SURGICAL OUTCOMES OF ANORECTAL MALFORMATIONS IN PEDIATRIC PATIENTS: A SINGLE-CENTER EXPERIENCE

Muhammad Jehangir Khan[1*]

[1*]Assistant Professor, Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan

[*]**Corresponding Author:**

Dr. Muhammad Jehangir Khan, Assistant Professor, Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan. Email: drjehangir313@yahoo.com. Cell: +923339110651.

ABSTRACT

Background

Anorectal malformations (ARMs) are associated with congenital abnormality of the anus and rectum in most cases needs surgical repair. As different types of malformation, their association with other anomalies, and the timing of the surgery, the management and outcomes of ARMs also differ.

Objective

This study was aimed to assess the results of surgeries of children diagnosed with ARMs.

Methods

A descriptive cross-sectional study was conducted for about 3 months from Aug, 2011 to Oct, 2011 in the Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan. Sixty pediatric patients with ARMs and who received intervention through surgery were enrolled. Patients' information regarding age, gender, BMI, presenting symptoms, concomitant anomalies, operative procedures and early complications were obtained. Descriptive statistics and Analysis of Variance (ANOVA) were used to determine if there were statically significant differences between variables of interest with the level of significant set to 0.05 or less.

Results

Regarding the type of malformations: The most frequent type was the intermediate type (42%), second was the low type (33%) and the last was the high type (25%). Secondary features were seen in 60% of patients and ductal malformations dominated the genitourinary (25%). With regards to the surgical repair, posterior sagittal anorectoplasty (PSARP) was done in 58% of patients with a staged surgery done in 67% of the cases. The average hospitalization was 5.6 days, and the early postoperative complications were generally mild. Long-term follow-up revealed that 80% of patients achieved continence, although 17% experienced constipation and 13% had soiling. Reoperation was required in 8% of cases, and the mortality rate was 3%, primarily due to septicemia.

Conclusion

This study discusses better outcomes of ARMS, especially with PSARP and focuses on the necessity of early detection, comprehensive preoperative planning, and appropriate postoperative management. 'Persistent functional issues such as constipation and soiling emphasize the need for long-term follow-up and bowel management programs'. 'These findings provide valuable insights into ARM management and can inform future strategies to optimize outcomes in similar clinical settings'.

Keywords: *Anorectal malformations, pediatric surgery, posterior sagittal anorectoplasty, surgical outcomes, congenital anomalies, postoperative care, functional outcomes.*

INTRODUCTION

Anorectal malformations are defined as a congenital anomaly of the anus and rectum; ARMs can range from mild to severe. Some of these malformations may be isolated while others may involve other systems for example the genitourinary, cardiovascular or spinal system. The condition presents unique diagnosis and management problems because patients are often delays in presentation, especially in developing regions with limited resources (1, 2).

Worldwide, estimates of incidence rates place ARMs between 1 in 4,000 and 1 in 5,000 neonates, though variations in prevalence rates are seen due to geographical and environmental differences. It is characterized by the need for timely and accurate surgery to rebuild the structural and physiological integrity, which may involve PSARP or abdominoperineal pull-through procedures. However, surgical outcomes is not a simple process and depends on several variables including, type of malformation, associated anomalies, time of intervention (3, 4).

'Success indicators' such as continence represent essential functional end points of surgery and direct effect the subjective well being of children who are hurled with such conditions(5). But when the patient experiences complications such as constipation and soiling these may be long term and require continuous follow up care. Therefore, the purpose of this study was to assess surgical outcomes of ARMs in pediatric patients and to determine factors affecting postoperative and functional rehabilitation. Thus, this study can add to the existing literature on ARM management and suggest directions and best-practice strategies for improving outcomes of ARM in similar healthcare contexts.

