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Incidence and Outcomes of Anorectal Malformations in Neonates: A Tertiary Care Experience

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ABSTRACT

Background: Anorectal malformations (ARM) present a continuum of birth defects affecting the distal hindgut and the anorectal canal. Their preoperative identification and surgical preplanning are vital to achieve maximum survival with functional outcome. To determine the occurrence, anatomical spectrum, and short-term outcome of ARMs in newborns in a tertiary care unit.

Methods: It is a cross-sectional retrospective study performed within the Department of Pediatric Surgery of one of the tertiary hospitals. A sampling of 180 ARM-neonates was done consecutively within the first 28 days of life. Demographic data were retrieved using medical records on mode of delivery, type of ARM, anomalies related to the type of ARM, surgical management, postoperative complications, hospital stay, and survival. Statistical analysis was performed using SPSS 26.0; Chi-square, independent t-test, and Mann-Whitney U test at a significance of $p < 0.05$.

Results: Of 180 neonates, 110 (61.1%) were male ($p = 0.023$). Most prevalent were high-type ARMs, 80 (44.5%), intermediate, 42 (23.3%), and low ARMs, 58 (32.2%) ($p = 0.001$). There were related anomalies in 72 (40%), mostly cardiac, 28 (15.6%), and urogenital, 22 (12.2%) ($p = 0.006$). Primary surgery was initial colostomy, 122 (67.8%), and posterior sagittal anorectoplasty (PSARP), 58 (32.2%) ($p = 0.001$). The surgical site infection was 23 (12.7%) ($p = 0.042$).

Conclusion: High-type ARM predominated in neonates, with frequent related anomalies and acceptable short-term survival. Multidisciplinary assessment, early referral, and standardized postoperative treatment are important in achieving the best neonatal results.

Keywords: Anorectal Malformations, Infant, Newborn, Digestive System Surgical Procedures.
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INTRODUCTION

Anorectal malformations (ARM) are a malformation of the hindgut resulting in both morbidity during the neonatal period and permanent lasting functional disability [1]. ARMS are among the most common birth defects worldwide, and stable levels of birth prevalence have been found in population studies [2]. There are differences in manifestation according to the degree of malformation, where the malformations with a high degree of complexity require more complicated management [3]. Co-morbid malformations, especially cardiac, urological, and anomalies of the genital tract, are prevalent and play a significant role in childhood morbidity and mortality [4]. Surgery, including staged diversion, posterior sagittal anorectoplasty (PSARP), laparoscopic-assisted repair, etc., continues to be put in the centre of the stage with signs that perhaps are explained by comparative analysis [5]. Recent literature reports findings, such as early postoperative morbidity and mortality, stoma morbidity, and late-time continence [6].

New perineal-body-preserving methods aim to minimize wound complications without disturbing anatomy and function [7]. Focus on postoperative measures, including calibrated anal dilations and standardized follow-up, has been associated with better anastomotic results and stricture rates [8]. Systematic efforts to harmonize outcome reporting are in progress to allow meaningful comparisons and core outcome sets for ARM research [9].

Despite improvements, gaps persist in the population-level incidence, early referral patterns, and optimized multidisciplinary pathways in low-resource settings. Furthermore, early survival and complication rates are often underreported, where prompt diagnosis and a thorough assessment may not always be feasible [10]. Addressing these shortcomings by targeting institutional data may enhance knowledge of the clinical spectrum and outcomes of affected neonates and inform future clinical advances in neonatal surgery.

This study aimed to identify the prevalence and clinical spectrum of anorectal malformations in neonates managed at a tertiary care hospital. This study characterized the related anomalies and initial surgical interventions in these patients. Other objectives included measuring early postoperative outcomes and short-term survival to determine areas for optimizing neonatal care pathways.

METHODS

This retrospective cross-sectional study aimed to assess the incidence, associated anomalies, and immediate outcomes of ARM among neonates in a tertiary care hospital at Department of Pathology and Pediatric Surgery of a tertiary care settings mainly at Federal Shaikh Zayed Postgraduate Medical Institute Lahore (Ref: admin1455/23) after an informed consent.

Non-probability consecutive sampling was used, whereby all eligible neonates presented during the study period were included. The sample size was estimated using OpenEpi version 3.0.0 (released 2013, Atlanta, GA, USA) with an assumed prevalence of 0.2% in ARMs, 95% confidence, and 5% margin of error, resulting in a minimum of 150 cases; to account for variability, 180 cases were analyzed [11]. All neonates who were hospitalized within a period of 28 days with a known diagnosis of anorectal malformation were included. Neonates with incomplete medical histories, syndromic or lethal congenital conditions incompatible with survival, and patients who are referred once they have received some prior surgical intervention in another institution were excluded.

