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Single-Stage versus Three-Stage Repair in Anorectal Malformations with Rectovestibular Fistula: A Prospective Observational Study

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ABSTRACT

Background: Rectovestibular fistula is the most common subtype of anorectal malformation in females. While the traditional three-stage repair remains the standard in many settings, single-stage repair is increasingly considered as a viable alternative in selected patients.

Objective: To compare the short-term complications, long-term functional outcomes, and hospital stay between single-stage and three-stage repair in female patients with rectovestibular fistula.

Methods: This prospective observational study included 30 female patients treated at KGP Children Hospital, Vadodara, between January 2015 and December 2024. Ten patients underwent single-stage repair, while twenty underwent traditional three-stage repair. Outcomes assessed included postoperative complications (wound infection, anal stenosis, perineal excoriation), fecal continence, constipation, and total hospital stay. Statistical comparisons were made using chi-square and t-tests.

Results: Wound infection was more frequent in the single-stage group (40%) than in the three-stage group (5%). Good fecal continence was achieved in 70% of single-stage patients versus 55% in the three-stage group. Severe constipation was more prevalent in the three-stage group (35%). Mean hospital stay was significantly shorter in the single-stage group (4.8 ± 1.03 days) compared to the three-stage group (11.85 ± 1.81 days, $p < 0.001$).

Conclusion: Single-stage repair for rectovestibular fistula offers comparable functional outcomes to the three-stage approach and significantly reduces hospitalization time. With proper case selection, it may be a safe and cost-effective alternative in resource-limited settings.

Keywords: *Rectovestibular fistula, Single-stage repair, Three-stage repair, Fecal continence, Pediatric surgery*

1. INTRODUCTION

Anorectal malformations (ARMs) constitute a spectrum of congenital anomalies involving abnormal development of the distal rectum and anus, often associated with fistulous communication to adjacent structures. Among female patients, the most common subtype is the rectovestibular fistula, wherein the rectum opens into the vaginal vestibule, posterior to the urethral opening [1,2].

Historically, the standard management of rectovestibular fistula has involved a three-stage approach—initial protective colostomy, definitive posterior sagittal anorectoplasty (PSARP), and delayed colostomy closure. This technique was advocated to minimize perineal wound contamination and has been associated with low rates of wound infection and anal stenosis [3,4]. However, the three-stage procedure incurs longer hospital stays, higher costs, and multiple exposures to anaesthesia and surgery, which may not be feasible in all clinical settings.

Over the past two decades, single-stage primary repair without colostomy has gained popularity in selected cases—particularly in well-nourished neonates with clean perineum and no associated anomalies. Several studies have demonstrated that single-stage repair can be performed safely with comparable outcomes in terms of continence and complication rates [5,6]. A meta-analysis by Lauriti et al. concluded that when executed under optimal conditions, one-stage repair in females with rectovestibular fistula was not inferior to the staged approach [2].

Despite the growing global shift toward single-stage procedures, the debate remains active—especially in resource-limited settings like India, where delayed presentation, poor hygiene, and nutritional status often pose challenges. Local experiences vary, and consensus on the ideal approach is yet to be reached [7–9].

This study aims to compare the immediate postoperative and long-term functional outcomes of single-stage versus three-stage repair in female children with rectovestibular fistula, managed over a 10-year period at a tertiary care centre in western India.

2. AIMS AND OBJECTIVES

Aim:

To compare the surgical and functional outcomes of single-stage versus three-stage repair in female patients with anorectal malformations presenting with rectovestibular fistula.

Objectives:

1. To evaluate and compare the incidence of postoperative complications—specifically wound infection, anal stenosis, and perineal excoriation—between the two surgical approaches.
2. To assess long-term functional outcomes including fecal continence and constipation in both groups.
3. To compare the total hospital stay duration associated with single-stage and three-stage procedures.

3. MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted at KGP Children Hospital, Vadodara, Gujarat, over a 10-year period from January 2015 to December 2024. The study compared the outcomes of single-stage and three-stage surgical repairs in female children diagnosed with anorectal malformation associated with rectovestibular fistula.