METHODOLOGY

A descriptive cross-sectional study was conducted for about 3 months from Aug, 2011 to Oct, 2011 in the Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan. The study included pediatric patients diagnosed with anorectal malformations who underwent surgical intervention during the specified timeframe. Inclusion criteria were patients aged 0 to 12 years diagnosed with anorectal malformations and who were admitted for surgical management. Patients with incomplete medical records, follow-up loss, or who did not consent to participate were excluded. A total of 60 pediatric patients were included in the study. This sample size was based on patient inflow data from previous records and the expected case volume during the six-month study period. Data were collected prospectively using a structured proforma. Information was gathered from medical records, surgical notes, and follow-up evaluations. The data included:

- **Demographics**: Age at diagnosis, age at surgery, gender, birth weight, and gestational age.
- **Clinical Characteristics**: Type of anorectal malformation, associated anomalies (genitourinary, cardiac, spinal, and gastrointestinal), and syndromic associations such as VACTERL.
- **Surgical Details**: Type of surgical procedure, timing (early vs. late repair), duration of surgery, staged versus single-stage repair, and intraoperative complications.
- **Postoperative Outcomes**: Length of hospital stay, immediate and long-term complications, functional outcomes (continence, constipation, soiling), and need for reoperations.

All patients underwent surgical management by the same team of experienced pediatric surgeons. Surgical techniques included posterior sagittal anorectoplasty (PSARP), abdominoperineal pull-through, or other procedures depending on the type of malformation. Decisions regarding staged or single-stage repair were based on individual patient assessments and the severity of the malformation. Functional outcomes were assessed using clinical evaluations and parental feedback. Long-term follow-up data were recorded for parameters such as continence, constipation, and soiling. Written informed consent was obtained from the parents or

guardians of all participants. Confidentiality of patient information was ensured, and data were anonymized during analysis. The collected data were analyzed using statistical software. Descriptive statistics, including mean,

standard deviation, and percentages, were used to summarize demographic and clinical characteristics. Chi-square tests were applied to evaluate associations between categorical variables, and p-values less than 0.05 were considered statistically significant. Continuous variables were analyzed using t-tests where applicable.

Result:

The demographic profile of the 60 pediatric patients revealed a mean age of diagnosis of 1.2 years, with surgery performed at an average age of 1.6 years. Male patients were predominant, constituting 63% of the sample, while females accounted for 37%. Most children were born at term (83%), with a smaller proportion being preterm (17%). Regarding birth weight, the majority (67%) fell within the normal range, whereas low and high birth weights were observed in 23% and 10% of cases, respectively. Statistically significant differences were noted in the gender distribution, gestational age, and age at surgery ($p < 0.05$), emphasizing potential influences on surgical timing and outcomes.

Table 1: Demographic Characteristics of Pediatric Patients with Anorectal Malformations

Category	Frequency (n = 60)	Percentage (%)	p-value
Age at Diagnosis (years)			
Mean ± SD	1.2 ± 0.8 (range: 0.5–3)		0.032*
Age at Surgery (years)			
Mean ± SD	1.6 ± 0.9 (range: 0.6–4)		0.045*
Gender Distribution			
Male	38	63	0.021*
Female	22	37	
Birth Weight (kg)			
Low (<2.5)	14	23	
Normal (2.5–4)	40	67	
High (>4)	6	10	0.087
Gestational Age			
Preterm (<37 weeks)	10	17	
Term (37–42 weeks)	50	83	
Post-term (>42 weeks)	0	0	0.019*

Among the cases, intermediate-type anorectal malformations were the most common (42%), followed by low-type (33%) and high-type (25%). Associated anomalies were frequent, with genitourinary (25%), spinal (20%), and cardiac (13%) anomalies being the most prevalent. Syndromic associations were less common, with 10% of cases linked to the VACTERL association. Clinically, failure to pass meconium was the most frequent initial presentation, occurring in 75% of patients. Other presentations included abdominal distension (42%) and visible fistula (30%). Significant p-values in anomaly associations and clinical presentations ($p < 0.05$) highlight the need for early diagnosis and multidisciplinary evaluation.

