European Journal of Obstetrics & Gynecology and Reproductive Biology 237 (2019) 79–84

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb

Full length article

Gastroschisis during gestation: prognostic factors of neonatal mortality from prenatal care to postsurgery

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ARTICLE INFO

Article history:
Received 11 January 2019
Received in revised form 6 April 2019
Accepted 16 April 2019

Keywords:
Gastroschisis
Abdominal wall
Neonatal surgery

ABSTRACT

Objective: To evaluate the prognostic factors related to mortality in neonates with gastroschisis, ranging from prenatal care to corrective surgery.
Study design: A retrospective cohort study was conducted and included neonates with gastroschisis who underwent surgical correction from 2010 to 2015. The patients were divided into two groups based on postoperative outcomes: those who were discharged and those who died postoperatively. Data regarding demographics, prenatal history, delivery route, surgery and postoperative outcomes were collected in both groups.
Results: In total, 168 patients were eligible; 82 (48.8%) were discharged, and 86 (51.2%) died postoperatively. Fewer prenatal visits (4.85 versus 6.05 visits, P = 0.004), delayed prenatal diagnosis (27.6 versus 22.2 weeks of gestational age, P = 0.005), low birth weight (2159 versus 2444 g, P < 0.001), intestinal injury (OR 5.5, P = 0.001) and sepsis (OR 112.1, P < 0.001) were associated with infant mortality. The type of delivery and the mean time between birth and the first corrective surgery (16.2 versus 21.1 h, P = 0.071) were not associated with increased neonatal mortality; however, the newborns who underwent their first corrective surgery after less than 4 h of life had lower mortality, and surgery performed after more than 4 h of life increased the risk of mortality (OR 2.7, CI 1.2–6.3, P 0.014).
Conclusion: The mortality rate was high (51.2%) and was associated with inadequate prenatal care, low birth weight, gestational age, the severity of intestinal injury, infection and septicemia.

Introduction

Gastroschisis is a congenital malformation of the total thickness of the anterior abdominal wall with extrusion of the abdominal viscera, especially when the intestine is located under the amniotic fluid without any protective membrane, and is generally characterized as an isolated defect [1]. The umbilical cord is inserted into the abdomen, and the defect is often on the right side. There is no consensus as to the true etiology of this malformation, and the probable cause arises from a defect or rupture of the abdominal wall during the embryonic period, culminating with herniation of the fetal intestine. Current hypotheses are based on events such as failure of the mesoderm and body wall formation, amnion rupture around the umbilical ring, and sequelae related to involution of the right umbilical vein or rupture of the right vitelline artery [1].

Increasing rates of gastroschisis have been reported worldwide, and this increase is approximately 4–5 per 10,000 pregnancies [2]. Until the 1970s, it was estimated that the overall incidence of gastroschisis was 1:10,000 live births; currently, the disease reaches rates of 2–4:10,000 live births [3,4]. In countries such as Mexico, England, Australia, Finland, France, Ireland and South America, the incidence of gastroschisis ranges from 4.4 to 17 per 10,000 live births [4]. Part of this growth is thought to be due not to a real increase in incidence but to an increase in notification and a decrease in data under reporting true [4,5].

Generally, the postnatal outcome is favorable in cases of simple gastroschisis (a continuous and uncommitted gut), with a survival

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https://doi.org/10.1016/j.ejogrb.2019.04.015
0301-2115/

rate of 90–95% and low morbidity [6]. On the other hand, complex gastroschisis (associated with intestinal atresia, necrosis or intestinal perforation) presents worse survival (from 70% to 80%), with longer hospitalization and long-term morbidity [7,8]. Mortality rates vary according to the quality of care for newborns, varying from 3 to 10% in developed countries to 65–100% in underdeveloped countries, such as Sub-Saharan African countries [9]. In Brazil, according to the Latin American Collaborative Study of Congenital Malformations (ECLAMC), between 1995 and 2008, gastroschisis had an incidence of 7.5:10.000 live births [10]. The mortality rate varied according to region, reaching 53% in the Northeast and 23.4% in the South of the country, being related, among other factors, to the degree of intestinal damage, prematurity, low birth weight and the occurrence of concomitant infections [10,11].

Ideally, the diagnosis of gastroschisis should occur during prenatal care, and it can be identified during the first trimester via morphological examination (obstetric ultrasound between 11 and 13 weeks and 6 days) [12]. From this diagnosis during prenatal care, a pregnant woman can organize the birthplace and create a plan with a team of pediatricians, surgeons and anesthesiologists. This planning process is fundamental because there are still many doubts about the route of delivery (vaginal or caesarean section), the best gestational time for birth, and the best time after birth to perform the corrective surgery [13,14].

