

Original Research Article

Intestinal atresia: histopathologist view

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Received: 15 October 2020

Revised: 22 November 2020

Accepted: 03 December 2020

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ABSTRACT

Background: Intestinal atresia forms one of a common cause for intestinal obstruction in neonates. There is a debate about its pathogenesis and many theories have been suggested. Studies regarding its clinical and histomorphological features are less in Indian literature. The present study aimed to determine the clinical and histomorphological features of cases of intestinal atresia.

Methods: Thirty-nine cases of intestinal atresia were studied both retrospectively (twenty-six) and prospectively (thirteen) over a period of two years. Their clinical and histomorphological features were studied.

Results: Intestinal obstruction was most common clinical diagnosis. Type II atresia was most common. Ileal atresia was highest in number. Associated congenital anomalies noted were situs inversus with splenunculi, patent vitelo-intestinal duct, duplication cyst, Meckel's diverticulum, ileocecal web, duodenal web and omphalocele. Histological features such as inspissated meconium, calcification, ulceration, fibrosis, thick-walled vessels, edema were noted.

Conclusions: Findings such as mucosal edema, congestion, ulceration, submucosal edema, thick-walled blood vessels, fibrosis, hemorrhage, transmural ischemia, calcification, suggest that an intra vascular accident may be responsible for origin of the atresia.

Keywords: Colon, Congenital anomaly, Ileum, Intestinal atresia, Inspissated bile, Jejunum

INTRODUCTION

Intestinal atresia is the second most common congenital malformation for intestinal obstruction.¹ It can involve any portion of bowel and is associated with wide variety of congenital anomalies.² There is debate about its etiopathogenesis. A hypothesis of intra uterine mesenteric vascular accident has been demonstrated by Louw and Barnard.³ Second is Tandler's theory of lack of revacuolisation of solid cord stage of intestinal development.⁴

The present study was carried out to analyse the spectrum of clinical presentations, associated anomalies and histomorphological features in cases of intestinal atresia and to suggest its possible pathogenesis.

METHODS

The present study was both retrospective (1st January 2018 to 30th June 2019) and prospective (1st July 2019 to 31st December 2019).

Inclusion criteria

Cases with final histological diagnosis of intestinal atresia were included.

Exclusion criteria

Those cases where intestinal obstruction was due to intussusception, volvulus, meconium ileus and Hirschprung's disease were excluded from the study.

In retrospective study, twenty six cases could be traced out from the departmental record. Gross description of the surgically resected specimens was retrieved from the record. The stained slides and paraffin blocks were available for review. In the prospective study, there were thirteen cases and the gross features of the resected specimens were recorded, appropriate tissue blockings were sampled. Hematoxylin and eosin stained slides and any special stains whenever required were used. A total of thirty nine cases were included in the study. Clinical details including any associated congenital anomalies were noted. Intestinal atresia was classified according to Martin and Zerella classification.^{5,6} Type I- septal atresia, Type II- fibrous cord joining atretic ends, Type IIIa- atretic ends separated by V shape mesenteric defect, Type IIIb- apple peel or Christmas tree atresia, Type IV- multiple atresia (string of sausages). Histological features studied were complete obliteration or extent of narrowing of the affected intestinal lumen, presence of inspissated meconium, calcification, hemosiderin laden macrophages, mucosa at the site of atresia and the adjoining area, fibrosis, thick walled blood vessels, thinning or hypertrophy of the muscularis propria, features of serositis, edema, congestion and hemorrhage. These features were studied in different layers of the wall of intestine.

Statistical analysis

Statistical tool used was Microsoft (MS) excel. The data was compiled and entered in Microsoft excel. Descriptive statistics were computed. Data was presented as mean, ranges, numbers, ratios and percentage.

