Original Article

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Pathology Section

A Clinicopathological Study of Developmental and Acquired Causes of Intestinal Obstruction in Paediatric Population- A Retrospective Study

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ABSTRACT

Introduction: Intestinal Obstruction (IO) in the paediatric age group can be due to a variety of developmental and acquired causes which depend on the age at presentation. Histopathological examination of the resected intestine can provide definite evidence of underlying aetiology.

Aim: To analyse the spectrum of lesions causing IO and it's relation with clinicopathological features.

Materials and Methods: This was a retrospective study conducted in the Department of Pathology at Seth G.S. Medical College and Dr. R.N. Cooper Hospital, Mumbai, Maharashtra, India. Gross and microscopy of 70 surgically resected specimens of patients with IO, received over a period of five years, from January 2009 to December 2013, data was analysed between January 2021 to June 2021, studied after getting ethical clearance. Clinical details were retrieved from the records. Lesions were classified as developmental and acquired which were further categorised into infective, neoplastic and miscellaneous categories. Data was analysed using Microsoft excel 2010 and was expressed as frequency and percentage.

Results: Out of the 70 cases studied there were 40 males and 30 females. There were 37 cases less than one month old, 13 cases between one month to one year age and 20 cases between 1-12 years of age. The developmental category comprised of 52/70 cases (74.29%) with 17 cases of Meckel's diverticulum,16 cases of intestinal atresia, three cases each of mesenteric cysts and duplication cysts, five cases of duodenal webs, four cases of congenital bands, one case each of lymphangiectatic cyst, malrotation, blind ileal loop and meconium ileus. In the acquired category, there were three cases of tuberculosis and one case each of fungus and *Ascaris* infection. In the neoplastic category, there were five cases of polyps and one case each of cystic teratoma and Burkitt's lymphoma. There were three cases of volvulus, two of perforation and one case of intussusception.

Conclusion: The present study highlights the various causes of IO in children from neonatal period up to 12 years of age. With proper gross and microscopic examination, it was possible to give confirmed diagnosis, which is necessary for further management of the patient.

Keywords: Cyst, Infection, Intestinal atresia, Meckel's diverticulum, Neoplasm

INTRODUCTION

The IO in paediatric age group can be due to a variety of developmental and acquired causes which differ in neonatal and older age groups [1]. It is one of the most common surgical emergency seen in paediatric age group with significant mortality and morbidity. Mode of presentation is acute in majority of the cases. Patients present with abdominal distension, vomiting, abdominal pain, constipation and failure to pass meconium [2]. Common causes of surgical specimens received due to developmental IO which are present mainly in the neonatal period include intestinal atresias, intestinal webs, congenital bands, Meckel's diverticulum, meconium ileus and malrotation [3]. Acquired causes include infections like tuberculosis, worm infestations, neoplasms like polyps, lymphoma and other causes like intussusception, volvulus and perforation [4]. Earlier studies done on the causes of IO have focussed on clinical presentation and management [1-4]. However, analysis of gross and histopathological features did not reflect in these studies. Surgical pathology specimens can help to confirm the diagnosis and also unravel the predisposing factors which can lead to IO. Hence, the present study was undertaken to classify, study the various causes and complications of IO in children and also to analyse its relation with clinicopathological features.

MATERIALS AND METHODS

This was a retrospective study conducted in the Department of Pathology at Seth G.S. Medical College and Dr. R.N. Cooper Hospital, Mumbai, Maharashtra, India. It was done on all surgical pathology specimens of paediatric patients operated for IO for five years between January 2009 and December 2013. Data was analysed between January 2021 to June 2021. Institutional Ethics Committee (IEC) permission was obtained (ethical clearance number-IEC/171/2012).

Inclusion criteria: Specimen of IO cases, less than 12 years of age were included in the study.

Exclusion criteria: Functional obstructions due to Hirschsprung's disease were excluded from the study.

