Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/13964
DOI URL: http://dx.doi.org/10.21474/IJAR01/13964

*RESEARCH ARTICLE*

# HISTOMORPHOLOGICAL FINDINGS AND CLINICO-RADIOLOGICAL CORRELATION OF INTESTINAL ATRESIA AT A TERTIARY CARE CENTRE

**Dr. Kumari Sunita Bharati[1], Dr. Sanjeet Kumar Singh[2], Dr. Kalpana Chandra[3], Dr. Zaheer Hasan[4] and Dr. Umakant Prasad[5]**

1. Senior Resident, Department of Pathology, IGIMS, Patna.
2. Additional Professor, Department of Pathology, IGIMS, Patna.
3. Assistant Professor, Department of Pathology, IGIMS, Patna.
4. Additional Professor, MCH, Department Pediatric Surgery, IGIMS, Patna.
5. Associate Professor, Department of Radiology, IGIMS, Patna.

## Manuscript Info

***Manuscript History***
Received: 20 October 2021
Final Accepted: 24 November 2021
Published: December 2021

***Key words:-***
Intestinal Atresia, Congenital, Gastrointestinal Tract, Mucosa, Edema

## Abstract

**Background:** An atresia is a congenital defect of a hollow viscus that results in complete obstruction of the lumen. Intestinal atresia is one of the most frequent causes of bowel obstruction in the newborn and can occur at any point in the gastrointestinal tract. This study was undertaken to study the histomorphological findings of intestinal atresia and to correlate it with different subtypes and clinico-radiological feature.

**Material and methods:** This was a prospective observational study conducted in 24 months on the resected gastrointestinal tract of 40 neonatal intestinal obstruction cases admitted in Pediatric surgery ward received in the Department of Pathology, Indira Gandhi Institute of Medical Sciences, Patna. Control Group- A total of 5 cases of vitello-intestinal duct patency were taken as control and compared with the study group.

**Results:** With respect to total 40 cases, there were six, i.e. 15.0% female babies and 34, i.e. 85.0% male babies studied. Out of that, 15 i.e. 37.50% were full term and 25, i.e. 62.5% were premature. Mucosa showed oedema, ulceration and flattening in 9 cases. Apart from flattening and oedema, mucosa was denuded at some places and also showed congestion and extravasated blood in 6 cases each. Abnormal villus configuration, calcium deposition in 4 cases each and hypertrophied mucosa were found in 3 cases. Luminal narrowing, loss of mucosa, duplication of mucosa and gangrenewere found in one case each. Sub mucosal changes showed congestion in 33 cases, oedema in 15, Fibrosis in 4, thickened submucosa in 2 cases and dilated irregular branching blood vessels, extravasted blood, calcification in 1 case each. Muscularispropria having changes i.e. thinning in 16 cases, congestion, hypertrophy in 4 cases each, focal loss in 3 cases, calcification in 2 cases and thinning in 2 cases. Similarly, histopathological changes in serosa shows serositis in 16 cases, congestion in 11 cases and thinning in 3 cases. Oedema and congestion were present in 2 cases, hypertrophy and calcification in 1 case each.

**Corresponding Author:- Dr. Kumari Sunita Bharati, Senior Resident**
Address:- Department of Pathology, IGIMS, Patna.

**Conclusion:**In this study spectrum of histomorphological changes in the atretic segment has been described. Histomorphological changes at atretic segment can be valuable to surgeons in deciding the type of surgery and minimizing the postoperative intestinal dysmotility, which remains the most common complication of intestinal atresia.



……

## Introduction:-

An atresia is a congenital defect of a hollow viscus that results in complete obstruction of the lumen. Intestinal atresia is one of the most frequent causes of bowel obstruction in the newborn and can occur at any point in the gastrointestinal tract [1]. The reported incidence of intestinal atresia ranges from 1.3 to 3.5 per 10,000 live births of which approximately 20 percent have associated anomalies vary by anatomical site. Duodenal atresia occurs in approximately 50 percent of small intestinal atresia [1]. It is characterized by obliteration of bowel lumen and its replacement by fibrous cord that connects the proximal and distal segment. It can involve any portion of small bowel and distal segment. It can involve any portion of small bowel [2].The morphological classification into four types according to Grosfeld Modification of Louw's classification 1979 has both prognostic and therapeutic implications.