RESULTS

Out of total thirty nine cases of intestinal atresia, twenty six cases were retrospective and thirteen were prospective. Majority of the patients presented in the first week of life with mean age of three days (Table 1). There were twenty five males and fourteen females with M:F of 1.8:1. Most common clinical diagnosis was intestinal obstruction in twenty nine (73%) patients, rest had perforation i.e. in eight (20%) cases, volvulus in one (3.5%) and peritonitis in one (3.5%). Ileal atresia was most common and seen in twenty three cases (59%); second most common was jejunal atresia seen in ten cases (25.4%), (Figure 1A). There were two (5.2%) cases of colonic atresia, and one each (2.6%) of duodeno-jejunal, ileo-jejunal and rectal atresia. In one case (2.6%), the exact site of atresia or the radiological details were not available, however microscopy showed small intestinal mucosa with atresia. Cases were grossly classified into Type I- three (8%), Type II- twelve (32%), Type IIIa- two (5%), Type IIIb- five (13%), and Type IV- five (13%). Three cases of the type II atresia had associated anomalies like- patent vitelo-intestinal duct in one, omphalocele in one and duplication cyst in one case. Type IIIb cases had associated situs inversus with splenunculi in one and Meckel's diverticulum in another

case. One type IV anomaly also had associated Meckel's diverticulum (Table 1).

Out of the twenty six retrospective cases, exact typing could not be carried out in twelve cases (30.7%) due to lack of detail grossing and the specimens were received in two or more fragments. The site of atresia in these twelve cases was- five of jejunal atresia, four of ileal atresia, one each of colon and rectum, and one of unknown site. Histology in these twelve cases confirmed the respective sites mentioned in the gross and the one of unknown site was found to be of small intestine in origin. On microscopy one case of ileal atresia showed complete obliteration of lumen, (Figure 1B). Two ileal atresia cases and one jejunal atresia case showed luminal calcification. Two cases of ileal atresia showed inspissated meconium in the lumen and one case of jejunal atresia showed hemosiderin laden macrophages in the lumen. Mucosa showed ulceration in two cases of ileal atresia. Focus of antral metaplasia was noted in one case of jejunal atresia. Mucosal congestion and edema noted in three cases of ileal, jejunal and colonic atresia. Submucosa showed congestion in seven cases, edema in four, thick walled blood vessels in three, fibrosis in three and hemorrhage in one. Muscularis propria was thinned out in eight cases and showed hypertrophy in four cases, along with edema in one, hemorrhage in one and fibrosis in one case. Serositis was noted in three cases along with thick walled blood vessels in one case. Serosal congestion was noted in two, fibrosis and edema in one case, (Figure 1C, 1D).

Out of thirteen prospective cases, ten cases were of ileal atresia, two of jejunal and one of colonic atresia. Further six cases were of type II atresia, three cases of type IV atresia and two cases each of Type IIIa and IIIb atresia. Of these thirteen cases two cases of ileal atresia showed inspissated meconium in the lumen. Two cases of ileal atresia showed luminal calcification and foci of mucosal ulceration. Hemosiderin laden macrophages in the lumen and complete luminal obliteration were noted in one case each of ileal atresia. Five cases showed fibrosis, one in mucosa, two each in muscularis propria and serosa. Eight cases showed congestion, one in mucosa, three in submucosa and four in serosa. Two cases of ileal atresia showed thick walled blood vessels in submucosa. Seven cases showed thinning of muscularis propria and four cases showed its hypertrophy. Serositis was seen in two cases of ileal and one case of colonic atresia.

Morphological and histological features of all thirty nine cases studied along with their clinical findings and correlation are shown in Table 2. Eight cases of total thirty nine had associated congenital anomalies. Situs inversus with splenunculi (one case) and Meckel's diverticulum (two cases) were associated with jejunal atresia. Patent vitelo-intestinal duct (one case), duplication cyst (one case), duodenal web (one case), and omphalocele (one case) were associated with ileal atresia. Whereas ileocecal web (one case) was associated with colonic atresia.

Table 1: Clinical features studied in cases of intestinal atresia (total number of cases, n=39).

