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UMBILICAL LOOP STOMA: A SAFE AND COSMETIC ALTERNATIVE FOR INTESTINAL DIVERSION IN PEDIATRIC PATIENTS

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Abstract

Purpose: *Pediatric stomas are often temporary, necessitating techniques that ensure ease of management, minimal complications, and superior cosmetic outcomes. This study evaluates the safety, efficacy, and cosmetic results of umbilical loop stomas compared to conventional abdominal stomas in a tertiary care center in Pakistan.*

Methods: *We conducted a comparative cohort study of 96 pediatric patients who underwent stoma construction between March 2018 and March 2025. The umbilical stoma group comprised 58 patients, while 38 underwent conventional abdominal stoma creation. We compared perioperative parameters, complications, and cosmetic outcomes using the Manchester Scar Scale (MSS) and Patient and Observer Scar Assessment Scale (POSAS).*

Results: *The two groups showed comparable complication rates (umbilical 12.1% vs. conventional 13.2%; P = 0.88). No emergency surgical interventions were required in either group. Cosmetic outcomes were significantly superior in the umbilical group: MSS scores (8.31 ± 1.92 vs. 16.58 ± 3.14; P < 0.001), POSAS observer scores (9.62 ± 2.41 vs. 22.15 ± 7.38; P < 0.001), and POSAS patient scores (10.68 ± 1.52 vs. 22.87 ± 7.51; P < 0.001). Parents reported high satisfaction with umbilical stoma management and the concealed final scar.*

Conclusions: *Umbilical loop stomas represent a safe and cosmetically superior alternative to conventional abdominal stomas in appropriately selected pediatric patients. With careful patient selection and meticulous technique, this approach offers excellent functional outcomes while preserving body image–a critical consideration for children's long-term psychological well-being.*

INTRODUCTION

Stoma creation remains a cornerstone of pediatric surgical management for conditions including anorectal malformations (ARM), Hirschsprung disease (HD), intestinal perforation, necrotizing enterocolitis, and inflammatory bowel disease [1,2]. Unlike adult stomas, which are frequently permanent, pediatric stomas are predominantly temporary, forming part of staged surgical strategies [3,4]. This temporary nature heightens the importance of straightforward creation, ease of management, minimal complications, and excellent cosmetic outcomes after closure [5].

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With declining mortality rates from neonatal surgical conditions due to advances in perioperative care, attention has increasingly focused on quality-of-life considerations, including minimizing visible scarring that may impact children's psychosocial development and body image during growth [6,7]. The psychological burden of visible abdominal scars in children and adolescents is well-documented, making cosmetically favorable surgical approaches particularly valuable [8].

The concept of umbilical stoma creation was pioneered by Turnbull et al. in 1980 for adult rectal cancer surgery [9]. Cameron et al. introduced the technique to pediatric surgery in 1982 for Hirschsprung disease, and Fitzgerald et al. demonstrated its safety in 47 pediatric cases in 1989 [10]. The umbilicus offers inherent advantages: it is a natural site routinely used for laparoscopic port placement, eliminates the need for additional abdominal incisions during minimally invasive procedures, and heals with scars that blend into the normal umbilical contour [3,11,12].

Despite these theoretical advantages, literature on pediatric umbilical stomas remains limited, particularly from resource-variable settings. Recent Asian series have demonstrated favorable safety profiles and cosmetic outcomes in ARM and HD populations [1,2,13,14], but quantitative comparative data remain sparse. This study aimed to evaluate the safety, efficacy, and cosmetic outcomes of umbilical loop stomas in our pediatric surgical practice and to provide quantitative scar assessment data to guide clinical decision-making.

Methods

We conducted a comparative cohort study at the Department of Pediatric Surgery, Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan, between March 2018 and March 2025, with institutional ethics approval and parental informed consent. All pediatric patients (age < 12 years) undergoing temporary stoma creation were eligible and assigned to umbilical or conventional abdominal stoma groups based on clinical suitability and parental preference after counseling, yielding 96 patients: 58 umbilical and 38 conventional stomas.

Inclusion criteria for umbilical stoma were age < 12 years requiring temporary fecal diversion, adequate umbilical anatomy with normal cord separation, absence of umbilical infection or anomalies, single stoma requirement, and stable hemodynamic status. Exclusion criteria included pre-existing umbilical pathology (patent omphalomesenteric duct, umbilical hernia, hernia of the umbilical cord, active omphalitis), malpositioned umbilicus, multiple stoma requirements, severe hemodynamic instability or extensive contamination, and cloaca or complex genitourinary malformations.

Figure 1: A close-up view of the surgical sites, showing the formation of the stoma at the umbilicus.

