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Review Article

Comparing Loop and Divided Colostomy for Anorectal Malformation: A Systematic Review and Meta-Analysis

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A B S T R A C T

Introduction: The optimal type of colostomy for patients with anorectal malformations (ARM) remains unclear. We conducted a systematic review and meta-analysis to compare the clinical outcomes of loop colostomies (LC) versus divided colostomies (DC) in patients with ARM.
Methods: After review registration (PROSPERO: CRD42024513335), we searched multiple databases for comparative studies on LCs and DCs in patients with ARMs. Gray literature was sought. The complications examined included stoma prolapse, urinary tract infection (UTI), skin excoriation, stoma retraction, parastomal hernia, wound infection rate, and stoma stricture. Three reviewers independently assessed the eligibility and quality of the included studies. Meta-analysis of selected complications was performed using Revman 5.4, with $p < 0.05$ considered significant.
Results: Eleven studies were included in the analysis, incorporating a total of 2550 neonates with ARMs, of which 1147 underwent LCs and 1403 underwent DCs. The meta-analysis revealed no significant differences between the two groups in the incidence of stoma prolapse (OR: 1.55, 95 % CI: 0.63 to 3.79; p = 0.34), UTIs (OR: 1.78, 95 % CI: 0.50 to 6.36; p = 0.38), skin excoriation (OR: 1.26, 95 % CI: 0.68 to 2.34; p = 0.46), stoma retraction (OR: 0.79, 95 % CI: 0.09 to 6.64; p = 0.83), parastomal hernia (OR: 0.99, 95 % CI: 0.22 to 4.48; p = 0.99), wound infection (OR: 0.35, 95 % CI: 0.10 to 1.20; p = 0.10), and stoma stricture (OR: 0.70, 95 % CI: 0.22 to 2.18; p = 0.53).
Conclusions: The findings suggest that LCs and DCs are viable options for fecal diversion, presenting similar risks and benefits. The choice between these techniques should consider individual patient characteristics and surgical expertise.
Type of Study: Meta-analysis.
Level of evidence: II.

Abbreviations: ARM, Anorectal malformation; LC, Loop colostomy; DC, Divided colostomy; UTI, Urinary tract infection; NOS, The Newcastle–Ottawa Scale; NR, Non-reported; SP, Stoma prolapse; SE, Skin excoriation; SR, Stoma retraction; PH, Parastomal hernia; WI, Wound infection; SS, Stoma stricture.

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1. Introduction

Anorectal malformations (ARM) are complex congenital disorders with an occurrence rate of one in every 3000 to 5000 live births. They are marginally more prevalent in males than in females [1]. The management of ARM is highly variable and depends on the malformation's specific type and anatomical characteristics. Treatment strategies can range from a single surgical procedure to multiple staged interventions necessary to correct the anomaly effectively.

Colostomy formation constitutes the initial phase in staged surgical treatments, serving to decompress the bowel in anticipation of definitive anorectal reconstructive procedures. Typically, the colostomy is retained for 6–8 weeks following the perineal procedure to ensure ongoing fecal diversion and reduce the risk of surgical site infections [2]. While colostomies are regarded as protective and potentially life-saving, they are not without significant risks; high rates of morbidity and mortality can occur, influenced by both the surgical technique employed and the patient's overall condition [3].

Two principal types of colostomies are utilized in managing ARM: loop colostomy (LC) and divided colostomy (DC). Determining the optimal colostomy type for ARM has been a persistent topic of discussion within pediatric surgery, as each type offers specific benefits and drawbacks. The separated descending colostomy is often recommended as the preferred ostomy for ARM patients, as noted by Levitt and Pena [4]. This configuration is believed to mitigate the risks of urinary tract infections and stoma prolapse. It also facilitates the performance of the high-pressure distal colostogram, which is crucial for detecting recto-urethral fistulas [4]. Conversely, DCs have been associated with a higher incidence of wound site infections, according to various studies [5,6].

Despite these concerns, many pediatric surgeons frequently perform LCs due to their distinct advantages. These include the relative ease of formation and closure, which do not require a full laparotomy, and the reduced potential for intraabdominal adhesion formation [7]. Additionally, applying a stoma bag is more straightforward with a single orifice, which is particularly advantageous in small infants as opposed to those with a separated divided stoma [7].

The ongoing debate among medical professionals regarding choosing between these colostomy types underscores the complexity of surgical decision-making in ARM treatment. This meta-analysis aims to provide a comparative assessment of the short-term outcomes associated with each colostomy technique, offering evidence-based guidance to improve clinical decisions.