Out of a total of 798 paediatric gastrointestinal specimens received during the study period 70 cases showed features of IO and comprised the study population.

Data Collection

The medical records of the patients were retrieved and analysed with respect to age, gender, symptoms of abdominal pain, distension of abdomen, constipation, inability to pass stools, vomiting, X-ray findings, preoperative diagnosis and diagnosis made during exploratory laparotomy. Gross examination of all the specimens was done and the site, size, external appearance, cut surface, cystic change, intussusception, stricture, gangrene, perforation and peritonitis were noted. Representative histopathology sections were studied. Cases were divided based on aetiology into developmental and acquired causes which were further classified into infective, neoplastic and miscellaneous categories (volvulus, perforation and intussusception) [2].

STATISTICAL ANALYSIS

Data was collected and analysed using Microsoft excel 2010 and was expressed as frequency and percentage for different aetiologies.

RESULTS

Out of a total of 798 paediatric gastrointestinal specimens received during the study period, 70 cases showed features of IO giving an incidence of 8.77%. Majority of the cases were in the age group of less than one month 37/70 (52.86%). There were 13 cases (18.57%) in the age group between one month to one year and 20 cases (28.57%) between 1-12 years. There were 40 males and 30 females children with a male:female ratio of 4:3. Patients presented with the complaints of abdominal distension in 45 cases (64.3%), pain in abdomen in 27 cases (38.6%), vomiting in 35 cases (50%) and inability to pass meconium/constipation in 20 cases (28.56%). There were 61 cases (87.14%) which presented with acute obstruction. Depending on the aetiology the cases were classified as developmental causes in 52 cases (74.29%), acquired in 18 case (25.71%) which were further divided as infective in 5 cases (7.14%), neoplastic in 7 cases (10%) and others in 6 cases (8.57%).

[Table/Fig-1] shows the developmental causes and [Table/Fig-2] depicts the acquired causes of IO along with the frequency, age distribution, male female ratio and salient histopathological findings. [Table/Fig-3a-d] shows the gross appearance of the cases. Meckel's diverticulum and intestinal atresia showed gangrenous changes. Meckel's Diverticulum (MD) ranged in size from 1-10 cm with giant MD more than 5 cms long in six out of 17 cases. Mesentric cyst shows a thin wall and duplication cyst is arising from the intestinal wall.

[Table/Fig-4a-d] shows microscopic features of MD, intestinal atresia, mesentric cyst and duplication cyst. There was one case of Burkitt's lymphoma which presented as ileo-colic intussusception.

[Table/Fig-5a] shows the cut surface of Burkitt's lymphoma with solid greyish white appearance. [Table/Fig-5b] shows the cut surface of teratoma with solid cystic variegated appearance. [Table/Fig-6a,b] shows the microscopic features of Burkitt's lymphoma and cystic teratoma.

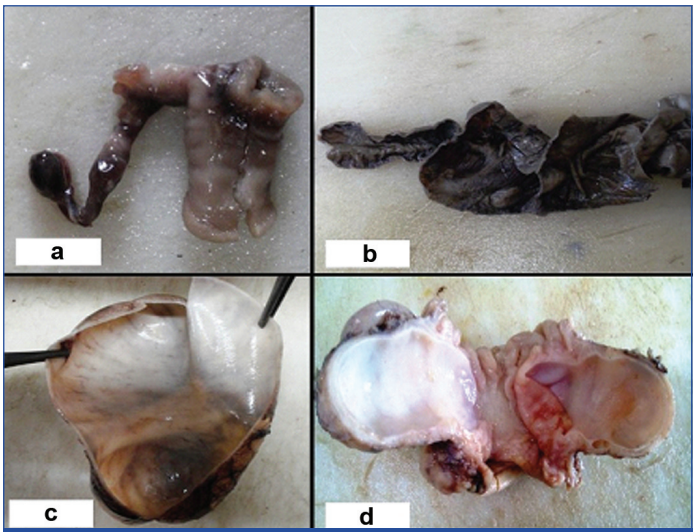
[Table/Fig-7] shows developmental and acquired causes of IO in children along with their complications like intussusception, structure, perforation gangrene and meconium peritonitis. Out of 70 children, only 62 had secondary complications, rest of the cases did not have any secondary complication. There were nine (12.86) cases of secondary intussusception. Mortality was seen in 3/70 cases (4.28%). In 15 cases, more than one lesion was found. [Table/Fig-8] shows conditions with more than one lesion. [Table/Fig-9] shows the discordant cases with different preoperative/operative and histopathological diagnosis. In eight cases, the final histopathological diagnosis was different from the clinical diagnosis.