Age of presentation (no. of cases, %) n=39	Type of atresia (No. of cases, %) n=39						Site of atresia (No. of cases, %) n=39							Associated anomalies (no. of cases, %)
	Type I	Type II	Type IIIa	Type IIIb	Type IV	Un - classified	Duodeno jejunal	Ileo jejunal	Jejunum	Ileum	Colon	Rectum	Site not known	
In 1st week (17), 42.50%	3, (7.5)	5, (12.5)	-	2, (5)	-	7, (18)	-	-	6, (15)	9, (23)	1, (2.5)	-	1, (2.5)	4, (10)
In 2nd week (12), 30.0%	-	4, (10)	-	2, (5)	4, (10)	2, (5)	1, (2.5)	-	1, (2.5)	9, (23)	1, (2.5)	-	-	2, (5)
In 3rd week (3), 10.0%	-	1, (2.5)	1, (2.5)	-	-	1, (2.5)	-	1, (2.5)	2, (5)	-	-	-	-	-
In 4th week (2), 5.0%	-	1, (2.5)	-	1, (2.5)	-	-	-	-	-	2, (5)	-	-	-	-
In 5th week (1), 2.5%	-	-	1, (2.5)	-	-	-	-	-	-	1, (2.5)	-	-	-	-
At 5 months (1), 2.5%	-	1, (2.5)	-	-	-	-	-	-	-	1, (2.5)	-	-	-	1, (2.5)
At 6 months (1), 2.5%	-	-	-	-	1, (2.5)	-	-	-	1, (2.5)	-	-	-	-	1, (2.5)
At 1 year (2), 5.0%	-	-	-	-	-	2, (5)	-	-	-	1, (2.5)	-	1, (2.5)	-	-

Table 2: Correlation of clinical and morphological features in cases of intestinal atresia, (total number of cases, n=39).

Morphological features studied at atretic site	Site of atresia (No. of cases, %)						Type of atresia (No. of cases, %)						Site in atretic segment (No. of cases, %)					
	Duodeno-jejunal	Jejunum	Ileum	Colon	Rectum	Site not known	Type I	Type II	Type IIIa	Type IIIb	Type IV	Unclassified	Lumen	Mucosa	Sub mucosa	Muscularis propria	Serosa	
Inspissated meconium	-	2 (5)	7 (18)	-	-	-	1 (2.5)	3 (7.5)	-	-	2 (5)	2 (5)	9 (23)	-	-	-	-	
Complete obliteration	-	4 (10)	1 (2.5)	-	-	-	-	-	1 (2.5)	2 (5)	1 (2.5)	1 (2.5)	5 (17)	-	-	-	-	
Calcification	-	3 (7.5)	2 (5)	-	-	-	-	1 (2.5)	-	2 (5)	1 (2.5)	1 (2.5)	5 (17)	-	-	-	-	
Hemosiderin laden macrophages	-	-	1 (2.5)	-	1 (2.5)	-	1 (2.5)	-	1 (2.5)	-	-	-	2 (5)	-	-	-	-	
Foci of ulceration	-	-	7 (18)	-	-	-	1 (2.5)	2 (5)	1 (2.5)	-	1 (2.5)	2 (5%)	-	7 (18)	-	-	-	
Hemorrhage	-	1 (2.5)	6 (15)	-	-	-	2 (5)	3 (7.5)	-	-	-	2 (5)	-	1 (2.5)	2 (5)	1 (2.5)	5 (12.5)	
Antral metaplasia	-	1 (2.5)	-	-	-	-	-	-	-	-	-	1 (2.5)	-	1 (2.5)	-	-	-	
Fibrosis	1 (2.5)	6 (15)	9 (23)	-	-	1 (2.5)	1 (2.5)	4 (10)	2 (5)	4 (10)	1 (2.5)	5 (12.5)	-	1 (2.5)	8 (20.5)	5 (12.5)	4 (10)	
Congestion	1 (2.5)	6 (15)	18 (46)	1 (2.5)	1 (2.5)	1 (2.5)	3 (7.5)	8 (20.5)	-	4 (10)	4 (10)	9 (23)	-	5 (12.5)	17 (43.5)	-	8 (20.5)	
Edema	-	7 (18)	13 (33.3)	1 (2.5)	1 (2.5)	-	1 (2.5)	7 (18)	-	1 (2.5)	5 (12.5)	8 (20.5)	-	10 (25)	13 (33.3)	2 (5)	1 (2.5)	
Thick walled blood vessels	-	2 (5)	6 (15)	1 (2.5)	1 (2.5)	-	-	3 (7.5)	1 (2.5)	-	2 (5)	4 (10)	-	-	7 (18)	-	3 (7.6)	
Thinning (muscularis p.)	1 (2.5)	5 (12.5)	13 (33.3)	1 (2.5)	1 (2.5)	1 (2.5)	1 (2.5)	8 (20.5)	1 (2.5)	1 (2.5)	4 (10)	7 (18)	-	-	-	22 (56)	-	
Hypertrophy (muscularis p.)	-	6 (15)	10 (25.6)	1 (2.5)	-	-	2 (5)	4 (10)	1 (2.5)	4 (10)	1 (2.5)	5 (12.5)	-	-	-	15 (43.5)	-	
Serositis	-	4 (10)	6 (15)	1 (2.5)	-	-	2 (5)	3 (7.5)	1 (2.5)	1 (2.5)	1 (2.5)	3 (7.5)	-	-	-	-	11 (28)	