Type I atresia (23%) is a transluminal septum with proximal dilated bowel in continuity with collapsed distal bowel. The bowel is usually of normal length. Type II atresia (10%) involves two blind-ending atretic ends separated by a fibrous cord along the edge of the mesentery with mesentery intact. Type IIIa atresia (15%) is similar to type II, but there is a mesenteric defect and the bowel length may be foreshortened. Type IIIb atresia (19%) ("Apple peel" or "Christmas tree" deformity) consists of a proximal jejunal atresia, often with malrotation with absence of most of the mesentery and a varying length of ileum surviving on perfusion from retrograde flow along a single artery of supply. Type IV atresia is a multiple atresia of types II, III, and I like a string of sausages. Bowel length is always reduced. The terminal ileum, as in type III, is usually spared [3].

It most commonly presents within first week of life with complaints of bilious vomiting, not passing meconium since birth and absence peristalsis. Complication included gangrene, perforation and meconium peritonitis and at times fungal infection (Mucormycosis) [4].The management of intestinal atresia has greatly improved in recent decades due to refinements in neonatal intensive care, operative technique, use of total parenteral nutrition and neonatal anesthesia [5]. Outcome of the intestinal atresia following surgical repair is very good. In general, morbidity and mortality depend upon associated medical conditions such as prematurity or cystic fibrosis, other congenital anomalies, the complexity of the lesion, and surgical complications [6].This study was undertaken to study the histomorphological findings of intestinal atresia and to correlate it with different subtypes and clinico-radiological feature.

## Objectives:-

To evaluate clinical characteristic and radiological signs of intestinal atresia, to study the gross morphological features of different sub types of intestinal atresia and to study the histopathological findings of different atresia.

## Material and methods:-

This was a prospective observational study conducted on the resected gastrointestinal tract specimen fixed in buffered 10% formalin of 40 neonatal intestinal obstruction cases admitted in Pediatric surgery ward of either sex received in the Department of Pathology,Indira Gandhi Institute of Medical Sciences,Patna, Bihar. Ethical committee approval was obtained from ethics committee for Post Graduate Studies of government medical college & tertiary care centre. The confidentiality of the study participants was ensured.

Examination was done as following:

1. Gross morphology – Clinical examination of the resected intestinal specimen was done meticulously to classify and subtype the intestinal atresia. After noting the relevant findings, proper sectioning of the intestine was performed, with special care to take sections from the resected margins and the fibrotic or atretic segment.
2. Histomorphology evaluation –

• The biopsy specimen was processed using Thermo Fischer Scientific processor.
• The section was embedded in paraffin wax, labelled and block were made.