Condition	Number	<1 mnth	1 mnth-1 yrs	1 yr-12 yrs	M:F	Histopathological findings
Tuberculosis	3	0	0	3	0:3	Caseating granulomas were seen
Fungal infection	1	1	0	0	1:0	Fungal hyphae seen
Ascaris	1	0	1	0	1:0	Lumen was filled with worms
Polyps	5	1	0	4	4:1	One case each was Peutz's-Jeghers polyp and serrated adenomatous polyp. Three cases were infarcted polyps
Mature teratoma	1	1	0	0	0:1	Cyst lined by stratified squamous epithelium with sebaceous glands, adipose tissue and keratin in the wall
Burkitt's lymphoma	1	0	1	0	1:0	Lymphoma cells infiltrating the intestinal wall with overlaying normal mucosa
Volvulus	3	3	0	0	2:1	Showed gangrenous changes
Perforation	2	0	2	0	1:1	Perforative peritonitis was seen
Intussusception	1	1	0	0	0:1	Showed gangrenous changes

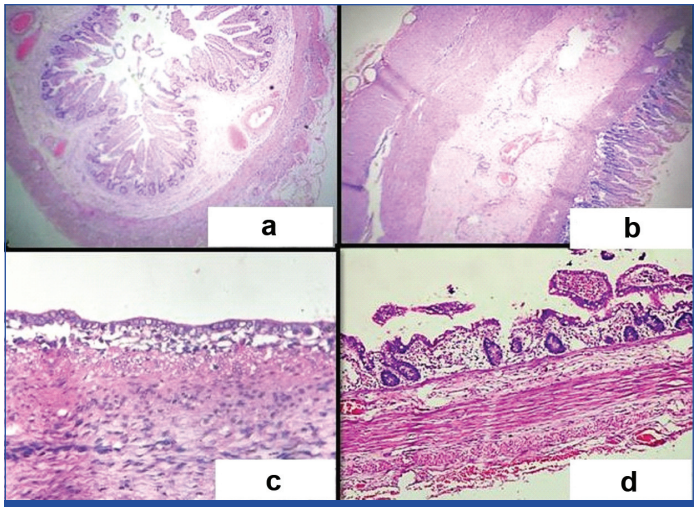
[Table/Fig-2]: Acquired causes of intestinal obstruction along with their histopathological findings.

Condition	Number	<1 mnth	1 mnth-1 yrs	1-12 yrs	M:F ratio	Histopathological findings
Meckel's diverticulum	17	4	3	10	12:5	Showed all layers of intestine. Diverticulitis was seen in four cases and ectopic gastric mucosa in four cases
Intestinal atresia	16	15	1	0	10:6	Increased submucosal fibrosis
Duplication cyst	3	3	0	0	2:1	Two cyst were lined by intestinal mucosa and one by gastric mucosa
Mesenteric cyst	3	1	0	2	1:2	Cysts lined by cuboidal and columnar epithelium
Lymphangiectatic cyst	1	1	0	0	0:1	Multiloculated cyst with flattened lining and lymphoid follicles in the wall
Intestinal web	5	3	2	0	0:5	Showed increased fibrosis in the submucosa
Congenital bands	4	0	3	1	3:1	Showed fibrosis
Blind ileal loop	1	1	0	0	1:0	On gross one end of intestine was blind and showed gangrenous changes
Meconium-ileus	1	1	0	0	0:1	On gross cyst with meconium seen
Malrotation	1	1	0	0	1:0	Segment showed necrotising enteritis