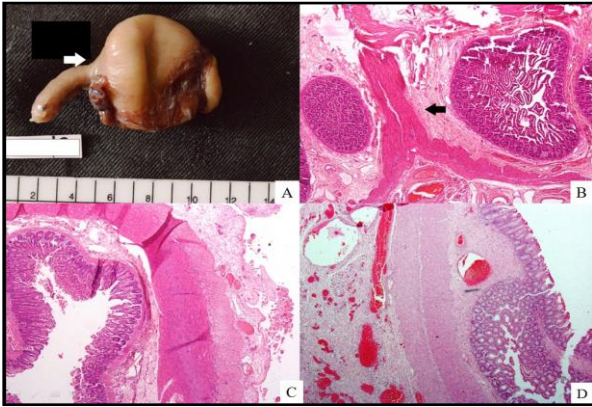


Figure 1: A) Gross photograph shows site of jejunal atresia (arrow). The atretic segment measures 1.5 cm in length with complete luminal obliteration of one end (left side). Adjacent segment is dilated (right side); B) Narrowed lumen with complete atresia and infolding of muscularis propria (arrow). Submucosa shows fibrosis. ($\times 40$, H and E); C) Atretic segment with intact small intestinal mucosa. Submucosa is edematous. Congested vascular spaces noted in serosa. ($\times 40$, H and E); D) Atretic segment shows intact colonic mucosa with dilated and congested vessels in submucosa and serosa. ($\times 40$, H and E).

DISCUSSION

Intestinal atresia is among the most common causes of intestinal obstruction in neonates.⁷ Its incidence is one in 5,000 newborns.⁸ Common presenting symptoms are bilious vomiting and failure to pass meconium. Approximately 75% of all intestinal stenosis and 40% of all intestinal atresias are duodenal.⁹ Although incidence of jejunum and ileum involvement is equal in some studies, approximately one third of atresia involve the proximal jejunum, one third the distal ileum and the remaining one third all other segments.¹⁰ The numbers may vary from study to study. In the present study, 59% cases involved ileum, 25.4% involved jejunum and 2.6% ileo-jejunum, making ileum the most common site. Intestinal atresias can be classified into Type I- septal atresia, Type II- fibrous cord joining atretic ends, Type IIIa- atretic ends separated by V shape mesenteric defect, Type IIIb- Apple peel or Christmas tree atresia, Type IV- multiple atresias (string of sausages).^{5,6} In our study Type II (32%) was most common. Various congenital anomalies associated with intestinal atresia are known. Duodenal atresias are more commonly associated with the hepatobiliary and pancreatic abnormalities in foregut portion because of its close proximity to the biliary and pancreatic ducts.⁹ The later portion is associated with malrotation and midgut volvulus.⁸ Present study had one case of duodeno-jejunal atresia, which was associated with Meckel's diverticulum. In cases, clinically where there are ulcers of the umbilical cord, the suspicion of duodenal or proximal jejunal atresia should be kept.¹¹ Many congenital anomalies also have been associated with jejuno-ileal atresia, however the frequency is lower than other sites.¹²