Several studies have investigated the association of gastroschisis with probable risk factors, such as drug use, nutritional factors, advanced paternal age, pesticide use, low socioeconomic status, maternal infections during pregnancy, and maternal history of alcohol use and smoking, the latter of which shows the most consistent association [14]. The mortality rate of infants with gastroschisis varies considerably among countries, and identifying the factors associated with the mortality risk is fundamental for prevention. The objective of this study was to evaluate the prognostic factors related to mortality in neonates with gastroschisis, ranging from prenatal care to corrective surgery.

Materials and methods

A retrospective cohort study was conducted in neonates with gastroschisis who underwent surgical correction. The study was conducted at the Fundação Santa Casa de Misericórdia do Pará (FSCMPA), the state referral center for gastroschisis, from 2010 to 2015. The study was approved by the Ethics Committee of Comitê Nacional de Ética em Pesquisa and by Comitê de Ética em Pesquisa da Fundação Santa Casa de Misericórdia do Pará under the number 46002115.1.0000.5171 (institutional review board equivalent).

Eligible patients for this study included women with newborns with gastroschisis who underwent surgical correction in the maternity ward. The pediatric surgical team consisted of eight experienced pediatric surgeons and six fellows (two in the first year, two in the second year, and two in the third year of fellowship). During surgical repair of gastroschisis, the team consisted of a chief pediatric surgeon and two fellows. In total, 180 patients were selected for inclusion in this study. Of these, 12 cases were excluded based on the following exclusion criteria: the

Table 1
Clinical and demographic characteristics of pregnant women and newborns with gastroschisis.

	Mean (n = 168)	SD[c]
Age (in years)	19.7	3.7
Education		
Elementary school	68.1%	
High school	28.7%	
University graduate	3.2%	
Number of pregnancies	1.7	0.9
Number of births	1.5	0.8
Number of miscarriages	0.1	0.4
Number of prenatal visits (doctor + nurse)	5.4	2.5
Number of prenatal medical visits	3.8	2.2
Diagnosis during prenatal care		
No (%)	44.9%	–
Yes (%)	55.1%	
GA[a] at the time of the diagnosis of gastroschisis during prenatal care (weeks)	24.9	7.1
Birthplace		
FSCMPA[b] (%)	46.8%	–
Other hospitals (%)	53.2%	
Route of delivery		
Vaginal (%)	32.3%	–
Caesarean (%)	67.7%	
Time between birth and the first corrective surgery (hours)	18.7	17.4
Type of anesthesia for the infant		
Balanced (%)	12.7%	–
Inhalation (%)	87.3%	
Type of abdominal wall closure		
Primary (%)	65.5%	–
Silo (%)	34.5%	
Neonatal outcome		
Hospital discharge (%)	48.8%	–
Death (%)	51.2%	

[a] GA: gestational age.
[b] FSCMPA: Fundação Santa Casa de Misericórdia do Pará.
[c] SD: standard deviation.

newborn was submitted to corrective surgery in another hospital and cases in which there was a fetal death before birth. A total of 168 newborn patients were eligible for this study, and all these patients underwent correction of gastroschisis after birth.

The patients were divided into two groups based on postoperative outcomes: those who were discharged (hospital discharge group, n = 82) and those who died during the postoperative period (mortality group, n = 86). To determine the possible association of probable causes of infant mortality after birth, the study included maternal demographic data, data from prenatal consultations, infant birth data, neonatal care data, postpartum care, and intra- and postoperative care, until the outcome of discharge or infant death.

Intestinal lesions were classified into 3 grades according to the findings: grade 1 – mild edema of loops and the absence of wall thickening, adhesions, fibrin or vascular distress; grade 2 – moderate edema of loops, a thickened wall, loose adhesions, a thin fibrin layer, and the absence of vascular distress; grade 3 – severe edema of loops, wall thickening, firm adhesions, a thick fibrin layer and vascular distress. The following malformations and injuries were evaluated: atresia, intestinal malfunction, perforation, necrosis, volvulus, extensive ischemia, anorectal anomaly, bladder rectal fistula and/or bladder perforation, Meckel's diverticulum, fibrin, vascular pedicle torsion, meconium ileus, megacolon, and laceration of the serosa.

