Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Challenges and Outcomes in the Management of Rectal Atresia and Stenosis: A Comprehensive Review

Juan Ignacio Siffredi

juansiffredi@gmail.com

Garrahan Hospital

Lucila Alvarez

Garrahan Hospital

Maria Victoria Dominguez Marquez

Garrahan Hospital

Javier Ruiz

Garrahan Hospital

Maria Daniela Neder

Garrahan Hospital

Ana Marcela Rocca

Garrahan Hospital

Maria Marcela Bailez

Garrahan Hospital

Victor Pedro Di Benedetto

Garrahan Hospital

Research Article

Keywords: Rectal atresia, Rectal stenosis, Anorectal malformations, Laparoscopic endorectal technique, Fecal continence, Long-term outcomes

Posted Date: April 23rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9316945/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at Pediatric Surgery International on June 15th, 2026. See the published version at https://doi.org/10.1007/s00383-026-06492-6.

Abstract

Purpose

Rectal atresia (RA) and rectal stenosis (RS) are rare anorectal malformations (ARM), comprising 1–2% of all cases. No consensus exists regarding optimal surgical technique. This study evaluated surgical approaches, complications, and long-term functional outcomes at a single referral center.

Methods

Retrospective review of patients with RA or RS treated between 2003 and 2020. Surgical technique, complications, and bowel function were analyzed. Fecal continence was assessed using the Krickenbeck classification in patients older than 3 years with minimum 6-month follow-up after colostomy closure.

Results

Eleven patients were included (7 RS, 4 RA), representing 1.2% of 900 ARM cases. Surgical approaches included posterior sagittal anorectoplasty (PSARP) in 4 (36.4%), transanal in 4 (36.4%), abdominoperineal pull-through in 1 (9.1%), and laparoscopic endorectal technique in 2 (18.2%). Two patients required redo surgery. Of 9 eligible for functional assessment, 6 (66.7%) achieved fecal continence, 3 without additional treatment. Three had constipation and soiling due to poor adherence. Median follow-up was 100.4 months (range 13–168).

Conclusion

Despite surgical complexity, most patients achieved satisfactory outcomes. The high incidence of constipation, particularly in RS, underscores the need for long-term follow-up and early intervention. The laparoscopic endorectal technique offers a reproducible, sphincter-preserving approach to rectal web correction.

Introduction

Rectal atresia (RA) and rectal stenosis (RS) are among the rarest forms of anorectal malformations (ARM), comprising 1–2% of all cases according to the Krickenbeck classification [1, 2]. Both entities are characterized by the presence of an anatomically normal anus within an intact sphincter complex, a feature that distinguishes them from other ARM subtypes and poses unique diagnostic and surgical challenges.

Both congenital defects are characterized by the presence of a normal anus located within the anal sphincter complex. Sometimes it appears skin lined and it is known as funnel anus. The diagnosis of RA is suspected when a newborn presents obstruction and impossibility to pass a rectal catheter through an apparently normal anal canal. Conversely, patients with RS may pass meconium, mimicking Hirschsprung disease or severe constipation, leading to suspicion due to the inability to pass a rectal catheter.

Several surgical techniques have been described for the correction of RA and RS, including posterior sagittal anorectoplasty (PSARP), transanal (TA) approaches, abdominoperineal pull-through (APT), and laparoscopic-assisted techniques [3–9]. However, the rarity of these conditions has precluded the development of evidence-based consensus guidelines, and surgical decision-making remains largely individualized based on institutional experience and anatomical findings.

The aim of this study was to describe our single-center experience in the surgical management of RA and RS, with emphasis on technique selection rationale, complications, and long-term functional outcomes. We additionally describe our experience with a laparoscopic endorectal (LE) technique for rectal web correction as a reproducible, minimally invasive option in selected cases.

Methods

Study design and patient selection

A retrospective review was conducted of all patients diagnosed with RA or RS and treated at our institution between January 2003 and December 2020. RA and RS were analyzed as distinct entities given their differences in presentation, timing of diagnosis, and surgical management. The study was approved by the institutional review board. Patients with fewer than 6 months of postoperative follow-up were excluded.