2. Materials and methods

2.1. Search strategy

This review protocol was prospectively registered in PROSPERO (CRD42024513335) (http://www.crd.york.ac.uk/PROSPERO/). We reviewed the literature using databases such as EMBASE, PubMed, SCOPUS, Web of Science, and Cochrane, covering all relevant publications from 1995 to March 2024, ensuring a comprehensive search over the past 30 years. The search strategy was conducted manually by three researchers (GG, EK, and MA) based on specific PICO (Population, Intervention, Comparison, Outcome) questions related to "anorectal malformation," "divided colostomy," and "loop colostomy," as well as terms associated with urinary tract infection (UTI) incidence, prolapse, and wound infection. The results were then compared and cross-checked to ensure accuracy. We also manually examined references and reviewed articles for comprehensive coverage and relevance. No assistance from a librarian was sought for this process. The inclusion criteria encompassed all patients with anorectal malformations (ARM) who had undergone diverting stoma.

2.2. Study selection

Studies comparing LC and DC for the treatment of ARM were included.

Inclusion criteria [1]: Clinical studies comparing LC versus DC for ARM, and [2] stoma prolapse, urinary tract infection, skin excoriation, stoma retraction, parastomal hernia, wound infection, stoma stricture, and stoma necrosis were all reported. General demographic information such as patient weight and age was also incorporated.

Exclusion criteria [1]: A lack of comparative case series serving as controls [2], studies failing to provide useable raw data or being instances of duplicate publications, and [3] grey literature, which refers to materials produced outside of traditional academic or commercial publishing channels, such as reports, theses, and conference papers, and are not peer-reviewed.

2.3. PICOS strategy

Participant/Population(s): Patients diagnosed with anorectal malformations.

Intervention(s): Patients underwent loop colostomy opening for anorectal malformations.

Comparator(s)/Control: Patients underwent divided colostomy opening for anorectal malformations.

Outcome(s): Operative time, hospital length of stay, urinary tract infections rate, stoma prolapse rate, skin excoriation rate, stoma retraction rate, parastomal hernia rate, wound infection rate, and stoma stricture rate.

Studies: RCT, prospective, and retrospective studies.

2.4. Data extraction

Three researchers (GG, EK, and MA) independently evaluated the studies included in this review. They gathered details on the number of participants, the design of each study, and the year it was published. Data regarding the population, such as birth weight and age at surgery, were also collected. Beyond authorship and publication year, this meta-analysis deemed the following variables critical: stoma prolapse, urinary tract infection, skin excoriation, stoma retraction, parastomal hernia, wound infection rate, stoma stricture, and stoma necrosis.

2.5. Risk of bias assessment

The Newcastle–Ottawa Scale (NOS), specifically designed to assess observational studies, was chosen to evaluate the quality of the selected research. Three authors (GG, EK, and MA) independently analyzed the included studies, reconciling any differences in opinion through discussion among the reviewers. The interobserver agreement reached a high and satisfactory level, attributed to the diligent efforts of the three authors (GG, EK, and MA). They employed a predefined meta-analysis form to meticulously extract pertinent data from each study.

2.6. Statistical analysis

We employed Review Manager (RevMan) software, version 5.4, for the statistical analysis. Continuous and dichotomous variables were evaluated using risk ratios and mean differences. The I^2

statistic quantified the degree of statistical heterogeneity, while the Chi-square test assessed its presence. A significance level of $p < 0.05$ was established for the analysis. We adopted a random effects model to analyze the data comprehensively.

2.7. Reporting

The outcomes of this systematic review were documented according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

3. Results

Fig. 1 illustrates the PRISMA study screening process. Initially, an online search yielded 690 titles, from which 502 records were selected after removing irrelevant entries and duplicates. Subsequent screening of titles and abstracts led to retrieving 42 full-text articles for more detailed evaluation. Of these, 31 articles were excluded for failing to meet the inclusion criteria. Consequently, eleven studies that compared LC (n = 1147) to DC (n = 1403) were deemed suitable for meta-analysis [5,6,8–16]. Table 1 summarizes demographic data for each of the eleven studies, including the country of the study, published year, study design, number of patients, and the Newcastle–Ottawa Scale (NOS) bias score. Table 2, meanwhile, displays the primary outcomes obtained from each study.

