

# Congenital Gastrointestinal Tract Abnormalities and Anterior Abdominal Wall Defects in the Neonatal Intensive Care Units and Neonatal Intermediate Care Unit

Júlia Mioranza Malheiro<sup>1</sup>, Marcela Cristina Weber Pasa<sup>1</sup>, Paola de Lima<sup>2</sup>

<sup>1</sup>University Center for the Development of Alto Vale do Itajaí – UNIDAVI – Rio do Sul, SC, Brazil

<sup>2</sup>Postgraduate Program in Morphofunctional Sciences, Federal University of Ceará, Fortaleza, CE, Brazil and University Center for the Development of Alto Vale do Itajaí – UNIDAVI – Rio do Sul, SC, Brazil

**Disclose and conflicts of interest: none to be declared by all authors**

## ABSTRACT

**Introduction:** investigating the health profile of newborns (NB) with congenital gastrointestinal tract abnormalities and congenital anterior abdominal wall defects along with their mothers admitted in the Neonatal Intensive Care Units (NICU) and Neonatal Intermediate Care Unit (NIMCU) in a reference hospital.

**Methods:** a transversal study with quantitative approach and admitted NB health records analysis, between 2010 and 2020 in the NICU and NIMCU in a Santa Catarina reference hospital. There was a gastrointestinal tract and anterior abdominal wall congenital abnormalities confirmed diagnosis on these NB. The dependent and independent variables analyzed through absolute frequency and association studies were performed using a chi-square test.

**Results:** 39 patients were identified with the researched abnormalities, the most frequent were gastroschisis (43,5%), cleft palate (38,5%) and omphalocele (7,7%). The variables associated to congenital abnormalities related to the NB were: very low weight or low weight ( $p < 0,0001$ ), death ( $p < 0,0001$ ) and associated abnormalities presence ( $p < 0,0001$ ). Thus, regarding the mother: older than 35 years old, gestational or chronic comorbidities and other congenital abnormalities offspring ( $p < 0,0001$ ).

**Conclusion:** the congenital abnormalities in the gastrointestinal tract and anterior abdominal wall showed relative increased risk in the low weight and other congenital abnormalities NB, as well as increased death risk in this population.

**Keywords:** Congenital Abnormalities; Intensive Care Units Neonatal; Gastrointestinal Tract; Abdominal Wall.

## Introduction

Gastrointestinal and anterior abdominal wall CM are made up of congenital structural and/or functional alterations of the involved organs or wall, which may harm the physical, intellectual or social well-being of the patient<sup>1</sup>.

These are highly prevalent in several Brazilian studies and are second only to musculoskeletal and cardiac malformations<sup>2,3</sup>. In addition, musculoskeletal, nervous, cardiac and digestive CM are the most prevalent, together representing 60% of all<sup>3</sup>.

Most CM related to the gastrointestinal tract and anterior abdominal wall can be diagnosed on morphological ultrasound (USG) between the 18th and 22nd weeks of gestation.<sup>4</sup> However, its etiology is poorly understood, relating to environmental and genetic risk factors<sup>6</sup>. Thus, depending on the degree of the anomaly, there may be a need for specific surgical interventions, care in the NICU and other multidisciplinary care, with prolonged hospitalization, in addition to possible irreversible damage to the NB<sup>6</sup>. The objective of this study was to investigate the epidemiological profile of newborns and their mothers with CM of the gastrointestinal tract and anterior

abdominal wall hospitalized in the NICU and NIMCU of a tertiary hospital in the micro-region of Alto Vale do Itajaí.

## Material and Method

This is a cross-sectional and retrospective study with a quantitative approach. All NBs (<28 days of life) admitted between January 2010 and December 2020 at the NICU and NIMCU of a referral hospital in a micro-region of Alto Vale do Itajaí (Santa Catarina) who had a confirmed diagnosis were included in this study. CM of the gastrointestinal tract and anterior abdominal wall. All NBs who did not have a confirmed diagnosis of gastrointestinal and/or anterior abdominal wall CM, who were not admitted to the NICU and NIMCU or who were admitted after 28 days of life were excluded. The data were obtained through the analysis of the medical records of these patients, through clinical descriptions, physical examinations and image reports.

The dependent variable analyzed was the CM of the gastrointestinal tract and anterior abdominal wall according to the International Code of Diseases (CID) 10. The independent variables analyzed were in relation

to the NB: origin, gestational age by the date of the last menstrual period and by USG, existence of prenatal diagnosis of the anomaly, associated anomalies, sex, Apgar score, birth weight, number of surgical medical interventions performed, outcome and length of hospital stay. And in relation to the mother: age, comorbidities, number of prenatal consultations, gestational history and type of delivery.