Preoperative workup

All patients underwent systematic preoperative evaluation including abdominal and lumbosacral ultrasound and plain radiography to assess sacral anatomy and screen for presacral masses. Magnetic resonance imaging (MRI) was performed in selected cases based on clinical suspicion. Distal colostogram or barium enema was conducted to delineate rectal anatomy and guide surgical planning. The sacral ratio was calculated according to standard methodology [1].

Surgical techniques

Four surgical approaches were employed based on anatomical findings and clinical context:

- PSARP: indicated for RA and RS with complex anatomy or those requiring combined perineal and abdominal access.
- Transanal (TA): used for RS with accessible anatomy allowing primary correction without colostomy in selected patients.
- Abdominoperineal pull-through (APT): employed in one patient with extensive rectal fibrosis and complex anatomy; the specific operative rationale was not fully retrievable from the available records given the retrospective nature of the study.
- Laparoscopic endorectal (LE) technique: applied in patients with rectal web and severe caudal regression precluding standard prone jackknife positioning. Three trocars were placed (4 mm umbilical, 3 mm left flank, 5 mm right flank). The anterior rectal wall was opened longitudinally at the caliber change zone. The web was excised under direct laparoscopic vision, and rectal wall closure was performed transanally or laparoscopically according to the distance between the rectal opening and the anal canal (Fig. 1).

Patients with RA underwent diverting colostomy in the neonatal period prior to definitive correction. Three RS patients with adequate fecal decompression capacity underwent primary correction without colostomy using a TA approach. All patients underwent digital dilations beginning 15 days post-surgery, extending until colostomy closure or, in cases of primary correction, for 1 month following a weekly dilations schedule.

Outcome assessment

The primary outcome was fecal continence at follow-up, assessed using the Krickenbeck classification [1]. Patients were eligible for functional assessment if they were older than 3 years and had completed a minimum of 6 months of follow-up after colostomy closure. Patients with severe neurological impairment precluding reliable functional evaluation were excluded from continence assessment. Secondary outcomes included constipation rate, surgical complications, and need for reintervention. Follow-up was conducted by a multidisciplinary team including pediatric surgery, gastroenterology, and urology.

.

Results

Patient demographics and associated anomalies

Out of 900 ARM patients managed at our institution during the study period, 11 (1.2%) were eligible for inclusion: 7 RS (63.6%) and 4 RA (36.4%). Seven patients (63.6%) were male and 4 (36.4%) female. Mean age at diagnosis was 2.25 days (range 2–3 days) for RA and 15.43 months (range 0–57 months) for RS, consistent with the expected later presentation of RS due to partial luminal patency.

Associated anomalies were identified in 9 patients (81.8%). Urinary anomalies were present in 4 patients, cardiac anomalies in 2, caudal regression in 2, and severe neurological impairment in 1. Presacral masses were identified in 2 patients (18.2%), both anterior meningoceles, which were resected prior to definitive colorectal repair. Sacral ratios were normal (> 0.7) in 2 patients (18.2%), intermediate (0.4–0.7) in 5 (45.5%), and severely abnormal (< 0.4) in 4 (36.4%).

Surgical management

Mean age at definitive surgery was 26.4 months (27.9 months for RS and 23.8 months for RA). Surgical approach was individualized based on anatomical findings, sacral morphology, and patient positioning constraints (Table 1).

For RA patients (n = 4): LE technique was used in 2 (50%), PSARP in 1 (25%), and TA approach in 1 (25%). For RS patients (n = 7): PSARP in 3 (42.9%), TA in 3 (42.9%), and APT in 1 (14.3%). The APT approach was selected for a patient with extensive rectal fibrosis and complex anatomy; complete operative documentation was not available for retrospective verification. Three RS patients underwent primary correction without colostomy via TA approach, given adequate fecal decompression capacity. Four RS patients had a preceding diverting colostomy.

Two patients (18.2%, one RA, one RS) required redo surgery: one for persistent stenosis and one for rectovaginal fistula, both following PSARP. No intraoperative or immediate postoperative complications were recorded for patients managed with the LE technique.