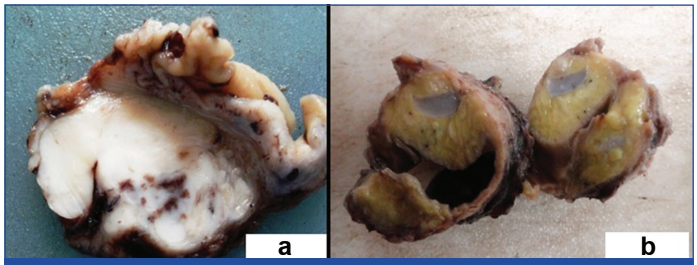
[Table/Fig-1]: Developmental causes of intestinal obstruction in children along with their histopathological findings.



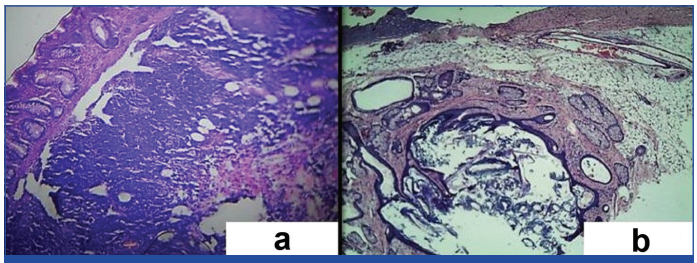
[Table/Fig-3]: a) Meckel's diverticulum showing gangrenous changes; b) Intestinal atresia with gangrenous changes; c) Mesenteric cyst- thin walled cyst with smooth internal surface; d) Duplication cyst- cyst arising from the wall of the intestine.



[Table/Fig-4]: a) Meckel's diverticulum showing all layers of intestinal wall (H&E X100); b) Ileal atresia- Submucosal fibrosis with congested blood vessels (H&E X100); c) Mesenteric cyst-cyst lined by cuboidal epithelium with fibrocollagenous tissue (H&E X100); d) Duplication cyst- cyst showing all layers of intestine (H&E X100).



[Table/Fig-5]: a) Lymphoma- Solid white fleshy growth in the intestinal wall; b) Teratoma- solid cystic lesion with cartilage and fat.



[Table/Fig-6]: a) Burkitt's Lymphoma- Lymphoma cells infiltrating the intestinal wall with overlying normal mucosa (H&E X100); b) Teratoma- Cyst lined by stratified squamous epithelium,sebaceous glands, adipose tissue and keratin (H&E X100).

Condition	Number	Complications				
		Intussusception	Stricture	Perforation	Gangrene	Meconium peritonitis
Meckel's diverticulum	17	3	0	2	3	0
Intestinal atresia	16	0	0	2	2	5
Duplication cyst	3	0	0	0	0	1
Congenital bands	4	0	1	2	2	0
Blind ileal loop	1	0	0	0	1	0
Meconium-ileus	1	0	0	0	0	1
Malrotation	1	0	0	1	1	0
Tuberculosis	3	0	2	1	0	0
Fungal infection	1	0	0	1	0	1
Ascaris	1	0	0	1	1	0
Polyps	5	5	0	1	2	0
Burkitt's lymphoma	1	1	0	0	0	0
Volvulus	3	0	0	1	3	1
Perforation	2	0	0	0	0	2
Intussusception	3	1	0	0	1	0

[Table/Fig-7]: Developmental and acquired causes of intestinal obstruction in children along with their complications (n=62).

