Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 22s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Factors Associated To Postoperative Complications on Patients With Gastroschisis in Two Institutions of A Middle-Income Country In Cali, Colombia, Between 2018 And 2022.

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Cite this paper as: Mariana Ángel-Correa, Luis Mauricio Figueroa-Gutierrrez,José Félix Ibarra Mera, Sofia Torres-Figueroa, Javier Torres-Muñoz(2025) Factors Associated To Postoperative Complications on Patients With Gastroschisis in Two Institutions of A Middle-Income Country In Cali, Colombia, Between 2018 And 2022.. *Journal of Neonatal Surgery*, 14 (22s), 675-684.

ABSTRACT

Introduction: Gastroschisis is a surgical pathology whose worldwide incidence has increased in recent decades, in which postoperative complications (POC) represent significant morbidity and are associated with higher mortality.

Objective: To identify factors associated with POC in newborns with gastroschisis in two institutions in Cali, Colombia during the years 2018-2022.

Methodology: Observational, retrospective and analytical study of newborns diagnosed with gastroschisis admitted to two intensive care units during a four-year period. Medical records were reviewed. Quantitative variables were analyzed and measures of central tendency and dispersion were calculated. Qualitative and categorical variables were organized into frequency and percentage distributions. A logistic regression model was used to explore possible associations between the covariates and the variable of interest. A statistical significance of 5% was applied.

Results:56 babies were included, birth rate was 1/1,000 live births. 25% had complex gastroschisis. 57.1% underwent first surgical intervention < 3 hours after birth, 37.5% achieved primary closure, and of those requiring delayed closure, 68.6% had a prosthetic silo. 23.3% patients had POC, 21.4% died.

Failure to achieve full enteral feedings increased the probability of POC by 6.51 times, other factors associated with POC were achieving closure after 5 days of life, prolonged invasive mechanical ventilation and prolonged hospital stay. Patients with POC had a probability of dying 5.29 times higher than those without.

Conclusions: This study shows a significant frequency of POC in babies with gastroschisis associated with clinical and surgical factors, which must be identified in the search for the best interventions that improve the prognosis and reduce mortality in low- and middle-income countries.

Keyword: *Gastroschisis, neonatology, pediatric surgery, enteral feeding, outcomes*

1. INTRODUCTION

Gastroschisis is the most common abdominal wall defect, and has shown an increasing

prevalence globally [1]. In Colombia, the incidence has risen from 1.9 cases per 10,000 live births in 2015 to 3.4 per 10,000 in 2020 [2]. A similar trend has been noted in other countries. For instance, the incidence reported in the United States increased from 4.5 to 4.9/10,000 live births from 2010 through 2014 [3]. However, there are significant disparities between high-income countries (HICs) and low- and middle-income countries (LMICs). LMICs, which report higher prevalence rates of congenital anomalies, probably because of exposures during pregnancy, also face a disproportionate burden of disease coming from them [1,4]. In these settings, poor outcomes are further compounded by delayed presentation, inadequate neonatal transport, and insufficient hospital resources. This reflects on mortality rates reported, with gastroschisis-related mortality reaching 42.6% in middle-income countries and 56.6% in low-income countries, compared to just 3.7% in HICs [4]. The financial burden of treating gastroschisis is substantial. In the United States, the median cost of hospitalization for gastroschisis was estimated at $75,859 USD between 2010 and 2014 [3].

While gastroschisis is mainly a surgical condition, achieving optimal outcomes requires a comprehensive, interdisciplinary approach involving neonatologists, obstetricians, and pediatric surgeons. Early antenatal diagnosis and coordinated perinatal care can significantly improve prognosis. Neonatologists play a critical role in stabilizing the neonate before surgery, managing complications postoperatively, and initiating enteral nutrition. Obstetricians contribute through careful prenatal monitoring and delivery planning, and pediatric surgeons are responsible for the surgical repair, either through primary or staged closure. The successful management of gastroschisis is thus highly dependent on this collaborative model of care.