Statistical analysis was performed using the GraphPad Prism software version 5.0, with the chi-square test ( $\chi^2$ ). The test was used to compare proportions, according to the number of cases, as it sought to analyze the variables in a comparative and qualitative way, in order to analyze possible associations between malformations and the variables studied<sup>7</sup>.

This work was submitted to the research ethics committee through the Brazil platform and approved under the CAAE opinion number (38845820.9.0000.5676).

### Results

From 2010 to 2020, 39 cases of CM of the gastrointestinal tract and anterior abdominal wall were found in the NICU and NIMCU in a referral hospital in a micro-region of Santa Catarina. When analyzing the independent variables of newborns and mothers, there was a rate of unreported data that ranged from 0 to 46%.

The prevalence was slightly higher in male newborns (53.84%). Most of the CM found were gastroschisis, followed by cleft palate and omphalocele, as shown in

**Table 1.** Absolute frequencies of gastrointestinal and anterior abdominal wall CM.

Gastrointestinal MC and anterior abdominal wall	N	Frequency
Gastroschisis	17	43,6%
Cleft palate	15	38,5%
Omphalocele	3	7,7%
Pointed palate	1	2,6%
Jejunal atresia	1	2,6%
Esophageal atresia	2	5,1%

CM. congenital malformations; n. number.

Table 1.

From the association analysis of the variables with the chi-square test, we observed that the CM of the gastrointestinal tract and the anterior abdominal wall are largely related to very low birth weight (<1500g) or low birth weight (<2500) NBs. ( $p < 0.0001$ ), as shown in Table 2. However, most newborns were born at term (37 - 42 weeks of gestation) in the two forms analyzed (ultrasound and date of last menstrual period).

The average length of stay of newborns in the NICU and NIMCU was 19.2 days, and 64.10% had a total hospital stay of less than 20 days. This fact correlated with the very high risk of death in these patients ( $p < 0.0001$ ) (Table 2), as well as a transfer rate to other services of around 20%.

In addition, it was found that there is a high relative risk of newborns having malformations associated with gastrointestinal and anterior abdominal wall CM ( $p < 0.0001$ ). Furthermore, 46.2% of all NBs studied required one or more surgical interventions, both to correct the studied CM and associated ones.

Regarding the Apgar score, more than half of the newborns were born with an adequate score (greater than or equal to 8) in the 1<sup>st</sup> minute and about 70% had the adequate score in the 5<sup>th</sup> minute after birth. And, among children who were born with an inadequate index in the 1st minute, most were very low birth weight or underweight, and 42.8% of these children had 1 or more malformations associated with the main abnormality.

**Table 2.** Relationship between gastrointestinal CM and anterior abdominal wall and NB variables.

NB independent variables	Gastrointestinal CM and anterior abdominal wall			
	n	%	RR	p*
Very low birth weight or low birth weight	18	46,14%	2,167	<0,0001
CM associated with gastrointestinal and anterior abdominal wall CM	11	28,20%	2,63	<0,0001
Neonatal death	8	20,51%	4,37	<0,0001

NB. Newborn; CM. congenital malformations; RR. relative risk.

\* Chi-square test.

Regarding the mothers, most were between 19 and 34 years old (61.5%), were primigravidae (89.7%), had negative serology for HIV, toxoplasmosis, hepatitis B and C (87.1%), underwent prenatal care with a number of consultations greater than or equal to 6 (56.4%) and delivery via cesarean section (74.3%). In addition, half of the mothers knew about the presence of CM before the child was born.

When the risk was analyzed through independent maternal variables, an increase in the relative risk was observed in mothers over 35 years of age, with gestational or chronic comorbidities (type 2 or gestational diabetes mellitus, chronic and pregnancy-specific hypertensive disease, bacterial infections, depression and hypothyroidism), ( $p < 0.0001$ ). A higher relative risk was also demonstrated in mothers who already had children with congenital malformations, even if from other systems ( $p < 0.0001$ ), as shown in Table 3.

**Table 3.** Relationship between gastrointestinal and anterior abdominal wall CM and maternal independent variables.

Maternal independent variables	Gastrointestinal and anterior abdominal wall CM			
	N	%	RR	p
Advanced maternal age (>35 years)	6	15,38%	6,50	<0,0001
Presence of maternal comorbidities	17	43,58%	1,70	<0,0001
Other children with diagnosed CM	4	10,25%	5,25	<0,0001

CM. congenital malformations; RR. relative risk.

## Discussion

In this research, 39 cases of gastrointestinal and anterior abdominal wall CM were found in 10 years of analysis of medical records of newborns admitted to the NICU and NIMCU of a referral hospital in a region of Santa Catarina. The main challenge of this work was to identify CM carriers in physical and electronic medical records, as it was not possible to filter the data by digital mode.

Among the 39 cases of CM, the absolute prevalence was slightly higher in male NBs. As found in other analyses, both when evaluating the rate of CM in both sexes<sup>8,5</sup>, and the rate of NB admissions to the NICU, possibly due to slower lung maturation in males<sup>9</sup>.

