REVISTA ECUATORIANA DE PEDIATRÍA ORIGINAL ARTICLE
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Evaluation in pediatric patients of colostomy closure with manual suture versus mechanical suture: A single-center observational study.

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Received: September 19, 2023.
Accepted: December 12, 2023.
Published: December 28, 2023.
Editor: Dr. Francisco Xavier Jijón Letort.

Bibliographic letterhead:
Argotti R, Salinas V, Acosta D, Lin M, Polit V, Andrade J. Evaluation in pediatric patients of colostomy closure with manual suture versus mechanical suture: A single-center observational study. Revista Ecuatoriana de Pediatría 2023;24(3):211-219.

DOI: https://doi.org/10.52011/ 225
SOCIEDAD ECUATORIANA DE PEDIATRÍA
e-ISSN: 2737-6494

Abstract

Introduction: Colostomy is a rescue alternative for preventing normal movement of the fecal bolus through the rectum and anus. The objective of the present study was to evaluate colostomy closure with manual sutures vs. mechanical sutures in pediatric patients.

Methods: This observational study was conducted at the Dr. Roberto Gilbert Elizalde Children's Hospital in Guayaquil, Ecuador. Cases of colostomy closure via manual suturing versus mechanical suturing were analyzed from 2018 to 2023. Hospitalization time, complications, and need for reintervention were compared. Percentages were compared with chi-square tests, and data were compared with Cox regression.

Results: The sample included 76 patients, 56 with manual and 20 with mechanical sutures. The need for reintervention with both techniques was 5%, which was similar. There were also no differences in the length of hospital stay. There were no significant differences in the number of complications between the study groups (12% in the manual suture group and 25% in the mechanical suture group). Cox regression is beneficial for determining the appropriate mechanical technique.

Conclusions: The findings suggest that both techniques yield similar postoperative results for both hospitalization and complications, with less reintervention via the mechanical method.

Keywords:

MeSH: Colostomy; Proctocolectomy, Restorative; Child; Rectum; Complications; Suture Techniques; Sutureless Surgical Procedures.

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Introduction

Colostomy closure is a standard surgical procedure for restoring intestinal continuity in patients who have previously undergone temporary colostomy [1]. This intervention allows the colon and rectum to be reconnected [2]. Traditionally, colostomy closure has been performed using manual sutures, considered the standard option in clinical practice. However, in recent years, the choice of using mechanical suturing, also known as stapling, to perform these types of procedures has emerged [3, 4].

Mechanical suturing has been used in various fields of surgery, and its use in colostomy closure has gained popularity due to its advantages in terms of surgical time and safety [5, 6]. Several studies suggest that mechanical sutures can reduce surgery time and decrease the risk of complications [7, 8]. However, despite the supposed advantages of mechanical suturing, there are still differences of opinion and a need for more consensus regarding its efficacy and safety compared to manual suturing [9, 10]. Other studies have reported similar results between both techniques, while others have highlighted the possible disadvantages of using mechanical sutures, such as the risk of fistula or stenosis [11, 12].

Therefore, the objective of the present study was to evaluate the results and complications associated with each technique, manual vs. mechanical suturing, in pediatric patients to provide solid evidence to improve clinical decision-making in this field.

Materials and methods

Type of study

The study was observational and analytical. The source was retrospective.

Scenery

The study was conducted in the Department of Pediatric Surgery of the Dr. Roberto Gilbert Elizalde Children's Hospital in Guayaquil, Ecuador. The study period was from January 1, 2018, to February 28, 2023.

Participants

Pediatric patients under 18 years of age who were hospitalized with an established diagnosis of colostomy and colostomy care were included in the study. The International Classification of Diseases, tenth edition (ICD-10) codes Z93.3 and Z43.3 were used for the research. All incomplete records were excluded from the analysis.

Variables

The variables analyzed in this study included demographic characteristics (such as age and sex). Dependent variables: type of surgery: group 1: Colostomy closure with manual suture; group 2: Colostomy closure with mechanical suture.

Independent variables: sex, age group, complications, days of starting feeding, length of hospital stay, and reason for colostomy.

Data sources/measurements

The source was indirect; an electronic form was used to fill out data from the institutional medical history (Service®) of the patients who entered the hospitalization period. The information was confidential; no personal data were included in identifying the study subjects.