4. Outcomes

4.1. Stoma prolapse

Stoma prolapse rate was reported in 10 studies, which included 1092 patients in the LC group and 1356 in the DC group. None of the studies provided a clear definition of prolapse. The overall prolapse rates in the LC and DC groups were 12.4 % and 5 %, respectively. No statistically significant difference was found between groups in terms of stoma prolapse rate ($I^2 = 75$ %) (OR: 1.55, 95 % CI: 0.63 to 3.79; $p = 0.34$) (Fig. 2). In three of the studies, it was reported that the timing of prolapse development, whether within or beyond six months, showed no significant difference regardless of the stoma type [13–15]. Three studies indicated that the occurrence of prolapse was associated with whether the stoma was created at the fixation site of the colon, irrespective of the stoma type [9,11,12].

4.2. Urinary tract infections

Six studies reported the urinary tract infection rate, which included 711 patients in the LC group and 446 in the DC group. In

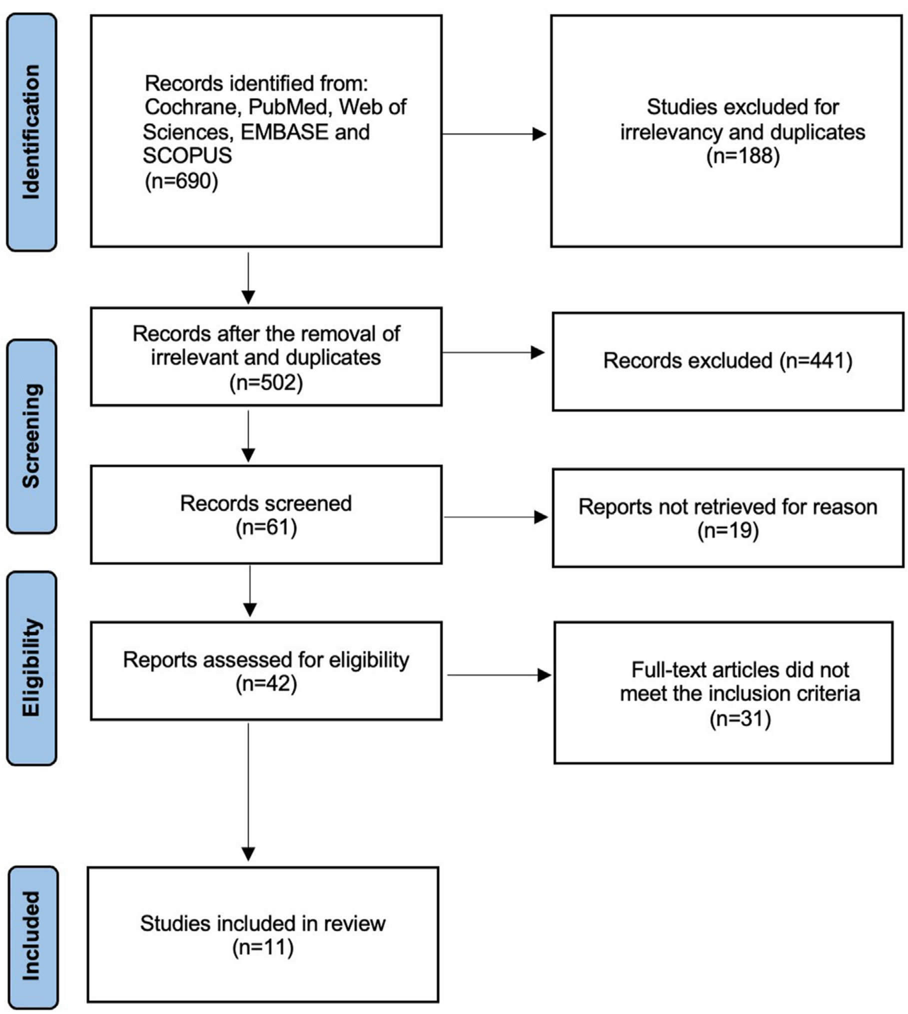

Fig. 1. PRISMA flow diagram of study selection.

Table 1
The characteristics of the included studies.

Study	Published year	Country	Study design	Center	Groups		NOS score
					Loop (n = 1147)	Divided (n = 1403)	
Wilkins et al. [8]	1998	USA	Retrospective	Multicentric	57	250	9
Patwardhan et al. [9]	2001	UK	Retrospective	Single center	39	10	9
Sheikh et al. [10]	2006	Pakistan	Retrospective	Single center	51	20	9
Pena et al. [11]	2006	USA	Retrospective	Multicentric	351	805	9
Demirogullari [6]	2011	Turkey	Retrospective	Single center	79	58	9
van del Handel [12]	2014	Netherlands	Retrospective	Single center	133	19	9
Oda et al. [13]	2014	Canada	Retrospective	Single center	73	71	9
Liechty et al. [5]	2016	USA	Retrospective	Single center	78	93	8
Alassiri et al. [14]	2016	Saudi Arabia	Retrospective	Single center	55	47	9
Mullassery [15]	2018	UK	Retrospective	Single center	171	9	8
Calisti et al. [16]	2021	Italy	Retrospective	Multicentric	60	21	9

Table 2
The primary outcomes from studies comparing loop colostomy and divided colostomy.

