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Gastrointestinal Tract Duplications, a Multicenter study

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ABSTRACT

Background: Gastrointestinal tract duplications are uncommon congenital abnormalities with variable clinical presentations, ranging from abdominal distension to intestinal obstruction.

Objective: To describe the clinical characteristics, surgical management, and outcomes of pediatric patients with gastrointestinal tract duplications at a tertiary center.

Methods: This retrospective study was conducted on 28 pediatric patients diagnosed with gastrointestinal tract duplications. Inclusion criteria comprised patients who underwent surgical management with complete medical records. Data on demographics, clinical presentation, anatomical site, duplication type, associated anomalies, surgical procedures, and postoperative outcomes were analyzed. Clinical evaluation, imaging, and histopathology confirmed diagnoses. Surgical approaches included resection with primary anastomosis, stoma formation, excision/enucleation, and partial excision with mucosal stripping, depending on lesion type and location.

Results: The most prevalent symptoms were abdominal distension and vomiting (50%), followed by abdominal mass (28.6%). Ileal duplications were most frequent (67.8%), followed by jejunal (14.3%) and gastric (7.1%) lesions. Cystic duplications predominated (60.7%). Resection with primary anastomosis was performed in 75% of patients. Overall, 23 patients (82.1%) had favorable outcomes, while 5 (17.9%) experienced complications, primarily sepsis (4 cases) and anastomotic leak (1 case).

Conclusion: Gastrointestinal tract duplications mainly present in early childhood with a slight male predominance. Early diagnosis and appropriate surgical management, primarily resection with anastomosis, result in favorable outcomes, with complications largely related to infection.

Keywords: *Gastrointestinal duplications, pediatric surgery, cystic duplication, ileum*

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1. INTRODUCTION

Gastrointestinal tract duplications are uncommon congenital abnormalities that can happen anywhere along the alimentary tract, from the esophagus to the rectum. These lesions are marked by the existence of a well-developed smooth muscle wall and an epithelial lining resembling that of the gastrointestinal tract. Although uncommon, they represent an important clinical entity in pediatric surgery due to their variable presentation and potential for serious complications **(1, 2)**.

The clinical presentation of gastrointestinal duplications is highly variable and based on factors like patient age, location, size, and type of the lesion. Common symptoms include abdominal distension, vomiting, abdominal pain, and the existence of an abdominal mass, while some cases may present with intestinal obstruction, bleeding, or intussusception. Because of

this wide spectrum of manifestations, early diagnosis remains challenging and often requires a combination of clinical suspicion and imaging modalities **(3).**
Surgical management is considered the definitive treatment for most symptomatic cases, with complete excision being the preferred approach whenever feasible. Outcomes are generally favorable when timely diagnosis and appropriate surgical intervention are achieved **(4)**.

This research aimed to describe the clinical features, surgical management, and outcomes of pediatric cases with gastrointestinal tract duplications at a tertiary center.

Patients and methods
This retrospective research has been performed on 28 cases and involved pediatric cases identified with gastrointestinal tract duplications.

Inclusion Criteria: Pediatric cases identified with gastrointestinal tract duplications, patients who underwent surgical management at our center during the study period, and cases with complete medical records, including demographics, clinical presentation, operative details, and postoperative results.

Exclusion Criteria: Cases with incomplete or missing medical records, cases managed conservatively without surgery, and patients with gastrointestinal anomalies other than duplications as the primary diagnosis.

2. METHODS

All patients were subjected to the following:
Clinical Assessment
Detailed clinical evaluation was performed, focusing on presenting symptoms such as vomiting (bilious or non-bilious), abdominal distension, palpable mass, abdominal pain, and signs of intestinal obstruction or intussusception. Associated congenital anomalies, including intestinal atresia, abdominal wall defects, Meckel's diverticulum, and anorectal malformations, were identified through history, physical examination, and imaging.
Diagnostic Workup

Diagnosis was based on clinical suspicion supported by imaging modalities, including abdominal ultrasonography, plain radiography, and contrast studies where indicated. The anatomical site and type of duplication (cystic or tubular) were confirmed intraoperatively and validated by histopathological examination.

Surgical Management
Surgical intervention was performed in all patients, with the approach tailored to duplication type, site, size, and involvement of adjacent structures. Most cases underwent resection with primary intestinal anastomosis (ileum, jejunum, or ileocecal junction), while complicated duplications, such as those involving the sigmoid colon, required resection with stoma formation. Accessible duplications were managed by complete excision or enucleation, and duodenal duplications were treated with partial excision and mucosal stripping to preserve adjacent vital structures.

