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TOTAL COLONIC TUBULAR DUPLICATION ASSOCIATED WITH ANORECTAL MALFORMATION: A CASE REPORT AND SURGICAL RECONSTRUCTION APPROACH

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Abstract

Total colonic duplication is an exceptionally rare subtype of gastrointestinal duplication, often associated with anorectal malformations. Diagnostic difficulty arises from variable morphology, shared mesenteric structures, and inconsistent imaging findings. Early recognition remains limited, and many cases are identified only during operative exploration. Methods a 10-month-old male with a history of anorectal malformation previously treated with colostomy underwent evaluation for definitive repair. Intraoperative assessment, including loop colonography, identified two parallel colonic lumens extending from cecum to rectum. Results exploratory laparotomy confirmed complete tubular duplication with a shared mesentery. Reconstruction was achieved through a side-to-side window anastomosis using a stapling device, followed by creation of a protective ileostomy. Postoperative recovery was uneventful, with adequate stoma perfusion and preserved bowel function. The patient remained stable during follow-up and was scheduled for staged abdominoperineal anoplasty. Discussion complete colonic duplication may not be detected preoperatively and frequently requires intraoperative confirmation. Preservation of vascular supply and staged reconstruction are central to optimizing outcomes. Conclusion individualized surgical planning and careful anatomical delineation support favorable early recovery and functional prognosis in total colonic duplication with anorectal malformation.

Keywords: *Anastomosis, Anorectal Malformation, Colonic Duplication, Congenital Anomaly, Pediatric Surgery*

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Introduction

Gastrointestinal duplications constitute rare congenital anomalies, with an estimated incidence ranging from 1 in 4,500 to 1 in 10,000 live births, and colonic involvement accounting for 10–15% of documented cases. Tubular variants of colonic duplication are particularly uncommon, representing less than 20% of colonic duplication anomalies and frequently presenting with parallel lumens that complicate diagnostic assessment and operative planning (Zheng et al., 2022). These anomalies often coexist with additional congenital abnormalities, most notably anorectal malformations, which occur in approximately 1 in 5,000 live births and significantly increase the complexity of surgical management (Jun et al., 2021).

The concurrence of total colonic tubular duplication and an anorectal malformation constitutes an exceptionally rare anatomical configuration, with only isolated cases reported in contemporary literature. Diagnostic challenges arise because standard imaging modalities often fail to differentiate duplicated lumens when they course in close parallel alignment within a shared mesentery (Zheng et al., 2022; Li et al., 2022). As a result, definitive identification is frequently achieved only during operative exploration, emphasizing the need for meticulous intraoperative assessment and coordinated perioperative planning to determine an individualized and safe surgical approach (Jun et al., 2021; Li et al., 2022).

The embryological basis of this dual malformation remains incompletely defined, and current hypotheses include aberrant recanalization, abnormal budding, or disruptions in hindgut development occurring between the 5th and 8th weeks of gestation. These developmental disturbances contribute to a broad spectrum of clinical presentations, ranging from incidental findings to severe obstructive symptoms that mimic more common gastrointestinal disorders (Fan et al., 2023; Zheng et al., 2022). This case report details a presentation of total colonic tubular duplication associated with an anorectal malformation, emphasizing the intraoperative findings, the decision-making process, and the surgical technique selected to achieve a functional anatomical reconstruction.

Case Presentation

10-month-old male with a history of anorectal malformation treated initially with a colostomy shortly after birth was referred to the Department of Pediatric Surgery for definitive management. Inspection during the scheduled anoplasty revealed two distinct colonic openings at the stoma, raising suspicion of an undetected duplication anomaly (Figure 1). Additional intraoperative assessment was undertaken to delineate the bowel configuration.

Figure 1. Tubular duplication of the colon observed intraoperatively, with two adjacent bowel channels visible at the stoma site.

Loop colonography performed intraoperatively demonstrated two parallel colonic lumens extending proximally, confirming complete tubular colonic duplication. Operative exploration showed both colonic channels running side by side along their entire length and sharing a single mesenteric attachment, consistent with characteristics of tubular duplication (Figure 2). No further intra-abdominal abnormalities were identified.

Figure 2. Double-lumen colon demonstrated intraoperatively, showing two fully formed, parallel colonic channels within a shared mesentery.

Exploratory laparotomy carried out immediately after imaging enabled confirmation of the duplicated anatomy and guided subsequent reconstruction. A side-to-side window anastomosis was created between the duplicated

and native colons using a GIA stapler, unifying the lumens while maintaining mesenteric vascular integrity (Figure 3). Completion of the anastomosis demonstrated adequate alignment, preserved perfusion, and reliable continuity of the reconstructed lumen (Figure 4).

