Original Research

FREQUENCY OF WOUND DEHISCENCE IN POSTERIOR SAGITTAL ANORECTOPLASTY IN CHILDREN

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ABSTRACT

Objective: To identify independent risk factors, assess the clinical role of the occurrence of wound dehiscence after PSARP in pediatric patients with anorectal malformations and to determine the frequency.

Material and Method: The study was conducted as a prospective cohort study in a tertiary surgical center specializing in children's surgery from January 2023 to December 2025. The children enrolled were those who were ≤12 years old at PSARP or staged PSARP. Wound dehiscence was partial or complete separation of the midline perineal wound, necessitating clinical intervention. A p-value of <0.05 was considered statistically significant.

Results: 218 patients were enrolled and 31 (14.2%) had wound dehiscence. High/intermediate malformation type (p=0.003), complications in relation to the colostomy (p=0.011), operation of more than 3 hours (p=0.008) and the weight-for-age that was below the 5th percentile (p=0.024) showed significant univariate associations. The surgeon's experience level (p=0.14) and the type of prophylactic antibiotic (p=0.29) did not appear to be associated.

Conclusions: The incidence of wound dehiscence in children undergoing PSARP is ~1/7, and is correlated with the complexity of the surgery, length of surgery and nutritional status at surgery. Such perioperative optimization that employs a protocol (including nutritional rehabilitation) can minimize this complication. Anorectal malformations (ARMs) are a common complication of posterior sagittal anorectoplasty (PSARP) surgery, with a 0.6% incidence of surgical site complications.

Keywords: Wound Dehiscence, Posterior Sagittal Anorectoplasty (PSARP), Pediatric Patients.

INTRODUCTION

Anorectal malformations (ARMs) are a complex group of congenital malformations that occur because of abnormal development of the hindgut and cloaca and urogenital tract with a reported incidence of 1/4000-1/5000 live births [1]. PSARP uses midline sagittal perineal incision to view directly and preserve the striated muscle complex, allowing the rectum to be placed within the sphincteric apparatus.

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Although the functional outcome has significantly improved over the last 20 years, surgical morbidity remains a constant problem in surgery with wound complications being one of the most common early postoperative problems [2]. Dehiscence is a failure of fascial or deep dermal approximation that can expose the neorectum, affect reconstruction of the sphincter, and require a secondary surgery including local wound management, to surgical revision [3]. Perineal surgical field is a very susceptible area because it is near the fecal stream, is highly colonized by microbes, constant force from mechanical activities due to pelvic floor dynamics, and has relatively low vascularization of the midline raphe tissue [4].

In addition, the plane of dissection passes through the external sphincter complex, puborectalis, and the levator ani muscles, and strict hemostasis and tension free closure is essential to prevent ischemic necrosis of the wound margins. Dehiscence slows

down wound healing, can result in secondary pull-through rectum retraction, change in sphincter morphology and chronic fecal incontinence, compromising the functional objectives of the surgery [5,6]. Wound dehiscence after PSARP has been reported with varying frequencies ranging from 6% - 22% across institutional series which suggests that there are differences in patient populations, the complexity of the malformation, surgical approach and postoperative care [7].

This variation highlights that perineal reconstruction is a multifactorial process and results in wound failure. Malnutrition, long term dependency on colostomy and syndromic conditions associated with the condition (such as VACTERL association) all reduce the ability to repair tissue because of the disruption of collagen synthesis, angiogenesis and recruitment of immune cells in the pre-operative state [8]. The effects of the various factors involved during surgery on tensile strength and early wound integrity (operative duration, degree of rectal mobilization, thermal damage caused by electrocautery, choice of suture material, and management of dead space) are directly related [9].

On the postoperative period, early enteral feeding, initiation of bowel regimen, diaper dermatitis, and compliance of caregivers on hygiene practices are factors responsible for the modulation of the microbial and mechanical environment of the healing incision [10]. However, despite all these known influences, there is still a lack of prospective, standardized data quantifying the actual incidence of dehiscence, and determining modifiable predictors in modern practice. Although there has been increased focus on the importance of ERAS protocols in paediatric colorectal surgery, there is less guidance available about management of wounds in PSARP [11]. Whether or not to perform a prophylactic drain, as well as closed suction versus passive drainage and interrupted absorbable versus layered fascial-muscle approximation are debated by some centers [12].

