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Original Research

Clinical and Epidemiological Profile of Newborns with Gastroschisis Operated on in a Referral Hospital in Angola

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Abstract: Gastroschisis is a congenital malformation characterized by non-closure of the anterior abdominal wall, a paraumbilical defect usually to the right of the umbilical cord with externalization of the intestinal viscera. This study aims to analyze the clinical and epidemiological profiles of gastroschisis cases and examine associations between maternal and neonatal factors in a public referral hospital in Angola. This is an observational, descriptive cross-sectional hospital-based study conducted with the collection of information in 361 newborns medical records with gastroschisis treated at the David Bernardino Pediatric Hospital from January 1st, 2010 to July 15th, 2021. The variables that characterize the clinical, socioeconomic and demographic profile of 361 newborns (NB) with gastroschisis presented the following characteristics: 28% of mothers aged < 20 years; maternal mean age was 22,34+ 4.5 years, the occurrence of death was higher among NB of mothers aged 20 years corresponding to 96.5%, primiparous 127 (35.2%); without schooling 10 (2.8%), primary education 59 (16.3%), secondary education 43 (11.9%); out-of-hospital births 201 (55.7%); simple gastroschisis 326 (90.3%); primary closure 115 (31.9%); neonatal sepsis 145 (40.2%); mucosal skin pallor 70 (19.4%); gastroschisis-related mortality was 347 (96.1%). The clinical, socioeconomic and demographic profile of mothers and newborns with gastroschisis are widely studied and associated with well-known risk factors, including maternal age under 20 years, out-of-hospital delivery, low level of education, and reduction of the number of prenatal consultations as well as absence of prenatal diagnosis and multiparity.

Keywords: Newborn; Gastroschisis; Clinical and Epidemiological Profile; Angola.

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1. Introduction

Gastroschisis is a congenital malformation characterized by a defect in the closure of the anterior abdominal wall, resulting in the exteriorization of intra-abdominal structures, typically 1-5 cm to the right of the umbilical cord insertion [1-5]. The prevalence of gastroschisis has been steadily increasing worldwide over the last decades, imposing significant financial and resource burdens on health systems [6-11]. Prenatal diagnosis plays a crucial role in improving outcomes. The gold standard for diagnosis is fetal ultrasound, which is typically possible from 16 to 20 weeks of gestation [1, 18, 19]. This imaging modality identifies the abdominal wall defect and the intestinal loops floating in the amniotic fluid without a surrounding membrane. In addition, alpha-fetoprotein lev-

els, produced by the fetal gastrointestinal tract and liver, may support the diagnosis [1, 18]. Structures commonly involved include the small intestine, large intestine, stomach, appendix, uterine and ovarian tubes, and portions of the urinary and genital tracts [1, 18, 19].

Prenatal care is critical for monitoring fetal well-being, as early delivery may be necessary due to altered fetal vitality [2, 11, 12, 20]. Although vaginal delivery does not appear to increase morbidity or mortality, cesarean section is often preferred due to obstetric indications [2, 11, 12, 20]. The advent and widespread use of ultrasound in prenatal care over the past two decades have allowed early diagnosis and intervention, enabling obstetricians, along with fetal medicine specialists, pediatric surgeons, and neonatologists, to optimize perinatal outcomes [3, 12-16].

The complexity of gastroschisis depends on its associations with intestinal atresia, perforation, necrosis, volvulus, and poor intestinal rotation. These complications often require surgical intervention, which increases the risk of short bowel syndrome, prolonged hospital stays, and higher morbidity [8, 20, 25, 26]. In developing countries, the absence of prenatal diagnosis, prematurity, low birth weight, and delayed surgical repair beyond four hours of life significantly increase neonatal mortality rates [1, 2, 10, 11, 27]. In sub-Saharan Africa, data on congenital malformations remains limited, with few studies on gastroschisis [15, 32-33]. Identifying modifiable factors offers opportunities for innovative approaches to perinatal care, particularly in resource-constrained settings [10, 18, 28-31,34]. This study aims to analyze the clinical and epidemiological profiles of gastroschisis cases and examine associations between maternal and neonatal factors in a public referral hospital in Angola.