Table 1
Surgical approach by diagnosis and clinical rationale

Patient	Diagnosis	Technique	Rationale	Outcome
1	RA	LE	Rectal web + severe caudal regression — positioning constraints	Continent — no treatment required
2	RA	LE	Rectal web + severe caudal regression — positioning constraints	Not evaluable — severe neurological impairment
3	RA	PSARP	Complex anatomy	Continent
4	RA	TA	Accessible anatomy, primary correction	Continent
5	RS	PSARP	Complex anatomy, prior colostomy	Redo surgery (persistent stenosis)
6	RS	PSARP	Complex anatomy, prior colostomy	Redo surgery (rectovaginal fistula)
7	RS	PSARP	Complex anatomy	Continent with laxatives
8	RS	TA	Primary correction — adequate decompression	Constipation and soiling (non-adherence)
9	RS	TA	Primary correction — adequate decompression	Constipation and soiling (non-adherence)
10	RS	TA	Primary correction — adequate decompression	Constipation and soiling (non-adherence)
11	RS	APT	Extensive rectal fibrosis — complex anatomy (operative rationale not fully retrievable)	Continent with enemas

Functional outcomes

Median follow-up was 100.4 months (range 13–168 months). Nine of 11 patients were eligible for fecal continence assessment. Two patients were excluded: one due to severe neurological impairment precluding reliable functional evaluation, and one due to age below 3 years at the time of analysis.

Of the 9 eligible patients, 6 (66.7%) achieved fecal continence based on Krickenbeck criteria: 2/3 RA patients (66.7%) and 4/6 RS patients (66.7%). Among continent patients, 3 (50%) required no treatment, 2 (33.3%) used laxatives, and 1 (16.7%) required enemas. Three patients (33.3%) experienced constipation and soiling; all three were RS patients who had undergone TA primary correction and shared

a common pattern of non-adherence to the prescribed bowel management program. No patient achieved continence without some degree of constipation management in the RS group.

Both patients managed with the LE technique had favorable postoperative courses with no technique-specific complications. One achieved full continence without treatment; the second was excluded from functional assessment due to the aforementioned neurological condition.

Discussion

This study presents a single-center series of 11 patients with RA and RS with a median follow-up of over 8 years, one of the longest reported in the literature for this rare condition. Our overall continence rate of 66.7% among eligible patients is consistent with published data, which reports continence rates ranging from 50% to 80% depending on the series and follow-up duration [7, 10, 11].

The ARM-Net Consortium recently published the largest multicenter series of RA and RS to date, including 49 patients with a median follow-up of 43 months [11]. Their reported continence rate of 69% aligns closely with our findings despite methodological differences, lending external validity to our results. Notably, our follow-up period is more than twice as long, providing insight into the long-term trajectory of these patients beyond what multicenter studies have captured.

A central finding of our study is the notable incidence of constipation, particularly in the RS group, a pattern consistent with the literature [11, 12]. We identified two potential mechanisms that likely contribute to this observation. First, RS falls within the low ARM spectrum, which carries an inherently higher constipation rate due to preserved but dysfunctional anorectal sensory mechanisms. Second, and critically, the ability of RS patients to pass stool through a stenotic lumen delays diagnosis — in our series, only 1 of 7 RS patients (14%) received timely diagnosis, versus all 4 RA patients who were identified neonatally. Prolonged diagnostic delay allows progressive rectal distension and megarectum formation, which likely compounds postoperative constipation regardless of technical outcome.

In our series, sacral ratio did not consistently predict functional outcome, with patients across the full range of sacral morphology achieving continence. Given the small sample size, no conclusions can be drawn regarding the predictive value of sacral ratio in this specific population.

Regarding surgical approach, our experience supports individualized technique selection over a standardized algorithm. The absence of consensus in the literature reflects the anatomical heterogeneity of these conditions rather than a failure of any single technique. The TA approach without prior colostomy was feasible and effective in 3 RS patients with adequate fecal decompression, consistent with recent series reporting successful primary correction in selected cases [10]. The APT approach was employed in one patient with extensive rectal fibrosis and complex anatomy; although complete operative documentation was not available for retrospective verification, this case illustrates the need for flexible surgical planning in anatomically challenging presentations.

