric surgery for gastrointestinal obstruction from January 2017 to December 2022 were included. 58% of the children belonged to the neonatal age group. Most common etiology encountered in this group was anorectal malformation and intestinal atresia. The second commonest group was infants, and the most common etiology was intussusception. In the age group of 1 to 5 years intussusception and adhesive obstruction were the leading causes whereas in children older than 5 years Meckel's diverticulum and adhesive obstruction were the prominent causes. In our study, the majority of the patients (63%) were males. **Conclusion:** Paediatric gastrointestinal obstruction is a common surgical emergency in our geographical area. The sex predilection was similar to national and international data and showed a male preponderance. The etiology in our study was comparable to national and international data to a considerable extent in neonates and infancy. But in older children, causes like worm mass and intestinal tuberculosis are rarely seen in our area.

INTRODUCTION

Intestinal obstruction (IO) refers to a partial or complete blockage of the gastrointestinal tract, preventing the normal flow of intestinal contents. It is one of the most common emergencies encountered in the paediatric age group which needs immediate diagnosis, resuscitation and surgery in most of the cases.[1] The etiology and incidence of paediatric intestinal obstruction varies from nation to nation and also from one part of the nation to another. These differences are not only due to geographical and sociological factors but also due to the state of economic development of that particular region.[2]

In the paediatric age group, intestinal obstruction is a complex condition with a multitude of etiologies when compared to the adult counterpart. It includes a wide spectrum of conditions ranging from congenital anomalies such as intestinal atresias, anorectal malformations, malrotation, meconium ileus and Hirschsprung's disease to acquired conditions such as intussusceptions, hypertrophic pyloric stenosis, adhesive obstructions and rarely inguinal hernias.[2]

Paediatric intestinal obstruction can have a varied presentation. Upper gastrointestinal (GI) obstruction presents with vomiting (bilious or non-bilious, depending on location) whereas lower GI obstruction presents as abdominal distension and constipation with or without vomiting. The presence of perforation or gangrene may complicate the situation and endanger the patient's life. Prompt investigation and immediate surgery are needed in most of the

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cases. Even though there are a set of common conditions which present in the paediatric age group, there may be a few very rare conditions that can present as intestinal obstruction and need a high index of suspicion to be diagnosed and treated on time. Our aim is to study the prevalence of the common causes of intestinal obstruction in our geographical area and compare it to national and international data and to highlight those rare conditions which we have encountered in our clinical practice.

MATERIALS AND METHODS

Our study was a retrospective descriptive study conducted at our tertiary care institution. All children from birth to 12 years of age who were operated at the Department of Paediatric surgery for gastro intestinal obstruction from January 2017 to December 2022 were included in the study. Our primary objective was to determine the different etiologies of gastrointestinal obstruction in children and to highlight a few rare causes. Our secondary objectives were to identify the clinical features, to estimate the prevalence, age, sex distribution and outcome of each condition causing intestinal obstruction and to compare it to the national and international data. Patients with intestinal obstruction due to medical causes like sepsis and electrolyte imbalances and subacute cases which were managed conservatively were excluded from the study. Patients with peritonitis without distal obstruction, cases of intussusception managed by saline reduction and cases operated elsewhere and referred for management of complications were also excluded from the study. The hospital inpatient records, the outpatient records and theatre records will be used for data collection. These data were evaluated and analyzed to arrive at the results.

RESULTS

A total of 348 cases of GI obstructions were operated during the period of January 2017 to December 2020. Out of these 63% (n=219) were males and 37% (n=129) were females. Majority of the cases, 58% (n=201) were neonates (Group A). 25% (n=87) belonged to category of 29 days to 1 year of age (Group B). 8% (n=28) of cases belonged to the age group 1to 5 years (Group C) and 9% (n=32) belonged to the age group 5 to 12 years (Group D).

The most common pathology encountered was anorectal malformation (15.5%, n=54) followed by small bowel atresia (14.5%, n=51). The various conditions we encountered are depicted in the following table [Table 1].