2. Material and methods

This is an observational, descriptive study based on a retrospective survey of clinical and epidemiological characteristics and on a review of the medical records of newborns from January 2010 to July 2021. David Bernardino Pediatric Hospital was the research site, a tertiary national reference hospital for comprehensive child health care for all regions of Angola, located in the province of Luanda, in operation since 2001, performed on average 240 surgical procedures/month, assisting patients from the public and private system with newborns assisted and operated with gastroschisis diagnosis as the target population. The study included 361 live newborns with gastroschisis retrieved from clinical files after identification of cases in the operating room, neonatal service, and intensive care registry books. Data collection was carried out between September 2023 and January 2024.

The information was first extracted from records in the statistical books of anesthesiology, surgery, intensive care and neonatology services in order to find potential clinical records based on the diagnosis of gastroschisis during the study period. The clinical records were then searched based on the patient's name and medical diagnosis of gastroschisis in the archives of the wards of the neonatology and intensive care services, the department of statistics, and the hospital's general archives.

The data collection was carried out based on physical medical records and the use of a data collection form that included the research variables associated with the mother, namely: age, prenatal consultation, number of prenatal consultations, presence of urinary infection, parity, type of delivery, place of delivery (In-Hospital-Out-Hospital), type of delivery, level of education and variables related to the newborn: sex, weight, gestational age, type of gastroschisis and outcome. Newborns diagnosed with gastroschisis who died in the emergency room before the surgical intervention were excluded. These are two newborns with vaginal at home in the presence of family members who were unaware of the clinical history of the newborns. They were later admitted lifeless to the A&E.

2.1 Statistical analysis

Differences in clinical and socio-demographic characteristics of mothers and newborns with gastroschisis who died were compared to those who were discharged from hospital. We compared the two groups using the Student t-test for independent samples; continuous variables were presented as mean and standard deviation (e.g., maternal age, estimated gestational age and birth weight). Categorical variables (e.g., intra- and extra-hospital births, primiparous and multiparous) were evaluated with chi-square test. After bivariate analysis, multivariate logistic regression was used to calculate the adjusted odds ratio for death, comparing the newborns who died with those who were discharged from hospital.

The variables that were likely to be associated with an increased risk of mortality were included in the logistic regression analysis to find the clinical and epidemiological profile of mothers and newborns. The relationship between the clinical status and the sociodemographic characteristics of mothers and the risk of death was evaluated.

The level of statistical significance was established at $p<0.05$. All statistical analyses were performed using the "Statistical Package for the Social Sciences (SPSS)" version 26.0 for Windows (Illinois, USA).

3. Results

Table 1 shows the clinical and epidemiological characteristics of the mother of newborns with gastrointestinal infection. Regarding the gestational age, 336 (93.1%) were term newborns and 25 (6.9%) were preterm newborns. Birth weight ranged from 800g to 4200g, with a mean of 2453.90; 55.4% had birth weight lower than 2500g ($p<0.0001$). Male newborns who died accounted for 55.6%, while female newborns represented 64.3% of surviving newborns. As for the type of delivery, eutocic births were 95.8% of the total, and 4.2% caesarean section. As for the maternal education level was described in 102 cases of which 16.3% primary school education and 11.9% secondary education. Regarding the type of gastroschisis, 90.3% of newborns had simple gastroschisis and 9.7% had complex gastroschisis. Regarding the place of delivery, 55.7% of delivery were out-of-hospital births and 44.3% in-hospital births; newborn mortality occurred in 43.8% of in-hospital births and 56.2% of out-of-hospital births respectively.

Table 1. Clinical and epidemiological parameters of mothers and newborns with gastroschisis.

Parameters	Death (n=347)	Improved hospital discharge (n=14)	Total (n=361)	p-value
Mother´s age (Years)	22,3±4,57	22,9±5,0	22,3±4,5	0,498
Gestational age (Week)	38,2±2,17	38,0±2,18	38,2±2,2	0,948
NB Weight (g)	2432,8±501,3	2976,43±606,71	2453,9±515,6	<0,001
Gender	193 (55,6%)	5 (35,7%)	198 (54,8%)	0,186
Male	154 (44,4%)	9 (64,3%)	163 (45,2%)	
Fem				
Primary education	59 (17%)	2 (14,3%)	59 (16,3%)	<0,001
Secondary education	41 (11,8%)		43 (11,9%)	
Simple gastroschisis	313 (90,2%)	13 (92,9%)	326 (90,3%)	<0,001
Complex gastroschisis	34 (9,8%)	1 (7,1%)	35 (9,7%)	
Out-of-hospital Childbirth	195 (56,2%)	6 (42,9%)	201 (55,7%)	<0,001
Primiparous Women	117 (33,7%)	8 (57,1%)	125 (34,6%)	0,003
Multiparous Women	230 (66,3%)	6 (42,9%)	236 (65,4%)	0,016
Mucous and skin pallor	86 (24,8%)	1 (7,1%)	87 (24,01%)	<0,001