The laparoscopic endorectal technique was employed in two patients presenting with rectal web and severe caudal regression precluding standard prone jackknife positioning. This approach allowed direct visualization of the caliber change zone, precise web excision, and valuable intraoperative assessment of anatomical variants, rectal caliber, and the distance between the resection site and the anal canal — which guided the decision between transanal and laparoscopic rectal wall closure. Both patients had uncomplicated postoperative courses. Previous reports have described laparoscopic approaches in rectal atresia [6]. The laparoscopic endorectal technique described in this article represents a novel approach for rectal web correction that, beyond fulfilling the primary surgical objective of preserving sphincter integrity, offers the additional advantage of intraoperative laparoscopic assessment of anatomical variants, rectal caliber, and the distance between the resection site and the anal canal — information that directly guides the surgical strategy.

The reintervention rate of 18.2% in our series (2 patients, both following PSARP) is within the range reported in the literature [7, 11]. Both cases involved technically demanding anatomy, and the complications — persistent stenosis and rectovaginal fistula — are recognized challenges of PSARP in this context rather than technique-specific failures.

This study has several limitations. The retrospective design and small sample size, inherent to the rarity of these conditions, limit statistical analysis and preclude formal comparison between techniques. The exclusion of two patients from functional assessment reduces the analyzable cohort further. Additionally, the non-adherence to bowel management observed in three RS patients may reflect socioeconomic or systemic barriers not captured in our data, and their outcomes should be interpreted in that context rather than as treatment failures.

One patient was excluded from functional assessment due to age below 3 years at the time of data collection; this patient has since reached evaluable age and prospective follow-up is ongoing.

Notwithstanding these limitations, our series contributes meaningful data on the long-term natural history of RA and RS, underscores the importance of systematic multidisciplinary follow-up, and provides early technical experience with the LE approach for rectal web correction.

Conclusion

Rectal atresia and stenosis remain among the most surgically challenging anorectal malformations, yet individualized management yields satisfactory continence outcomes in most patients. Notably, timely diagnosis was achieved in all RA patients, while only 1 of 7 RS patients (14%) was diagnosed without delay — a finding that may reflect the partial luminal patency inherent to RS and warrants heightened clinical awareness. Delayed diagnosis may contribute to progressive rectal distension and megarectum formation, potentially compounding postoperative constipation regardless of surgical technique. The high burden of constipation — particularly in RS — highlights the need for systematic postoperative follow-up and proactive bowel management. The laparoscopic endorectal technique represents a reproducible, sphincter-preserving option for rectal web correction with favorable early outcomes.

Multicenter collaboration remains essential to generate sufficient evidence for guideline development in this rare condition.

Declarations

Compliance with Ethical Standards

Conflict of interest: The authors declare no conflict of interest.

Ethical approval:

This study was approved by the institutional review board. All procedures were performed in accordance with the ethical standards of the institution and with the 1964 Helsinki Declaration and its later amendments.

Informed consent:

Informed consent was obtained from the parents or legal guardians of all patients included in the study.

Funding

No funding was received for conducting this study.

Author Contribution

JIS: Conceptualization, Data collection, Formal analysis, Writing – original draft, Writing – review and editing. LA: Data collection, Formal analysis, Writing – review and editing. MVDM: Data collection. JR, MDN, AMR: Writing – review and editing. VPDB, MMB: Supervision. All authors read and approved the final manuscript.

Data Availability

The data that support the findings of this study are not publicly available as they are contained in institutional medical records. Data are available from the corresponding author upon reasonable request and subject to institutional approval.

References

1. Holschneider A, Hutson J, Peña A, Beket E, Chatterjee S, Coran A, Davies M, Georgeson K, Grosfeld J, Gupta D, Iwai N, Kluth D, Martucciello G, Moore S, Rintala R, Smith ED, Sripathi DV, Stephens D, Sen S,

Ure B, Grasshoff S, Boemers T, Murphy F, Söylet Y, Dübbers M, Kunst M (2005) Preliminary report on the International Conference for the Development of Standards for the Treatment of Anorectal Malformations. Journal of Pediatric Surgery. octubre de. ;40(10):1521-6. 10.1016/j.jpedsurg.2005.08.002