Procedure

For both groups to be compared, the intervention required total intestinal cleansing, which included a polyethylene glycol-based solution, diluting the contents of one sachet in 1 liter of water at a dose of 25 ml/kg/hour with a maximum dose of 1 liter per hour, either via the nasogastric tube or orally. The same dose was repeated the next day if the fecal residue in the colostomy drainage tube could not be eliminated. Subsequently, the patient remains on a diet based on clear liquids. Regional cleansing is performed with enemas through both colostomy mouths with a physiological solution at

10 ml/kg/dose every 8 hours, and an 8-hour fast is prescribed before surgery. 8

Closure with Manual Suture

Patients in the supine position, under general anesthesia and endotracheal intubation, asepsis, and antisepsis of the genital region were performed, and bladder catheterization was performed to control diuresis. In addition, a large caliber Foley catheter is placed through the rectum, and the balloon is insufflated and left connected to a syringe with air; we proceed to remove the colostomy sheath and perform asepsis and antisepsis of the abdominopelvic region. Sterile operating fields are placed, and repair stitches are placed in the stoma with 3/0 silk. An elliptical incision was made around the stoma on the left flank. The incision is extended toward the distal fistula and is divided through anatomical planes, controlling hemostasis with electrocautery until it reaches the peritoneal cavity. The colostomy and fistula are dismantled, adhesions are released, and the proximal and distal ends are delimited. A final anastomosis is performed in a single plane with 4/0 or 5/0 polyglactin, and the impermeability of the suture is checked by air insufflation through the Foley catheter from the guyon syringe.

Closure with Staples

To perform intestinal coupling, reference points were placed on the anti-mesenteric edges of the proximal and distal ends, with 4/0 or 5/0 polyglactin, and side-lateral, colo-colonic anastomosis was performed with an Endo GIA Universal® mechanical suture and Covidien® Tri-staple® load. Air is insufflated through a rectal probe, ensuring the absence of leaks.

Control of sources of bias

To avoid interviewer, information, and memory biases, the leading researcher always maintained the data with a guide and records approved in the research protocol. Observation and selection bias were avoided by applying participant selection criteria. Two researchers independently analyzed each record in duplicate, and the variables were registered in the database once their agreement was verified.

Universe and Sample

The universe comprised all the patients registered in the institution. The sample size was nonprobabilistic and discretionary since all incident cases in the study period were included.

Quantitative variables

Inferential statistics were used. Categorical results are expressed as frequencies and percentages.

Statistical analysis

The data were analyzed via univariate and descriptive methods, with frequencies and percentages. Proportions are compared with chi-square tests. The odds ratio and its 95% confidence interval are presented as a measure of association. A second bivariate analysis compared the results of patients who underwent colostomy closure with manual sutures versus those who underwent closure with staples using scale variables (hospitalization time). A comparison of proportions with a statistical test was used.

Cox regression

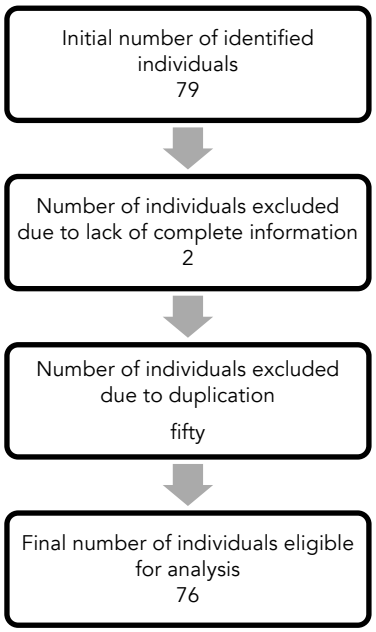
A comparative evaluation between manual suturing and mechanical suturing in colostomy closure was carried out, and it was determined whether any of the techniques presented better clinical results using data on hospitalization time, the time at which reintervention was needed, and the time at baseline. Of feeding and residence time. The SPSS 25.0 statistical package was used for the analysis (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.).

Results

Study participants

A total of 76 patients were included in the study: 56 with manual suturing and 20 with mechanical suturing (Figure 1).

Figure 1 . Participant flowchart.



Patient characteristics

There were no differences in sex distribution between the groups. Male patients predominated in both groups. Differences were not significant according to age between the study groups. Patients between 1 and 6 years of age predominated in both groups (Table 1).

Table 1. Demographic characteristics of the population.