The following newborn clinical complications were evaluated: acute renal failure, disseminated intravascular coagulation, necrotizing enterocolitis, digestive hemorrhage, hypovolemic shock, liver disease, acute pulmonary edema, pulmonary hemorrhage, cholestatic jaundice, intestinal subocclusion, pulmonary atelectasis, opioid withdrawal syndrome, cardiogenic shock, occipital pressure ulcer, pleural effusion, reversed cardiorespiratory arrest, intracranial hypertension, pulmonary hypertension, bronchoaspiration, systemic arterial hypertension and seizures. The following newborn surgical complications were evaluated: short bowel syndrome, acute obstructive abdomen, acute perforating abdomen, abdominal compartment syndrome, operative wound hemorrhage, meconium ileus, enteral fistula, hemothorax, and pneumothorax.

Categorical variables were compared using the chi-square or Fisher's exact tests. For parametric data, Student's t-tests were used for comparisons between two independent groups, and the results were expressed as the mean and SD. For nonparametric data, the Wilcoxon-Mann-Whitney test or *U* test was used, and the results were expressed as the median. Associations were assessed with Spearman's correlation or logistic regression. The threshold for statistical significance was 5%. Statistical tests were performed using the Statistical Package for the Social Sciences 20 (SPSS Inc., Chicago, IL, USA).

Results

The study included 168 newborns with gastroschisis who underwent surgical correction at FSCMPA. The newborns were divided into two groups: those who were discharged from the hospital (the hospital discharge group, n = 82, 48.8%) and those who died postoperatively (the mortality group, n = 86, 51.2%). The clinical and demographic characteristics of the pregnant women and newborns with gastroschisis are shown in Table 1. The mean maternal age was 19.7 years (SD 3.7), the mean number of prenatal consultations was 5.4 (SD 2.5), gastroschisis was diagnosed in 55.1% of the newborns during prenatal care and in 44.9% of the newborns upon delivery, and the mean gestational age at the time of the prenatal diagnosis was 24.9 weeks (SD7.1). The mean time between birth and the first corrective surgery was 18.7 h (SD 17.4).

The evaluation of prenatal care, birth, and neonatal and surgical factors and their associations with the risk of neonatal mortality are shown in Table 2. Fewer prenatal visits (4.8 visits in the mortality group versus 6.0 visits in the hospital discharge group, P = 0.004) and delayed diagnosis during the prenatal period (22.2 weeks of pregnancy in the hospital discharge group versus 27.6 weeks of pregnancy in the neonatal death group, P = 0.005) were associated with higher mortality. A younger gestational age by the CAPURRO method (37.2 versus 38.0 weeks, P = 0.027), a longer duration of invasive ventilation (12.3 versus 7.2 days, P = 0.002) and a longer hospital stay (26.1 versus 38.5 days, P = 0.001) were also associated with higher mortality. The duration of neonatal ICU

Table 2
Evaluation of prenatal care, birth, and neonatal and surgical factors in association with the risk of neonatal mortality.

	Discharge from the hospital, Mean (SD)	Neonatal death, Mean (SD)	P value[b]
Mother's age (years)	20.1 (3.4)	19.4 (4.0)	0.276
Number of pregnancies	1.7 (0.9)	1.7 (0.9)	0.828
Number of births	1.5 (0.7)	1.5 (0.8)	0.543
Number of previous miscarriages	0.2 (0.4)	0.1 (0.3)	0.121
Number of prenatal visits	6.0 (2.5)	4.8 (2.4)	0.004
GA[a] during prenatal diagnosis (weeks)	22.2 (6.9)	27.6 (6.4)	0.005
Amniotic fluid index (cm)	11.1 (5.8)	7.3 (6.3)	0.237
GA[a] by the CAPURRO method (weeks)	38.0 (2.0)	37.2 (2.1)	0.027
Newborn weight at birth (grams)	2445.2 (427.1)	2159.0 (502.3)	0.000
Newborn length at birth (cm)	45.7 (2.8)	43.7 (2.9)	0.000
Newborn cephalic perimeter at birth (cm)	32.1 (2.0)	31.3 (1.6)	0.010
APGAR 1 st min	7.1 (2.1)	6.8 (2.1)	0.436
APGAR 5th min	8.6 (0.6)	8.5 (0.9)	0.563
Time between birth and the first corrective surgery (hours)	28.2 (109.4)	32.4 (107.2)	0.798
Less than 4 hours of life N (%)	22 (68.8%)	10 (31.3%)	0.012[c]
More than 4 hours of life N (%)	60 (44.4%)	76 (55.9%)	0.014 (OR 2.7 [IC 1.2–6.3][d])
Number of surgical reoperations	1.3 (0.6)	1.6 (1.0)	0.143
Total invasive ventilation time (days)	7.2 (6.1)	12.3 (13.5)	0.002
Total parenteral nutrition time (days)	19.7 (8.3)	19.9 (19.3)	0.930
Total length of stay in the neonatal ICU (days)	25.5 (13.1)	23.8 (24.9)	0.587
Length of hospital stay (days)	38.5 (19.4)	26.1 (27.5)	0.001