Our study had 56% cases of ileal, 26% jejunal and 3% ileo-jejunal atresias. Ileal atresia had associated patent vitelo-intestinal duct (one case), duplication cyst (one case), duodenal web (one case) and omphalocele (one case), whereas jejunal atresia had associated situs inversus with splenunculi (one case) and Meckel's diverticulum (two cases). Occasionally multiple atresias can be accompanied by malrotation, which makes them important because the malrotation may be diagnosed and corrected, however the atresia can be missed.¹³ Colonic atresia is rare, with reported incidence of one in 66,000 live births.¹⁴ Almost fifty percent of the cases reported to have associated with congenital anomalies such as abdominal wall defect, multiple intestinal atresia, Hirschsprung's disease and malrotation along with musculoskeletal, ocular and facial anomalies.¹⁵ In our study we had five percent cases of colonic atresia, which were associated with ileocecal and duodenal web. Anorectal atresias have incidence of one in 4,000 live births.¹⁶ Our study had one case without any associated anomaly. Studies on the histological features of atretic segments are limited. On microscopic examination thick walled blood vessels were noted in ten cases in the submucosa and serosa. Two cases were associated with transmural ischemia, of which one case had thick walled blood vessels in submucosa and subserosa. No significant inflammatory infiltrate was noted in the intestinal wall. No thrombi or features of vasculitis or any atherosclerotic changes were noted. Vascular proliferation and haemangiomas complicating as intestinal atresia are documented in the literature.^{17,18} However our study had none. Mucosal ulceration with replacement of the lamina propria by granulation tissue containing hemosiderin-laden macrophages has been described, supporting the suggestion that an interruption of blood supply may be causative.¹⁹ Flattening of villi may be seen. Muscularis mucosa and submucosa show fibrosis. In complete atresia the bowel is proximally dilated and can be complicated with gangrene.²⁰ There are numerous theories pointing towards the possible cause of atresia.^{21,22} The theory that developing epithelial cells normally occlude the lumen at one stage of development and fail to break down or the other one suggesting that at some stage, epithelial proliferation fails to keep pace with longitudinal growth seem to be excluded by the finding of bile, squames and lanugo hairs distal to atretic segments.^{23,24} These findings indicate that a lumen was originally present and subsequently it became occluded.²⁵ The currently accepted explanation, which is supported by experimental evidence from the ligation of mesenteric vessels in dogs, is that the interruption of the blood supply occurs locally, due to either intrauterine intussusception or splanchnic shunting of blood in intrapartum asphyxia.^{3,20,26}

However, a limitation noted was lack of radiological findings, detail grossing and specimens which were received in two or more fragments in twelve cases. Exact typing in these twelve cases could not be done. This could have led to underestimation of percentage of the types of atresia in present study.

CONCLUSION

Intestinal atresia is a common cause of intestinal obstruction in neonates. It is associated with spectrum of other congenital anomalies. Pathogenesis of atresia is till date debatable and many theories have been suggested. Findings such as mucosal edema, congestion, ulceration, submucosal edema, thick walled blood vessels, fibrosis, hemorrhage, transmural ischemia and calcification are more in favor of an intra vascular accident, which may be responsible for pathogenesis of atresia.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