Among the neonates, the most common conditions encountered were anorectal and bowel atresia followed by malrotation and Hirschsprung's disease. Meconium peritonitis and necrotising enterocolitis also contributed to the etiology of intestinal obstruction in this age group.

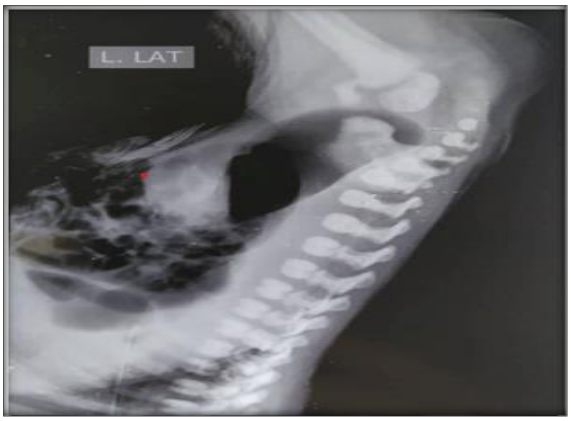
In the age group of 1month to 1 year intussusception was the most common, closely followed by IHPS. In the age group of 1 to 5 years intussusception and adhesive obstruction were the leading causes whereas in children older than 5 years Meckel's diverticulum and adhesive obstruction were the prominent causes.

Anorectal malformation was the most common condition which we encountered in our study [Figure 1]. Out of the 54 cases 46 were male and 8 were female, the reason being female ARM mostly has a fistula and hardly presents as intestinal obstruction (IO). Graph 1 depicts the type of ARM. Rectovaginal fistula, cloaca and Y anomaly were the conditions that necessitated colostomy in females. Tracheo-esophageal fistula, duodenal atresia, uterus diadelphis, hematocolpos and renal anomalies like single kidney, ectopic kidney and duplex were some of the conditions seen in association with ARM.

Figure 1

A. Invertogram film showing high ARM

B. Clinical photograph of the perineum of the same patient



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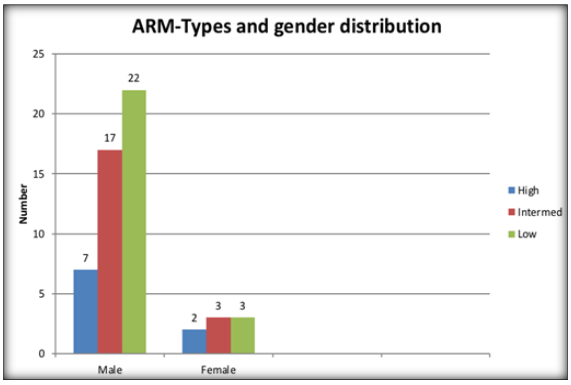


Graph 1: Bar diagram showing gender distribution and types of ARM

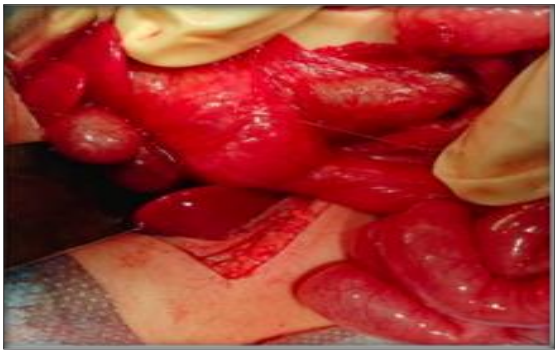
The second most common diagnosis we encountered was small bowel atresia [Figure 2]. Out of the 50 cases, all the patients presented in the first month of life, the oldest patient being 29 days old. Out of these 30%(n=15) were males and 70%(n=35) were females. The patients who presented beyond 2 weeks of life were all cases of Type-1 atresia (Intraluminal web with fenestration). The site of atresia according to the frequency was as follows- duodenal: 54%, jejunal:22%, ileum: 22% and multiple: 2%.