Sepsis	142 (40,9%)	3 (21,4%)	145 (40,2%)	<0,001
Yes	205 (59,1%)	11 (78,6%)	216 (59,8%)	
No				
Prenatal consultation	244 (70,3%)	13 (93%)	257 (71,2%)	<0,001
Yes	53 (15,3%)	1 (7%)	54 (14,9%)	
No				
Ultrasound examination	56 (16,1%)	2 (14,3%)	58 (16%)	<0,001
Yes	291 (83,9%)	12 (85,7%)	303 (84%)	
No				
Type of delivery	334 (96,3%)	12 (85,7%)	346 (95,8%)	<0,001
Vaginal route	13 (3,7%)	2 (14,3%)	15 (4,2%)	
Cesarean				
Alcoholic Consumption			-	
Yes	54 (15,6%)	-	54 (15%)	0,328
No	121 (34,9%)	3 (21,4%)	124 (34,3%)	0,275
Smoking				
Yes	-	-	-	
No	164 (47,3%)	3 (21,4%)	167 (46,3%)	0,698
UTI				
Yes	21 (6,1%)	1 (7,1%)	22 (6,1%)	0,820
No	96 (27,7%)	3 (21,4%)	99 (27,4%)	

While 8 cases corresponding to 57.1% of in-hospital births had improved to hospital discharge, 6 (42.9%) of out-of-hospital births were discharged from the hospital. Regarding parity, 64.8% of the mothers were multiparous and 35.2% primiparous; 32.7% of the newborns of primiparous mothers died and 64.3% of the multiparous newborns died, 8 (57.1%) newborns of primiparous women and 6 (42.9%) newborns of multiparous women were discharged from the hospital. Regarding alcohol consumption during pregnancy, 54 mothers had consumption of alcoholic beverages during pregnancy corresponding to 15%, and 34.3% did not consume alcoholic beverages.

Regarding smoking habits during pregnancy, only 167 were reported and none of these showed smoking habits. Neonatal sepsis occurred in 145 (40.2%) of the cases, and 142 (40,9%) of these cases died. In relation to pallor 87 (24.01%), skin-mucosal pallor was presented on admission to the A&E and 86 (24.8%) died. The ultrasound as the gold standard test for prenatal diagnosis of gastroschisis was not performed during pregnancy in the majority (84%) of our patients (83.9% of the cases that died and 85.7% of surviving newborns). As for the occurrence of urinary tract infection during pregnancy, 22 (6.1%) of the mothers had urinary tract infection and 99 (27.4%) had no urinary tract infection.

Table 2 shows the number of prenatal consultations, 257 (71.2%), of these 70.3% of cases that died had prenatal consultation and 15.3% did not have prenatal consultation. From the surviving newborns, 93% of mothers had a prenatal consultation. As for the number of consultations, 25.1% made one consultation, 39.6% made 2, 23.7% made 3, 10.1% made 4 and 1.5% made 5 consultations, respectively (Table 2).

Table 2. Number of consultations to the mother of a newborn with gastroschisis.

Number of consultations	Death		Total	%
	Yes	No		
1	63	1	64	25,1
2	99	3	102	39,6
3	54	7	61	23,7
4	24	2	26	10,1
5	4	0	4	1,5
Total	244	13	257	100

4. Discussion

The maternal age below 20 years is one of the most studied risk factors associated with gastroschisis [35,36]. The present study observed a slightly higher mean age that was 22.3 + 4.5 years old, in contrary to several studies such as Shalaby et al. [18] and Apfeld et al. [10], in which the mean maternal age was less than 20 years. Another study by Bhat et al. [46] found that gastroschisis disproportionately affects newborns of younger mothers, with the highest prevalence among mothers aged <20 years (15.7 per 10,000 live births); in this study it was also observed that the incidence among adolescent mothers was about seven-fold higher than that for mothers aged 25 years. Additionally, recent studies have observed that mothers under 20 years of age are more likely to have children with gastroschisis [1, 33, 36]. Women under 20 years of age are 11 times more likely to have a fetus with gastroschisis than women above this age; the association of prevalence with maternal age is well established, however, the interaction between these two findings is still unknown [31].