Outcome Assessment
Postoperative outcomes were evaluated in terms of complications, including sepsis, anastomotic leak, and need for reoperation. Follow-up included clinical assessment and imaging as needed. Data were analyzed descriptively using frequencies and percentages.

3. RESULTS

Table 1: Demographic data of cases with gastrointestinal duplication in our research

	Number of patients (n=28), n (%)
Sex distribution	
Male	16 (57.1)
Female	12 (42.9)
Age group	
Neonates	13 (46.4)
1 month-1 year	9 (32.2)
1-2 years	3 (10.7)
>2 years	3 (10.7)

There was a slight male predominance with 16 men (57.1%) and 12 women (42.9%). Most cases (n=13, 46.4%) presented

in the neonatal age group. 9 patients (32.2%) presented between 1 month and 1 year of age. Overall, 22 patients (78.6%) were under 1 year of age, and 25 patients (89.3%) were under 2 years of age **(Table 1)**.

Table 2: Clinical features of cases with gastrointestinal duplication in our research

	Number of patients (n=28), n (%)
Presenting chief complaints	
Distension and vomiting (bilious/nonbilious)	14 (50.0)
Abdominal mass	8 (28.6)
Abdominal pain	3 (10.7)
Intussusception	3 (10.7)
Site of duplication	
Ileum	19 (67.8)
Gastric	2 (7.1)
Ileocecal junction	1 (3.6)
Duodenum	1 (3.6)
Sigmoid	1 (3.6)
Jejunum	4 (14.3)
Associated malformations/pathologies	
None	18 (64.3)
Intestinal atresia	5(17.9)
ARM with CPC type 2	1 (3.6)
Abdominal wall defect	2 (7.1)
Meckel's diverticulum	2 (7.1)

The most common presenting complaint was abdominal distension with bilious or nonbilious vomiting, observed in 14 patients (50.0%), followed by an abdominal mass in 8 patients (28.6%). Abdominal pain and intussusception were each noted in 3 patients (10.7%). Regarding the site of duplication, the ileum was the most frequently involved segment, seen in 19 patients (67.8%), followed by the jejunum in 4 patients (14.3%). Gastric duplications were identified in 2 patients (7.1%), while the ileocecal junction, duodenum, and sigmoid colon were each involved in 1 patient (3.6%). Most patients had isolated duplications without associated malformations, accounting for 18 cases (64.3%). Among associated anomalies, intestinal atresia was the most common, present in 5 patients (17.9%). Abdominal wall defects and Meckel's diverticulum were each observed in 2 patients (7.1%), while anorectal malformation with congenital pouch colon type 2 was noted in 1 patient (3.6%) **(Table 2).**

Table 3: Type and procedures in our research

	Number of duplications (n=28), n (%)
Shape of duplication	
Cystic	17 (60.7)
Tubular	11 (39.3)
Procedure for duplication	
Resection and intestinal anastomosis	21 (75)
- Ileum	16 (57.1)
- Ileocecal junction	1 (3.6)
- Jejunum	4 (14.3)
Resection and intestinal stoma	1 (3.6)
- Sigmoid	1 (3.6)
Excision/enucleation	5 (17.6)
- Ileum	3 (10.7)
- Gastric	2 (7.1)
Partial excision with mucosal stripping	1 (3.6)
- Duodenum	1 (3.6)

Cystic duplications were more common, identified in 17 cases (60.7%), while tubular duplications were observed in 11 cases (39.3%). Resection with intestinal anastomosis was the most frequently performed procedure, undertaken in 21 patients (75%). This included resections involving the ileum in 16 cases (57.1%), the ileocecal junction in 1 case (3.6%), and the jejunum in 4 cases (14.3%). Resection with creation of an intestinal stoma was required in 1 patient (3.6%), including 1 sigmoid resection with stoma formation (3.6%), typically in the setting of complicated presentations. Excision or enucleation of the duplication was performed in 5 patients (17.6%), comprising 3 ileal duplications (10.7%) and 2 gastric duplications (7.1%). Partial excision with mucosal stripping has been carried out in 1 patient (3.6%) with duodenal duplication to preserve adjacent vital structures while removing ectopic mucosa. **(Table 3)**.

Table 4: Outcome analysis of cases in our research

Final outcomes	**Number of patients (n=28), n (%)**
Favorable	23 (82.1)
Unfavorable	5 (17.9)
	Cause of unfavorable outcomes
Unfavorable outcomes (N=)	Sepsis (4 cases) Leak (1 case)

Overall outcomes were favorable in the majority of patients, with 23 patients (82.1%) experiencing a favorable postoperative course. Unfavorable outcomes were observed in 5 patients (17.9%). The causes of unfavorable outcomes included sepsis in 4 patients and an anastomotic leak in 1 patient, highlighting infection-related complications as the predominant contributor to adverse outcomes. **(Table 4)**.