Figure 2

A. Intraoperative picture of multiple small bowel atresia

B. Intraoperative picture of duodenal atresia

A



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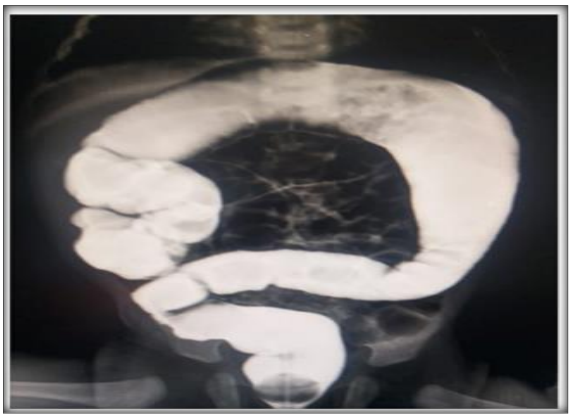
We encountered 42 cases of malrotation. Even though majority of cases presented in the neonatal period, we had 2 patients in the older age group beyond 5 years of age. Male to female ratio was almost equal ie male: 52% (n= 22) and female 48% (n=20). 2 patients had mesocolic hernia and one patient had annular pancreas with intrinsic obstruction. An interesting association we encountered was the presence of chylous ascites in a few patients. 2 of the older patients had associated appendicitis and Meckel's diverticulitis and presented with peritonitis.

Hirschsprung's disease (HD) was one of the common causes of GI obstructions we encountered in the neonatal period **[Figure 3]**. A total of 40 cases of **HD** were in our study and the age distribution was as follows- Group A: 77.5%, group B: 17.5%, group C: 2.5% and group D: 2.5%**.** The level of aganglionosis is the most important factor which determines the management of children with HD. We found an increase incidence of HD in males (NBA's=29 ie 72.5%) In our series 72.5 % (n=29) belonged to the Rectosigmoid group, 12.5 % (n=5) belonged to the long segment group and 15% (n=6) belonged to the Total colonic group **(TCA) [Graph 2].** 3 of the patients in the HD group were of the Down's phenotype and had an increased incidence of complications in the form of wound infections and fecal fistula.

Figure 3

A. Barium enema picture of Hirschsprung's disease

B. Intraoperative picture showing transition zone of Hirschsprung's disease



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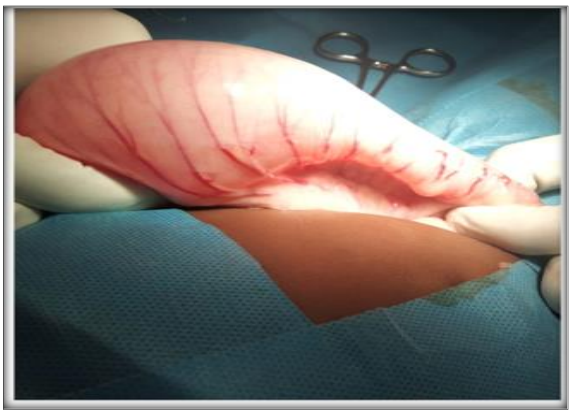

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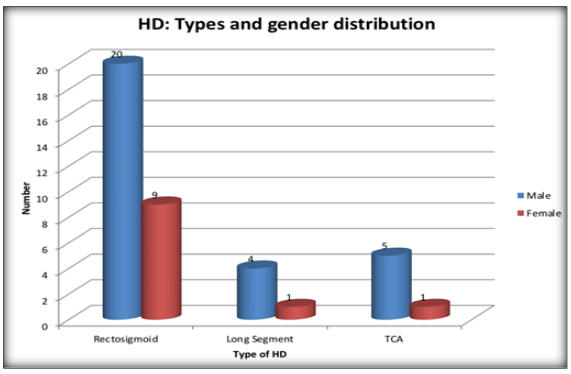