We postulated that wound dehiscence would be present in a clinically significant number of cases and that the length of operation, the type of malformation and the level of nutritional deficit would be most important independent factors.

MATERIALS AND METHODS

This study was a prospective cohort study performed in the Department of Pediatric Surgery, Lady Reading Hospital Peshawar, Pakistan. The study protocol was registered in the national clinical trials registry and approved by the Institutional Review Board and Ethics Committee. Parental informed consent and assent was obtained. Inclusion criteria were: (1) diagnosis of ARM confirmed by physical examination and cross-sectional imaging (MRI of the pelvis or cross-table lateral radiograph); (2) scheduled PSARP either as definitive or staged repair; (3) complete intraoperative documentation; and (4) postoperative follow-up for at least 30 days. Inclusion in the study was restricted to patients who: (1) had no cloacal exstrophy or had severe pelvic lipomeningocele that required alternative surgical reconstruction; (2) did not have a major abdominal procedure that affected the perineal wound dynamics prior to surgery; (3) did not have immunodeficiency or chronic corticosteroid use prior to surgery; (4) were not lost to follow-up before day 14; and (5) had complete data capture. All patients were evaluated in a standardized manner prior to surgery, termed as preoperative Assessment and Optimization. Nutritional evaluation was done by using WHO growth charts and weight for age (W/A) and height for age (H/A) Z scores were determined. Within 72 hours after surgery, hematological parameters (CBC, serum albumin, prealbumin, and CRP) were collected. Routine assessment of the colostomy for stomal prolapse, retraction or peristomal dermatitis was done on patients with a diverting stoma. When clinically indicated, the diagnosis of fistula anatomy and position of the distal rectal pouch was further defined by colonoscopy or by contrast studies. All surgeries were done under general anesthesia and caudal epidural anesthesia. Patients were under supine position with legs in jack-knee position. The midline sagittal incision was made between the intended anal dimple and the coccyx, confirming the location of the striated muscle complex by using electrical stimulation mapping (0.5–2.0 mA). Interrupted 4-0 PDS sutures were used to achieve rectal fixation to the posterior muscle wall. The wound closure was in three layers: deep fasciomuscular closure (4-0 PDS), closure of the subcutaneous tissue (5-0 Vicryl) and closure of the skin (5-0 Monocryl running subcuticular suture). Closed suction drains (8–10 Fr) were used in 68% of the cases, depending on the surgeon's discretion and the amount of dead space. Intravenous antibiotics were given for 48 hours - ampicillin-sulbactam or ceftriaxone-metronidazole. Enteral feeding was started from 6–12 hours after surgery and gradually increased. On day 5, the bowel management began with glycerin suppository and osmotic laxatives to prevent constipation and straining. Zinc oxide barrier cream was used and the diapers changed every 2-3 hours with gentle washing. Drain removal was performed when output was <10 mL/24h, which was usually at a later stage (days 3-7). Wound care was provided and patients were discharged on day 5-7. The follow-up visits were planned at days 7, 14, 21 and 30, and the wound evaluation was done by a blinded pediatric wound care nurse. Dehiscence was classified as: Grade I (superficial, < 25% of wound length, treated conservatively); Grade II (moderate, 25–50% of wound length, treated by wound packing); and Grade III (complete, > 50% of wound length or exposure of muscle or rectum, surgical

revision). All data were analyzed statistically with the OpenEpi v3.01 program. Chi-square or Fisher's exact test for categorical variables and independent t-test or Mann-Whitney U for continuous variables were used for bivariate analysis. Hosmer-Lemeshow goodness-of-fit ($p>0.05$ acceptable) was used to assess model fitness, as was Nagelkerke R^2. Variance inflation factor (VIF < 5) was used to evaluate multicollinearity. The p value of <0.05 was considered statistically significant. All the data was analyzed using SPSS v28.0.

RESULTS

218 paediatric patients who fulfilled the inclusion criteria were prospectively enrolled and followed up for 30 days.

Weight-for-age (WFA) below 5th percentile and hypoalbuminemia were significantly correlated with wound dehiscence.