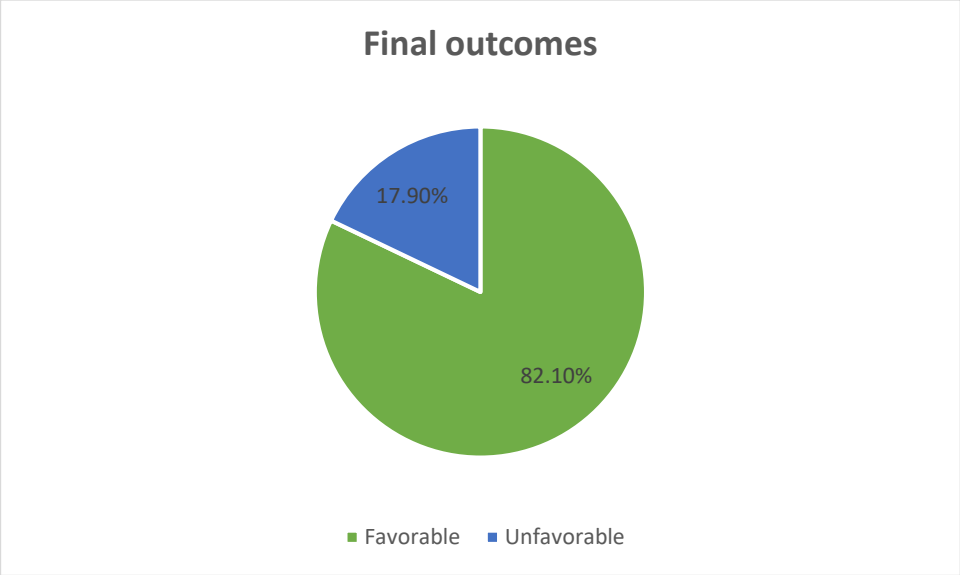

Figure 1: Distribution of Final outcomes in our study

4. DISCUSSION

Congenital abnormalities of the gastrointestinal tract represent a significant diagnostic and therapeutic challenge in pediatric practice, among which gastrointestinal tract duplications are considered one of the rarest entities. Despite their low incidence, these lesions carry considerable clinical importance due to their potential to cause morbidity in early life and their wide variability in anatomical location and morphology **(5)**.

Patients with gastrointestinal duplications may present at different ages and with nonspecific symptoms that often mimic other more common abdominal conditions. This diversity in presentation frequently leads to delayed recognition, increasing the possibility of complications like obstruction, infection, perforation, or bleeding. Advances in radiological techniques have improved diagnostic accuracy; however, definitive diagnosis is still commonly confirmed intraoperatively **(6, 7).**

Understanding the clinical patterns, associated anomalies, and outcomes of these cases is essential for improving patient care. Reporting institutional experiences from tertiary centers contributes valuable data that may help in optimizing diagnostic pathways and treatment strategies **(8).**

Our results showed that there was a slight male predominance with 16 men (57.1%) and 12 women (42.9%). Most cases (46.4%) presented in the neonatal age group. 9 patients (32.2%) presented between 1 month and 1 year of age. Overall, 22 patients (78.6%) were under 1 year of age, and 25 patients (89.3%) were under 2 years of age.

Our results are supported by **Oskayli et al. (9),** who aimed to present a single institutional experience in the identification, management, pathological results, and follow-up of pediatric cases with gastrointestinal duplications. They reported that

their research involved nineteen cases, of whom ten (52.6%) were men and nine (47.4%) were women. Otherwise, nine (47%) patients were aged <2 years.
On the other hand, **Perveen et al. (10),** who aimed to emphasize the varied presentation of gastrointestinal duplications, their diagnostic challenges, and results, reported that a total of 5 cases with identification of gastrointestinal duplication were included in their study; 3 cases were men and 2 were women (male:female = 1.5:1). 3 out of 5 cases (sixty percent) were below one year old.

In the present study, the most common presenting complaint was abdominal distension with bilious or nonbilious vomiting, observed in 14 patients (50.0%), followed by an abdominal mass in 8 patients (28.6%). Abdominal pain and intussusception were each noted in 3 patients (10.7%).

Similarly, **Okur et al. (11),** who aimed to evaluate gastrointestinal tract duplications in children, reported that common clinical presentations included vomiting, reported in 25% of the studied cases; palpable abdominal mass, in 13%; and abdominal distension, in 16%.