Primary presentation	Associated anomaly
Meckel's diverticulum (3 cases)	Bands
Ileal atresia	Duplication cyst
Ileal atresia	Giant cystic meconium peritonitis
Jejuna atresia (2 cases)	Giant cystic meconium peritonitis
Duplication cyst	Ileal atresia
Duplication cyst	Duodenal band
Duodenal web (2 cases)	Malrotation
Duplication cyst	Necrotising enteritis
Mature teratoma	Foregut mesenteric cyst
Volvulus	Enteric duplication cyst
Meconium ileus	Ileal atresia, giant cystic meconium peritonitis

[Table/Fig-8]: Conditions with multiple pathologies.

Preoperative/operative diagnosis	Diagnosis on histopathology
Duodenal atresia	Meckel's diverticulum
Mesenteric cyst	Intestinal duplication cyst
Duplication cyst	Cystic teratoma
Stricture	Tuberculosis
Perforation	Tuberculosis
Perforation	Fungal infection
Polyp	Burkitt's lymphoma
Intussusception	Polyp

[Table/Fig-9]: Cases with discordant preoperative/operative diagnosis and final histopathology.

DISCUSSION

A wide spectrum of developmental and acquired causes can be due to IO in paediatric population which requires prompt diagnosis and surgical intervention. These causes vary in the neonatal period and in older children. Regional variation is also seen with more number of infective causes like tuberculosis and ascariasis in developing countries [5]. [Table/Fig-10] shows comparison of age, sex ratio and clinical symptoms found in present study as compared to other studies [2,4,6]. Congenital/developmental causes of obstruction were found in 52/70 cases while acquired causes were divided as infective 5/70, neoplastic 7/70 and others 6/70 cases. Maheshwari M et al., [2] reported 58/94 congenital causes of obstruction and 36/94 as acquired causes in their study which was similar to present study.

Eight out of 10 cases presenting with intussusception were more than one year of age, nine showing lead points formed by Meckel's diverticulum, polyps and lymphoma while only one case of primary intussuception was found. This is unlike other studies because present study has analysed only surgically resected specimens [2,4,5].

Clinical presention and histopathological examination of both developmental and acquired causes of IO were analysed. MD was the commonest developmental abnormality seen in present study. 10/17 cases were seen in children more than one year of age. Soomro S and Mughal SA [4] reported 16.4% cases of MD in their study of intestinal obstruction in children older than one year and Bhedi A et al., [6] reported an incidence of 12% and Gangopadhyay AN and Wardhan H reported incidence of 3.7% [5]. Chen JJ et al., have mentioned that age, gender, inflammation and presence of ectopic gastric mucosa are factors associated with symptomatic MD [7]. Severity of the symptoms also relates with the size of MD [8]. In the present study 6/17 cases showed giant MD with size more than 5 cms long. Demonstration of cases with large size of MD, presence of ectopic gastric mucosa, bands, diverticulitis and leading point were seen in present study which explains the presentation of MD with obstruction, perforation, intussusception and gangrene.

Atresia can be divided into duodenal, jejunal, ileal and rectal and is an important cause of neonatal obstruction with some patients having

Study	Place of the study	Total number of cases	M:F ratio	% of cases in <1 year age	Symptoms			
					Abdominal distension	Vomitting	Pain	Inability to pass meconium/Constipation
Present study Talpade Y et al., (2022)	Mumbai, Maharashtra, India	70	4:3	71.43%	64.3%	50%	38.6%	28.56%
Maheshwari M et al., [2] (2016)	India	94	3.5:1	66%	61.7%	52.1%	40.4%	72.3%
Soomro S and Mughal SA [4] (2013)	Pakistan	55	2.9:1	-	81.81%	85.45%	89.09%	100%
Bhedi A et al., [6] (2017)	India	50	3:2	64%	76%	40%	34%	64%

[Table/Fig-10]: Comparison of present study with other studies [2,4,6].

associated congenital anomalies. In the present study, 16 cases of atresia all presenting with acute obstruction with 15/16 in neonatal age group were encountered. Subbarayan D et al., have reported association of atresia with duplication cysts and meconium cysts [9]. Even in present study cases of ileal atresia were associated with duplication cysts, giant cystic meconium peritonitis and meconium ileus. All were type 1 atresia and showed submucosal fibrosis. Complications seen were perforation, gangrene and meconium peritonitis. According to previous studies Maheshwari M et al., reported an incidence of intestinal atresia to be 10.8% and Bhedi A et al., of 8% in their studies [2,6].