Table 1. There Were No Significant Associations between Baseline Demographic and Nutritional Parameters and Wound Dehiscence (N=218)

Variable	Total (N=218)	Dehiscence (N=31)	No Dehiscence (N=187)	P-Value
Age at surgery (months), median (IQR)	8.4 (6.1–14.2)	7.2 (5.0–11.8)	8.6 (6.3–14.8)	0.18
Male sex, n (%)	132 (60.6)	20 (64.5)	112 (59.9)	0.62
Weight-for-age <5th percentile, n (%)	42 (19.3)	12 (38.7)	30 (16.0)	0.004
Preoperative serum albumin <3.5 g/dL, n (%)	38 (17.4)	11 (35.5)	27 (14.4)	0.007
Associated VACTERL anomaly, n (%)	67 (30.7)	14 (45.2)	53 (28.3)	0.06
Preoperative colostomy present, n (%)	176 (80.7)	26 (83.9)	150 (80.2)	0.61

The statement that was statistically supported was that the anatomical complexity was highly correlated with dehiscence incidence.

Table 2. There Was No Association between Complexities of the Anorectal Malformation with Wound Dehiscence

Malformation Type (Kransenbein Classification)	Total (N=218)	Dehiscence (N=31)	No Dehiscence (N=187)	P-Value
Low (perineal/vestibular fistula)	64 (29.4)	4 (12.9)	60 (32.1)	0.003
Intermediate (bulbous/rectourethral fistula)	89 (40.8)	13 (41.9)	76 (40.6)	
High (rectovesical/cloacal/no fistula)	65 (29.8)	14 (45.2)	51 (27.3)	

Wound dehiscence was significantly associated with prolonged operative duration (>3 hours), increased blood loss and transfusion requirement. These are technical difficulties, extensive tissue handling and microvascular compromise.

Table 3**.** An Association Was Observed Between Surgical Factors and Wound Dehiscence

Intraoperative Variable	Total (N=218)	Dehiscence (N=31)	No Dehiscence (N=187)	P-Value
Operative time >3 hours, n (%)	58 (26.6)	16 (51.6)	42 (22.5)	0.001*
Estimated blood loss >30 mL, n (%)	47 (21.6)	12 (38.7)	35 (18.7)	0.009
Intraoperative transfusion, n (%)	12 (5.5)	5 (16.1)	7 (3.7)	0.006
Surgeon experience (attending vs fellow-led), n (%)	189 (86.7) / 29 (13.3)	25 / 6	164 / 23	0.14
Use of closed-suction drain, n (%)	148 (67.9)	22 (71.0)	126 (67.4)	0.71

The delayed initiation of enteral feeding, postoperative constipation, and moderate-severe diaper dermatitis were all significantly associated with dehiscence.

Table 4. Association between Factors of Postoperative Management and Wound Dehiscence was established

Postoperative Variable	Total (N=218)	Dehiscence (N=31)	No Dehiscence (N=187)	P-Value
Early enteral feeding (<12h), n (%)	194 (89.0)	24 (77.4)	170 (90.9)	0.032
Constipation requiring intervention by day 10, n (%)	36 (16.5)	11 (35.5)	25 (13.4)	0.005

Diaper dermatitis grade ≥2, n (%)	48 (22.0)	13 (41.9)	35 (18.7)	0.004
Antibiotic duration >48h, n (%)	82 (37.6)	14 (45.2)	68 (36.4)	0.31
Drain removal day (median, IQR)	4 (3–6)	5 (4–7)	4 (3–5)	0.11

Multivariate analysis revealed that operative time, nutritional deficit before PSARP, anatomical complexity, postoperative constipation and severe diaper dermatitis are independent risk factors for PSARP wound dehiscence.

Table 5. Multivariate Binary Logistic Regression Analysis for Independent Predictors of Wound Dehiscence was used

Predictor	Adjusted OR	95% CI	P-Value
Operative time >3 hours	3.12	1.41–6.89	0.005
Weight-for-age <5th percentile	2.87	1.29–6.38	0.010
High/intermediate malformation	2.64	1.18–5.91	0.018
Postoperative constipation by day 10	2.41	1.08–5.38	0.032
Diaper dermatitis ≥2	2.28	1.04–5.01	0.039

DISCUSSION

The present prospective cohort study shows that 14.2% of children with anorectal malformations who have undergone posterior sagittal anorectoplasty develop wound dehiscence, consistent with the more recent institutional reports, and underline the ongoing difficulties with maintaining perineal wound integrity during colorectal reconstruction in children [13]. Our results support these conclusions that the dehiscence is not an unavoidable complication but rather the result of a combination of preoperative, operative and postoperative factors that converge operative duration, nutritional status and anatomic complexity proved to be independent factors. This frequency is on the high end of the recent literature, which cited malformation frequencies between 8% and 19% depending on the malformation spectrum and the postoperative protocol [14].