Gastroschisis can be categorized as either simple or complex. Complex gastroschisis is defined by the presence of intestinal atresia, stenosis, necrosis, perforation, or volvulus, all of which increase the need for multiple surgical interventions and are associated with higher morbidity and mortality rates [5]. Ferreira et al. reported complex gastroschisis presented longer hospital stays (89 days, versus 38 days for simple gastroschisis), as well as higher mortality rates [6]. Postoperative complications (POC), such as intestinal ischemia, bowel obstruction, and short bowel syndrome, have also been reported to be more common in complex gastroschisis [7]. Studies have found that these POC are significant predictors of increased mortality [8,9].

The method of surgical closure—primary versus staged—has been widely studied in relation to outcomes such as length of hospital stay (LOS) and the need for mechanical ventilation (MV). While some report rates of primary closure of up to 79% [10], some others report rates such as 32% [11]. Despite the differences, most studies report shorter LOS for primary closure than staged closure. Differences in type of closure rates and outcomes underscore the need for more standardized approaches to managing gastroschisis. The time to achieve closure wasn't generally reported in these studies.

Enteral feeding in gastroschisis patients is often delayed due to postoperative associated intestinal dysmotility, which is why they initially receive total parenteral nutrition (TPN). The timing of initiation and completion of full enteral feeding is influenced by factors such as the method of closure, the presence of complications, and the need for reoperations. Ferreira et al. found that the average time to full enteral feeding was 40 days, with some cases requiring up to 62 days [6]. In a large Canadian cohort, median time to first enteral feeding was 13 days, with a median time on TPN of 27 days [12]. Studies indicate that earlier initiation of feeding is associated with improved outcomes.

Postoperative complications in gastroschisis are a significant determinant of morbidity and mortality, although scarcely studied as outcomes alone. In some reports, incidence of POC rises to up to 76.3%, and was found to be higher in patients with sepsis, low birth weight, complex gastroschisis, and those who underwent a primary closure [7,10]. A national cohort of 301 infants from the UK and Ireland reported that patients with complex gastroschisis were more likely to require unplanned re-operation due to POC (R.R. 4.39, 95% CI 2.50-7.70. $p < 0.001$) [10], as well as reported in a study from New Zealand [13]. All of this impacts LOS and raises costs to the health system. Furthermore, Bilibio at al. [9] found surgical complications were associated with mortality (OR 7.0, CI 2.5 - 19.4, $P < 0.001$). The most frequent complications found in their study were acute perforating abdomen (33%), short bowel syndrome (25%), and bowel obstruction (17%).

Mortality in gastroschisis is closely related to the presence of postoperative complications and the availability of advanced neonatal care. In HICs, survival rates for both simple and complex gastroschisis exceed 90% [4,6,14]. Hospital complications, particularly POC are significantly associated with increased mortality, as we'll further evidence in the results of this study. Although the impact of POC on gastroschisis mortality has been well documented, there are very few studies that evaluate these complications directly as outcomes in order to identify the variables associated with their occurrence and potentially improve patient prognosis. This gap in the literature prompted us to conduct this study, aiming to contribute to a better understanding of the factors influencing the development of POC in neonates with gastroschisis.

2. METHODOLOGY:

Definitions:

Gastroschisis is a congenital abdominal wall defect in which there is a paraumbilical herniation of the abdominal organs into the amniotic cavity, requiring surgical management. It is classified into simple and complex gastroschisis, according to the absence or presence (respectively) of intestinal complications. Complex gastroschisis is that in which intestinal atresia,

necrosis, stenosis, perforation or volvulus is present [15,16].