Study	SP		UTI		SE		SR		PH		WI		SS	
	LC	DC	LC	DC	LC	DC	LC	DC	LC	DC	LC	DC	LC	DC
Wilkins et al. [8]	4 (7 %)	1 (0.04 %)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Patwardhan et al. [9]	5 (12.8 %)	3 (30 %)	11 (28 %)	3 (30 %)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sheikh et al. [10]	9 (17.6 %)	4 (20 %)	3 (5.8 %)	0	28 (55 %)	10 (50 %)	2 (4 %)	3 (15 %)	1 (2 %)	0	1 (2 %)	3 (15 %)	2 (4 %)	1 (5 %)
Pena et al. [11]	55 (15.6 %)	42 (5.2 %)	223 (63.5 %)	42 (5.3 %)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Demirogullari [6]	6 (7.5 %)	0	NR	NR	NR	NR	NR	NR	1 (1.3 %)	1 (1.7 %)	NR	NR	NR	NR
van del Handel [12]	21 (15.7 %)	0	NR	NR	NR	NR	NR	NR	NR	NR	2 (1.5 %)	1 (5.2 %)	0	1 (5.2 %)
Oda et al. [13]	13 (17.8 %)	2 (2.8 %)	12 (16.4 %)	5 (7 %)	NR	NR	1 (1.3 %)	3 (4.2 %)	2 (2.6 %)	0	NR	NR	NR	NR
Liechty et al. [5]	6 (7.6 %)	9 (9.6 %)	11 (14 %)	21 (22.5 %)	2 (2.5 %)	4 (4.3 %)	8 (10 %)	2 (2.1 %)	0	2 (2.1 %)	2 (2.5 %)	3 (3.2 %)	4 (5 %)	5 (5.4 %)
Alassiri et al. [14]	NR	NR	NR	NR	17 (31 %)	10 (21 %)	NR	NR	NR	NR	NR	NR	NR	NR
Mullassery [15]	15 (8.7 %)	2 (22 %)	36 (21 %)	4 (44.4 %)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Calisti et al. [16]	2 (3.3 %)	4 (19 %)	NR	NR	7 (11.6 %)	0	NR	NR	NR	NR	NR	NR	2 (3.3 %)	0

NR: Non-reported, LC: Loop colostomy, DC: Divided colostomy, SP: Stoma prolapse, UTI: Urinary tract infections, SE: Skin excoriation, SR: Stoma retraction, PH: Parastomal hernia, WI: Wound infection, SS: Stoma stricture.

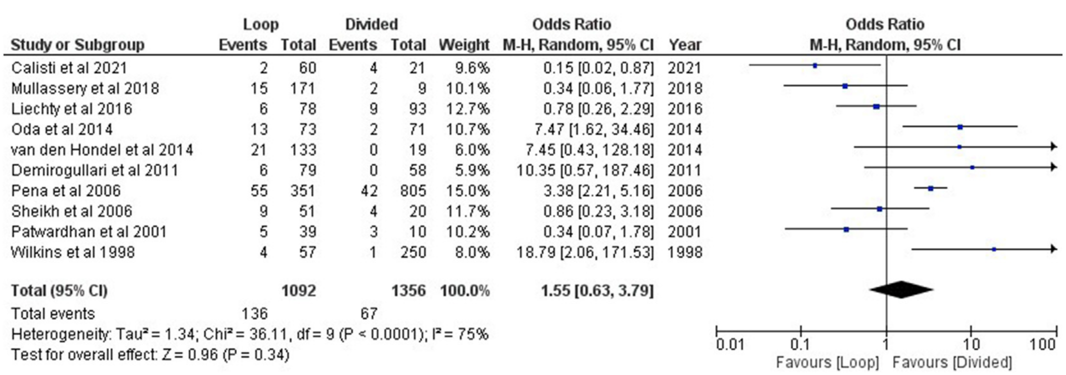

Fig. 2. Forest plot of stoma prolapse rate comparing loop and divided colostomy groups.

one of the studies, urinary tract infection was defined, and it was noted that the diagnosis was based on clinical symptoms of infection in conjunction with a positive urine culture [9]. The overall UTI rates in the LC and DC groups were 41.6 % and 16.8 %, respectively. No statistically significant difference was found between groups in terms of the UTI rate ($I^2 = 88$ %) (OR: 1.78, 95 % CI: 0.50 to 6.36; p = 0.38) (Fig. 3).