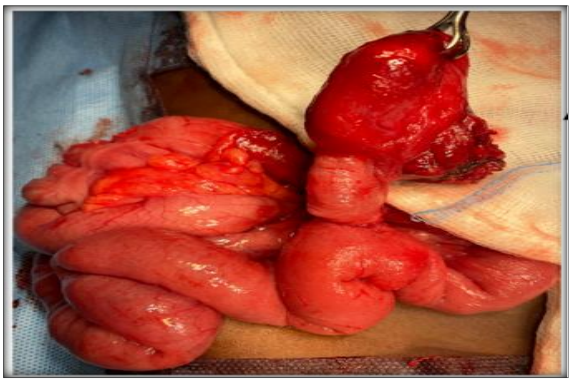
Graph 2: Types and gender distribution of Hirschsprung's disease

Although intussusception is a very common condition encountered in paediatric age group especially in infancy, only very few cases with delayed presentation show features of IO. We had 34 cases which ended up in laparotomy. Out of these 50% (n=17) were reduced by manual reduction and rest 50% ended up in intestinal resection. 4 patients had a pathological lead point. Lead points which we encountered were Meckel's diverticulum (n=2) [Figure: 4A], lymphoma (n=1) and jejunal polyp (n=1) in case of Peurtz Jegher's syndrome [Figure:4B]

Figure 4

A. Intraoperative picture of Meckel's diverticulum

B. Intraoperative picture of jejunojejunal intussusception



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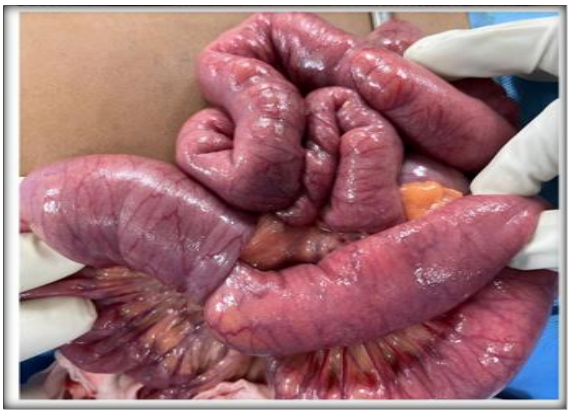


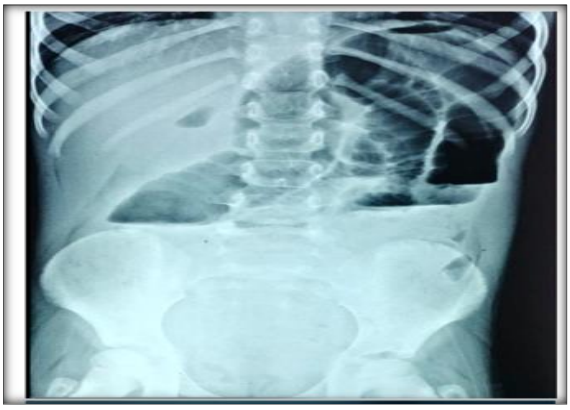
B

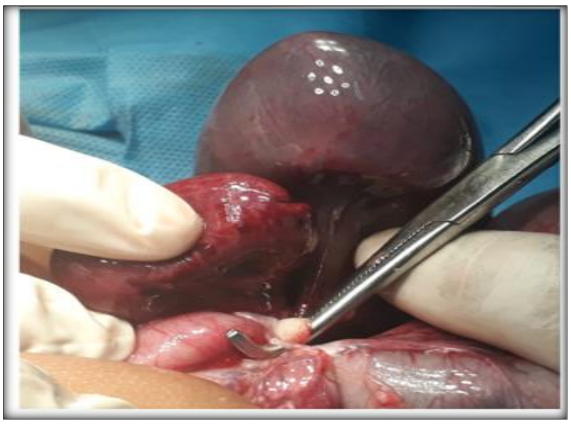
Adhesive obstruction was a common cause of IO in infancy and childhood. In our study most of the cases belonged to the B group ie 42% (n= 11). Among these most were neonates who underwent laparotomy for Congenital diaphragmatic hernia (CDH), malrotation, necrotising enterocolitis and meconium ileus. Among older children, appendicectomy was the most common cause of IO. [Figure 5] The surgeries that led to adhesive obstruction are depicted in the following table. [Table 2]