For umbilical stoma construction, neonates with attached cord received circular incision at the cord base with vertical core-out of tissues, while post-separation cases had V-shaped incisions preserving periumbilical skin [2,3]. After ligating umbilical vessels and urachus, the selected bowel segment was mobilized for tension-free delivery. Loop or double-barrel stomas were fashioned as

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indicated (Figure 1). For ARM, we employed a "high chimney" technique (>2 cm protrusion) to minimize peristomal dermatitis [2], with bowel secured to peritoneum and fascia using 4-0 absorbable sutures and anti-prolapse 4-0 non-absorbable sutures between limbs and mesentery [5]. Loop division occurred at 5-7 days when indicated [2,13]. Conventional stomas utilized standard quadrant sites with circular incisions, muscle splitting, and standard maturation [15,16].

Stomas were closed 2-3 months post-definitive repair after confirming adequate healing. Umbilical closures involved peristomal incision, mobilization, edge resection, anastomosis, and semi-open umbilical reconstruction [3,13]. Conventional sites received standard fascial and skin closure.

Data extracted included demographics, clinical indication, bowel segment, operative parameters, stoma duration, and complications (ischemia, retraction, obstruction, prolapse, dermatitis, infection, hernia) [15,16]. At final follow-up (minimum 6 months), scars were assessed using the Manchester Scar Scale (MSS; range 5-20, lower better) and Patient and Observer Scar Assessment Scale (POSAS; range 6-60 each component, lower better) [6,7]. Data were analyzed using SPSS version 25 with independent t-tests for continuous variables and chi-square/Fisher's exact test for categorical variables; $P < 0.05$ was significant.

Results

The study included 96 patients: 58 in the umbilical stoma group and 38 in the conventional stoma group. Baseline characteristics are presented in Table 1 and figure 2.

Table 1: Baseline characteristics and clinical parameters

Parameter	Umbilical Stoma (n=58)	Conventional Stoma (n=38)	P-value
Age at construction (months)	2.8 ± 4.2	18.5 ± 24.6	<0.001
Weight at construction (kg)	4.2 ± 1.8	8.6 ± 5.4	<0.001
Male:Female	36:22	24:14	0.92
Primary indication			
Anorectal malformations	38 (65.5%)	8 (21.1%)	<0.001
Hirschsprung disease	12 (20.7%)	6 (15.8%)	0.55
Intestinal perforation	4 (6.9%)	12 (31.6%)	0.002
Necrotizing enterocolitis	2 (3.4%)	8 (21.1%)	0.006
Other	2 (3.4%)	4 (10.5%)	0.20
Bowel segment			
Sigmoid colon	42 (72.4%)	10 (26.3%)	<0.001
Transverse colon	8 (13.8%)	14 (36.8%)	0.008
Ileum	8 (13.8%)	14 (36.8%)	0.008

The umbilical group was significantly younger and lighter, reflecting the predominance of neonatal ARM cases. Anorectal malformations constituted the most common indication for umbilical stomas (65.5%), significantly higher than in the conventional group (21.1%; $P < 0.001$). The sigmoid colon was the most frequently used segment in umbilical stomas.

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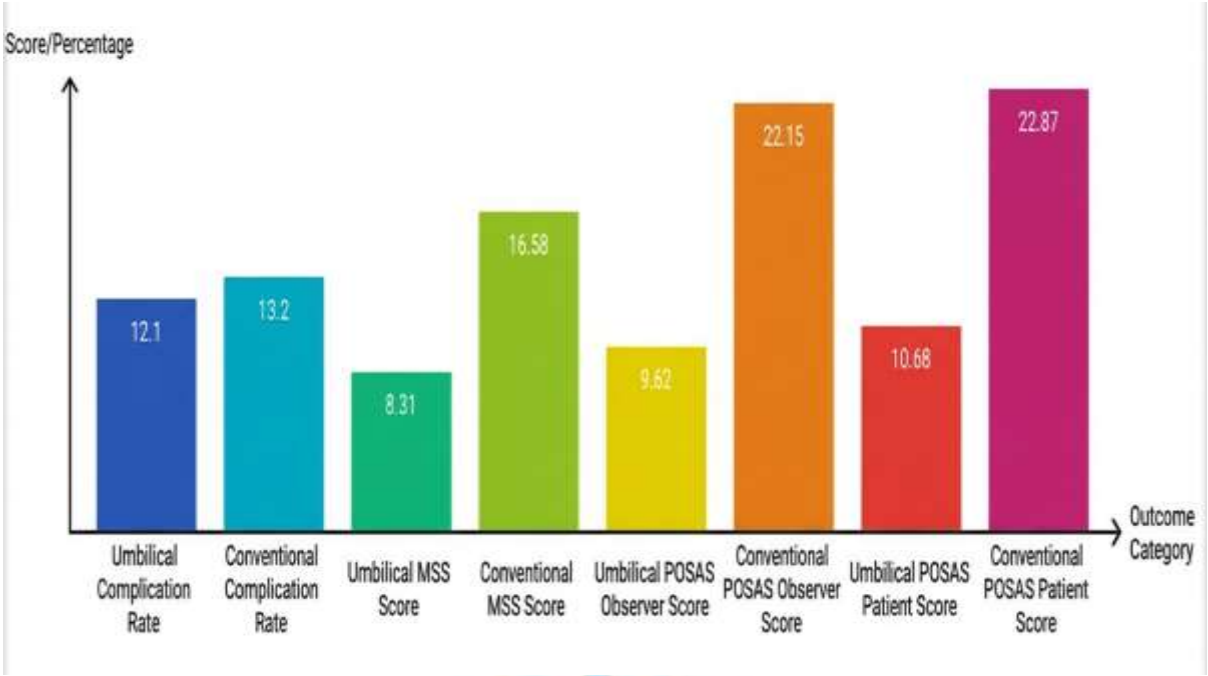