Gastroschisis, a CM of the anterior abdominal wall, was the most prevalent in the population surveyed. In a study in Rio de Janeiro, the frequency ranged between 2.7 and 4 cases of gastroschisis per 10,000 live births<sup>10</sup>, in a study carried out in the United States<sup>11,12</sup>, the prevalence ranged between 2.04 and 2.7 cases per 10,000 live births. And in both sites<sup>12,11</sup>, as in this study, gastroschisis was associated with a higher death rate, especially when related to other CM, low birth weight, maternal comorbidities, or failure to provide care at birth.

Labiopalatine CM, also found with great frequency in this research, represent the most prevalent anomalies of the upper gastrointestinal tract, ranging in incidence from 0.82 to 2 cases per 1000 live births in developed countries<sup>13,14</sup>. However, due to lack of standardization of hospital records from this study, NBs with CM may have been excluded, since patients with labiopalatine CM are often admitted to the units due to associated adversities.

According to Taib<sup>13</sup>, NBs with cleft lip and palate usually need a NICU, since they have feeding difficulties, as they cannot perform suction and swallowing properly, in addition to performing multiple corrective surgeries in the first months of life. This fact was found in this study, in which NBs with gastrointestinal and anterior abdominal wall CM mostly require multiple surgical interventions.

Another evidence was that most mothers had 6 or more prenatal consultations and about half of the mothers were aware of their child's CM before birth. A finding similar to a study in Rio Grande do Norte, where the frequency of malformations was higher in women who had 7 or more prenatal consultations<sup>2</sup>. Since, according to the Brazilian Ministry of Health, at least 6 consultations are necessary for a prenatal care-adequate birth<sup>10</sup>, a fact that demonstrates the good prenatal care in the regions when analyzing access to the health service.

Thus, about 70% of the births analyzed in this research were through cesarean sections, which is due to the high rate of antenatal diagnosis, which allows for obstetric planning. This fact corroborates the literature, considering a cesarean rate of 80% in NB with CM in the state of São Paulo<sup>8</sup>.

Regarding the Apgar score, it is considered adequate and represents a good fetal prognosis when it is greater than 8 in the first and fifth minutes of the newborn's life.<sup>6</sup> In this analysis, an adequate index was found in the first and fifth minutes in most cases, probably related to the fact that most NBs were born with adequate GA, were children of mothers who were already aware of CM and, therefore, were born in a planned way. Thus, it can be said that the hospitalizations of these NBs in the NICU and NIMCU were largely due to the severity of the CM presented, a fact similar to what was found in a study in the city of Joinville, where CM was the second main cause of death. admission to the NICU<sup>9</sup>.

However, in a study from the São Carlos maternity hospital (São Paulo), most NBs with CM were born with Apgar below 6 in the first minute and maintained the inadequate index in the fifth minute, and these NBs were mostly low birth weight NBs and with a GI less than 37 weeks' gestation<sup>8</sup>.

As in this study, in Rio Grande do Norte and São Paulo, the authors also found a higher frequency of malformations in mothers with an appropriate age (19 to 40 years)<sup>1</sup>. However, when the relative risk in the population of this study was analyzed, it was high in mothers over 35 years old, who had comorbidities and who already had other children with some abnormality. This fact corroborates the literature regarding the association of CM with genetic and epigenetic etiologies, and the environment where the fetus and mother meet may be responsible for changes<sup>2</sup>.

## Conclusion

It can be concluded that the data found in this study in relation to gastrointestinal and abdominal wall CM reinforce the need for constant epidemiological monitoring. Since gastrointestinal and anterior abdominal wall CM are associated with other CM and increase the risk of low birth weight, as well as increase the risk of death. Furthermore, there was an increased relative risk of the CM studied in newborns born to

mothers over 35 years of age, who had comorbidities or had already had children with other CM. Thus, we seek to highlight risk factors for the population and optimize programs for the prevention and treatment of CM. In

addition, it should be recommended that medical and hospital records be done with standardization and caution, since a major challenge in this work was the lack or inconsistency of data on some variables.