Figure 5

A. Plain radiograph of adhesive obstruction

B. Intraoperative picture of an adhesive band compromising bowel vascularity





Among the B group, the second most common we encountered was IHPS. Out of the total 23 cases, 87% (n=20) belonged to B group and only 3 cases presented in the A group. Male predominance was seen 74% (n=17). Most common complication we encountered was wound dehiscence due to malnourished status of babies with IHPS (n=3). 1 patient had pneumoperitonium 48 hours after the surgery and needed a re-laparotomy.

We had 20 cases of NEC, out which 65% (n=13) belonged to A group and rest belonged to B group. [Figure: 6]

Figure 6

A. Plain radiograph of a newborn with NEC

B. Intraoperative picture of NEC with obstruction

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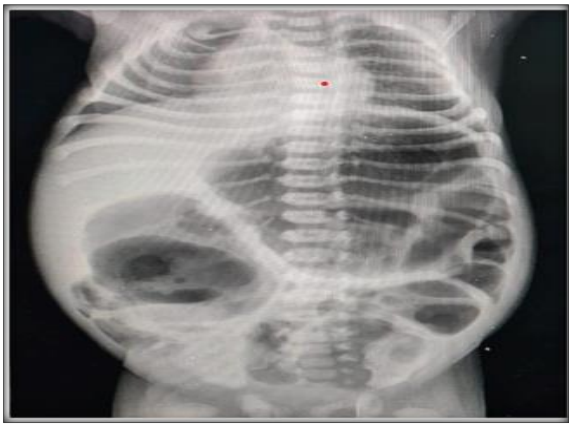

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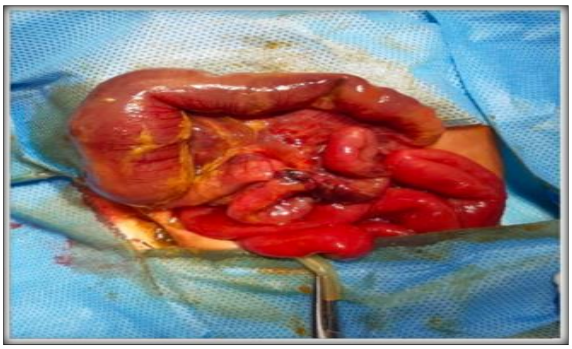

B

Meckel's diverticulum which was one of leading causes of IO in older children, presented as either peritonitis with obstruction, closed loop/band obstruction or Vitello intestinal duct. Out of the total 13 cases in our study 54% (n=7) belonged to the D group and 38% (n=5) belonged to the B group.

We had 7 cases of mesentric cyst, 1 case of mecocolic cyst,6 cases of meconium peritonitis, 5 cases of meconium pseudocyst and 5 cases of duplication cyst. We also encountered rare cause of IO like congenital mesentric defect (n=2), pre-duodenal portal vein, CSF pseudocyst (post VP shunt) (n=2), ileo-caecal mass due to Tuberculosis (n=1) and lymphoma (n=1) and gastric outlet obstruction due to diffuse eosinophilic gastritis (n=1) and trichobezoar (n=1)