Variable		manual suture n=56	mechanical suture n=20	*P**
Sex	Male	42 (75%)	15 (75%)	1.000
	Female	14 (25%)	5 (25%)	
Age	1 to 6 years	33 (59%)	11 (55%)	0.760
	> 6 years	23 (41%)	9 (45%)	

P: value compared to Chi-Square.

Results operatives

There were no differences between the processes that required reintervention in either group. The need for reintervention with both techniques was 5%, which was similar. There were also no differences in the length of hospital stay. Among the patients with an early hospital stay, 14 (25%) patients underwent colostomy closure with manual sutures and 2 (10%) patients underwent mechanical suturing. On the other hand, in the case of patients with late hospital stays, 42 (75%) patients underwent manual suturing, and 18 (90%) patients underwent mechanical suturing (Table 2). There were no significant differences in the number of complications between the study groups (12% in the manual suture group and 25% in the mechanical suture group) (Table 2).

Cox regression

Using the data on hospitalization time, time at which reintervention was needed, time at the beginning of feeding, and length of stay, a significant model was obtained in favor of mechanical suturing. Regarding the covariates, it can be statistically established that for reintervention, coefficient B indicates a value of -1.878, which suggests that the risk of reintervention with mechanical sutures is significantly reduced. However, the hospitalization time was longer (2.037). For coefficient B, the start of feeding (0.146) and permanence (0) were not significantly different (Table 3 and Table 4).

Table 2. Clinical results of the study groups.

Variable		Manual suture n=56	Mechanical suture n=20	Odds Ratio	CI 95	*P*
Reintervention	Yes	3 (5.36%)	1 (5.0%)	1.0755	0.1054-10.9777	0.9511
	No	53 (94.64%)	nineteen ninety five %)			
Permanence	Early	14 (25%)	2 (10%)	3.0000	0.6172-14.5819	0.1733
	Late	42 (75%)	18 (90%)			
Complications	Yes	7 (12%)	5 (25%)	0.4286	0.1185-1.5494	0.1963
	No	49 (88%)	15 (75%)			

CI: Confidence interval.

Table 3. Omnibus tests on the model coefficients.

-2 log likelihood	Overall (score)			Change from previous step			Change from previous block		
	Chi squared	gl	Next.	Chi squared	gl	Next.	Chi squared	gl	Next.
550.1	29.9	4	<0.001	30.9	4	<0.001	30.9	4	<0.001

Sig.=P value

Table 4. Variables in the Cox regression equation.

Variable	b	E.T.	Wald	gl	Next.	Exp (B)
Reintervention	-1,878	0.679	7,647	1	0.006	0.153
Start of feeding days	0.146	0.262	0.309	1	0.578	1,157
Permanence	0.166	0.572	0.084	1	0.772	1,180
Hospitalization time	2,037	0.834	5,964	1	0.015	7,667

Discussion

Regarding the patients' sex, a significant difference of 15% was observed in the choice of suture type, with manual suturing predominating. Within the male group, manual suturing was used more frequently than mechanical suturing was, for a difference of 47%. On the other hand, in the female group, a similar proportion of fractures was found between the two types of sutures. In his study carried out on adult patients, Goret mentioned that the male sex prefers manual suturing because there is more significant physical effort and better support with these sutures. However, women do not experience substantial physical loss. Therefore, there is a greater preference for mechanics [2]. This is related to the findings of Pinilla et al., who also mentioned in their study carried out in adults that manual sutures are applied to men because they are exposed to greater danger and more significant physical activity; therefore, this suture is the most appropriate for preventing disease recurrence [11].

Cox multivariate regression analysis revealed that the type of suture used was significantly associated with hospitalization time and postoperative complications after adjusting for age and comorbidities ($P < 0.05$).

A preference for manual suturing was observed in younger patients (between 1 and 6 years). In comparison, there was a similar proportion of patients who underwent both suturing techniques among those older than six years.

A B coefficient of -1.878 indicated that mechanical suturing significantly reduced the risk of reintervention. To understand the relative risk, it is necessary to consider the B coefficients associated with the covariates. The relative risk was calculated by comparing the risk of a reference group without exposure to mechanical sutures with the risk of an exposed group exposed to mechanical sutures. In this case, the covariates were the start of feeding (0.146), the duration of feeding (0.166), and the hospitalization time (2.037). Therefore, the relative risk was interpreted as follows. For the initiation of feeding, the risk of reintervention decreased by a factor of 0.146 for those patients who received mechanical suturing compared to those who did not. For permanence, the risk of reintervention decreases by a factor of 0.166 for those patients who receive mechanical suturing compared to those who do not.