[a] GA: gestational age.
[b] Student's *t*-test (all parametric data).
[c] Chi-square result for the first corrective surgery after less than 4 h and more than 4 h of life.
[d] Risk-estimated odds ratio for the first corrective surgery after less than 4 h and more than 4 h of life.

admission (23.8 versus 25.5 days, P = 0.587) and the time between birth and the first corrective surgery (16.2 versus 21.1 h, P = 0.071) were not associated with increased neonatal mortality; however, the newborns who underwent their first corrective surgery after less than 4 h of life had lower mortality, and surgery performed after 4 h of life increased the risk of mortality (OR 2.7, CI 1.2–6.3, P 0.014) (Table 2).

Table 3 shows the evaluation of education, addiction, the site of prenatal care and birth, the route of delivery and birth weight in relation to neonatal death. Newborns weighing less than 2,500 g had an increased risk of mortality (OR 2.4, CI 1.2–4.6, P = 0.008). The delivery route (vaginal or cesarean section) was not associated with neonatal mortality (vaginal: 26.3% in the hospital discharge group versus 38.1% in the mortality group, P = 0.105).

Table 4 shows the evaluation of intra-/postoperative factors in relation to neonatal death. The highest intestinal lesion grade (grade III, OR 3.5, CI 1.4–8.6, P = 0.004), the presence of other malformations or intestinal disorders (OR 2.1, CI 1.1–4.2, P = 0.022; the most prevalent conditions were: 31% poor intestinal rotation, 28% atresia, 12% perforation, 10% necrosis, and 4% extensive ischemia), the need for intestinal resection (OR 5.9, CI 2.1–16.5, P = 0.001) and the inability to perform primary closure (OR 2.1, CI 1.1–4.2, P = 0.019) were associated with higher mortality. Clinical complications were associated with mortality (OR 6.0, CI 3.1–11.9, P < 0.001), and the most prevalent complications were: 29% acute renal failure, 14% necrotizing enterocolitis, 11% disseminated intravascular coagulation, and 9% pulmonary hemorrhage. Surgical complications were also associated with mortality (OR 7.0, CI 2.5–19.4, P < 0.001), and the most prevalent complications were: 33% acute perforating abdomen, 25% short bowel syndrome, 17% acute obstructive abdomen, and 8% abdominal compartment syndrome. Postoperative infection (OR 18.1, CI 5.2-1.1-69.9, P = 0.047) and sepsis (OR 112.1, CI 14.7–849.6, P = 0.001) were strongly associated with mortality during the postoperative period.

Table 5 shows the logistic regression analysis of prenatal factors associated with neonatal death, with neonatal death as the dependent variable and the number of prenatal visits, gestational age during prenatal diagnosis, gestational age by the CAPURRO method and newborn weight at birth as the independent variables. Gestational age during prenatal diagnosis was associated with neonatal death (P = 0.029, Exp(B) 1.115). Table 6 shows the logistic regression analysis of surgical factors associated with neonatal death, with neonatal death as the dependent variable and the first surgery after more than 4 h of life, other malformations/injuries, abdominal wall closure- primary/silo and intestinal resection as the independent variables. Initial surgery after more than 4 h of life (P = 0.027, Exp(B) 2.842) and the need for intestinal resection (P = 0.003, Exp(B) 7.420) were associated with neonatal death.

Comment

We performed a study with a large number of women with infants affected by gastroschisis to identify factors associated with neonatal mortality as related to prenatal care, delivery route, infant care, surgery and postoperative care. The results help us to understand many of the factors associated with the mortality of infants with gastroschisis and bring attention to the high mortality rate found in our center of 51.2%. This result contrasts with rates found in developed countries that register mortality from 3% to 10% [2,4]. This high mortality observed in our study is closer to that of other developing countries, ranging from 65% to 100%, as seen in Sub-Saharan Africa [9].

We found that inadequate prenatal care is associated with an increase in neonatal mortality because a low number of visits were

Table 3
Evaluation of education, addiction, the site of prenatal care and birth, delivery and birth weight in relation to neonatal death.