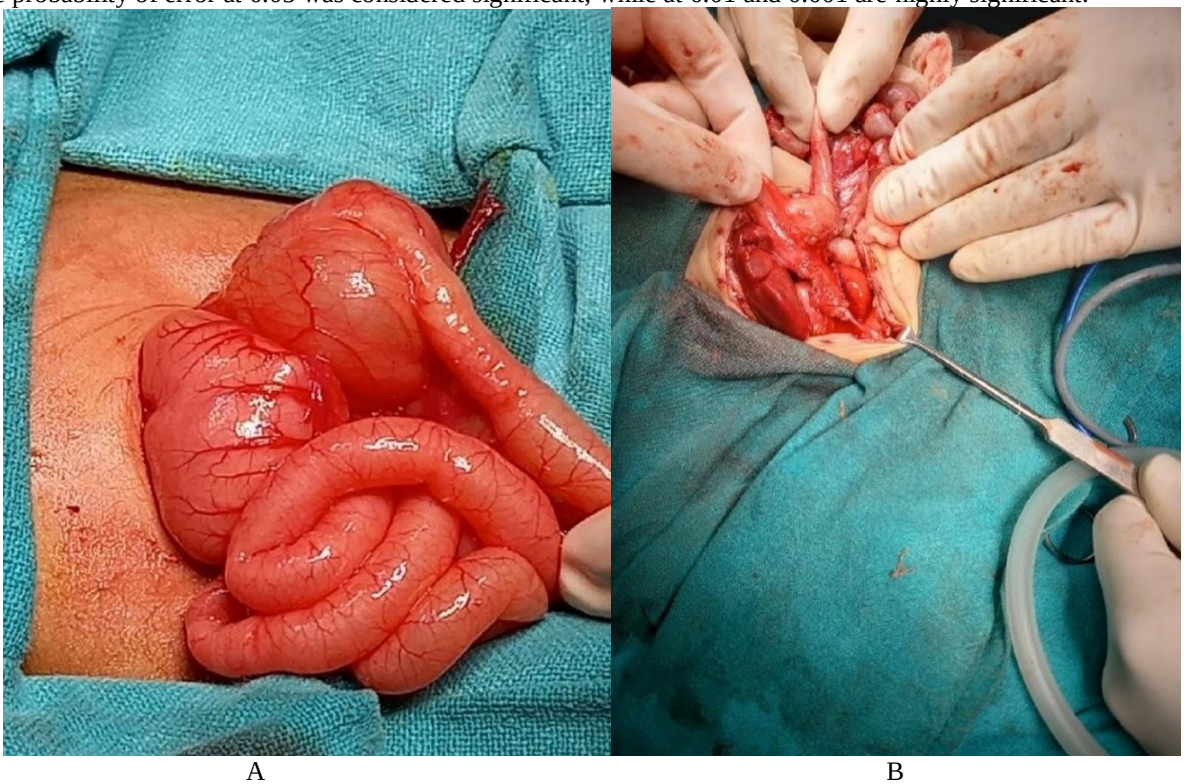
• The section was cut using "Leica rotatory microtome at a setting of 4µm''.
• The section was floated on water bath at $60^0$ c.
• The section were mounted on a slide which was precoated with glycerol egg albumin.
• Four serial section of biopsy was prepared. One of them was stained with hematoxylin-eosin and three others subjected to special stains.
3. Special stain - Masson trichrome, Von Kossa and Perl's staining had been done to demonstrate fibrosis, calcification and hemorrhage.
4. Radiological evaluation was done in the radiology department with the help of radiologist.

**Duration of the study:**
24 months.

**Inclusion criteria:**
Cases of neonatal intestinal obstruction.

**Exclusion criteria:**
Cases where intestinal obstruction was due to intussusception, volvulus, meconium ileus, malrotation and Hirschsprung's disease and inability to give consent.Control Group- A total of 5 cases of vitello-intestinal duct patency were taken as control and compared with the study group.

**Data entry and analysis:**
All the data was tabulated and analysed with appropriate statistical tools "SPSS 25th version". Data was presented as a mean with standard deviation or proportions as appropriate. Mean, standard deviation and variance was calculated and following statistical significance tests was applied."Chi – square Test" and "Fisher's exact test" was used for statistical significance test.Student's T-test was used as the statistical tool to test for significance of observed mean differences. The calculated value, finally was compared with the tabulated value at particular degree of freedom and finds the level of significance. A "p-value" was considered to be non-significant if > 0.05 and significant if <0.05. The probability of error at 0.05 was considered significant, while at 0.01 and 0.001 are highly significant.



A B

**Fig 1:-** (A) Nature of surgery - Laparotomy and (B) Resections of proximal and distal atretic segment and ends to back anastomosis.


**Fig 2:-** Image of part of gut (10 cm in length), one end of the gut is 1.6 cm diameter and the end is blind.

## Results:-

A prospective observational study conducted on the resected gastrointestinal tract specimen fixed in buffered 10% formalin of 40 neonatal intestinal obstruction cases admitted in Pediatric surgery ward of either sex received in a tertiary care centre. Among 40 patients of bowel atresia were operated and analysed which resulted in 40 patients, 2 had Jejuno-Ileal Atresia, 17 had ileal atresia and 14 had jejunal atresia and 7 had large bowel atresia.