2. Peña A, Levitt MA (2005) Imperforate anus and cloacal malformations. En: Ashcraft KW, Holcomb GW, Murphy JP, editors. Pediatric Surgery. 4.ª ed. Philadelphia: Elsevier Saunders; pp. 496–517
3. Hamzaoui M, Ghribi A, Makni W, Sghairoun N, Gasmi M (2012) Rectal and sigmoid atresia: transanal approach. J Pediatr Surg junio de 47(6):e41–e44. 10.1016/j.jpedsurg.2012.02.025
4. Dias RG, Santiago ADPG, Ferreira MC (1982) Rectal atresia: Treatment through a single sacral approach. J Pediatr Surg agosto de 17(4):424–425. 10.1016/S0022-3468(82)80506-X
5. Zia-ul-Miraj Ahmad M, Brereton RJ, Huskisson L (1995) Rectal atresia and stenosis. J Pediatr Surg noviembre de 30(11):1546–1550. 10.1016/0022-3468(95)90153-1
6. Liem NT, Hien PD (2007) Laparoscopic and transanal approach for rectal atresia: a novel alternative. J Pediatr Surg noviembre de 42(11):e25–e27. 10.1016/j.jpedsurg.2007.08.049
7. Hamrick M, Eradi B, Bischoff A, Louden E, Peña A, Levitt M (2012) Rectal atresia and stenosis: unique anorectal malformations. J Pediatr Surg junio de 47(6):1280–1284. 10.1016/j.jpedsurg.2012.03.036
8. Russell KW, Rollins MD, Feola GP, Scaife ER (2014) Magnamosis: a novel technique for the management of rectal atresia. BMJ Case Rep 5 de agosto de 2014:bcr2013201330. 10.1136/bcr-2013-201330
9. Lane VA, Wood RJ, Reck C, Skerritt C, Levitt MA (2016) Rectal atresia and anal stenosis: the difference in the operative technique for these two distinct congenital anorectal malformations. Tech Coloproctol abril de 20(4):249–254. 10.1007/s10151-016-1435-5
10. Sharma S, Gupta DK (2017) Varied facets of rectal atresia and rectal stenosis. Pediatr Surg Int agosto de 33(8):829–836. 10.1007/s00383-017-4106-3
11. De Beaufort CMC, Gorter RR, Iacobelli BD, Midrio P, Sloots CEJ, Samuk I, Van Rooij IALM, Lisi G, for the ARM-Net Consortium, De Blaauw I, Fascetti-Leon F, Vázquez AG, Krois W, Lacher M, Leva E, Schmiedeke E, Schukfeh N, Stanton M (2023) Rectal atresia and rectal stenosis: the ARM-Net Consortium experience. Pediatr Surg Int 28 de julio de 39(1):242. 10.1007/s00383-023-05518-7
12. Rintala RJ, Lindahl HG, Rasanen M (1997) Do children with repaired low anorectal malformations have normal bowel function? J Pediatr Surg junio de 32(6):823–826. 10.1016/S0022-3468(97)90628-X

Figures

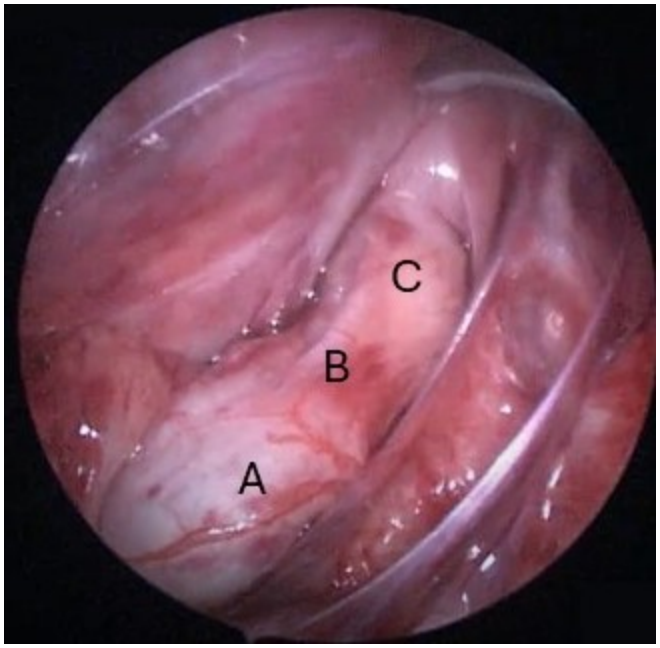


Figure 1

Laparoscopic view of rectal stenosis. (A) Dilated proximal stump. (B) Transition zone. (C) Distal rectum