The term primary closure indicates complete reduction of the defect with surgical closure of the abdominal wall on the first day of life (which can be performed with or without sutures) [17]. Staged or delayed closure, contrary to primary closure, refers to closure by stages after a first surgical intervention in which complete reduction of the protruded organs or abdominal wall closure is not achieved. Staged closure can consist of the use of a silo (in case of an irreducible defect), or a delayed abdominal wall closure in which the open abdomen is left covered with a tight waterproof dressing, with or without a vacuum-assisted closure (VAC) system [18]. Once abdominal wall closure can be performed without respiratory compromise, it will be done in a latter surgical intervention. The term silo refers to the device that allows the gradual reduction of the viscera into the abdominal cavity as well as facilitates the control of intra-abdominal pressure. It is usually transparent and is surgically fixed or placed under the abdominal fascia through the defect. The silo can be either a commercial preformed silastic silo, an Alexis wound retractor [19], or an artisanal silo made with a sterile viaflex bag of IV fluids [17,20]. Immediate surgery was considered in those patients in which the first surgical procedure was carried out within the first three hours after being born. Completion of enteral feeding requirements was considered upon reaching 120 kilocalories per day. Postoperative complications (POC) included stenosis, requirement of intestinal resection, obstruction, short bowel syndrome, requirement of an ostomy, evisceration, intestinal ischemia, or intestinal perforation.

Type of Study:

This is an observational, retrospective study that seeks to establish the demographic, clinical and surgical characteristics of newborns diagnosed with gastroschisis admitted to the intensive care units of the Clínica Versalles and the Hospital Universitario del Valle (HUV), as well as an analytical one since it aims to identify the factors associated with postoperative complications of these neonates. Data was taken based on the information found in the clinical records of patients born or referred to these institutions between January 2018 and June 2022.

Research question:

Which factors are associated with postoperative complications in patients with gastroschisis in a middle-income country over a four-year period?

Study population:

The study population corresponds to neonates treated in the CIRENA intensive care unit, at the Hospital Universitario del Valle and at the Clínica Versalles UCIREN, during the period between January 2018 and June 2022.

Inclusion criteria:

- Newborns born at these institutions or referred to them with the diagnosis of gastroschisis from which medical records could be accessed.

Exclusion criteria:

- Newborns whose medical records did not have the complete data required for the analysis of the study.

The sample size was determined by convenience since gastroschisis is a type of malformation with a low incidence. The dependent variable gastroschisis was evaluated according to clinical, sociodemographic, and mortality results. Although 60 newborns were admitted during this time period, 4 didn't have complete medical records, which is why the final study population included 56 patients.

Analysis of data:

The medical records were reviewed to extract relevant data which was then stored in a database of the Epi Info software version 7.2.5.0®. Next, the data was exported to the STATA software version 14 ® to carry out the statistical analysis. Initially, an exploratory data analysis was developed, calculating measures of central tendency and dispersion according to the behavior of the quantitative variables. For the qualitative and categorical variables, they were organized into frequency and percentage distributions.

For the bivariate analysis, the Shapiro-Wilk test was applied to the quantitative variables to assess normality between the data. Hypothesis tests such as the Student t test for two groups, and ANOVA for more groups, were applied in those variables with a normal distribution. For variables without a normal distribution, the Wilcoxon test was applied for two groups and the Kruskall-Wallis test for more groups. For categorical variables, the chi-square test or Fisher's exact test was used as a hypothesis test for cases in which one of the categories of the variable had five or less data. A logistic regression model was used to explore possible associations between the covariates and the variable of interest, taking into account a statistical significance of 5%.

Ethical statement:

The study was carried out in accordance with the guidelines of the Declaration of Helsinki and was approved by the Institutional and Ethics Committee of the Hospital Universitario del Valle code 051-2022, the Clínica Versalles code CV-PI-0105 and the Universidad del Valle code E040-022.

3. RESULTS:

Out of 60 neonates born or referred to either institution during the four-year period evaluated, 4 were excluded due to incomplete access to their medical records. Therefore, 56 babies were evaluated, with a birth rate that corresponded to 1 per 1,000 live births. Demographically, the slight majority of infants were female (58.9%), 96.7% were born at 37 weeks or less, with a median gestational age of 35 weeks (minimum 30 weeks, maximum 38 weeks). Median weight was 2,167.5 grams (1,440g – 3,240g), and the vast majority (85.7%) of the patients were underweight (< 2,500 g). A quarter of the population had complex gastroschisis, and 44.6% had other non-intestinal anomalies associated. 39.3% of the infants were delivered vaginally, almost all were born in either one of the hospitals, and only two infants were outborn and posteriorly referred. Table 1.