## References

1. De Stefani RR, Böckmann BS, Baldissar GSA, Scherer MH, Lüdtke M, Signor ND, et al. Malformações congênitas: principais etiologias conhecidas, impacto populacional e necessidade de monitoramento. *Acta méd. (Porto Alegre)*. 2018; 39:155-84. <https://editora.pucrs.br/edipucrs/acessolivre/periodicos/acta-medica/assets/edicoes/2018-1/arquivos/pdf/14.pdf>
2. Lucena EES, Lima NA, Silva CF, Santos MM, Fernandes TAAM. Perfil Epidemiológico das Malformações Congênitas em Recém-Nascidos no Estado do Rio Grande do Norte no Período de 2004 a 2011. *Revista Brasileira de Ciências da Saúde*. 2018; 22:45-50. <https://doi.org/10.22478/ufpb.2317-6032.2018v22n1.27529>
3. Oliveira M, Lopez L. Panorama Epidemiológico De Malformações Congênitas No Brasil (2013-2017). *Revista Saúde Multidisciplinar*. 2020; 8:21-5. <http://revistas.famp.edu.br/revistasaudemultidisciplinar/article/view/121/115>
4. Matos APP, Duarte LB, Castro PT, Daltro P, Werner Júnior H, Araujo Júnior E. Avaliação do abdome fetal por ressonância magnética. Parte 2: malformações da parede abdominal e tumores. *Radiol Bras*. 2018; 51:187-92. <https://doi.org/10.1590/0100-3984.2016.0142>
5. Cosme HW, Lima LS, Barbosa LG. Prevalência De Anomalias Congênitas E Fatores Associados Em Recém-nascidos Do Município De São Paulo No Período De 2010 A 2014. *Revista Paulista de Pediatria*. 2017; 35: 33-8. <https://doi.org/10.1590/1984-0462/;2017;35;1;00002>
6. Miranda SAF, Miranda ME, De Aguiar MJ, Bouzada VMC. Nutritional management and postoperative prognosis of newborns submitted to primary surgical repair of gastroschisis. *J Pediatr (Rio J)*. 2016;92(3):268-275. <https://doi.org/10.1016/j.jpeds.2015.07.009>
7. Jeffrey, C, Douglas, D. *Estatística Aplicada - Série Essencial*. 3rd ed. Rio de Janeiro: Saraiva; 2010.
8. Nhoncanse GC, Germano CMR, Avô LRS, Melo DG. Aspectos maternos e perinatais dos defeitos congênitos: um estudo caso-controle. *Rev. paul. pediatr.* [Internet]. 2014; 32(1): 24-31. <https://doi.org/10.1590/S0103-05822014000100005>
9. Mucha F, Franco SC, Silva GAG. Frequência e características maternas e do recém-nascido associadas à internação de neonatos em UTI no município de Joinville, Santa Catarina - 2012. *Rev. Bras. Saúde Mater. Infant.*, 2015;15(2):201-8. <https://doi.org/10.1590/S1519-38292015000200006>
10. Barreiros CFC, Gomes MASM, Gomes SCS. Mortality from gastroschisis in the state of Rio de Janeiro: a 10-year series. *Revista de Saúde Pública*. 2020; 54(63):1-11. <https://doi.org/10.11606/s1518-8787.2020054001757>
11. Brebner A, Czuzoj-Shulman N, Abenheim HA. Prevalence and predictors of mortality in gastroschisis: a population-based study of 4803 cases in the USA. *J Matern Fetal Neonatal Med*. 2018;1-7. <https://doi.org/10.1080/14767058.2018.1529163>
12. Anderson JE, Galganski LA, Cheng Y, Stark RA, Saadai P, Stephenson JT, et al. Epidemiology of gastroschisis: a population-based study in California from 1995 to 2012. *J Pediatr Surg*. 2018;53(12):2399-403. <https://doi.org/10.1016/j.jpedsurg.2018.08.035>
13. Taib BG, Taib AG, Swift AC, Van Eeden S. Cleft lip and palate: diagnosis and management. *British Journal of Hospital Medicine*. 2015; 76(10):584-91. <https://doi.org/10.12968/hmed.2015.76.10.584>
14. Matthews JLK, Oddone-Paolucci E, Harrop RA. The Epidemiology of Cleft Lip and Palate in Canada, 1998 to 2007. *The Cleft Palate-Craniofacial Journal*. 2015;52(4):417-424. <https://doi.org/10.1597/14-047>
15. Brazil - Ministério da Saúde. Programa de Humanização no Pré-natal e Nascimento. Portaria SAS/MS 569/GM, 2000.
16. Kliegman RM, Stanton BF, Geme JW, Schor NF. *Nelson Tratado de Pediatria*. 20 ed. Rio de Janeiro: Elsevier; 2017.

## Mini Curriculum and Author's Contribution

1. Júlia Mioranza Malheiro. Responsible for collecting data, analyzing the results, and drafting the manuscript. ORCID: 0000-0001-7438-6434
2. Marcela Cristina Weber Pasa. Responsible for collecting data, analyzing the results, and drafting the manuscript. ORCID: 0000-0003-1912-6538
3. Paola de Lima. Responsible for idealizing the project, revising the data, revising and approving the final version of the manuscript. ORCID: 0000-0001-7647-266X

Received: August 1, 2022  
Accepted: August 10, 2022

Corresponding author  
Paola de Lima  
E-mail: [paola.lima@unidavi.edu.br](mailto:paola.lima@unidavi.edu.br)