The adolescent fertility rate in the region is very high, ranging from 28 per 1,000 in Mauritius, 39 per 1,000 in Botswana and 51 per 1,000 in South Africa, 166 per 1,000 in Angola, 74 per 1,000 in Comoros, 144 per 1,000 live births in Malawi and 154 per 1,000 in Mozambique [32, 34]. The rising rate of teenage pregnancy and the need to examine its causes is a growing concern for the region. Teenage pregnancy is linked to several social, cultural and economic factors that make adolescents particularly vulnerable to early sexual initiation and forced or same-sex marriages [10, 34]. Teenage pregnancy contributes to the high levels of maternal mortality in Member States. According to the IIMS 2015 – 2016, the percentage of women in Angola aged 15–19 who become pregnant for the first time is 4,756 [10, 18, 34]. The teenage pregnancy rate in Madagascar is over 40 percent. The contraceptive prevalence rate (CPR) ranges from 13 percent in Angola, 54.6 percent in South Africa, 18 and 66.5 percent in Zimbabwe [34]. Poor and poorly educated women are less likely to have access to family planning because they face barriers to accessing health services, with only three countries allowing adolescents to use contraceptives from the age of 12. Current health expenditure (as a proportion of GDP) in the SADC region is uneven. Several countries such as Angola, Madagascar and the Seychelles have seen a decrease, while Mozambique, Namibia, Lesotho and South Africa have increased their expenditure. Economic development is generally constrained by relatively low growth, high unemployment and huge social demands [10, 18, 28, 34]. With government revenues from taxation falling, health budgets have been put under pressure by other competing demands [34].

The low level of education has been widely observed in several studies and is usually associated with gastroschisis [3, 6, 18, 31, 48]. Our study observed that 2.8% of mothers had no schooling, 16.3% had primary education and 11.9% secondary education, none had higher education, a study conducted by Shalady et al. [18] indicates that the level of education varied from no schooling [n = 6 (25%), high school; n = 14 (58%) to a university degree, n = 4 (17%)]. This data corroborate with our study, to highlight that the

low level of education is an important factor associated with gastroschisis [9, 18, 48, 50, 51]. These results are consistent with other studies that revealed that 60% of the mothers had only the minimum level of education (primary level), and 80% were of low socio-economic class [10, 18].

Similarly, the results of other studies showed that gastroschisis occurs more frequently in low and middle-income countries, where the low level of education, difficulty in accessing basic public services (water, sanitation, energy, health, education and housing), with low socio-economic resources, high birth rates and neonatal mortality, with poor health systems and marked cultural aspects. Associated with factors such as low birth weight, prematurity, absence of prenatal diagnosis, absence of neonatal intensive care units, and lack of tertiary centers for the treatment of simple and complex gastroschisis [28].

Study by Togneri et al. [3] found that in relation to socioeconomic factors, the prevalence of gastroschisis was higher in mothers with lower education level [3, 18, 28, 48, 52]. For these authors there will probably be evidence that low education is responsible for the greater exposure to teratogenic phenomena, due to the poor level of knowledge of the risks involved. However, the studies did not analyze the relationship between schooling and gastroschisis directly, only the level of education was evaluated in relation to gastroschisis and other congenital anomalies in general [3, 15].

Early diagnosis in prenatal NBs with gastroschisis is important to conduct a complete assessment of the malformation including assay of serum alpha-fetoprotein levels, karyotype, ultrasound and fetal echocardiography, to facilitate pre-natal follow-up adequate birth and decision-making at the end of pregnancy [31]. However, our study found that 84% of the cases did not undergo an ultrasound examination. None of the women who underwent ultrasound was correctly diagnosed. These data are similar to those observed in several studies conducted in Africa, where ultrasound and prenatal consultations are not often performed in pregnant women [10, 18, 45, 46].