- Ratan SR, Rattan KN, Pandey RM, Sehgal T, Kumar A, Ratan J. Surgically treated gastrointestinal obstruction in children: causes and implications. *Indian J Gastroenterol.* 2006;25(6):320-2.
- Adams SD, Stanton MP. Malrotation and intestinal atresias. *Early Hum Dev.* 2014;90(12):921-5.
- Louw JH, Barnard CN. Congenital intestinal atresia: observations on its origin. *Lancet.* 1955;269(68899):1065-7.
- Rao KL, Chowdhary SK, Suri S, Narasimhan KL, Mahajan JK. Duodenal atresia: Outcome analysis from a regional neonatal center. *Indian Pediatr.* 2001;38:1277-80.
- Martin LW, Zerella JT. Jejunoileal atresia: a proposed classification. *J Pediatr Surg.* 1976;11(3):399-403.
- Martin CE, Leonidas JC, Amoury RA. Multiple gastrointestinal atresias, with intraluminal calcifications and cystic dilatation of bile ducts: a newly recognized entity resembling "a string of pearls". *Pediatrics.* 1976;57:268-71.
- Tuschka O, Hyde D. Intestinal obstruction in newborn. *WJM Calif Med.* 1956;84(4):237-41.
- Burjonrappa S, Crete E, Bouchard S. Comparative outcomes in intestinal atresia: a clinical outcome and pathophysiology analysis. *Pediatr Surg Int.* 2011;27(4):437-42.
- Ando H, Kaneko K, Ito F, Seo T, Harada T, Watanabe Y. Embryogenesis of pancreaticobiliary maljunction inferred from development of duodenal atresia. *J Hepatobil Pancreat Surg.* 1999;6(1):50-4.
- Dalla Vecchia LK, Grosfeld JL, West KW, Rescorla FJ, Scherer LR, Engum SA. Intestinal atresia and stenosis: a 25-year experience with 277 cases. *Arch Surg.* 1998;133(5):490-7.
- Ohyama M, Itani Y, Yamanaka M, Imaizumi K, Nishi T, Ijri R, et al. Umbilical cord ulcer: a serious in utero complication of intestinal atresia. *Placenta.* 2000;21(4):432-5.
- Huff DS. Developmental anatomy and anomalies of the gastrointestinal tract, with involvement in major malformative syndromes. In: Russo P, Ruchelli E, Piccoli D, eds. *Pathology of Pediatric Gastrointestinal and Liver Disease.* New York: Springer; 2004:3-37.
- Knutrud O, Eek S. Combined intrinsic duodenal obstruction and malrotation. *Acta Chir Scand.* 1960;119:506-17.
- Davenport M, Bianchi A, Doig CM, Gough DC. Colonic atresia: current results of treatment. *J R Coll Surg Edinb.* 1990;35(1):25-8.
- Etensel B, Temir G, Karkiner A, Melek M, Edirne Y, Karaca I, et al. Atresia of the colon. *J Pediatr Surg.* 2005;40(8):1258-68.
- Herman RS, Teitelbaum DH. Anorectal malformations. *Clin Perinatol.* 2012;39(2):403-22.
- Elefant E, Jeklerova J, Le Breux L. Intestinal obstruction in a newborn with congenital atresia and volvulus caused by haemangioma of the small bowel. Case report. *Clin Pediatr.* 1970;9(5):287-9.
- Heycock JB, Dickinson PH. Haemangiomas of the intestine. *Br Med J.* 1951;1(4707):620-1.
- Louw JH. Congenital intestinal atresia and severe stenosis in the new born. *S Afr J Clin Sci.* 1952;3:209-34.
- DeSa DJ. Congenital stenosis and atresia of the jejunum and ileum. *J Clin Pathol.* 1972;25(12):1063-70.
- Louw JH. The pathogenesis of congenital abnormalities of the digestive tract. *S Afr Med J.* 1967;2:1057.
- Walker K, Badawi N, Hamid CH, Vora A, Halliday R, Taylor C, et al. A population-based study of the outcome after small bowel atresia/stenosis in New South Wales and the Australian Capital Territory, Australia 1992–2003. *J Pediatr Surg.* 2008;43(3):484-8.
- Feggetter S. Congenital intestinal atresia. *Br J Surg.* 1955;42:378.
- Morison JE. *Fetal and Neonatal Pathology*, 2nd edn. London: Butterworths; 1963.
- Santulli TV, Blanc WA. Congenital atresia of the intestine. Pathogenesis and treatment. *Ann Surg.* 1961;154(6):939-48.
- Gaillard D, Bouvier R, Scheiner C, Nessmann C, Delezoide AL, Dechelotte P, et al. Meconium ileus and intestinal atresia in fetuses and neonates. *Pediatr Pathol Lab Med.* 1996;16(1):25-40.

Cite this article as: Shweta S, Vaiphei K. Intestinal atresia: histopathologist view. *Int Surg J* 2021;8:226-31.