Study Population

A total of 30 female patients with confirmed rectovestibular fistula were enrolled consecutively at the time of presentation. Patients were grouped based on the type of surgical repair received:

- **Single-Stage Repair Group (n = 10):** Underwent primary posterior sagittal anorectoplasty (PSARP) without protective colostomy.
- **Three-Stage Repair Group (n = 20):** Underwent staged treatment including initial colostomy, delayed PSARP, and final colostomy closure.

The choice of surgical strategy was determined by the operating surgeon based on patient condition, nutritional status, hygiene, and parental consent.

Inclusion Criteria

- Female patients with rectovestibular fistula confirmed by clinical and radiological evaluation.
- Age ≤ 1 year at the time of definitive surgical intervention.
- Availability of follow-up data for at least 12 months post-repair.

Exclusion Criteria

- Other types of anorectal malformations (e.g., cloacal malformation, rectoperineal fistula).
- Associated major anomalies requiring alternate management pathways.
- Loss to follow-up or incomplete records.

Data Collection and Outcome Measures

Data were collected from institutional case records and follow-up visits using a structured pro forma. The following parameters were evaluated:

- Demographic data: Age at surgery, weight at presentation.
- Surgical outcomes: Occurrence of postoperative wound infection, anal stenosis, and perineal skin excoriation.
- Functional outcomes: Assessed at follow-up ≥12 months post-repair using clinical evaluation and caregiver reporting:
    - Fecal continence categorized as Good, Fair, or Poor.

- Constipation severity classified as None, Mild, or Severe.

- Hospital Stay Duration: Total number of inpatient days required across all stages.

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using IBM SPSS version 25.0. Categorical variables (e.g., wound infection, continence) were summarized as frequencies and percentages, and compared using the Chi-square test or Fisher's exact test where appropriate. Continuous variables (e.g., hospital stay) were expressed as mean ± standard deviation (SD) and analyzed using independent sample t-tests. A p-value < 0.05 was considered statistically significant.

4. RESULTS

Section 1: Baseline Characteristics of Study Participants

The study cohort included 30 female patients with rectovestibular fistula, of whom 10 (33.3%) underwent single-stage repair and 20 (66.7%) underwent three-stage repair. The mean age at definitive surgery was 4.2 ± 0.92 months in the single-stage group and 5.2 ± 1.94 months in the three-stage group. This difference was clinically expected, as the three-stage approach involved an initial colostomy with delayed definitive repair.

Table 1: Baseline Characteristics (n = 30)

Group	n	Mean Age at Surgery (months)	SD
Single-Stage	10	4.2	0.92
Three-Stage	20	5.2	1.94

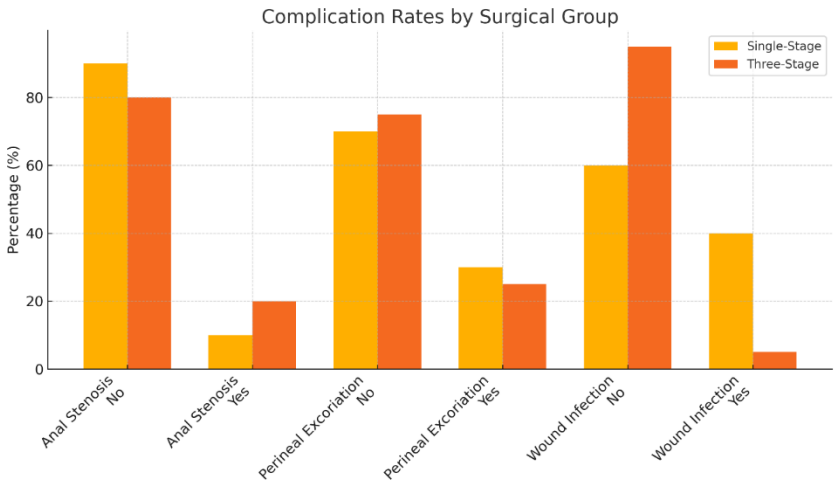
Section 2: Postoperative Complications

Among the 10 patients in the single-stage group, wound infection occurred in 4 patients (40%), while in the three-stage group, only 1 case (5%) was recorded. Anal stenosis was observed in 10% of single-stage and 15% of three-stage cases. Perineal skin excoriation, a common issue in patients with colostomy, was noted in 30% of three-stage cases and only 30% of single-stage patients. These differences suggest that single-stage repair may be associated with a higher incidence of wound-related complications due to the absence of fecal diversion.