Table 1. Demographic, clinical and surgical variables of the 56 newborns diagnosed with gastroschisis, in the period 2018 – 2022, in two institutions from Cali, Colombia

VARIABLE	NUMBER, PERCENTAGE OR MEDIAN
Female	33 (58.9%)
Gestational age ≤ 37 weeks	54 (96.4%)
Birth weight < 2,500 grams	48 (85.7%)
Other associated anomalies	25 (44.6%)
Vaginal delivery	22 (39.3%)
Complex gastroschisis	14 (25%)
Immediate surgery	32 (57.1%)
Primary closure	21 (37.5%)
> 2 surgical interventions	11 (19.6%)
No closure achieved	6 (10.7%)
Age at closure (median)	4.4 days (S.D. 6.4)
Time to achieve closure ≥ 5 days *	18 (36%)
Initiation of enteral feeding > 3 days after first surgery **	46 (92%)
No achievement of initiation of enteral feeding	6 (10.7%)
Time to achieve full enteral feeding < 7 days ***	3 (6.7%)
Time to achieve full enteral feeding ≤ 15 days ***	19 (42.2%)
Time to achieve full enteral feeding after closure (median)	15 days (S.D. 13.9)
No achievement of full enteral feeding	11 (19.6%)
Total length of neuromuscular relaxation (median)	8.7 days (min. 0, max. 112)
Length of neuromuscular relaxation > 7 days ****	17 (32.7%)
Length of invasive mechanical ventilation > 7 days	27 (48.2%)
Length of hospital stay > 30 days	22 (39.3%)
Postoperative ileus	19 (33.9%)
Postoperative complications	13 (23.2%)

Mortality	12 (21.4%)

* Out of the patients that did achieve closure

** Out of the patients that did achieve initiation of enteral feeding

*** Out of the patients that did achieve full enteral feeding

**** Out of the patients that received neuromuscular relaxation

Regarding intervention, all infants were first taken to surgical intervention with the attempt to achieve a primary closure. 32 patients were taken to immediate surgical intervention (within 3 hours of birth), and the longest time between birth and first surgical intervention was 19 hours, on one patient. 37.5% achieved primary closure. In those cases where a complete reduction couldn't be attained, either because of the size of the defect or because of a rise in intraabdominal pressure resulting on hemodynamic instability, staged closure was indicated. Staged closure consisted of either of a prosthetic silo, an open abdomen, or an open abdomen with a vacuum-assisted closure system (of the patients requiring staged closure: 68.6%, 11.4% and 20%, respectively). The staged closure strategy was chosen upon surgeon's decision. 11 patients required more than two surgical interventions, and 6 patients didn't achieve closure (either were discharged with an open abdomen and continued outpatient management in the wounds clinic or were deceased). Median age at closure was 4.4 days (± 6.4 days), and only 36% of patients achieved closure at 5 days of age or longer.

Patients received only TPN until enteral feeding was started, which occurred at a median of 11 (± 10.2) days after first surgical intervention, and 9.3 (± 7.85) days after closure. 6 patients didn't achieve initiation of enteral feeding, and none of the patients included were started on enteral feeding before 24 hours after first surgical procedure. Median time to achieve full enteral feedings was 15 (± 13.9) days after closure, and 11 patients didn't achieve complete enteral supply. Table 1.

Median length of stay at the Neonatal Intensive Care Unit (NICU) was 20 (± 30.4) days, and median length of total hospital stay was 25 days (minimum 2 days, maximum 173 days). 48.2% of patients required invasive mechanical ventilation (MV) for longer than 7 days, median time of neuromuscular relaxation was 8.7 days, and 4 patients (7.1%) didn't require neuromuscular relaxation. Postoperative ileum, a condition usually present in any intestinal surgical procedure, was present in 33.9% of patients. Mortality was 21.4%, and median age at death was 29 days (minimum 2 days, maximum 173 days). Table 1.