4.3. Skin excoriation

Four studies reported skin excoriation rates, including 355 patients in the LC and 169 in the DC groups. None of the studies provided a comprehensive definition of skin excoriation. The overall skin excoriation rates in the LC and DC groups were 15.2 % and 14.2 %, respectively. No statistically significant difference was found between groups in terms of skin excoriation rate ($I^2 = 0$ %) (OR: 1.26, 95 % CI: 0.68 to 2.34; p = 0.46) (Fig. 4).

4.4. Stoma retraction

Stoma retraction rate was reported in 3 studies, which included 202 patients in the LC group and 184 in the DC group. In one of the studies, stoma retraction was defined as the descent of the stoma to a level below the surface of the skin [10]. The overall retraction rates in the LC and DC groups were 5.5 % and 4.3 %, respectively. No statistically significant difference was found between groups in terms of stoma retraction ($I^2 = 74$ %) (OR: 0.79, 95 % CI: 0.09 to 6.64; p = 083) (Fig. 5).

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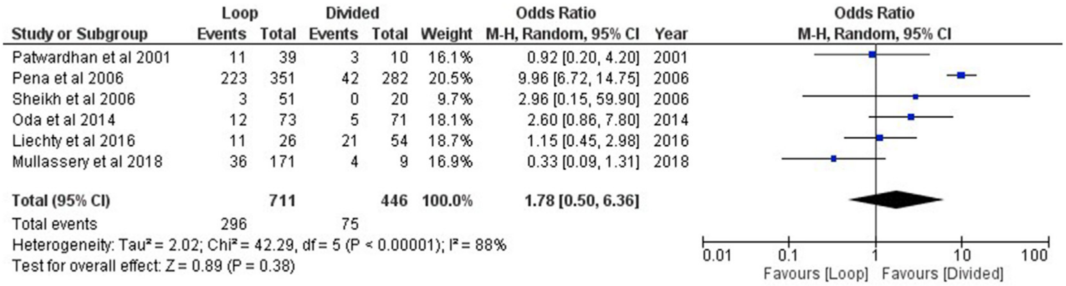

Fig. 3. Forest plot of urinary tract infection rate comparing loop and divided colostomy groups.

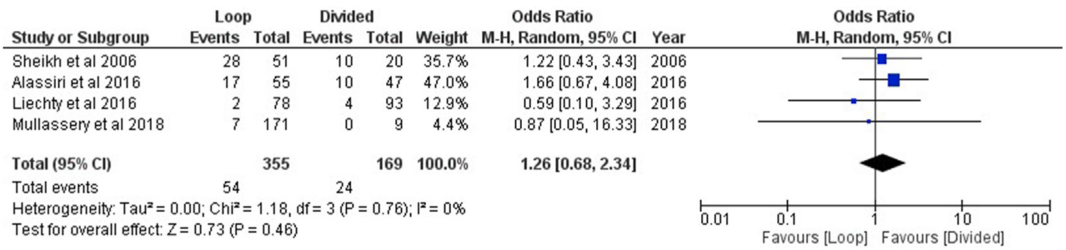

Fig. 4. Forest plot of skin excoriation rate comparing loop and divided colostomy groups.

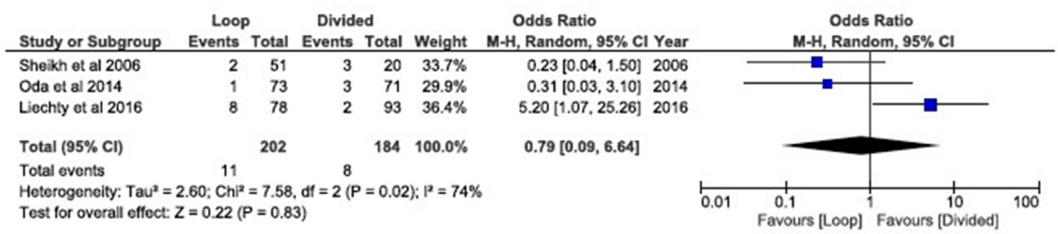

Fig. 5. Forest plot of stoma retraction rate comparing loop and divided colostomy groups.

4.5. Parastomal hernia

Four studies reported the parastomal hernia rate, which included 281 patients in the LC group and 242 in the DC group. None of the studies provided a comprehensive definition of parastomal hernia. The overall parastomal hernia rates in the LC and DC groups were 1.4 % and 1.2 %, respectively. No statistically significant difference was found between groups in terms of parastomal hernia rate ($I^2 = 74$ %) (OR: 0.99, 95 % CI: 0.22 to 4.48; $p = 0.99$) (Fig. 6).