Regarding the site of duplication, we found that the ileum was the most frequently involved segment, seen in 19 patients (67.8%), followed by the jejunum in 4 patients (14.3%). Gastric duplications were identified in 2 patients (7.1%), while the ileocecal junction, duodenum, and sigmoid colon were each involved in 1 patient (3.6%). Most patients had isolated duplications without associated malformations, accounting for 18 cases (64.3%). Among associated anomalies, intestinal atresia was the most common, present in 5 patients (17.9%). Abdominal wall defects and Meckel's diverticulum were each observed in 2 patients (7.1%), while anorectal malformation with congenital pouch colon type 2 was noted in 1 patient (3.6%).

In the same line, **Rattan et al. (9)** reported that the most common location was found to be the ileum, occurring in 71% of cases.

Also, **Okur et al. (11)** reported that the ileum constituted the most common site of GTD; otherwise, 7 cases were present with associated abnormalities. Prevalent abnormalities involved diastematomyelia, malrotation, block vertebra, hydronephrosis, cloaca, congenital dislocation of the hip, and anal atresia with rectovestibular fistula.

However, **Perveen et al. (10)** reported that all 5 cases had various locations of GI origin involving gastric in one case (20%), duodenal in one case (20%), jejunal in one case (20%), ileal in one case (20%), and thoracoabdominal in one case (20%).

In the present study, cystic duplications were more common, identified in 17 cases (60.7%), while tubular duplications were observed in 11 cases (39.3%). Resection with intestinal anastomosis was the most frequently performed procedure, undertaken in 21 patients (75%). This included resections involving the ileum in 16 cases (57.1%), the ileocecal junction in 1 case (3.6%), and the jejunum in 4 cases (14.3%). Resection with creation of an intestinal stoma was required in 1 patient (3.6%), including 1 sigmoid resection with stoma formation (3.6%), typically in the setting of complicated presentations. Excision or enucleation of the duplication was performed in 5 patients (17.6%), comprising 3 ileal duplications (10.7%) and 2 gastric duplications (7.1%). Partial excision with mucosal stripping was carried out in 1 patient (3.6%) with duodenal duplication to preserve adjacent vital structures while removing ectopic mucosa.

Our results agreed with **Rattan et al. (9),** who reported that the majority of cases presented were managed successfully by resection and end-to-end anastomosis.

While **Perveen et al. (10)** reported that two out of 5 (forty percent) duplications were cystic, whereas thoracoabdominal tubular duplication had involvement of the esophagus and a few centimeters of jejunum, sparing the proximal jejunal segment near DJ. Among five cases, complete cyst excision with mucosal stripping of the common wall was performed in one case (20%); partial excision and mucosal stripping of the common wall was performed in one case (20%); resection & end-to-end anastomosis was performed in two cases (40%); and staged excision was performed in one case (20%).

Moreover, **Okur et al. (11)** reported that cystic GTD was present in twenty-five (seventy-eight percent) and tubular in seven (twenty-two percent) cases. Among 32 cases, 19 cases (59%) had resection anastomosis, twelve (37.5%) had mucosal stripping, and one case received both.

Furthermore, **Oskayli et al. (9)** reported that, among the nineteen duplication cysts, fourteen (seventy-four percent) were cystic and 5 (twenty-six percent) were tubular. The duplication cyst has been removed through total cyst removal only in ten (52.6%) cases or relevant organ resection and anastomosis in nine (47.4%) cases.

In the present study, overall outcomes were favorable in the majority of patients, with 23 patients (82.1%) experiencing a favorable postoperative course. Unfavorable outcomes were observed in 5 patients (17.9%). The causes of unfavorable outcomes included sepsis in 4 patients and an anastomotic leak in 1 patient, highlighting infection-related complications as the predominant contributor to adverse outcomes.

This came in concordance with **Rattan et al. (12)**, who reported that the majority of cases were managed successfully by resection and end-to-end anastomosis.

Another study by **Perveen et al. (10)** reported that all 4 cases remained asymptomatic throughout a one-year follow-up.

5. CONCLUSION

Gastrointestinal tract duplications occur mainly in early childhood, with most patients presenting during the first year of life and a slight male predominance. Abdominal distension and vomiting were the most common presenting symptoms, and the ileum was the most frequently affected site. Most cases were isolated, while intestinal atresia was the most common associated anomaly. Cystic duplications were more common than tubular forms, and resection with primary anastomosis was the main surgical approach. The majority of patients achieved favorable outcomes, with complications being limited and mainly related to sepsis and anastomotic leak, emphasizing the importance of early identification and proper surgical treatment.

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