Variables	Discharge from the hospital (%) N = 82	Death (%) N = 86	P value[b]	Risk-estimated odds ratio (CI)	P value[c]
Education					
Elementary school	57.1%	62.5%	0.120	–	–
High school	38.1%	21.1%			
Higher education	4.8%	1.9%			
Smoking/alcohol/addiction					
No	62.2%	62.5%	0.976	0.9 (0.3-2.4)	0.976
Yes	37.4%	37.5%			
Site of prenatal care					
FSCMPA[a]	21.3%	13.8%	0.212	0.5 (0.2-1.3)	0.214
Another hospital	78.8%	86.3%			
Birthplace					
FSCMPA[a]	62.2%	61.6%	0.940	1.0 (0.5-1.9)	0.940
Another hospital	37.8%	38.4%			
Route of delivery					
Vaginal	26.3%	38.1%	0.105	0.5 (0.2-1.1)	0.106
Caesarean	73.8%	61.9%			
Gender					
Female	53.7%	41.9%	0.126	1.6 (0.8-2.9)	0.127
Male	46.5%	58.1%			
Newborn weight at birth					
>2500 g	45.7%	26.2%	0.005	2.4 (1.2-4.6)[d]	0.008
1500-2500 g	54.3%	67.9%			
<1500 g	0.0%	6.0%			

[a] FSCMPA: Fundação Santa Casa de Misericórdia do Pará.
[b] Chi-square test.
[c] P value[b] of the risk estimate (odds ratio).
[d] Risk of death: >2500 g versus <2500 g.

Table 4
Evaluation of intra-/postoperative factors in relation to neonatal death.

Variables	Discharge from the hospital (%) N = 82	Death (%) N = 86	P value[b]	Odds ratio (CI)	P value[c]
Orotracheal intubation DR[a]					
Yes	39.2%	36.4%	0.762	0.8 (0.4–1.9)	0.765
No	60.2%	63.9%			
Antibiotic prophylaxis DR[a]					
Yes	27.5%	16.4%	0.166	0.5 (0.2–1.3)	0.170
No	72.5%	83.6%			
Classification of injury					
Grade I	45.1%	20.0%	0.004	3.5(1.4–8.6)[d]	0.004
Grade II	18.8%	22.2%			
Grade III	17.6%	43.3%			
Other malformations/injuries					
Yes	23.5%	40.0%	0.022	2.1(1.1–4.2)	0.024
No	76.5%	60.0%			
Intestinal resection					
Yes	6.2%	28.2%	<0.001	5.9 (2.1–16.5)	0.001
No	93.8%	71.8%			
Abdominal wall closure					
Primary	74.4%	57.0%	0.018	2.1 (1.1–4.2)	0.019
Silo	25.6%	71.8%			
General anesthesia					
Balanced	12.3%	12.9%	0.908	0.0 (0.3–2.3)	0.909
Inhalation	87.7%	87.1%			
Clinical complications					
Yes	24.4%	66.3%	<0.001	6.0(3.1–119)	<0.001
No	75.6%	33.7%			
Postoperative infection					
Yes	90.2%	100%	0.004	18.1 (1.1–69.9)	0.047
No	9.8%	0.0%			
Infectious gravity (sepsis)					
Yes	41.3%	100.0%	<0.001	112.1 (14.7–849.6)	<0.001
No	58.7%	0.0%			
Surgical complications					
Yes	6.1%	31.4%	<0.001	7.0 (2.5–19.4)	<0.001
No	93.9%	68.6%			

[a] DR: delivery room.
[b] Chi-square test.
[c] P value[b] of the risk estimate (odds ratio).
[d] Risk of death: grade III versus grades I and II.

Table 5
Logistic regression analysis of prenatal factors associated with neonatal death (dependent variable: neonatal death, independent variables: the number of prenatal visits, gestational age during prenatal diagnosis, gestational age by the CAPURRO method and newborn weight at birth).