Table 1: Various conditions causing paediatric gastrointestinal obstruction

Serial No	Diagnosis	Number	Percentage
1	Anorectal malformation	54	15.51
2	Small bowel atresia	51	14.65
3	Malrotation	42	12.06
4	Hirschsprung's disease	40	11.49
5	Intussusception	34	9.77
6	Adhesive obstruction	26	7.47
7	IHPS	23	6.6
8	NEC	20	5.74
9	Meckel's diverticulum	13	3.73
10	Meconium peritonitis	11	3.16
11	Mesenteric cyst	7	2.01
12	Duplication cyst	5	1.43
13	Band obstruction	3	0.86
14	Peritonitis	3	0.86
15	Congenital mesenteric defect	2	0.57
16	Post VP shunt pseudocyst	2	0.57
17	Meconium ileus	2	0.57
18	Ileocecal mass	2	0.57
19	Pre-duodenal portal vein	1	0.28
20	Trichobezoar	1	0.28
21	Intestinal volvulus	1	0.28
22	Mesocolic cyst	1	0.28
23	Rectal perforation	1	0.28
24	Gastric outlet obstruction	1	0.28
25	Mesocolic hernia	1	0.28
26	Pseudocyst pancreas	1	0.28
	TOTAL	348	

Table 2: Etiology of adhesive obstruction

Serial No	Diagnosis	Number	Percentage
1	Appendicectomy	5	19.23
2	Laparotomy for CDH repair	4	15.38
3	Ladd's Procedure	3	11.54
4	Laparotomy for Meconium ileus	2	7.69
5	Duhamel's procedure	1	3.85
6	Laparotomy for Meckel's diverticulitis	1	3.85
7	Laparotomy for NEC	1	3.85

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8	Laparotomy for Omphalocele	1	3.85
9	General	8	30.76
	Total	26	100

DISCUSSION

GI obstruction is a common surgical emergency which can occur in any age group. In children, it differs from adults in terms of etiology, presentation and even management. Its etiology varies with the age of children. 3 The etiological factors may also vary from one geographical region to another.[2]

In 1973 Sran et al. published a paper enumerating the causes of intestinal obstruction in children in the Indian scenario. It revealed a male-to-female ratio of 2:1.[3] Belokar et al. from Maharashtra, India in 1978 described a male preponderance in the study "Paediatric acute intestinal obstruction in Central India". According to statistics presented, 34.3% were below 1 year of age.[2] In a more recent study by Bhedi A et al. in 2017 from Gujarat, India, the majority of patients were neonates than infants and children with slight male preponderance with a male to female ratio of 3:2.[4] Another study conducted in Chhattisgarh, India by Amin Memon et al.in 2017 also revealed a male preponderance.[5]

In our study, the majority of the patients (63%) were males. Most of our patients belonged to the neonatal age group (58%), followed by the category 29 days to 1 year of age, who consisted of 25% of cases.

Sran et al. in 1973 reported that imperforate anus, intussusception and external hernias were the commonest causes in children.[3] Belokar et al. describes intussusception as the major cause beyond infancy and anorectal malformation as the most common cause in infancy.[2] Bhedi A et al. in 2017 reports that the congenital causes were more common (82%) than the acquired causes (18%) and the majority (42%) of cases were anorectal malformations. 4 Memon et al.in 2016 revealed that anorectal malformation was the major cause of intestinal obstruction in the neonatal age group while IHPS and Hirschsprung's disease were the common causes from 1 month to 1 year of age.[5]

A study by Gangopadhyay et al. from Uttar Pradesh, India in 1989 reported that intussusception (16%), Ascaris bolus obstruction (13.5%), enteric perforation (12.3%), and abdominal tuberculosis (11%) formed the majority of the cases in non-neonatal age group. 6 Another study by the same author in 1996, elaborates on the causes of intestinal obstruction in neonates, the commonest being anorectal malformation (50%). The other causes are Hirschsprung's disease, intestinal atresia and malrotation in the decreasing frequency.[7]

According to international statistics also etiology varies from location to location. In studies carried out in different nations of Africa, Hirschsprung's disease was the predominant cause in Malawi.[8] In Uganda, Ghana and Rwanda, intussusception was the most common cause.[9] In Kenya, ascaris plug was the leading cause.[10] All the above studies showed male predominance.