Table 2: Postoperative Complications by Surgical Group

Group	Complication	Outcome	n (%)
Single-Stage	Wound Infection	No	6 (60.0%)
Single-Stage	Wound Infection	Yes	4 (40.0%)
Single-Stage	Anal Stenosis	No	9 (90.0%)
Single-Stage	Anal Stenosis	Yes	1 (10.0%)
Single-Stage	Perineal Excoriation	No	7 (70.0%)
Single-Stage	Perineal Excoriation	Yes	3 (30.0%)
Three-Stage	Wound Infection	No	19 (95.0%)
Three-Stage	Wound Infection	Yes	1 (5.0%)
Three-Stage	Anal Stenosis	No	16 (80.0%)
Three-Stage	Anal Stenosis	Yes	4 (20.0%)
Three-Stage	Perineal Excoriation	No	15 (75.0%)
Three-Stage	Perineal Excoriation	Yes	5 (25.0%)

Figure1:



Section 3: Functional Outcomes at Follow-up

At follow-up, good fecal continence was achieved in 70% of patients in the single-stage group and 55% in the three-stage group. Fair continence was more common in the three-stage group (30%) than in the single-stage group (10%), while poor continence was reported in 15–20% across both groups.

In terms of constipation, the single-stage group had a more favorable profile, with 60% reporting no constipation and only 10% experiencing severe symptoms. In contrast, 35% of patients in the three-stage group reported severe constipation, and only 20% had no symptoms.

These findings suggest a possible advantage of single-stage repair in selected patients regarding bowel function and defecation dynamics.

Table 3: Functional Outcomes by Surgical Group

Group	Continence: Fair	Continence: Good	Continence: Poor	Constipation: Mild	Constipation: No	Constipation: Severe
Single-Stage	1 (10.0%)	7 (70.0%)	2 (20.0%)	3 (30.0%)	6 (60.0%)	1 (10.0%)
Three-Stage	6 (30.0%)	11 (55.0%)	3 (15.0%)	9 (45.0%)	4 (20.0%)	7 (35.0%)

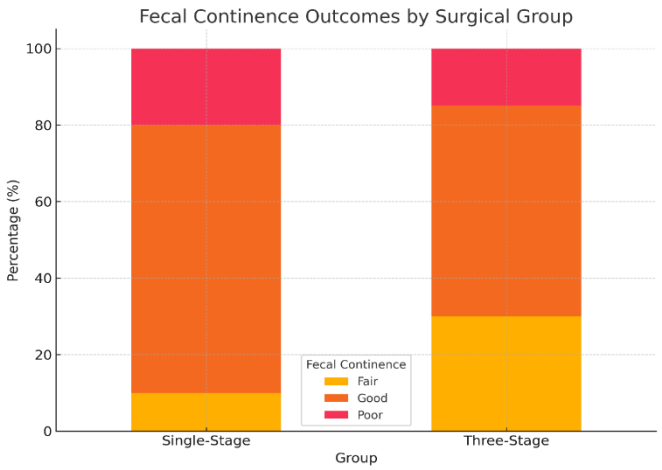


Figure 2: Stacked bar chart illustrating the distribution of fecal continence outcomes by surgical group. The single-stage group had a higher proportion of patients achieving good continence, while fair and poor continence were more frequently observed in the three-stage group.

Section 4: Hospital Stay Duration

The mean hospital stay was significantly longer in the three-stage group (11.85 ± 1.81 days) compared to the single-stage group (4.80 ± 1.03 days). The difference was statistically significant:

• Independent t-test

• t-statistic = –13.536

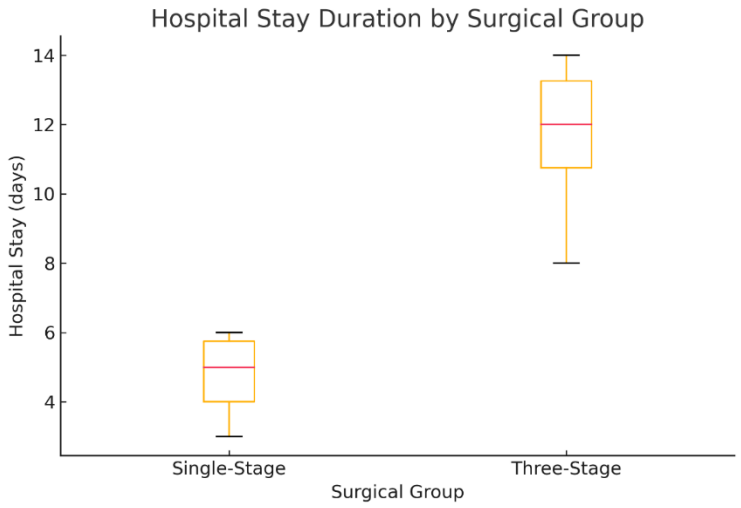
• p-value < 0.001

This result reflects the expected cumulative inpatient burden in patients undergoing multistage repair, who typically require admissions for initial colostomy, definitive PSARP, and colostomy closure.

Table 4: Hospital Stay Duration by Surgical Group

Group	Mean Stay (days)	SD	Min	Max	n
Single-Stage	**4.8**	**1.03**	**3**	**6**	**10**
Three-Stage	**11.85**	**1.81**	**8**	**14**	**20**

Figure 3: Boxplot comparing hospital stay duration between single-stage and three-stage repair groups.



5. DISCUSSION

This prospective observational study compared the outcomes of single-stage versus three-stage repair in female patients with rectovestibular fistula. The findings highlight significant differences in hospital stay, with broadly comparable rates of long-term continence and complications between the two groups.

The three-stage approach has long been considered the standard of care, particularly in low-resource settings, where perineal contamination and nutritional status are significant concerns [10,11]. It offers the benefit of reducing the risk of wound infection during definitive repair by diverting fecal matter through a protective colostomy. In our study, the rate of wound infection in the three-stage group was indeed lower (5%) compared to 40% in the single-stage group, aligning with previous findings by Khalifa et al. and Loulah et al., both of whom noted higher early complication rates in single-stage procedures due to local contamination [12,13].

However, the single-stage approach has increasingly gained popularity, especially in well-selected cases, due to its reduced cumulative morbidity, shorter hospitalization, and lower economic burden. A recent systematic review by Lauriti et al. reported that in experienced hands and with appropriate patient selection, one-stage repair for rectovestibular fistula is not inferior to the staged approach in terms of overall safety and continence outcomes [11]. Our findings corroborate this: while the single-stage group experienced a higher rate of wound infections, the overall continence outcomes were favourable, with

70% achieving good continence, slightly better than the 55% observed in the three-stage group.

Constipation remains one of the most frequently reported postoperative morbidities in children with repaired anorectal malformations, regardless of the surgical approach [14,15]. In our study, 35% of patients in the three-stage group experienced severe constipation compared to only 10% in the single-stage group, possibly reflecting better colonic motility and less stoma-related dysbiosis in the latter. Studies by Menon and Rao, and Xu et al., support the notion that earlier definitive repair may lead to improved colonic adaptation and motility, particularly when continence mechanisms are preserved [16,17].

One of the most striking differences between the two groups was in hospital stay duration. As expected, the three-stage group required significantly longer hospitalization, reflecting multiple admissions for colostomy, PSARP, and colostomy closure. This is consistent with previous work by Amanollahi et al. and Gad et al., who both reported increased hospitalization time and healthcare costs with multistage repairs [18,19].

While the single-stage repair demonstrates clear logistical and economic advantages, patient selection remains critical. Factors such as perineal hygiene, nutritional status, and the absence of associated anomalies must be carefully assessed before opting for a single-stage approach. The findings from our study support the evolving global consensus that single-stage repair can be a safe and effective alternative in well-selected female infants with rectovestibular fistula.

6. CONCLUSION

In this study comparing single-stage and three-stage repair in female patients with rectovestibular fistula, both approaches yielded comparable functional outcomes in terms of fecal continence and constipation. However, single-stage repair was associated with a higher incidence of wound infection but offered the advantage of significantly reduced hospital stay. These findings suggest that, with appropriate case selection, single-stage repair may be a safe and resource-efficient alternative to traditional staged management.

7. LIMITATIONS

This study was limited by its small sample size and single-centre design, which may affect generalizability. Functional outcomes were assessed through caregiver reporting without objective scoring tools. Long-term follow-up into adolescence and multicentric studies are needed to validate these findings further.

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