Study by Wesonga et al. [28] found that 93% had prenatal screening, but only 10 (24%) had prenatal ultrasound and only 2% of mothers had a correct diagnosis of gastroschisis in the prenatal period [38]. In high-income countries, almost all cases are diagnosed in prenatal care through ultrasound in follow-up visits [4, 9, 44]. This facilitates planned delivery in a center with access to pediatric surgical care. The low rates of prenatal diagnosis in our study, combined with a reduced number of prenatal visits, are an important barrier to timely planning of specialized postnatal care required for these NBs [18, 53]. Some studies discuss the influence of prenatal care on mortality rate of patients with gastroschisis.

A retrospective study showed an association between the non-performance of prenatal consultation and a higher mortality rate of patients with gastroschisis. According to these authors, when the prenatal consultation is not performed properly, the diagnosis of gastroschisis is not established during this period and therefore there is no adequate management of NBs [5, 8, 10, 18, 31, 48, 53]. Study conducted by Dias et al. [9] found that 73.3% of women had prenatal consultation, although 31.7% of these pregnant women died proportionally. However, a study conducted by Souza et al. [33] observed an average of six prenatal consultations and more than 80% of gastroschisis cases were diagnosed during the prenatal period (8.33). Silva et al. [8] observed that gastroschisis was diagnosed in four cases (80% of the cases), none of which underwent prenatal follow-up [8, 33].

Parity is a widely studied variable and an important prognostic factor for gastrointestinal mortality. In this study, we observed that multiparous women constituted 2/3 of the total NBs with gastroschisis, contrary to most studies in which primiparity was a risk factor for gastroschisis [1-4, 17, 18, 22, 25, 48]. Study conducted by Dias et al. [9] observed that primiparity was one of the factors associated with gastroschisis, and there was a predominance of pregnant women who were in their first pregnancy, around 63.3%, similar to the literature. This fact can be justified in general by the higher frequency of

congenital malformations in primitives [9]. A study by Silva et al. [8] found that the findings were compatible with the current evidence in relation to demographic characteristics, lower maternal age, prematurity, higher number of primiparous and low birth weight [5, 8, 10, 18, 48, 53].

The place of birth is one of the important conditions in several studies that also constitutes a determining factor for better or worse prognosis, in our study 55.7% of newborns were born outside the hospital similar to the studies conducted by, Shalaby et al. [18] who observed that 11 (46%) were born in the Cairo University Hospital, with others born elsewhere [public hospital, n = 4 (17%); private hospital, n = 4 (17%); private clinic, n = 4 (17%) and (4.1%) at home [18]. Study by Apfeld et al. [10] found that most NBs were born outside of the Harare Children's Hospital (96%) and outside of Harare Province (82%), and (26%) were born outside of the healthcare environment (at home or before arrival in a clinic or hospital) [10], the chances of survival for NBs born outside the province of Harare were estimated to be 50% lower than those born in the province of Harare [10, 18].

Gestational age is an important influence factor in neonatal prognosis. The average was 38.2+ 2.2 weeks, and (93.1%) were term newborns and 25 (6.9%) were preterm newborns, were classified as term (> or = 37 weeks gestational age) and premature (< 37 weeks). These data agree with some studies conducted in which the gestational age varied between 36.2-38 weeks [1-3, 5, 8, 10, 18, 31, 48, 53]. Study conducted by Dias et al. [9] which reported that the frequency of death was higher with gestational age below 37 weeks and 4 days [9]. In several studies the question of early termination of pregnancy to avoid prolonged exposure of viscera in the amniotic fluid, describing that planned late preterm labor is related to lower death rates, and increases the opportunity for surgical repair. However, other studies describe that full-term birth is related to lower deleterious consequences of prematurity. There is much controversy about this data. Study conducted by Raymond et al. [50], noted that the gestational age at delivery ranged from 28 to 40 weeks with a median gestational age of 36 weeks. Fifty-six percent of patients were born prematurely (defined as gestational age less than 37 weeks). Carvalho et al. [51] found that the average gestational age at birth was 36.1 weeks (range 29-38 weeks, SD 5.84 weeks) (35). In 13.6% (6/44), delivery occurred before 34 weeks, 40.9% (18/44) between 34 and 36 weeks and 45.5% (20/44) at 37 weeks, observed that the median gestational age was 37 (26-40) weeks, and 9 (38%) were premature. (35). Niles et al. [20] observed in their study that 39 neonates (56.5%) were premature, while 30 (43.5%) were born at term [20].