A study conducted in Nepal in 2015 showed a male-to-female ratio of 1.8: 1. Commonest cause was intussusception followed by Meckel's diverticulum and strangulated hernia.[11] Contrary to the above studies, a study conducted in China in 2023 February revealed congenital and acquired adhesions as the main cause of small bowel obstruction with an incidence of 58.67%.[12]

Regarding the etiology of IO in our series, anorectal malformation (15.5%) was the most common, closely followed by small bowel atresia (14.5%). These 2 conditions along with malrotation and Hirschsprung's disease caused majority of IO in the neonatal period. Intussusception followed by IHPS was the most common cause in children in the age group 1 month to 1 year. Adhesive obstruction and Meckel's diverticulitis were common in older children.

As most of the etiologies are congenital, majority of the patients present before the first year of life. In the study by Bhedi A et al., 15% of the study population were neonates, 14% were infants and 36 patients belonged to the age group of 1 to 12 years.[4] According to statistics presented by Belokar et al. 34.3% were below 1 year of age.2 International statistics also show an increased incidence of patients under 1 year (38.5%) of age presenting with GI obstruction as depicted in the study conducted by Twahirwa I et al.[9]

In our series, among the children with ARM 16.7 % had a high anomaly, 37 % had intermediate anomaly and 46.3 % had a low anomaly. Females were much lower than males in number (14.8% and 85.2 %, respectively). In the series by Memon et al. 75.76 % had a high anomaly and 24.24% had a low anomaly. Females were more in number compared to our series (27.27%). 5 This may be due to the fact that all the cases of female ARM with fistula (without intestinal obstruction) were excluded from our series.

Hirschsprung's disease, which is a common cause of IO in children usually shows a male predilection with the male to female ratio of 4:1.[13] In our series, male female ratio was 2.6:1. Down's syndrome is the most common chromosomal defect accompanied by HD. Its afflicts 10% of patients with Down's syndrome.[14] In our study 7.5 % of patients with HD had Down's syndrome.

Regarding the length of aganglionosis, the classical type (Rectosigmoid) is the most common form (75 to 80%), followed by long segment (10%) with aganglionosis extending up to splenic flexure. The rarest is total colonic aganglionosis which is only 5%. 15 In our study 72.5% belonged to the classical rectosigmoid group, 12.5% to the long segment group and 15 % to the total colonic group. Another observation we made was that post-operative

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complications like wound infection, fecal fistula and enterocolitis were more common in those with Down's phenotype. This is probably due to poor wound healing and intestinal dysmotility.

In a retrospective study conducted in 1998 by Dalla Vecchia LK et al. the incidence of duodenal atresia was 50%, jejunoileal was 46% and colonic atresia was 8%.[16] In our series, 50% had duodenal atresia, 20% had jejunal, 20% had Ileal and 12% had multiple atresias (including Apple peel deformity).

Adhesive obstruction is a common cause of morbidity in neonates and children. In a study by Cecilia et al. in Sweden, the most common diagnosis at index surgery were NEC (15.9%) and duodenal obstruction (14.8%).[17] In our study, the most common index surgery leading to adhesive obstruction in older children was appendicectomy and in neonates it was laparotomy for diaphragmatic hernia and Ladd's procedure.

We also encountered some rare cases of gastric outlet obstruction like pre-duodenal portal vein, eosinophilic gastritis and trichobezoar. Rare cases for small bowel obstruction were mesocolic cyst, duplication cysts and meconium peritonitis.

CONCLUSION

Paediatric gastrointestinal obstruction is a common surgical emergency in our geographical area which necessitates early diagnosis and expert management. The sex predilection in our institute was similar to national and international data and showed a male preponderance. The etiology in the neonatal age group of our study was comparable to national and international data to a considerable extent, ARM being the leading cause. Beyond infancy intussusception was the commonest etiology . The relative decrease in number of intussusception cases in our study when compared to other studies is may be due to the inclusion of only the operated cases. In children older than 5 years of age adhesive obstruction was the most common cause. Causes like worm mass and intestinal tuberculosis which are fairly common in African countries and northern states of India are rarely seen in our geographical area.

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Conflict of interest: None

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