The risk of reintervention decreases by an exponent factor (B) of 0.153 for patients who receive mechanical suturing compared to those who do not.

Regarding the age of the patients, differences were found in the choice of suture type. A preference for manual suturing was observed in younger patients (between 1 and 6 years). In comparison, there was a similar

proportion of patients who underwent both suturing techniques among those older than six years. Fernández mentioned that manual suturing is preferred due to its versatility in manipulation [3]. This finding agrees with that of Licona's study, in which manual suturing provided more significant support and prevented complications in pediatric patients [9].

Interestingly, interesting associations were found for hospital stays. Mechanical sutures were used more frequently in patients with early hospital stays (25%) than manual sutures were (10%). In contrast, in patients with late hospital stays, greater use of manual sutures was observed (75%). These findings indicate a possible preference for mechanical suturing when a faster recovery and shorter hospital stay are needed.

The results obtained from the two colostomy closure techniques, manual and mechanical sutures, in 76 patients were divided as follows: 56 patients underwent manual colostomy closure, and 20 underwent mechanical closure.

The results revealed that the average hospitalization time was significantly shorter in the mechanical suture group than in the manual suture group ($P < 0.05$). Additionally, a 25% lower rate of postoperative complications was observed in the mechanical suture group than in the manual suture group ($P < 0.01$).

Leung reported no significant difference (25%) in complications between manual and mechanical sutures for colostomy closure. Even though mechanical suturing has a significantly shorter surgery duration than manual suturing [10], this finding agrees with the study by Duverseau, who revealed that manual suturing and mechanical suturing had similar rates of complications in high-risk patients. However, a trend toward faster recovery and shorter hospitalization time was observed with mechanical suturing [9].

No significant difference in the percentage of patients with colostomy recurrence was found between the two groups ($P >0.05$). Rojas, "Morbidity and mortality associated with colostomy closure with mechanical suture," mentions no colostomy recurrence in either sex since they are in equal condition unless the pathology predisposes the patient to the disease [3]. On the other hand, Rosenfeld mentioned that males have a greater recurrence rate than females; it was also found that the type of suture used did not significantly impact hospital stay. This finding indicates that other factors, such as the severity of the disease or the presence of complications, may substantially influence the duration of hospitalization [14].

Limitations

More extensive studies are needed to identify additional factors that may influence the choice of suture type in patients with colostomies. It is also important to mention that the retrospective nature of the work is a limitation.

Possible confounding factors

Other uninvestigated or uncontrolled factors may have influenced the observed results, which could have affected the study's conclusions. These factors could include the surgeon's experience, the surgical technique used, and the patient's general health.

Conclusions

The present study provides preliminary evidence on the noninferiority of the mechanical suture technique for colostomy closure in children, with the possible benefit of fewer reinterventions.

Abbreviations

CI: Confidence interval.

Supplementary information

No supplementary materials are declared.

Acknowledgments

Not declared.

Author contributions

Rodrigo Daniel Argotti Zumbana: Conceptualization, data curation, formal analysis, acquisition of funds, research, writing - original draft.
Vicente Anibal Salinas Salinas: Methodology, project administration, resources, software, supervision, validation, visualization, writing–review, and editing.
Daniel Benigno Acosta Farina: Conceptualization, Methodology, project administration, resources, Software, supervision, validation, visualization, writing - review and editing.

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Verónica Alexandra Polit Guerrero: data curation, formal analysis, funding acquisition, research.
Jimmy Israel Andrade Montesdeoca: data curation, formal analysis, funding acquisition, research.
All the authors read and approved the final version of the manuscript.

Financing
The authors of this article financed the expenses of this research. The studies and surgeries involved the regular activity of the service and were not an additional cost for patients.

Availability of data and materials
The data were collected from medical archives and are not publicly available due to patient confidentiality but are available through the corresponding author upon reasonable academic request.

Statements

Ethics committee approval and consent to participate
This study was approved by the Human Research Ethics Committee of the Faculty of Medicine, Catholic University of Santiago de Guayaquil, Ecuador.

Publication consent
Patient-specific images, X-rays, and studies were not available for publication.

Conflicts of interest
The authors declare that they have no conflicts of interest.

Author information
Not declared

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DOI: Digital Object Identifier. PMID: PubMeD Identifier. SU: Short URL.

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