The presence of other congenital malformations, including intestinal malformations such as intestinal atresia, intestinal and extraintestinal rotation such as orthopedic and urogenital, and complications such as intestinal perforation, intestinal volvulus, ischemia and intestinal necrosis are also important factors in the neonatal prognosis and morbidity and mortality in NBs with gastroschisis even in industrialized countries [49-51], being usually an isolated defect [9, 23]. In this study, we found that complex type gastroschisis was present in 9.7% of cases; These data are like several studies where this type of gastroschisis corresponds to about 10% of the studied cases [9, 18, 23]. Barbieri et al. [16], in their study found that most cases were simple gastroschisis, and only 3 (12.5%) were complex gastroschisis [16]. Similar studies conducted by Carnaghan et al. [33] and Souza et al. [33] in which 10% of the cases were complex gastroschisis and in this group a greater number of deaths was observed, however these deaths were associated with sepsis, prolonged hospitalization [33, 45]. Raymond et al. [50] in their study noted that 77 (14%) were documented as having complex gastroschisis. A study by Santos et al. [6] and Dias et al. [9] showed results like ours, where about 10% of the NBs had complex gastroschisis [9, 23]. Muniz et al. [6] observed that the rate of complex gastroschisis was 22.9% (11% to 59.4%) [6, 23, 50].

The occurrence of urinary infection needs better understanding and clarification in pregnant women with gastroschisis because it is a widely studied condition, and this is

related to the occurrence of gastroschisis. The occurrence of urinary infection during pregnancy was 6.1%, like Dias et al. [6] study that found the occurrence of urinary infection in the first trimester was considered in view of its association with the occurrence of fetal gastroschisis [6]. Souza et al. [33] in their study revealed that the increase in frequency of genitourinary infection increases the chance of gastroschisis occurrence. More than 50% of the pregnant women presented some complication during pregnancy, the most common being urinary tract infection (UTI) (50%) [33].

The type of delivery was a subject of controversy in several studies and for its influence on the assessment of prognosis and follow-up of the newborn with gastroschisis. The comparison between the improvement of the outcome in newborns with gastroschisis submitted to caesarean and/or vaginal delivery is highlighted in many studies [1, 43-46, 48-52]. In this study, it was found that the type of vaginal delivery was 95.8% and only 4.2% was by caesarean section. However, the most appropriate delivery route for this condition is still controversial. Studies have not shown any benefit of routine surgical delivery [33]. In a study conducted by Shalaby et al. [18] showed normal vaginal delivery (n = 13, 54%) and caesarean delivery (n = 11, 46%).

Study by Santos et al. [23] found that the type of delivery was not significantly associated with overall mortality [23]. In this same study, caesarean section was identified as an independent risk factor for the development of respiratory problems at birth. Therefore, planned caesarean section in the absence of usual obstetric indications is not generally recommended [23, 28]. Study conducted by Dias et al. [9] revealed that the caesarean section rate was 63.3%, however, this type of delivery is usually related to prematurity, which may increase the risk of respiratory discomfort and other comorbidity in the NBs, although they can reduce the exposure of the intestine to amniotic fluid and the reduction of serious intestinal lesions [9].

Muniz et al. [6] found in their study that the caesarean section rate was 77.7% (45% to 92.2%). However, they were higher in studies conducted in high-resource economic environments in Brazil. The best birth route in fetuses with gastroschisis remains controversial [6]. The supposed benefits of inducing near term labor include reduced exposure of the intestine to amniotic fluid and reduction of severe intestinal lesions [1, 6, 8, 9]. On the other hand, this procedure increases the risk of preterm conditions, associated with respiratory discomfort and other comorbidities [1, 2, 6, 9]. Souza et al. [33] observed that in relation to the route of delivery, 79.2% of newborns were born by cesarian section, while 20.8% of those diagnosed in prenatal were born by vaginal delivery. Carvalho et al. [51] found that the main delivery method was cesarian section in 90.9% (40/44) and only 9.1% were vaginal deliveries (4/44). Silva et al. [8] found that the delivery route was caesarean in 100% of the cases [4-6, 8, 9].

None of the mothers had a history of smoking and use of illicit drugs. Regarding alcohol consumption during pregnancy, 54 (15%) mothers reported having consumed alcoholic beverages during pregnancy. Study conducted by Dias et al. [9] noted that illicit drug use and smoking are also frequently cited as factors related to the occurrence of gastroschisis, in the same study, 10% used drugs such as cocaine, crack and marijuana and 16.6% were smokers. Togneri et al. [3] also found that the use of illicit drugs has been shown to be a strong risk factor for the appearance of gastroschisis, especially when there is use of more than one drug in association (cocaine, amphetamines and marijuana) or compared to single use and in which both parents use narcotics [3, 53].