4.6. Wound infection rate

The wound infection rate was reported in 3 studies, which included 262 patients in the LC group and 132 in the DC group. In one study, wound infection was defined as cellulitis requiring antibiotic treatment or a superficial surgical site infection necessitating incision opening or stoma revision [5] The overall wound infection rates in the LC and DC groups were 1.9 % and 5.3 %, respectively. No statistically significant difference was found between groups in terms of wound infection rate ($I^2 = 0$ %) (OR: 0.35, 95 % CI: 0.10 to 1.20; $p = 0.10$) (Fig. 7).

4.7. Stoma stricture

Stoma stricture rate was reported in 4 studies, which included 322 patients in the LC group and 153 in the DC group. Stoma stricture was not explicitly defined in any of the studies. The overall stoma stricture rates in the LC and DC groups were 2.5 % and 4.6 %,

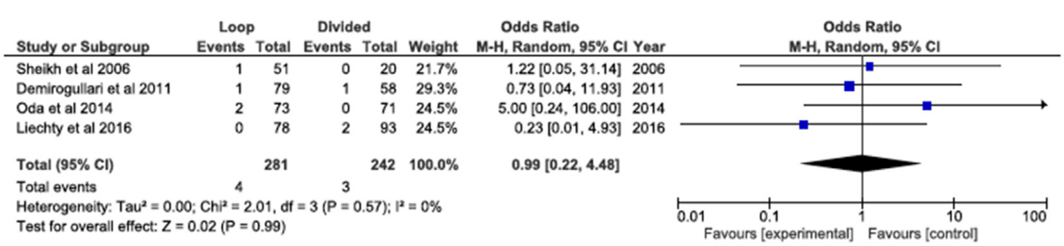

Fig. 6. Forest plot of parastomal hernia rate comparing loop and divided colostomy groups.

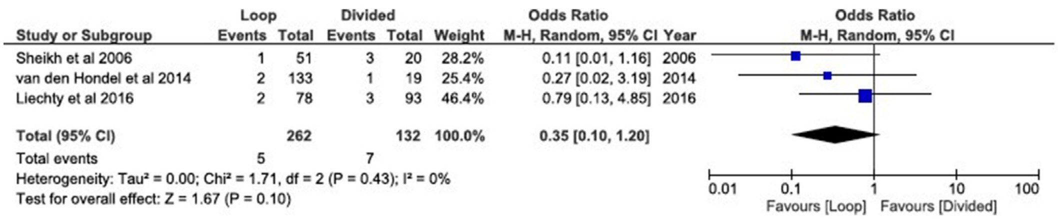

Fig. 7. Forest plot of wound infection rate comparing loop and divided colostomy groups.

respectively. No statistically significant difference was found between groups in terms of stoma stricture rate ($I^2 = 9$ %) (OR: 0.70, 95 % CI: 0.22 to 2.18; p = 0.53) (Fig. 8).

5. Discussion

ARMs represent a range of congenital defects that impact the development of the anus and rectum [1]. Low types of ARMs may be treated without needing a protective diverting colostomy. Although numerous studies have validated the safety of a one-stage corrective procedure for intermediate and high types of ARMs, a diverting colostomy remains a standard initial step in the surgical management of these conditions [17,18]. While the creation of a colostomy is a relatively minor surgical intervention, it carries the potential for significant morbidity. The general complication rate for all pediatric ostomies is reported to be around 31 % [19]. The specific complications associated with ostomies in ARMs vary based on the developmental standards and capabilities of different countries and medical centers. In developing countries, the mortality rate associated with these procedures can rise to as high as 44 %, mainly if the infant is small, ill, septic, and have additional comorbid conditions [20,21].

Additional complications can include UTIs, stoma retraction, prolapse, parastomal hernia, bowel obstruction, skin excoriation, the necessity for surgical revision, and complications such as anastomotic leak and wound infections post-stoma closure [5,10,11].

The choice between LC and DC colostomy depends on various factors, such as the specific anatomy of the malformation, the surgeon's preference and expertise, the patient's overall health, and the long-term treatment goals. Both LC and DC have their advantages and potential complications. A comprehensive understanding of the various surgical approaches and their associated risks is crucial for optimizing patient outcomes and reducing the incidence of complications.