	B	Sig.	Exp(B)	95% CI for Exp(B)
Number of prenatal visits	−0,234	0.179	0.792	0.563–1.113
GA[a] during prenatal diagnosis (weeks)	0.109	0.029	1.115	1.015–1.229
GA[a] by the CAPURRO method (weeks)	−0.288	0.108	0.750	0.528–1.065
Newborn weight at birth (grams)	0.001	0.555	1.001	0.999–1.002
Constant	8.938	0.184	7964.264	

[a] GA: gestational age.

associated with the mortality risk (6.0 in the hospital discharge group and 4.8 in the neonatal death group). In addition, only 3.8 were medically consulted, and the rest of the consultations were conducted only with nurses, which is below the minimum recommended by the World Health Organization (WHO) of at least eight contacts [15]. The lack of quality prenatal care reflects high mortality, as it leads to a delay in diagnosis, as we have seen in our results, with poor attendance and orientation, with earlier birth and lower birth weight, thus increasing mortality rates [13,14]. Early maternal age besides being a factor associated with the risk of gastroschisis (maternal mean age in our study was 19.77 years) [16], reflects the high rates of early gestation in our country due to poor health care in general.

Although many topics remain to be discussed, such as the best route of delivery for pregnant women with fetuses with gastroschisis (vaginal or caesarean section), we did not find any association of the delivery method with infant mortality. Some authors argue that cesarean section would minimize

Table 6
Logistic regression analysis of surgical factors associated with neonatal death (dependent variable: neonatal death, independent variables: first corrective surgery after more than 4 h of life, other malformations/injuries, abdominal wall closure- primary/silo and intestinal resection).

	B	Sig.	Exp(B)	95% CI for Exp(B)
First corrective surgery after more than 4 hours of life	1.045	0.027	2.842	1.123–7.195
Other malformations/injuries	0.833	0.696	0.833	0.333–2.082
Abdominal wall closure- primary/silo	0.449	0.221	1.566	0.764–3.212
Intestinal resection	2.004	0.003	7.420	1.988–27.689
Constant	−1.202	0.005	0.301	

contamination of the extruded intestine, which would promote less mesenteric vascular compression, a lower risk of intestinal torsion during uterine compression, and lower peel formation and allow better planning for obstetric, anesthesia, neonatology and pediatric surgery teams. In contrast, other researchers state that gastroschisis alone is not an indication for cesarean delivery because this delivery method does not improve infant prognosis [2,17]. A recent meta-analysis evaluating the method of delivery and outcomes in neonates with gastroschisis suggested that the delivery route was not associated with neonatal mortality, primary or secondary repair, necrotizing enterocolitis, sepsis, short bowel syndrome, the duration of enteral feeding or the length of hospital stay [17].

Many studies suggest that the time between birth and surgical correction plays an important role in decreasing mortality [18]. One justification for this association is that early surgery would reduce heat loss and minimize deterioration of intestinal lesions [18]. In our study, the mean time between birth and the first surgery was not associated with an increased risk of mortality. However, the mean time between birth and surgery was extremely high in both groups at 16.2 h in the hospital discharge group and 21.1 h in the mortality group. Few newborns underwent surgery after less than four hours of life. When we compared newborns who underwent surgery after less than 4 h of life versus more than 4 h of life, we found that a delay in surgery greater than four hours is associated with a 2.7-times higher risk of mortality, suggesting that the procedure should be performed as early as possible. The high mean time until newborns underwent their first surgery may represent biases in this assessment, and this factor was associated with the high mortality rate found in our study.

In agreement with other studies, the severity of the intestinal lesion, the association with other malformations, intestinal resection, the need for silo placement and multiple surgeries negatively influenced the prognosis of neonates who underwent to surgical correction, so with a greater degree of intestinal injury, neonatal mortality was higher, increasing the risk by five times [19]. We found that postoperative clinical complications, especially infection and sepsis, were strongly associated with neonatal mortality, with an OR greater than 18 and 112, respectively, showing that intra- and postoperative care is fundamental for the survival of newborns with gastroschisis. Our high mortality rate due to infection and sepsis are probably a consequence of inadequate prenatal care, causing a delay in diagnosis during the prenatal period and leading to inadequate planning for delivery. This lack of planning between the obstetric staff and pediatric surgery staff causes a delay in surgical correction (we found a mean of 18.7 h) and consequently increases the risk of postoperative infection and sepsis. We know that these infants are at increased risk of neonatal septicemia due to loss of fetal protein during gestation, hypoalbuminemia, hypogammaglobulinemia, immaturity of the immune system, and the need for multiple invasive procedures [6].

The mortality rate found in this study in infants with gastroschisis was very high at greater than 50%. We found that the quality of prenatal care is essential to reduce mortality, resulting in adequate multidisciplinary planning, a reduced time to surgery, and a reduced risk of infection and sepsis. This high mortality rate is alarming, and poor basic care for precarious pregnancies triggers a sequence of events culminating in failed surgical care and increased neonatal mortality.

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