The sex of NBs has not been pointed as a determining factor for gastroschisis occurrence. However, the male sex has been pointed out as a factor of worse prognosis in several studies [6]. In this study, there were 198 (54.8%) male NBs and 163 (45.2%) female NBs. Similarly, Carvalho et al. [51] revealed that there were 59.1% (26/44) male fetuses and 40.9% (18/44) female fetuses in their study. Study conducted by Dias et al. [9] there was a slight predominance of females (53.3%) over males (46.7%). Marshall et al. [20], (2017) also noted that 28 (35%) were male and 52 (65%) females. Muniz et al. [6] found

that the rate of occurrence of gastroschisis was 49.4% in females (40.9% to 54.6%) similar to those found in international literature [6].

Birth weight is a factor widely studied in NBs with gastroschisis. Low weight reflects the intrauterine growth restriction is one of the frequent complications in these NBs. Intrauterine growth restriction may be influenced by the loss of nutrients and proteins due to intestinal exposure to amniotic fluid, causing secondary growth deprivation [54, 55]. In this study the average weight of NBs was 2453.9+ 515.6. Several studies report the association of this factor that may lead to a lower tolerance for the progression of enteral feeding, requiring longer parenteral nutrition and, consequently, longer hospital stay [1, 2, 3, 6, 15, 31, 54]. In several studies, weight averages were observed (2,500g) [1-18]. Muniz et al. [6] observed that the average birth weight was 2,302 g (2,200 g to 2,349 g). Silva et al. [8] obtained an average birth weight of 2180g (1944g - 3036g) [19, 20, 26-29, 31, 35].

Gastroschisis has an important burden for early neonatal mortality [10, 18-20, 26-29, 31, 45, 47, 49, 53, 55]. The occurrence of death observed in this study was 96.1%. This figure is like that observed in studies carried out in Africa, especially in sub-Saharan Africa where mortality due to gastroschisis is above 90% [10, 18, 20]. Dias et al. [9] observed 40% death and Silva et al. [8] found that the mortality rate was 20% (one death among the five cases of NBs with gastroschisis). Apfeld et al. [10] showed that mortality related to gastroschisis was 84% (n = 80). Marshall et al. [20] observed that the mortality rate was 78.8% [9, 10, 18, 20, 49-51]. The deaths were associated in general with complex gastroschisis, low birth weight, out-of-hospital delivery, male sex, neonatal sepsis and paleness at admission to the emergency room. Health policies implemented by SADC countries to reduce maternal and neonatal mortality rates consist of increasing the number of skilled/specialized health workers, especially midwives; increasing antenatal and clinical consultations; reducing distances to health facilities; reducing unwanted pregnancies and deaths related to unsafe abortions through community health education programmes, counselling on family planning, especially for adolescents and young girls, and encouraging early sexual initiation [34].

The present study contains some limitations. First, the fact that this study was conducted in a single hospital unit (unicentric); and second, the data collection was carried out in medical records without any standardized computerized criteria and some vital information was missing, such as maternal education level, social and economic condition, marital status, which may have caused a bias.

4. Conclusion

The clinical, socioeconomic and demographic profile of mothers and newborns with gastroschisis are widely studied and associated with well-known risk factors, including maternal age below 20 years, low level of education, prenatal consultation, extra-hospital delivery. However, the mortality of newborns with gastroschisis in our study are related to low birth weight, multiparity and complex gastroschisis. However, some modifiable factors identified mean important opportunities for the development of innovative approaches to perinatal care in a resource-limited environment.

The effectiveness of health education programs for communities on issues related to family planning should be monitored and evaluated; the infrastructure of the service network should be improved, ensuring that health units have the equipment for early diagnosis and prenatal monitoring of pregnant women carrying fetuses with gastroschisis; the computerization and standardization of medical records should be implemented in the reference hospital unit for children's health care; investment in a national platform for the collection and control of anthropometric, clinical, socioeconomic and demographic data on newborns with congenital malformations; investment in a specialized center for the evaluation and treatment of malformations, mainly related to gastroschisis.

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