Figure 2: Comparison of outcomes between umbilical and conventional stoma management

Operative Parameters and Stoma Duration

Mean operative time for umbilical stoma construction was 52.3 ± 12.4 minutes versus 48.7 ± 14.2 minutes for conventional stomas (P = 0.19). Blood loss was minimal in both groups (<10 mL). Mean stoma duration was 126.4 ± 38.6 days for umbilical stomas and 118.2 ± 42.1 days for conventional stomas (P = 0.31). Mean follow-up after closure was 18.6 ± 8.4 months for umbilical and 17.2 ± 9.1 months for conventional groups (P = 0.43).

Complications

Overall complication rates were comparable between groups (Table 2).

Table 2: Complications

Complication	Umbilical (n=58)	Conventional (n=38)	P-value
Overall complications	7 (12.1%)	5 (13.2%)	0.88
Mucosal prolapse	2 (3.4%)	1 (2.6%)	0.82
Peristomal dermatitis	3 (5.2%)	3 (7.9%)	0.59
Wound infection	1 (1.7%)	1 (2.6%)	0.76
Stoma obstruction	1 (1.7%)	0 (0%)	0.42
Retraction	0 (0%)	0 (0%)	-
Parastomal hernia	0 (0%)	0 (0%)	-
Emergency reoperation	0 (0%)	0 (0%)	-

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No patient in either group required emergency surgical intervention for stoma-related complications. The two cases of mucosal prolapse in the umbilical group were managed conservatively; one conventional-group prolapse required minor revision. Peristomal dermatitis was mild and responded to barrier creams and appliance adjustments in both groups. One superficial wound infection occurred in each group, resolving with local care and antibiotics.

Cosmetic Outcomes

Cosmetic assessment revealed significant superiority of umbilical stomas across all validated scales (Table 3).

Table 3: Cosmetic outcome scores

Scale	Umbilical Stoma	Conventional Stoma	P-value
Manchester Scar Scale	8.31 ± 1.92	16.58 ± 3.14	<0.001
POSAS Observer Scale	9.62 ± 2.41	22.15 ± 7.38	<0.001
POSAS Patient Scale	10.68 ± 1.52	22.87 ± 7.51	<0.001

Lower scores indicate better cosmetic outcomes. The MSS for umbilical stomas (8.31 ± 1.92) demonstrated significantly less visible scarring than conventional sites (16.58 ± 3.14; $P < 0.001$). Similarly, both POSAS observer and patient scales showed marked superiority for umbilical stomas. Parents and older children consistently reported high satisfaction with the "hidden" scar that blended into normal umbilical contour.

Discussion

This study represents one of the largest single-center experiences with pediatric umbilical loop stomas from Pakistan and provides robust quantitative evidence of their cosmetic superiority without compromising safety. Our findings align with recent international literature demonstrating comparable complication rates but significantly better aesthetic outcomes for umbilical versus conventional abdominal stomas [1,5,13,14]. The comparable overall complication rate between umbilical (12.1%) and conventional (13.2%) stomas confirms findings from prior studies. Ishii et al. reported no significant difference in complications between 54 umbilical and 42 non-umbilical stomas over 22 years [1], while Sakaguchi et al. found equivalent complication rates (17% umbilical vs. 11% conventional; $P = 0.6$) in ARM neonates, with no emergency surgeries required [4]. Our zero rate of emergency reoperations corroborates this favorable safety profile. The absence of parastomal hernias in our umbilical cohort is noteworthy, as Yang et al. reported zero umbilical wound infections or parastomal hernias in their transumbilical colostomy series for ARM [13], while Xu et al. found no increase in herniation with transumbilical enterostomy for HD compared to conventional sites [14]. Prolapse occurred infrequently (3.4% umbilical vs. 2.6% conventional), consistent with literature rates when anti-prolapse suturing is employed [2,5,14].