**Table 1:-** Age analysis of studied cases.

| Variable | Age (Days)n=40 |
|---|---|
| Sample size | 40 |
| Lowest value | 1 |
| Highest value | 20 |
| Geometric mean | 6.1250 |
| 95% CI for the Geometric mean | 4.9586 to 7.5658 |
| 95% CI for the median | 5.0000 to 8.6478 |
| Coefficient of Skewness | -0.4668 (P=0.2002) |
| Coefficient of Kurtosis | 0.1679 (P=0.6445) |
| 95% CI of Trimmed mean | 5.0249 to 7.7261 |

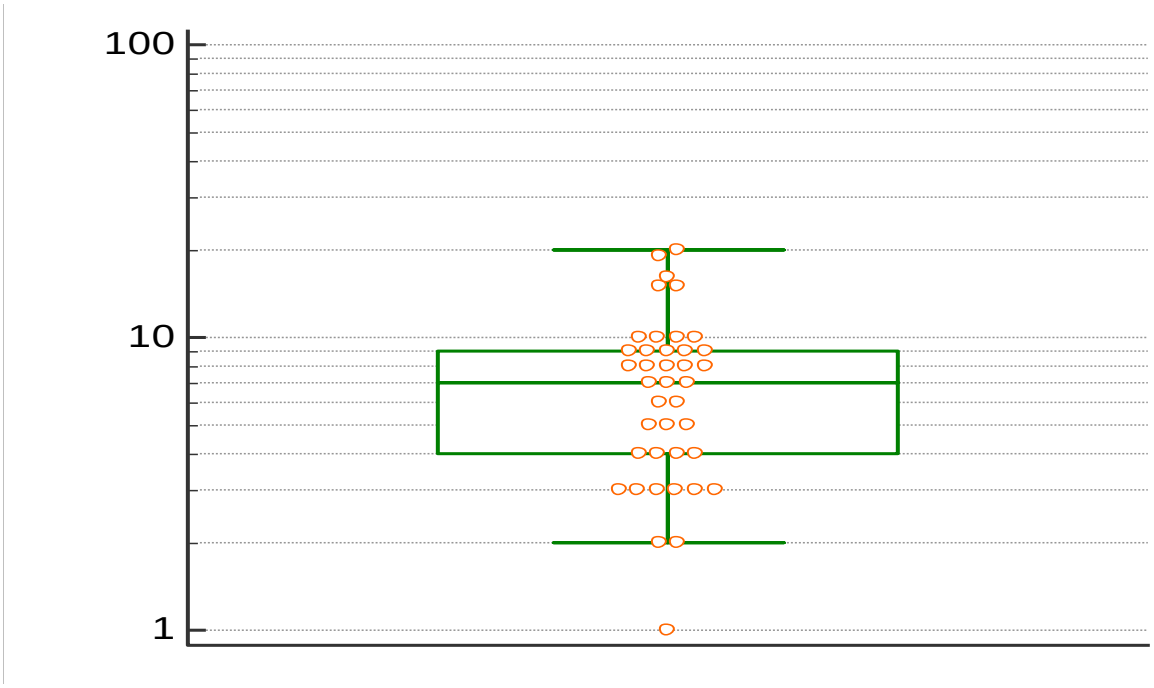



**Fig 3:-** Box-and-Whisker plot for age of studied cases.

**Table 2:-** Correlational between age, weight and maturity of studied patients

| | Age (days) | | Weight (Kg) | |
|---|---|---|---|---|
| Maturity | Full term | Premature | Full term | Premature |
| N | 15 | 25 | 15 | 25 |
| Minimum | 2 | 1 | 2 | 1.70 |
| Maximum | 20 | 10 | 3.5 | 2.70 |
| Mean | 10.60 | 5.520 | 2.927 | 2.16 |
| 95% CI | 6.337 to 12.921 | 3.844 to 6.111 | 2.659 to 3.153 | 2.041 to 2.268 |
| Median | 10 | 5 | 3 | 2.1 |
| Variance | 28.9714 | 6.6767 | 0.1821 | 0.075 |
| SD | 5.3825 | 2.5839 | 0.4267 | 0.2750 |
| 25 - 75 P | 7.250 to 15.0 | 3.000 to 8.0 | 2.550 to 3.150 | 2.000 to 2.425 |
| Normal Distr. | 0.0709 | 0.0902 | 0.0255 | 0.0623 |

**Table 3:-** Correlational between maturity and gender of studied patients.

| Maturity | Sex | | | | Total | |
|---|---|---|---|---|---|---|
| | F | | M | | | |
| | Number | % | Number | % | Number | % |
| Full term | 2 | 5.0 | 13 | 32.5 | 15 | 37.5 |
| Premature | 4 | 10.0 | 21 | 52.5 | 25 | 62.5 |
| Total | 6 | 15.0 | 34 | 85.0 | 40 | 100.0 |
| Chi-squared | 0.051 | | | | | |
| Significance level | P = 0.8214 | | | | | |

With respect to table number 3, there were six, i.e. 15.0% female babies and 34, i.e. 85.0% male babies studied.Out of that, 15 i.e. 37.50% were full term and 25, i.e. 62.5% were premature. Result is statistically not significant as p value >0.05.

**Table 4:-** Distribution of studied cases based on clinical findings.

| Clinical findings | | Number of patients | Percentage |