However, this may be attributed to the strict prospective surveillance, standardisation of wound grading and complex cases referred from peripheral centres in our cohort. Importantly, 70.9% of dehiscence cases were Grade I or II, and could be treated conservatively or with local wound care, while 12.9% required surgical revision. This association is biomechanically and surgically intuitive, complex ARMs involve significant rectal mobilization, deeper surgery through the pelvic floor and are often performed with additional urogenital fistula ligature, which add to tissue trauma and ischemic time and tension to wound closure [15]. Recent cadaveric studies have shown that the striated muscle complex has anisotropic tensile strength, and that midline closure will need to consider multidirectional vectors of stress when the muscle is contracting during defecation and during movement [16].

Multiple pathways are involved in the impairment of wound healing by malnutrition, including impaired collagen synthesis resulting from amino acid and vitamin C deficiencies, impaired angiogenesis due to zinc and copper deficiencies, and impaired function of neutrophils due to protein-energy malnutrition [17,18].

The risk was likely reduced but not eliminated in our institution by the enteral supplementation protocol of 7–10 days before PSARP because 38.7% of the malnourished patients had dehiscence. This also emphasizes the importance of earlier nutritional support, perhaps starting as early as the time of colostomy creation, not preoperatively; and the addition of prealbumin and transferrin as dynamic monitoring markers. The longest operative time (>3 hours) was the strongest independent predictor. The duration of the operation is used as an indirect measure of technique, intensity of tissue manipulation and exposure-induced drying. With every additional hour of perineal dissection, there is a greater risk of bacterial colonization, loss of evaporative fluids, and microvascular endothelial injury, all of which delay the inflammatory phase of perineal dissection and decrease the movement of fibroblasts [19,20]. Surgeon experience level was also not a significant factor in outcomes, which may be because of the presence of an established protocol, team familiarity, and decision making within the operating room. The result is consistent with recent ERAS literature that focused on system level optimization rather than individual operator metric [21].

However, in centers with smaller volumes of PSARP, checklists, simulation training, and proctoring should be used to decrease the operative time and reduce tissue trauma. Wound failure was greatly attributed to the postoperative factors, especially constipation and diaper dermatitis. The intra-abdominal and perineal pressure rises during straining which causes shear force to fresh sutures and affects the microcirculation [22]. Because the dehiscence induced by constipation was not prevented by early use of osmotic laxatives and glycerin suppositories as used in our protocol, more aggressive bowel management is needed, such as scheduled enemas or transanal irrigation in high-risk patients. Likewise, moderate to severe diaper

dermatitis gives rise to the presence of Candida and Enterobacteriaceae in the wound of the perineum, interferes with epithelial migration and activates the release of inflammatory cytokines [23].

Our results confirm that barrier cream, pH balanced washing the nappy and frequent changes of nappies should be considered mandatory elements of PSARP aftercare, especially during the first 14 days when the tensile strength of the wound is less than 20% of normal.

The less frequent the dehiscence, the better the children will recover and the more the functional integrity of sphincter reconstruction will be maintained, in line with the primary objective of the ARM surgery to provide children with social continence and better quality of life.

CONCLUSION

Wound dehiscence is found in 14.2% of children who have posterior sagittal anorectoplasty and is independently associated with operative time >3 hours, preoperative nutritional deficit, high/intermediate anatomical complexity, postoperative constipation, and/or substantial diaper dermatitis. These results emphasize that perineal wound failure is multifactorial, and that there are targets that can be modified to improve perioperative optimization. Structured nutritional rehabilitation, efficiency protocols during surgery, tension-free layered closure and aggressive bowel hygiene management could be effective in lowering the incidence of dehiscence.

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