The quantitative cosmetic advantage of umbilical stomas represents this study's most striking finding. Our MSS scores (8.31 vs. 16.58) and POSAS scores (observer 9.62 vs. 22.15; patient 10.68 vs. 22.87) demonstrate superiority comparable to Ishii et al.'s Japanese cohort (MSS 8.42 vs. 16.31; POSAS observer 9.48 vs. 21.78; patient 10.5 vs. 22.40) [1]. Xu et al. similarly reported better scar scores for transumbilical versus conventional enterostomy in HD (6.83 vs. 13.32; $P < 0.05$) [14]. The cosmetic benefit stems from the scar being concealed within the umbilical depression, blending with natural skin folds and pigmentation variation, and eliminating visible abdominal wall scarring [1,3,5]. For ARM and HD patients undergoing laparoscopic-assisted anorectoplasty or pull-

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through, the umbilical stoma site can be reused as a port, avoiding additional trocar scars [3,11,13,14]. The psychological impact of visible surgical scars on children's body image and self-esteem is increasingly recognized [8,17], and Coldicutt and Hill emphasized that cosmetic outcomes influence long-term acceptance [8]. Our qualitative feedback from families indicated high satisfaction with the "invisible" nature of healed umbilical stomas, particularly appreciated by parents concerned about future social and psychological impacts during adolescence.

Appropriate patient selection is paramount for umbilical stoma success, and our exclusion criteria were informed by literature documenting serious complications when umbilical pathology is overlooked. Active omphalitis or severe local contamination contraindicates umbilical use [2,5]. For cloaca and complex genitourinary malformations, we adopted individualized approaches, though high-quality comparative data are limited [18]. Our experience reinforces several technical principles: the "high chimney" stoma (>2 cm protrusion) minimizes peristomal dermatitis [2]; meticulous ligation of umbilical vessels and urachus prevents vascular complications [2,3]; tension-free construction with robust fascial fixation prevents retraction and herniation [15,16]; and semi-open umbilical closure recreates natural depth and contour [3,13]. The umbilical stoma integrates seamlessly with laparoscopic strategies, exemplifying three-stage minimally invasive management for ARM (transumbilical colostomy → laparoscopic-assisted anorectoplasty using the stoma site as a port → stoma closure with umbilical reconstruction) [3,11,13] and for HD with transumbilical enterostomy followed by laparoscopy-assisted pull-through [7,14].

Our study has limitations including the non-randomized design, unequal group sizes reflecting selection bias, and younger age with predominance of ARM in the umbilical group limiting generalizability. Longer follow-up would strengthen assessment of late complications such as incisional hernias, which Vigna et al. reported in 27% of umbilical stoma reversals in a mixed adult-pediatric cohort [19]. Our 18-month mean follow-up may underestimate this risk. Prospective randomized trials with age-matched cohorts and extended follow-up are needed to definitively establish umbilical stoma outcomes, and standardization of technique may further reduce complications while expansion to broader indications warrants investigation.

Conclusions

Umbilical loop stomas represent a safe, effective, and cosmetically superior alternative to conventional abdominal stomas in carefully selected pediatric patients. In our 7-year experience with 96 patients at Liaquat University Hospital, Jamshoro/Hyderabad, umbilical stomas demonstrated complication rates equivalent to conventional sites while achieving significantly better cosmetic outcomes across validated scar scales. The technique is particularly valuable for neonatal ARM and HD requiring staged management, integrating seamlessly with laparoscopic definitive repairs to minimize total scarring.

The psychological and quality-of-life benefits of concealed scarring cannot be overstated in pediatric populations. As surgical care increasingly emphasizes holistic outcomes beyond survival, umbilical stomas offer a practical means of preserving body image while maintaining clinical efficacy.

With rigorous attention to patient selection—excluding umbilical anomalies and infection—and meticulous surgical technique emphasizing tension-free, well-vascularized, protruding stomas with robust fascial fixation, umbilical loop stomas merit active consideration in contemporary pediatric surgical practice. Our experience affirms that this approach is not merely cosmetically favorable but fundamentally aligns with the modern imperative to optimize children's long-term quality of life.

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Conflicts of interest

None declared.

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