|---|---|---|---|
| Feeding pattern | Feeding | 03 | 07.50% |
| | Not feeding | 19 | 47.50% |
| | Feeding + vomiting | 18 | 45.00% |
| Abdominal distension | | 40 | 100.00% |
| Bilious vomiting | | 35 | 87.50% |
| Not passing meconium | | 19 | 47.50% |
| Jaundice | | 25 | 62.50% |

*clinical findings were overlapping

Table 4 shows that with respect to feeding habits, there were 3 cases noted having normal feeding, 19 children presented with refusal of feeding and rest 18 were found to have vomiting after feeding. On examination, all 40 cases were found to have abdominal distension. On enquiry, it was found that 19 cases had not passed meconium since birth. Bilious vomiting noted in 35 cases and jaundice were present in 25 children.

**Table 5:-** Representing types of atresia based on gross findings.

| Type of atresia | | Number pf patients | Percentage |
|---|---|---|---|
| I | | 16 | 40.00% |
| II | | 2 | 05.00% |
| III | III A | 8 | 20.00% |
| | III B | 3 | 07.50% |
| IV | | 11 | 27.50% |

**Table 6:-** Other associated findings on gross examination.

| Gross findings | Number pf patients | Percentage |
|---|---|---|
| Congestions | 31 | 77.50% |
| Perforation | 12 | 30.00% |
| Gangrene | 3 | 07.50% |
| Meconium pseudocyst | 1 | 02.50% |
| Pouching gut | 1 | 02.50% |
| Duplication cyst | 1 | 02.50% |
| Meconium cyst | 1 | 02.50% |

*findings were overlapping

With reference to Table no. 5 & 6, it showstypes of atresia based on gross findings and found that 16 cases (40.0%) had type 1 atresia, 2 cases (05.0%) type 2 atresia, 8 cases (20.0%)type 3a,3 cases (07.50%) type 3b and 11 cases (27.50%)had type 4 atresia. On gross examination, specimen of 31 cases (77.50%) had congestion, 12 cases (30.00%) had perforationand 3 cases (07.50%) had gangrene. Other associated findings include 1 case (02.50%) each with meconium pseudo-cyst, pouching of gut, duplication cyst and meconium ileus.