Stoma prolapse is a well-known complication of ostomy surgery, including LC and DC. The frequency of this complication varies widely, influenced by factors such as patient demographics, ostomy type, and surgical technique, with reported rates ranging from 2 % to 28 %. Notably, higher incidences are often associated with LC [22,23]. Liechty et al. [5] observed a lower incidence of stoma prolapse compared to other reports in the literature. Although they noted an increased occurrence of divided colostomies, they attributed this not to the type of stoma but rather to the surgical technique used. Specifically, they suggested that positioning the stoma at the junction of the descending and sigmoid colon could help reduce the rate of this complication.

In this meta-analysis examining stoma prolapse, which included 1092 patients with LC and 1356 with DC, no significant differences were observed in prolapse rates between the two groups. This conclusion is corroborated by findings from Pena et al. [11] and van del Handel et al. [12], who reported comparable complication rates for LC. In contrast, Calisti et al. [16] also found consistent prolapse rates within the DC group. These results suggest that the incidence of prolapse may be more strongly influenced by surgical techniques rather than the specific type of stoma utilized.

Research on UTIs in children with ARMs who have undergone LC versus DC is somewhat limited, but several factors may contribute to the risk of UTIs in these patients. LC and DC differ in their anatomy and proximity to the urinary tract. LCs typically involve a single opening on the abdominal wall, while DCs create two openings. The potential for fecal impaction in the distal loop and the subsequent risk of urinary tract contamination are vital factors influencing surgeons' preference for DC over LC in patients with ARMs [6,11]. Singh et al. [24] observed a high incidence of UTIs (86 %) in patients with high ARMs accompanied by rectourethral or vesical fistulas. To reduce the risk of UTIs, they advocated for a complete diversion of the fecal stream and regular washouts of the distal colon, strategies aimed at preventing fecal matter from contaminating the urinary tract and thus minimizing infection risks.

However, in this study, UTIs were not significantly higher in patients receiving an LC than those receiving a DC. In six studies, we observed 711 patients in the LC group and 446 in the DC group, and our analysis found no statistically significant difference between groups in terms of UTI rate [5,9–11,13,15]. Two studies reported information on urinary tract infections, with contradictory results [11,15]. Peña et al. [11] reported a prevalence of 64 % in loop colostomies and 36 % of the divided colostomies placed too close to each other.

Further research is necessary to understand better the factors contributing to UTIs in this population and to develop strategies for prevention and management. LCs and DCs can lead to fecal contamination of the peristomal skin and surrounding area, increasing the risk of UTIs. Poor stoma hygiene, leakage around the stoma, and inadequate ostomy appliance fit can contribute to fecal

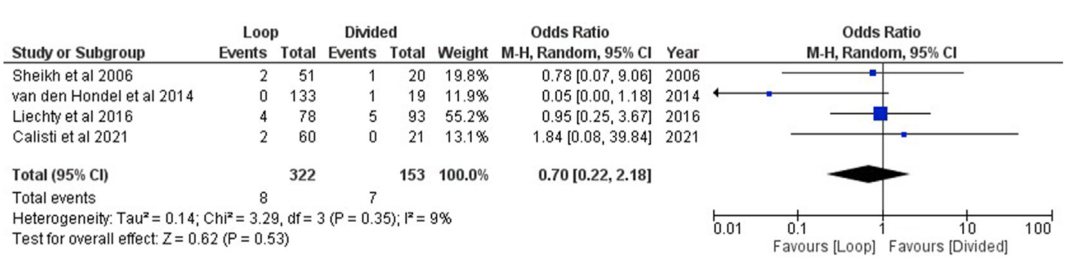

Fig. 8. Forest plot of stoma stricture rate comparing loop and divided colostomy groups.

contamination and subsequent UTIs. In clinical practice, close monitoring of urinary symptoms, appropriate stoma care, and early intervention for suspected UTIs are essential components of comprehensive care for children with ARM who have undergone colostomy surgery.

Skin excoriation, also known as peristomal dermatitis, is a common concern in children with ARMs who have undergone colostomy surgery. Several factors may contribute to peristomal skin issues in these patients, regardless of the type of colostomy, fecal contamination, stoma size and shape, stoma care practices, skin sensitivity, and medical management [25].

There are no significant differences in the incidence of peristomal skin excoriation in our analysis between LCs and DCs among four observed studies, which included 355 patients in the LC group and 169 in the DC group [5,10,14,16]. Individual patient factors and stoma care practices are critical in preventing and managing skin issues in children with ARM. Close collaboration between caregivers, healthcare providers, and pediatric ostomy nurses is essential for addressing peristomal dermatitis and optimizing the care of children with colostomies. Proper cleansing, selecting appropriate ostomy products, and ensuring a secure ostomy appliance fit to prevent leakage and irritation.