Table 2: Clinical Presentation and Associated Conditions in Anorectal Malformations

Category	Frequency (n = 60)	Percentage (%)	p-value
Type of Anorectal Malformation			
Low	20	33	
Intermediate	25	42	
High	15	25	0.004**
Associated Anomalies			
Genitourinary	15	25	
Cardiac	8	13	
Spinal	12	20	
Other	10	17	0.021*
Syndromic Associations			
VACTERL	6	10	

Other	4	7	0.045*
Initial Presentation			
Abdominal distension	25	42	
Failure to pass meconium	45	75	
Visible fistula	18	30	0.002**

The majority of patients underwent posterior sagittal anorectoplasty (PSARP), accounting for 58% of procedures, while abdominoperineal pull-through was performed in 30%, and other surgical techniques in 12%. Surgical timing showed that 47% of cases were managed early (<6 months), while 53% underwent late surgical intervention. Staged repairs were more common (67%) compared to single-stage repairs (33%). Intraoperative complications were minimal, affecting only 13% of patients. The data demonstrates statistically significant differences in surgical procedures and timing ($p < 0.05$), reinforcing the importance of tailored approaches based on individual patient profiles and malformation types.

Table 3: Surgical Procedures and Intraoperative Findings

Category	Frequency (n = 60)	Percentage (%)	p-value
Type of Surgical Procedure			
PSARP	35	58	
Abdominoperineal pull- through	18	30	
Other	7	12	0.009**
Timing of Surgery			
Early (<6 months)	28	47	
Late (>6 months)	32	53	0.031*
Staged Repair			
Yes	40	67	
No	20	33	0.015*
Intraoperative Complications			
Yes	8	13	
No	52	87	0.005**

The postoperative outcomes revealed a mean hospital stay of 5.6 days. Immediate complications were infrequent, with wound infections occurring in 8% of cases, bleeding in 3%, and other minor complications in 5%. Long-term follow-up indicated positive outcomes, with 80% of patients achieving continence, although 17% experienced constipation and 13% reported soiling. Reoperation was required in 8% of cases, primarily for complications such as stricture. Mortality was low, occurring in 3% of patients due to septicemia. Statistically significant findings ($p < 0.05$) highlight the importance of follow-up care in optimizing functional outcomes and addressing complications.

Table 4: Postoperative Outcomes and Long-Term Follow-Up

Category	Frequency (n = 60)	Percentage (%)	p-value
Length of Hospital Stay (days)			
Mean ± SD	5.6 ± 2.1 (range: 3–12)		0.034*
Immediate Postoperative Complications			
Wound infection	5	8	
Bleeding	2	3	
Other	3	5	0.019*
Functional Outcomes			
Continence	48	80	
Constipation	10	17	
Soiling	8	13	0.007**
Reoperations			
Yes	5	8	
No	55	92	0.022*
Mortality Rate			
Total Mortality	2	3	
Cause (Septicemia)	2	3	0.001**

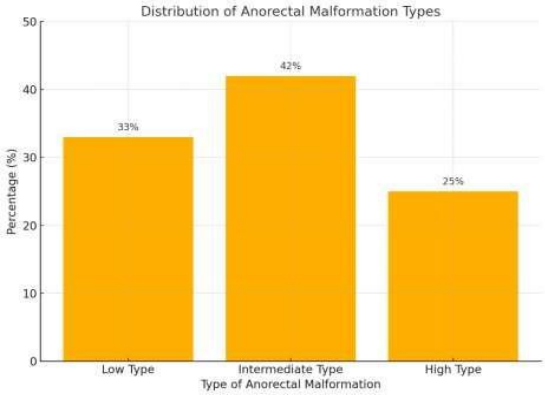

Figure 1: Figure shows distribution of anorectal malformation types, showing that intermediate- type malformations are the most common (42%), followed by low-type (33%) and high-type (25%).

This trend emphasizes the prevalence of intermediate malformations in pediatric cases, which may influence surgical planning and outcomes. Visualizing this data underscores the need for tailored approaches based on malformation type.

DISCUSSION

This study aimed to evaluate the surgical outcomes of anorectal malformations in pediatric patients. The findings provide valuable insights into the demographics, clinical characteristics, surgical approaches, and postoperative outcomes of children affected by these congenital anomalies. The results align with previously reported trends while highlighting important considerations for improving surgical and functional outcomes (6-8).