**Table 7:-** Histological Features.

| **Mucosa (no. of cases)** | **Submucosa (no. of cases)** | **Muscularis propria (no. of cases)** | **Serosa (no. of cases)** |
|---|---|---|---|
| Oedema, congestion & denudation (6) | Oedema(15) | Congestion (4) | Oedema & Congestion (2) |
| Ulceration + flattening of mucosa (9) | Congestion (33) | Thickening (2) | Congestion (11) |
| Flattening of mucosa (6) | | | |
| Abnormal villus configuration (4) | Dilated irregular branching vascular channels (1) | Thinning (16) | Serositis(16) |
| Gangrene (1) | Extravasated blood (1) | Focal loss (3) | |

| | | | |
|---|---|---|---|
| Hypertrophied mucosa (3) | | Hypertrophied (4) | Thinning (3) |
| Luminal narrowing (1) | Fibrosis (4) | | Hypertrophied (1) |
| Duplication of mucosa (1) | | | |
| Calcium deposition (4) | Calcification (1) | Calcification (2) | Focal calcification (1) |
| Loss of mucosa 1 | Thickened (2) | | |
| Extravasated blood 6 | | | |

With reference to the table number 7 representing histological features found,on microscopic examination: Mucosa showed oedema, ulceration and flattening in 9 cases. Apart from flattening and oedema, mucosa was denuded at some places and also showed congestion and extravasated blood in 6 cases each. Abnormal villus configuration, calcium deposition in 4 cases each and hypertrophied mucosa were found in 3 cases. Luminal narrowing, loss of mucosa, duplication of mucosa and gangrene were found in one case each.Sub mucosal changes showed congestion in 33 cases, oedema in 15, Fibrosis in 4, thickened submucosa in 2 cases and dilated irregular branching blood vessels, extravasted blood, calcification in 1 case each. Muscularispropriahaving changes i.e. thinning in 16 cases, congestion, hypertrophy in 4 cases each, focal loss in 3 cases, calcification in 2 cases and thinning in 2 cases. Similarly, histopathological changes in serosa shows serositisin 16 cases, congestion in 11 cases and thinning in 3 cases. Oedema and congestion were present in 2 cases, hypertrophy and calcification in 1 case each.

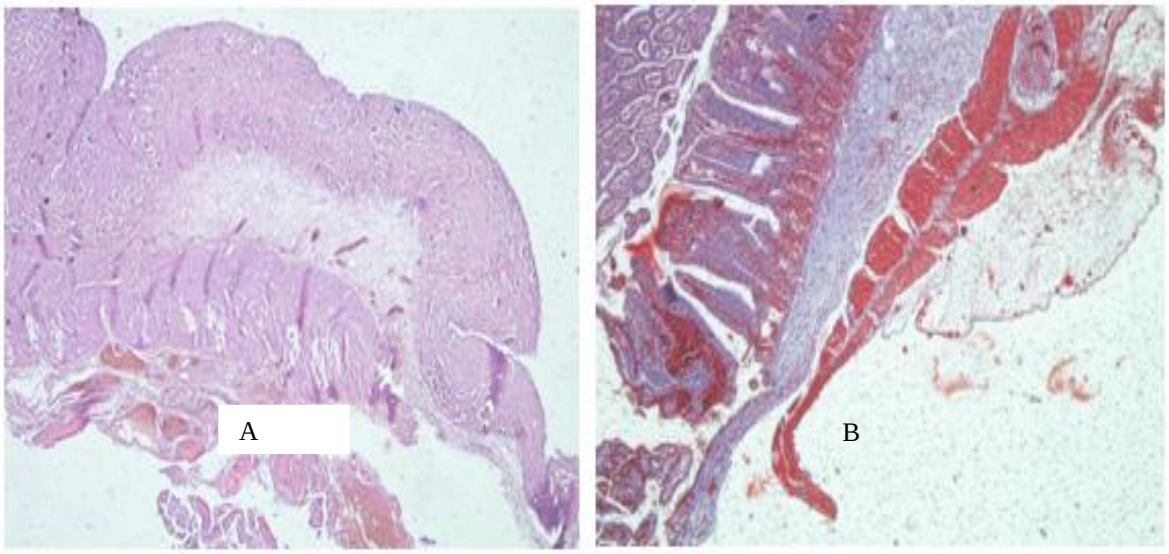



**Fig 2:-** A: LS showing atrophy of muscular lining and replacement by fibrosis at the level of atresia and hypertrophy of muscle layers proximally. B: LS showing mucosal atrophy and loss of submucosa in the segment of gut just proximal to the atresia.