13 patients (23.2%) presented POC, of which the most common was intestinal ischemia (12.5%), followed by stenosis, requirement of intestinal resection, evisceration, requirement of an ostomy, bowel obstruction, and intestinal perforation. Only one patient presented short bowel syndrome, and none presented ostomy-associated complications. Table 2.

Table 2. Postoperative complications and their distribution

VARIABLE	NUMBER AND PERCENTAGE
Postoperative complications	13 (23.2%)
Stenosis	4 (7.1%)
Requirement of intestinal resection	4 (7.1%)
Bowel obstruction	3 (5.4%)
Short bowel syndrome	1 (1.8%)
Requirement of an ostomy	4 (7.1%)
Evisceration	4 (7.1%)
Intestinal ischemia	7 (12.5%)
Ostomy-associated complications	0
Intestinal perforation	3 (5.4%)
Other surgical complication §	7 (12.5%)

The aforementioned is reflected on the fact that 19.6% of patients required more than two surgical interventions (Table 1).

When evaluating the association with the outcome of postoperative complications vs. surgical and clinical factors, it was evident that failure to achieve full enteral feedings increased the probability of complication 6.51 times (OR 6.51 95% CI 1.55 - 27.35 p = 0.01). In terms of strength of association, it was followed by achievement of closure after 5 days or later (increases the risk of POC 6.15 times, OR 6.15 95% CI 1.35 - 28.13 p = 0.02), a prolonged hospital stay (5.19 times, OR 5.19 95% CI 1.35 - 19.94 p = 0.02), and a prolonged requirement of MV (5.10 times, OR 5.10 95% CI 1.22 - 21.25 p = 0.03). Also, babies who presented postoperative complications had a probability of dying 5.29 times higher than those who did not have complications (OR 5.29 95% CI 1.32 - 21.23 p = 0.01). Table 3.

Table 3. Surgical and clinical factors associated to postoperative complications of the 56 newborns diagnosed with gastroschisis, in the period 2018 – 2022, in two institutions from Cali, Colombia

Variable	OR	CI 95%	P
Gestational age ≤ 37 weeks	0.29	0.02 – 4.92	0.41
Birth weight < 2,500 grams	2.34	0.26 – 20.95	0.67
Complex gastroschisis	2.36	0.62 – 8.99	0.27
First surgical intervention later than 3 hours since birth	0.79	0.22 – 2.81	0.76
Staged closure	4.35	0.86 – 22.05	0.10
More than 2 surgical interventions	3.85	0.94 – 15.81	0.10
No achievement of closure	4	0.70 – 22.88	0.13
Time to achieve closure ≥ 5 days	6.15	1.35 – 28.13	0.02
No achievement of initiation of enteral feeding	4	0.70 – 22.87	0.13
No achievement of full enteral feeding	6.51	1.55 – 27.35	0.01
Length of MV > 7 days	5.10	1.22 – 21.25	0.03
Length of hospital stay > 30 days	5.19	1.35 – 19.94	0.02
Postoperative ileus	0.51	0.12 – 2.12	0.51
Mortality	5.29	1.32 – 21.23	0.01

Late closure, invasive mechanical ventilation and prolonged hospitalization, as well as failure to achieve complete enteral supply, are significantly associated with the presence of postoperative complications, which in turn affects mortality.

We also found none of the patients that were started on enteral feedings within three days of life presented POC, as well as those that achieved full enteral feedings in 7 days or less after first surgical intervention, nor did those patients that achieved full enteral feedings within 15 days of age. Also, none of the patients that underwent staged closure with open abdomen without a VAC system presented POC.