The surgical technique used to create the colostomy can influence the risk of stoma retraction. Factors such as child age, anatomical considerations, the adequacy of stoma formation, preservation of blood supply to the stoma, and proper fixation of the stoma to the abdominal wall are critical in preventing stoma retraction. The size and shape of the stoma may also impact the likelihood of retraction. Stomas that are too small or irregularly shaped may be more prone to retraction [26]. Our review showed no statistical differences between the LCs and DCs regarding the stoma retraction rate reported in three studies, which included 202 patients in the LC group and 184 in the DC group [5,10,13].

Parastomal hernia, characterized by the protrusion of abdominal contents through the abdominal wall around the stoma, is a known complication following ostomy surgery in pediatric populations [21]. While LCs and DCs are associated with the risk of parastomal hernia, differences in stoma anatomy and configuration may influence hernia rates. Individual patient characteristics, such as age, body habitus, underlying medical conditions, and intra-abdominal pressure, may also affect the risk of parastomal hernia [3]. The present study revealed no significant differences in rates of occurrence of parastomal hernia found between four analyzed studies, including 281 patients in the LC group and 242 in the DC group, in terms of parastomal hernia rate [5,6,10,13].

While LCs and DCs are associated with the risk of wound infection, differences in stoma anatomy and configuration may influence infection rates. We found no statistically significant difference between analyzing groups in three studies regarding wound infection rate in 262 patients with LC vs 132 DC group for ARMs [5,10,12]. Pena et al. [11] reported no wound infections across 50 divided stomas. Patwardhan et al. [9] documented that only one patient (10 %) with a divided stoma experienced skin dehiscence. The surgical technique used to create the colostomy can significantly impact the risk of wound infection. Factors such as the sterility of the operating field, adequacy of tissue perfusion, and meticulous closure of the surgical incision are critical in preventing postoperative infections. Environmental factors, such as the prevalence of antibiotic-resistant organisms in healthcare, may also impact wound infection rates [7,25]. Strict adherence to infection control protocols and antimicrobial stewardship practices can help mitigate this risk.

Another possible complication following ostomy surgery is stoma stricture, characterized by narrowing the stoma opening, regardless of ostomy type. Stoma stricture rate in the presented study, reported in four studies, which included 322 patients in the LC group and 153 in the DC group, showed no statistically significant difference between groups [5,10,12,16]. While there may not be a specific randomized controlled study on this matter, several factors may contribute to the development of stoma strictures. Factors such as inadequate vascularization of the bowel segment or compromised tissue perfusion due to underlying conditions may contribute to stricture formation [10]. Adequate mobilization of the bowel and careful placement of the stoma to minimize tension are essential considerations in preventing strictures. Proper stoma care, including regular cleansing and monitoring for signs of infection, is critical for reducing these risks.

The management of ARM in children requires a multidisciplinary approach involving collaboration between pediatric surgeons, pediatricians, nurses, and other healthcare professionals. While both techniques have demonstrated efficacy in facilitating staged repair and optimizing functional outcomes, ongoing research is needed to refine surgical approaches and minimize long-term complications. In future analysis, we have to discuss potential sources of bias in the included studies, such as selection bias, confounding variables, and publication bias, and their implications for interpreting the results.

Several additional limitations of this review require acknowledgment and render judgment of best practice unclear. The quality of this systematic review depends on the collection of studies contained within it. With only one small randomized controlled trial and extreme differences in reporting practices across all included studies, firm conclusions cannot be drawn with the available dataset. Publication bias may also exist, although efforts to access gray literature were undertaken. In addition, this review encompassed a vast temporal and geographic variety of studies, aggregating publications from different countries and very different societal contexts. Moreover, the absence of standardized definitions for complications, the variability in surgical techniques depending on the surgeon, the localization of the stoma opening, the length of the distal colon segment, the timing of complication onset, and the lack of detailed information regarding patients' additional comorbidities may have influenced the assessment of the outcomes. While ARMs have always presented similarly, differences in care practices over time may have diluted our reported outcomes, thus preventing us from identifying differences when clinical variation existed.

6. Conclusion

The results of this meta-analysis provide valuable insights into the comparative effectiveness of stoma types in managing ARMs in children. The findings suggest that LCs and DCs are viable options for fecal diversion in children with ARM, with similar risks and benefits. The clinical implications for choosing between them encompass various factors influencing surgical decision-making and patient outcomes. These techniques should be selected based on individual patient characteristics and surgical expertise. By elucidating the intricacies of these surgical techniques, healthcare providers can better navigate the complexities of ARM management and improve the quality of care for this vulnerable patient population.

Ethical approval

This is systematic review and meta-analysis. No need for ethical approval.

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No.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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