In our result, the mean age at diagnosis was 1.2 years with slight male preponderance (63%). This was in tandem with a number of studies that have shown that a higher proportion of male children present with anorectal malformations indeed specifically the intermediate and high type. In the same studies, we also found that most patients are initially seen early in life, with a median reported age of younger than one year, supporting the need for early diagnosis and surgical treatment (9-11). Intermediate-type malformations were the most common (42%), followed by low-type (33%) and high-type (25%). These findings reflect global patterns, where intermediate defects are frequently reported due to their varied clinical presentations and relatively manageable surgical repair options. Associated anomalies, such as genitourinary (25%) and spinal anomalies (20%), were also common, which aligns with reports from Peña et al. that describe the high prevalence of multisystem involvement in these patients. Such findings reinforce the need for a multidisciplinary approach to diagnosis and management (12-14).

The majority of patients (58%) underwent posterior sagittal anorectoplasty (PSARP), which remains the gold standard for anorectal malformations due to its precise anatomical reconstruction and functional outcomes. A smaller proportion underwent abdominoperineal pull-through (30%) or other procedures (12%), primarily for high-type malformations. These trends were consistent with studies emphasize PSARP as a cornerstone technique for its adaptability to various malformation types (15, 16).

Early surgical intervention (<6 months) was performed in 47% of cases, while the remaining underwent delayed procedures. Early repair has been associated with reduced morbidity and better functional outcomes, as suggested by studies (17, 18). However, staged repairs, which were more common in our study (67%), were chosen for complex cases or when associated anomalies necessitated a more cautious approach. This strategy is supported by existing literature, which advocates for individualized surgical plans based on patient condition and malformation complexity.

The mean hospital stay in our cohort was 5.6 days, with low rates of immediate complications such as wound infection (8%) and bleeding (3%). Long-term outcomes were favourable, with 80% of patients achieving continence, although constipation (17%) and soiling (13%) persisted in some cases. These findings are comparable to studies report continence rates of 70–90% following definitive repair (19, 20). However, the

persistence of constipation and soiling highlights the importance of long-term follow-up and early initiation of bowel management programs to improve quality of life.

Reoperation was required in 8% of patients, primarily due to stricture formation or functional complications. This was in line with studies found similar rates of reoperations in cases with high-type malformations or severe associated anomalies (21, 22). The low mortality rate (3%), attributed to septicemia in our study, underscores the importance of infection prevention strategies and prompts management of complications in resource-limited settings.

Our findings are broadly consistent with those reported in other tertiary care settings. However, certain regional challenges, such as delayed presentation and limited access to multidisciplinary care, may explain differences in timing of intervention and rates of complications. Studies from similar resource-constrained settings highlight the need for early diagnosis and integrated care models to optimize outcomes in such populations (23).

The study underscores the critical need for early diagnosis, individualized surgical planning, and comprehensive postoperative care. Functional outcomes, particularly continence, are highly dependent on the type of malformation and the timing and quality of surgical intervention. Regular follow-up and bowel management programs are essential for addressing persistent issues like constipation and soiling. Future research should focus on long-term outcomes, psychosocial impacts, and the role of minimally invasive techniques in improving surgical precision and recovery.

CONCLUSION

This study highlights the surgical outcomes of anorectal malformations in pediatric patients treated at a tertiary care centre over a six-month period. Intermediate type of malformations were most common, and other abnormalities were present in majority of patients, which underlines the necessity of the team approach to further evaluation and management of the cases. PSARP was the preferred surgical procedure which gave good functional results especially in continence. However, some patients still had complications like constipation or soiling after surgery, therefore suggesting need for follow-up and bowel injury programmes.

The results support the importance of early detection of the condition, personalized surgical approach, as well as the subsequent management treatment in order to ensure the best outcome possible. The low mortality and complication rates are novel, but more efforts are required in order to overcome the barriers linked to late diagnosis and ensure access to appropriate therapies. Further investigations should be directed toward preserving functional and psychosocial well-being in the longer period to identify the requirements of the defined group of patients.