In the present study, there were two cases of jejunal web, two cases of duodenal web and one case of pyloric web. Histopathology showed submucosal fibrosis. Lin HH et al., have described 37 cases of gastrointestinal webs [10]. Duodenal webs were associated with other congenital anomalies in 50% cases. Even in present study, both cases of duodenal web were related with malrotation.

Duplication cysts are spherical structures attached to mesenteric border of the intestine and are lined by intestinal mucosa. According to the studies incidence of duplication cysts is low with obstruction presenting as the common complication [11,12]. Two cases were lined by intestinal mucosa and one with gastric mucosa. One was associated with duodenal band and one with intestinal atresia. All patients presented in the neonatal period. One case presented with meconium peritonitis. One case diagnosed as mesenteric cyst showed features of duplication cyst on histopathological examination. There was a discordance between preoperative and histopathology examination in 2/3rd cases.

Mesenteric cysts are believed to arise due to proliferation of ectopic lymphatic tissue which lack communication with remainder of lymphatics. They are more more common in ileal mesentery. Perrot M et al., reported an incidence of 1 per 20,000. Two out of three cases presented in older children [13]. Grossly, they were large in size and showed a columnar/cuboidal lining which is different from intestinal lining of duplication cyst. Tiwari C et al., have described 14 cases of cysts of GIT origin which included mesenteric cysts and duplication cysts [11].

One case of lymphangiectatic cyst was found in present study which is a rare presentation as reported by Prabhakaran K et al., [14]. The diagnosis was possible only only on histopathological examination. Hence, histopathological examination of all cystic leisons of GIT is advisable.

Four cases of congenital bands were seen, all in more than one month age group, causing intestinal obstruction. Two of them presented with gangrene and two with perforation. Soomro S and Mughal SA reported an incidence of 7.3% causing IO, while Gangopadhyay AN and Wardhan H reported an incidence of 6.17% causing IO [4,5].

The acquired causes were more common in older age group. Among the infective causes three cases of tuberculosis presented in the ileo-caecal region with perforation and stricture which is frequently reported [15]. Fungal infection presented with complications of perforation, and peritonitis in the neonatal period. Gangopadhyay AN and Wardhan H have reported an incidence of TB in 11% cases and ascariasis in 13.58% cases [5]. A higher incidence of ascariasis causing IO has been reported by other studies as compared to the present study. This could be due to regional variation and medical treatment [5,16].

Polyps in paediatric population are less frequent than in adults [17]. All cases presented as lead points causing intussusception. On histopathology one was a Peutz's-Jeghers polyp which is common in children and the other was an adenomatous polyp. One case of cystic teratoma was diagnosed as duplication cyst preoperatively and is rarely seen [18]. The case of Burkitt's lymphoma presenting as intussusception was identified as a polyp preoperatively. Thus, histopathology was necessary in the correct diagnosis of neoplastic lesions which is necessary for further treatment [19].

Limitation(s)

Cases of functional obstruction like Hirshprung's disease have not been included in the study. Cases of obstruction with surgical reduction but no excision were also excluded. As it was a retrospective study, no follow-up of these patients could be done.

CONCLUSION(S)

The present study highlights the various developmental and acquired causes of IO in children found on surgically resected specimens. A detailed gross and microscopic examination can show the exact aetiology of obstruction, type of infection or neoplasm and presence of complications for further management. In some cases, more than one lesion can be found.

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