All neonates were routinely assessed with detailed history, physical examination, and radiologic imaging (invertogram, abdominal ultrasound, echocardiography, and, when necessary, genitourinary imaging). Pediatric surgeons confirmed the diagnosis, and management decisions were based on the anatomical degree of malformation. Data on demographics, birth information, type of ARM, anomalies, surgery (first colostomy or primary PSARP), and outcomes (survival, complications, readmission, hospital stay) were retrieved.

The quality of data was ensured by cross-checking data with two independent investigators. SPSS version 26.0 (released 2019, IBM Corp., Armonk, NY) was used for statistical analysis. Chi-square test was used to compare categorical variables, and independent t-test or Mann-Whitney U test was used to compare continuous variables. A p-value < 0.05 was considered significant.

RESULTS

Table 1: Demographic Characteristics of Study Participants

Variable	Frequency n (%)	Test Value	p-value
Gender (Male/ Female)	110 (61.1%)/ 70 (38.9%)	$\chi^2 = 5.21$	0.023*
Mean Birth Weight (kg) (Male/Female)	2.8 ± 0.4/ 2.6 ± 0.5	t = 1.89	0.061
Mean Age at Presentation (days) (Male/ Female)	2.4 ± 1.2/ 2.2 ± 1.5	t = 0.97	0.332
Mode of Delivery Vaginal/ Cesarean section	124 (68.9%)/ 56 (31.1%)	$\chi^2 = 3.76$	0.052

*n = number of participants, ARM = Anorectal Malformations, SD = Standard Deviation, % = Percentage, * = Significance at <0.05*

This study examined anorectal malformations in 180 neonates in a tertiary care unit. Many of them presented at an early age, with predominant high-type lesions and related anomalies. The survival was typically good, but poor in complicated cases. The paper highlights the need to conduct early diagnosis and evaluation. **Table 1** indicates the demographic characteristics of neonates with ARM.

Table 2: Clinical Characteristics and Associated Anomalies

Variable	Category	Frequency n (%)	Test Value	p-value
Type of ARM	Low	58 (32.2%)	$\chi^2 = 14.63$	0.001*
	Intermediate	42 (23.3%)		
	High	80 (44.5%)		
Associated Anomalies	Present	72 (40.0%)	$\chi^2 = 6.41$	0.011*
	Absent	108 (60.0%)		
Type of Associated Anomalies	Cardiac	28 (15.6%)	$\chi^2 = 12.54$	0.006*
	Urogenital	22 (12.2%)		
	Gastrointestinal	14 (7.8%)		
	Others (skeletal, CNS)	8 (4.4%)		

*n = number of participants, ARM = Anorectal Malformations, CNS = Central Nervous System, % = Percentage, * = Significance at <0.05*

Among 180 neonates, 110 (61.1%) were male and 70 (38.9%) were female (p = 0.023). There were no significant differences in mean birth weight and age between the sexes, and the majority were delivered vaginally, 124 (68.9%), suggesting a need for prompt recognition. Clinical characteristics and associated anomalies of ARM in neonates are presented in **Table 2.**

Table 3: Postoperative Outcomes, Surgical Approach, and Early Complications

Outcome	Category	Frequency n (%)	Test Value	p-value
Initial Surgical Approach	Initial Colostomy	122 (67.8%)	$\chi^2 = 10.42$	0.001*
	Primary PSARP	58 (32.2%)		
Overall Survival	Survived	167 (92.8%)	$\chi^2 = 8.22$	0.004*
	Died	13 (7.2%)		
Surgical Site Infection (SSI)	Present	23 (12.7%)	$\chi^2 = 4.12$	0.042*
	Absent	157 (87.3%)		
Stoma-related Complications	Present	17 (9.5%)	$\chi^2 = 3.65$	0.056
	Absent	163 (90.5%)		
Readmission within 30 days	Yes	12 (6.7%)	$\chi^2 = 2.74$	0.098
	No	168 (93.3%)		
Length of initial hospital stay	Median (IQR) days	10 (7–16)	U = 3021	0.028*

*n = number of participants, PSARP = Posterior Sagittal Anorectoplasty, % = Percentage, IQR = Interquartile Range, * = Significance at <0.05*