Figure 3. Stapled side-to-side window anastomosis connecting the native and duplicated colonic segments.

Figure 4. Completed anastomosis demonstrating an intact vascular arcade and unified lumen.

Protective ileostomy formation followed the reconstruction to divert stool during the healing phase. Postoperative evaluation showed a well-perfused stoma and intact abdominal closure without early complications (Figure 5). Follow-up over the subsequent weeks demonstrated stable recovery, preserved bowel function, and preparation for abdominoperineal anoplasty scheduled three months later.

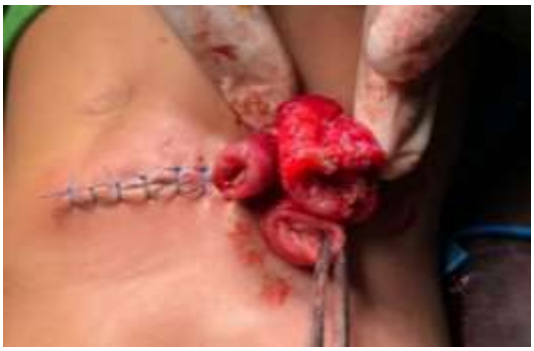

Figure 5. Postoperative appearance showing a well-perfused ileostomy and intact abdominal wound.

Discussion

The present case demonstrates the diagnostic difficulty of identifying total colonic tubular duplication in infants who undergo early diversion for anorectal malformation. The unexpected appearance of two luminal openings at the stoma site has been reported as an important intraoperative clue in similar cases and often represents the first indication of an underlying duplication anomaly (Piplani et al., 2022; Zheng et al., 2022). This pattern reflects the tendency of these anomalies to remain undetected during initial neonatal management, reinforcing the need for heightened intraoperative awareness when unexpected stoma anatomy is encountered (Li et al., 2022).

Intraoperative loop colonography in this patient revealed two parallel lumens extending proximally, illustrating the limitations of routine imaging techniques in detecting complete tubular duplications. When duplicated colonic channels lie in close parallel alignment within a shared mesentery, contrast studies may produce equivocal or misleading results because luminal separation cannot be clearly visualized (Keilani et al., 2023; Li et al., 2022). These challenges emphasize the importance of integrating intraoperative imaging with direct surgical assessment to ensure accurate identification of rare structural anomalies such as those encountered in this case (Zheng et al., 2022).

Operative exploration revealed two fully formed colonic lumens within a single mesenteric attachment, a configuration that significantly influences surgical decision-making due to the risk of vascular compromise. In cases where duplicated lumens share a common blood supply, resection may jeopardize bowel viability and is therefore generally avoided according to multiple reported experiences (Bahmad et al., 2021; Piplani

et al., 2022). The choice to proceed with a side-to-side window anastomosis in this case is consistent with recommended management strategies in situations where preservation of mesenteric vascular integrity is essential (Gunardi et al., 2021).

The stapled window anastomosis created for this patient provided a wide channel for unified colonic continuity while maintaining adequate blood supply. Stapled techniques offer reliable staple line integrity, reduced operative time, and minimal tissue trauma, making them advantageous in anatomically complex congenital conditions such as enteric duplications (Kanwal et al., 2024; Painuly et al., 2021). The addition of a protective ileostomy aligns with established staged approaches for children with anorectal malformations because diversion facilitates anastomotic healing and reduces the risk of postoperative complications (Bahmad et al., 2021).

The postoperative course in this patient was favorable, with stable stoma perfusion, preserved bowel function, and no early complications. Nevertheless, long-term surveillance is critical due to potential delayed issues such as anastomotic stenosis, dysmotility, or segmental stasis, which have been documented in similar duplication cases (Djordjević et al., 2020; Choochuen et al., 2025). Rare reports of malignant transformation in duplication segments further justify the need for careful follow-up, particularly in children who also have anorectal malformations and associated pelvic floor developmental challenges (Gunardi et al., 2021; Kostouros et al., 2020).

CONCLUSION

Total colonic duplication associated with anorectal malformation constitutes a rare congenital anomaly with significant diagnostic and operative complexity. Variation in embryologic development, shared mesenteric structures, and atypical anatomical configurations often limit accurate preoperative identification. Intraoperative delineation remains essential for determining a safe and effective reconstructive strategy. Side-to-side window anastomosis provides a reliable option when duplicated segments share vascular supply and cannot be resected safely. Early staged management, protection of vascular integrity, and structured follow-up allow preservation of bowel function and continence. Long-term monitoring remains necessary due to the potential for delayed complications, including rare malignant transformation.

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