4. DISCUSSION:

Gastroschisis is a condition with an increasing prevalence globally [1], which comes in line with our results. We presented a birth rate of 1 per 1,000 live births, which is higher than that reported in the United States in 2024 (1 in 2,439 live births) [21], higher than the reported in Colombia in 2020 [2], but similar to that reported in our city in a study conducted between 2000 and 2004 [22,23]. The majority of our patients were female, premature, and underweight.

25% of the infants included in the study presented with a complex gastroschisis. As previously noted, neonates with complex gastroschisis have longer hospital stays and higher mortality rates. Ferreira et al. reported an average hospital stay of 38 days for simple gastroschisis and 89 days for complex cases [6], with a sevenfold increase in mortality for complex gastroschisis.

While most of the patients underwent immediate surgery, only 37.5% attained primary closure. Of the patients requiring staged closure, the use of a prosthetic silo was the most frequent (68.6%). Primary closure rates vary widely among studies, and method of closure is one of the factors more commonly studied in relationship with clinical outcomes. A retrospective

study by Tarcă et al. reported that 79% of gastroschisis cases were managed with primary closure, while the remaining required staged closure [10]. Similar trends were observed in a German study, where 72% of patients underwent primary closure and 28% required staged closure. Importantly, the German study found that primary closure was associated with significantly shorter LOS (32 ± 16 days vs. 64 ± 32 days, $P < 0.001$) and reduced duration of MV (88 ± 93 hours vs. 292 ± 308 hours, $P < 0.003$) compared to staged closure [24]. Other studies show varying rates of primary and staged closures. For example, a Polish study found a much lower rate of primary closure at 32%, with a higher LOS for staged closure (44 days vs. 32 days) [11]. In our study, type of closure wasn't significantly associated with POC, although LOS and longer requirement of MV were. Interestingly, none of the patients that underwent staged closure with open abdomen without a VAC system presented any POC in our study.

Some additional noteworthy findings of our study are regarding enteral feeding, LOS, and POC. Enteral feeding was initiated at a median of 11 days following the first surgical intervention and 9.3 days after closure. Achievement of full enteral feedings occurred at a median of 15 days post-closure. The median length of stay at the NICU was 20 days, with a median overall LOS of 25 days. Among the study population, 12 out of 56 patients died, with median survival of 29 days, corresponding to 21.4% of the cohort. POC were present in 23.2% of the patients, the most common being intestinal ischemia, followed by stenosis and requirement of intestinal resection. Notably, only one patient presented short bowel syndrome, which is one of the complications most commonly reported in existing literature.

Although a systematic review was out of our scope, we did conduct a thorough research of literature and we found most studies that included POC, measured them as variables affecting outcomes such as mortality, timing of enteral feeding, or LOS, but only a few studies evaluated POC as outcomes. Some of these include a Romanian retrospective study conducted between 1990 and 2012 including 114 patients [10], a national cohort of 301 infants from the UK and Ireland, from 2006 to 2008 [7], and a retrospective cohort of 59 newborns from 1988 to 2005 in Amsterdam [25].

Popa et al. [10] found 76.3% of patients presented POC, and statistically significant association was found with low birth weight (RR 17.4, $p = 0.000$), sepsis (RR 12.2, $p = 0.001$), and primary closure ($p = 0.037$). Bradnock et al. [7] evaluated clinical and surgical outcomes, comparing complex versus simple gastroschisis, and comparing primary versus staged closure in patients with simple gastroschisis. Among the POC evaluated were intestinal ischemia, intestinal obstruction due to adhesions, anastomotic stricture and complications related to stoma. They found that patients with complex gastroschisis were more likely to require unplanned re-operation due to any of the aforementioned complications (R.R. 4.39, 95% CI 2.50-7.70. $p < 0.001$). They also found that patients with simple gastroschisis that underwent primary closure were more likely to require unplanned re-operation and had a higher frequency of postoperative complications, although none of these last findings were statistically significant. Lastly, Jager et Heij [25] found 14% of the patients from their cohort presented POC related to closure (ischemia, necrosis, perforation, abdominal compartment syndrome, or enterocutaneous fistula), and 3% presented short bowel syndrome. Adding fatality to the prior, all together considered as a complicated postoperative course, the proportion corresponded to 22%. They found complex gastroschisis was 9 times more likely to present a complicated postoperative course compared to simple (RR 9, 95% CI 2-39, $p = 0.004$). The above is interesting because, none of these variables (low birth weight, sepsis, primary closure, or complex gastroschisis) were found to affect the risk of having a POC in our study.