The most common malformations were high, 80 (44.5%), low, 58 (32.2%), and intermediate, 42 (23.3%) (p = 0.001). 72 (40%) had associated anomalies, predominantly cardiac, 28 (15.6%), and

urogenital, 22 (12.2%) (p = 0.006), highlighting the importance of systemic evaluation at diagnosis due to the high rate of anomalies. Postoperative outcomes are indicated in **Table 3.**

Initial colostomy was performed in 122 (67.8%), and primary PSARP in 58 (32.2%) cases (p = 0.001). The total survival and mortality rates were 167 (92.8%) and 13 (7.2%) (p = 0.004), respectively. SSI, 23 (12.7%), was also significant, and the incidence of stoma complications, 17 (9.5%), and readmissions, 12 (6.7%), was lower; the median hospital stay was 10 days (p = 0.028). Timely surgical intervention and follow-up are important for good survival with manageable complications, particularly in complex cases.

DISCUSSION

This study aimed to determine whether zirconia has greater fracture strength than lithium disilicate in implant-retained restorations in a controlled oral environment. The findings support that the zirconia crown provides increased fracture resistance and fatigue performance compared to lithium disilicate. Moreover, zirconia crowns demonstrated better mechanical properties, including higher fracture load capacity and improved marginal fit. Results demonstrated that zirconia crowns can withstand more loads before fracture, and most specimens passed extended cyclic loading. These findings are consistent with the laboratory work on the stronger flexural strength and crack resistance of zirconia in posterior implant applications [12]. Moreover, the transformation toughening inherent to zirconia enhances its strength capacity under high functional loads, as supported in experiments involving static and fatigue testing [13].

Zirconia crowns resisted considerably more load cycles before degradation, aligning with in-vitro fatigue models, which indicated prolonged survival of zirconia crowns in a dynamic masticatory environment [14,15]. Conversely, microcracks in lithium disilicate also support similar results in its susceptibility to fatigue [16]. Improved adaptation of zirconia crowns on abutments minimized the risk of cement leakage, and microbial colonization was also evident in the marginal gap analysis [17]. Narrower gaps will allow the devices to last longer and minimize biological complications, including peri-implantitis [18].

Although lithium disilicate can be used in anterior restorations due to its esthetic translucency, its posterior fracture resistance has been described in numerous studies [19]. This study supports the limited application of lithium disilicate in teeth with lower functional concerns [20]. Aesthetic cases require a balance between the visual and biomechanical stability when implants are in use. Zirconia also has better wear resistance and shows reduced surface degradation and antagonist tooth wear in comparison to lithium disilicate [21]. The long-term prosthetic reliability of lithium disilicate is better

represented by the higher survival rate of zirconia crowns in the posterior implant locations [22]. Present prosthodontic protocols encourage crown materials that correlate with the biomechanical requirements of the case, facilitating the broader use of zirconia in posterior restorations [23]. Fracture resistance information should be considered in prosthetic treatment planning to select materials used in implant-supported crowns [24]. Posterior zirconia may decrease the risk of mechanical failure and increase the restoration capacity [25]. It also facilitates prosthetic survivability without impairing biological integration [26].

Limitations include in-vitro experimental design, which may not consider intraoral variation in temperature, saliva enzymes, or idiosyncratic occlusal patterns. Confounding factors, including patient age, parafunctional habits, and implant differences, were not measured. Future research should include multicenter clinical trials to provide long-term outcomes and survival rates of both materials under real-life conditions.

CONCLUSION

In this study, the high-type ARMs were the most common and were associated with frequent malformations and significant surgical morbidities. These findings highlight the early referrals, multidisciplinary input, and standardized management to improve neonatal outcomes.

Future research should include multicenter and prospective studies, with long-term follow-up to determine functional recovery. The harmonized outcome reporting will facilitate sound international comparison. It is suggested that multidisciplinary studies can help direct evidence-based neonatal surgical care.

LIST OF ABBREVIATIONS

ARM: Anorectal Malformations

PSARP: Posterior Sagittal Anorectoplasty

CNS: Central Nervous System

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

This retrospective cross-sectional study was conducted at a tertiary care hospital at the Department of Pathology and Pediatric Surgery of a tertiary care setting, mainly at Federal Shaikh Zayed Postgraduate Medical Institute, Lahore (Ref: admin1455/23) after informed consent.

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE.

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