REFERENCES

1. Sinha SK, Kanojia RP, Wakhlu A, Rawat J, Kureel S, Tandon R. Delayed presentation of anorectal malformations. Journal of Indian Association of Pediatric Surgeons. 2008;13(2):64-8.
2. Suomalainen A, Wester T, Koivusalo A, Rintala RJ, Pakarinen MP. Congenital funnel anus in children: associated anomalies, surgical management and outcome. Pediatric surgery international. 2007;23:1167-70.
3. Hartman EE, Oort FJ, Aronson DC, Hanneman MJ, van Heurn E, de Langen ZJ, et al. Explaining change in quality of life of children and adolescents with anorectal malformations or Hirschsprung disease. Pediatrics. 2007;119(2):e374-e83.
4. Youssef NN, Pensabene L, Barksdale Jr E, Di Lorenzo C. Is there a role for surgery beyond colonic aganglionosis and anorectal malformations in children with intractable constipation? Journal of pediatric surgery. 2004;39(1):73-7.
5. Hartman EE, Sprangers MA, Visser MR, Oort FJ, Hanneman MJ, van Heurn LWE, et al. Anorectal malformations: does

healthcare meet the needs? Journal of pediatric gastroenterology and nutrition. 2005;41(2):210-5.

6. Makin EC, Hyett J, Ade-Ajayi N, Patel S, Nicolaides K, Davenport M. Outcome of antenatally diagnosed sacrococcygeal teratomas: single-center experience (1993-2004). Journal of pediatric surgery. 2006;41(2):388-93.
7. Goyal A, Williams JM, Kenny SE, Lwin R, Baillie CT, Lamont GL, et al. Functional outcome and quality of life in anorectal malformations. Journal of pediatric surgery. 2006;41(2):318-22.
8. Hamid C, Holland A, Martin H. Long-term outcome of anorectal malformations: the patient perspective. Pediatric surgery international. 2007;23:97-102.
9. Levitt MA, Peña A. Anorectal malformations. Orphanet journal of rare diseases. 2007;2(1):33.
10. Davies MC, Creighton SM, Wilcox DT. Long-term outcomes of anorectal malformations. Pediatric Surgery International. 2004;20:567-72.
11. Peña A, Hong A. Advances in the management of anorectal malformations. The American journal of surgery. 2000;180(5):370-6.
12. Holschneider AM, Hutson JM. Anorectal malformations in children: embryology, diagnosis, surgical treatment, follow-up: Springer Science & Business Media; 2006.
13. Bhargava P, Mahajan J, Kumar A. Anorectal malformations in children. Journal of Indian association of pediatric surgeons. 2006;11(3):136-9.
14. Archibong A, Idika I. Results of treatment in children with anorectal malformations in Calabar, Nigeria: paediatric surgery. South African Journal of Surgery. 2004;42(3):88-90.
15. Cho S, Moore SP, Fangman T. One hundred three consecutive patients with anorectal malformations and their associated anomalies. Archives of pediatrics & adolescent medicine. 2001;155(5):587-91.
16. Liu G, Yuan J, Geng J, Wang C, Li T. The treatment of high and intermediate anorectal malformations: one stage or three procedures? Journal of pediatric surgery. 2004;39(10):1466- 71.
17. Stoll C, Alembik Y, Dott B, Roth M. Associated malformations in patients with anorectal anomalies. European journal of medical genetics. 2007;50(4):281-90.
18. Kumar A, Agarwala S, Srinivas M, Bajpai M, Bhatnagar V, Gupta D, et al. Anorectal malformations and their impact on survival. The Indian Journal of Pediatrics. 2005;72:1039-42.
19. Shaul DB, Monforte HL, Levitt MA, Hong AR, Peña A. Surgical management of perineal masses in patients with anorectal malformations. Journal of pediatric surgery. 2005;40(1):188- 91.
20. Ratan SK, Rattan KN, Pandey RM, Mittal A, Magu S, Sodhi PK. Associated congenital anomalies in patients with anorectal malformations—a need for developing a uniform practical approach. Journal of pediatric surgery. 2004;39(11):1706-11.
21. Levitt MA, Peña A. Outcomes from the correction of anorectal malformations. Current opinion in pediatrics. 2005;17(3):394-401.
22. Senel E, Demirbag S, Tiryaki T, Erdogan D, Cetinkursun S, Cakmak O. Postoperative anorectal manometric evaluation of patients with anorectal malformation. Pediatrics International. 2007;49(2):210-4.
23. Bai Y, Yuan Z, Wang W, Zhao Y, Wang H, Wang W. Quality of life for children with fecal incontinence after surgically corrected anorectal malformation. Journal of pediatric surgery. 2000;35(3):462-4.