## Discussion:-

Intestinal atresias are one of the most common causes of intestinal obstruction in the neonate with an incidence of 1 in 5,000 new born [7]. In the present study of 40 neonatal intestinal obstruction, all were due to atresia.Duodenal atresia occurs in approximately 1 infant per 10,000 births, and represents up to 60 percent of small intestinal atresia [8]. In present study out of 40 cases of intestinal atresia, no case belong to duodenal atresia.Small intestinal atresia accounts for majority of the cases while colonic atresia is quite rare according to Etensel B et al [9]. In this study, also we found colonic atresia in 6 cases out of 40.Four types of intestinal atresia were recognized, type 1 (Septal atresia), type 2 (Fibrous cord joining atretic ends),type3A (Atretic end separated by v shaped mesenteric defect), type3B (Multiple atresia), type 4 (Apple-peel atresia). The most common type of atresia in this study is type I, which accounts for 59%.

The incidence of multiple atresias is said to be 15% by Davis DL et al [10]. Similar studyby Thomas V.Santulli et al [11] on 76 cases and found multiple atresia in single case and said that incidence of multiple atresia given by Davis DL et al [10] was probably higher. In our study also we found multiple atresias in 6 cases (15%). Various pathogenetic mechanisms have been proposed to explain the development of both duplication cysts and intestinal

atresia. Favara et al [12], and Sinha et al [13], attributed the occurrence of atresia secondary to mesenteric volvulus as being initiated by the duplication cyst leading to vascular compromise of the involved intestinal segment. In our study also we found 2 cases of intestinal atresia where according to above mechanism that supports pathogenesis of atresia. 1case was found to be associated with duplication cyst and the other 1 was with meconium pseudocyst.

Santulli and Blanc [11], study observed that there was presence of lanugo,squames and meconium distal to an atretic segment.Similar study done by Schultz and Lawrence [14] reviewed the perinatal deaths of 56 cases that showed gut ischaemia of varying degrees of severity, and in 19 out of 56 cases concluded stenosis and atresia were sequelae of previous gut ischaemia. Thuswe found out the presence of meconium distal to the atrectic segment of intestine and thus explained ischemia as an etiological factor rather than failure of recanalization. In the present study out of 40 cases, 36 cases have presence of meconium distal to atretic segment of intestine that suggested ischemia was causative factor.

Further, a phase of obliterative epithelial proliferation is not seen in the small bowel below the duodenum but Johnson et al [15]found that it was an explanation of stenosis/atresia of the small or large bowel were compromised leading to segmental absence of muscle in atresia cases. Thus, the histological changes observed in the Jejunoileal atresia is the most common cause of congenital intestinal atresia, and the most frequent cause of neonatal intestinal obstruction. In affected patients, there was no known gender skewing in the incidence, but when compared with dizygotic twins and singletons, monozygotic twins are reportedly at a higher risk. In our study we also found that jejunal and ileal atresia are the commonest type, but dominance of male neonates occured.This study revealed that in neonates with small bowel atresia, the musculature of the bowel wall upto 2 cm away from atretic segment were found to show some histology consistent with atreticchanges and ganglions were present. Therefore, adequate resection seems to be mandatory for the prevention of post-operative dysmotility.

Hamdy et al [16] reported that in the dilated bowel at 2 cm proximal to the atresia, the intermuscular ganglion was smaller and less in number and muscle layers were thinner on the antimesenteric side when compared to those on the mesenteric side in control specimens. In our study, the ganglion cells were normal both on the mesenteric and antimesenteric sides at 2 cm away from the atresia. Muscle layers were irregular with segmental muscular hypertrophy.