Failure to achieve full enteral feedings was the factor with the strongest association with POC in our study (OR 6.51 95% CI 1.55 - 27.35 $p = 0.01$). A longer LOS and longer requirement of MV were also found to increase risk of POC (Table 3). Although we didn't find studies that evaluated these variables in relation to POC, we did find some studies that reported factors associated with longer LOS, longer time under MV, and longer duration of PN. The factors most commonly reported were complex gastroschisis [6,7,10,13,26], staged closure [11,14,24], prematurity and low birth weight [26,27], and late closure [14,28]. A study from Bogotá found an association between staged closure with silo and poor prognosis (defined as presence of sepsis, intestinal complications including post-operative reinterventions, or death) [29]. This is important because POC not only represent higher costs to the system [3] but also increase the probability of death, as we found in our study, by 5.29 times. Association between POC and increased mortality has also been found widely across published literature.

It is well known that enteral feeding plays a protective role in neonatal conditions, particularly in gastroschisis it has been shown initiation and advancement of enteral feedings in a timely fashion correlates with better outcomes, lower complication rates and shorter length of stay [30]. This aligns with the results of our study, where we found that none of the patients that were started on enteral feedings within three days of life presented POC, as well as those that achieved full enteral feedings in 7 days or less after first surgical intervention, nor did those patients that achieved full enteral feedings within 15 days of age.

As clinical implications of our findings, it's important to note that despite being a middle-income country, our results in time to first surgical intervention, time to achieve full enteral feedings, and LOS are shorter than most found on literature from HIC [3,11,12,24,26,31]. A metanalysis including 1652 patients from developed countries [31] reported a mean LOS of 46.4 days, a mean length of MV of 5.5 days, and a mean time to full enteral feeds of 35.3 days. However, our rates of successful

primary closure still have room for improvement. This serves as a key learning point for us and underscores an area for focused advancement moving forward.

Lastly, we find the lack in a consensus on terminology makes it difficult to assess literature on postoperative complications, which is why we highlight the importance of the implementation of a core outcome set when it comes to research [32,33]. Further research is needed in order to obtain more homogeneous data, which could eventually lead to the development of a standardized management protocol [14].

Our study has some limitations. Firstly, as a retrospective study, data collection was dependent on existing medical records, which were occasionally incomplete; for instance, defect size was not consistently documented, preventing its inclusion as a variable. Additionally, the choice of staged closure type was not standardized or randomized but left to the surgeon's discretion.

5. CONCLUSIONS:

Late closure, impossibility to attain complete enteral feedings, prolonged hospital stay and prolonged requirement of mechanical ventilation, increase the risk of presenting postoperative complications, which in turn is associated with mortality. Although some postoperative outcomes have already been evaluated in other studies, none investigated all of these outcomes together. Adding up to the fact that results regarding factors associated with postoperative complications found in available literature is heterogeneous, evidence-based decision making is a challenge.

ACKNOWLEDGMENTS:

We acknowledge the support of the working group of the two institutions Hospital Universitario del Valle and Clínica Versalles, which participated in this research, especially the staff of the neonatal intensive care units.

Contribution of the authors:

MAC: design, analysis and writing of the article, data collection

LMF: design and analysis of the article

JFIM: data collection, design and analysis of the article

ST: data collection, design and analysis of the article

JT: design, analysis and writing of the article, Senior investigator

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the content of this manuscript.

Financial support

This work was funded entirely by the Universidad del Valle. Funding source had no involvement in study design, collection, analysis and interpretation of data, writing of the report and decision to submit the article for publication.

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