## Conclusion:-

In this study spectrum of histomorphological changes in the atretic segment has been described. Histological changes seen in the mucosa were flattening of villi, abnormal villous configuration, ulceration, denudation, gangrene, hypertrophy, luminal narrowing, calcium deposition and extravasated blood. Submucosal changes were edema, congestion, dilated irregular branching vascular channel, extravasated blood and fibrosis in the atretic segment. Muscularispropria congestion, thickening, thinning, focal loss, hypertrophy and calcification were seen. Muscle fibrosis was present in few sections. Ganglion cells were present in all sections. All layers were normal in the control specimens.

Histomorphological changes at atretic segment can be valuable to surgeons in deciding the type of surgery and minimizing the postoperative intestinal dysmotility, which remains the most common complication of intestinal atresia. This study has limitation due to small sample size and could not contribute in establishing predetermined limit of resected bowel for histomorphological analysis. A large and adequate sample size is required for this.

## References:-

1. David E Wesson, www.uptodate.com@2021, Up To Date, Inc. and/or its affiliates.
2. Rosai J (editor): Small Bowel, Gastrointestinal tract. In Rosai and Ackerman's Surgical Pathology. Tenth edition. Mosby Elsevier, 2011, pp 674.
3. Grosfeld JL, Ballantine TV, Shoemaker R. Operative mangement of intestinal atresia and stenosis based on pathologic findings. J PediatrSurg 1979; 14:368.
4. 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):320–22.
5. Jones KL, Smith DW: Smith's recognizable patterns of human malformation. ed. 6. Philadelphia, Saunders, 2006.

6. Subbarayan D, Singh M, Khurana N et al., Histomorphological Features of Intestinal Atresia and Its Clinical Correlation. Journal of Clinical and Diagnostic Research. 2015 Nov, Vol-9(11): 26-29.
7. Galván-Montaño A, Suárez-RoaMde L, Carmona-Moreno E. Congenital stenosis of the colon with foreign bodies. Case report. Cir cir. 2010 May 1;78(3):259-61.
8. Vegar-Zubovic S, Behmen A, Sefic-Pasic I, Džananović A, Bukvic M, Prevljak S, Kuskunovic A, Hadzihasanovic B. Gastrointestinal atresia in newborn-systematic approach. European Congress of Radiology-ECR 2019.
9. Etensel B, Temir G, Karkiner A, Melek M, Edirne Y, Karaca İ, Mir E. Atresia of the colon. Journal of pediatric surgery. 2005 Aug 1;40(8):1258-68.
10. Davis D. L., and Poynter, C. W. M.: Congenital Occlusion of the Intestine. Surg. Gynec. Obst. 1922 Jan;34:35.
11. Santulli TV, Blanc WA. Congenital atresia of the intestine: pathogenesis and treatment. Annals of surgery. 1961 Dec;154(6):939.
12. Favara BE, Franciosi RA, Akers DR. Enteric duplications: Thirty-seven cases: A vascular theory of pathogenesis. American Journal of Diseases of Children. 1971 Dec 1;122(6):501-6.
13. Sinha S, GANGOPADHYAY HARSHWARDHAN AN, Chooramani Gopal S. Ileal atresia with intestinal duplication. Indian pediatrics. 1992;29(12):1573-4.
14. Schultz LR, Lawrence GH. ASSOCIATED RECTAL AND JEJUNAL ATRESIA IN THE NEWBORN: Report of a Case. Pediatrics. 1960 Jul 1;26(1):122-5.
15. JH L. Congenital intestinal atresia and stenosis in the newborn. Observations on its pathogenesis and treatment. Annals of the Royal College of Surgeons of England. 1959 Nov 1;25:209-34.
16. Hamdy MH, Man DW, Bain D, Kirkland IS. Histochemical changes in intestinal atresia and its implications on surgical management: a preliminary report. Journal of pediatric surgery. 1986 Jan 1;21(1):17-21.