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Original Article

Medical-surgical and sociodemographic aspects in patients with gastroschisis in a Third Level Hospital in Mexico during the period 2018-2022.

Guillermo Yanowsky-Reyes[1], Elvia Ximena Rodríguez-Frausto[2], Zacnicté Viridiana Corona-Guzmán[3], Denisse Estefanía Alfaro-Castellanos, Franklin Daniel Norori-Escobar, Arely Jaqueline Pérez Padilla, Laura Olivia Montaño-Ángeles, Nidia Raquel Álvarez-Rosales, Carlos Oswaldo Yanowsky-González.

[1]Hospital Civil de Guadalajara Fray Antonio Alcalde/ Servicio de Cirugía Pediátrica. Guadalajara, Jalisco, México.
[2]Universidad Autónoma de Sinaloa. Facultad de Medicina, Campus Doctor Carlos Alfredo Zambada Sentíes. Culiacán, Sinaloa, México
[3]Universidad de Guadalajara. Facultad de medicina, Centro Universitario de Tonalá. Tonalá, Jalisco, México.

*** Corresponding author:** Guillermo Yanowsky-Reyes, Hospital Civil de Guadalajara Fray Antonio Alcalde/ Servicio de Cirugía Pediátrica, Calle Hospital 278, Colonia El Retiro, C.P. 44280, Guadalajara, Jalisco, México. E-mail: gyanowsky@gmail.com. 0000-0003-2891-8561

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Abstract: Introduction: Gastroschisis is a birth defect in which a hole in the abdominal wall (Belly) lateral to the umbilicus allows the infant's intestines to be exposed, in addition to other organs such as the stomach and liver. **Objective:** To obtain information on the medical-surgical approach to this congenital anomaly, identify aspects of probable risk in the demographic areas where the pregnant women reside, pathological and non-pathological personal history of the patients' mothers, newborns diagnosed with gastroschisis attended from January 2018 to January 2022 and drug addictions used in the perinatal period of the pregnant women. **Method:** descriptive, retrospective, retrospective, cross-sectional, observational, epidemiological cohort study. An analysis of the clinical records of the Antiguo Hospital Civil de Guadalajara Fray Antonio Alcalde of patients with a diagnosis of gastroschisis attended in January 2018 to January 2022 was performed. The data were collected in Microsoft Excel and SPSS 22 software. They were subsequently interpreted and analyzed by means of measures of central tendency and association. **Results:** A sample size of 48 patients was analyzed revealing that the prevalence of gastroschisis in the Antiguo Hospital Civil Fray Antonio Alcalde from 2018 to 2022 was 0.0089%. In addition, 83% success rate was observed in the treatment of patients with gastroschisis in pediatric surgery, with higher prevalence in male neonates (M=55.3%, F=22%), among others. A positive association was found with gastroschisis and exposure to environmental pollutants (OR=1.67), teenage mothers (OR=2) and ORH+ blood group (OR=1.29). The risks by demographic area according to their exposure and locality, 50% exposure to insecticides and 17% to polluting industries. The diagnosis of this malformation was made in 47% in the second trimester, 28% in the first trimester and 23% in the third trimester. Within the personal pathological and non-pathological history of the parents, no pathology of importance was identified. Surgical management was 59.2% with deferred

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closure and 40% with primary closure, medical management was for 100% of the patients and 16 of them required mechanical ventilation. **Conclusion:** According to the results obtained, the main positive relationship for presenting gastroschisis was the presence of a teenage mother and exposure to environmental pollutants in the studied sample.

Key words: gastroschisis, medical-surgical approach, risk factors, gestation, complications, demographics, teenage mother.

1. Introduction

According to the Center for Disease Control and Prevention (CDC) definition, gastroschisis is a birth defect in which a hole in the abdominal (belly) wall lateral to the navel allows the baby's intestines to remain exposed outside the abdominal cavity potentially containing other organs such as the stomach and liver[1]. The word Gastroschisis comes from the Greek word "gastroschisis" (gastro means belly and schisis means fissure, opening or separation), coined by Taruffi in 1894[2, 3].
Gastroschisis within developed countries in North America is reported with an incidence of 3-4.5 cases per 10,000 live births, according to the European Congenital Anomalies Surveillance Network (EUROCAT), the reported incidence is 2.63 cases per 10,000 live births[4].

There are no exact data on the incidence of gastroschisis in Mexico, however, according to data published by a third level hospital the incidence varies from 1.6 to 4.6 patients per 10,000 live births with an economic and social impact within families with patients affected by this pathology, most of them being families with vulnerability factors such as low social status (poverty), drug addictions in the mother, drugs, maternal age below 20 years, low schooling, short inter-gestational period and infectious processes during pregnancy[5-7].

Gastroschisis is also associated with other conditions that require a multidisciplinary approach by health professionals, with up to 10-20% of newborns presenting conditions such as intestinal atresia of 10-30%, musculoskeletal defects, cardiac, renal, nervous system, and other conditions[8, 9].

The pathogenesis of gastroschisis occurs during the normal development of the abdominal wall and formation of the intestine, which herniates through the midline during the first stage of gestational formation, the intestine returns to the abdominal cavity during the 10-12 week, producing intestinal rotation outside the body and later fixation after its return to the abdominal cavity, and closure of the abdominal wall where the folding of the cranial, caudal and 2 lateral embryonic folds occurs. To date there is no described cause, however, there are several theories about the cause of this pathology among which are mentioned: Abnormal folding of the body wall, failure of the yolk sac and of structures to be included in the stalk, infarction and necrosis at the base of the umbilicus caused by interruption of blood flow through the vitelline artery, regression of the right umbilical vein due to localized weakness in the paraumbilical tissue, rupture of the amniotic membrane at the base of the umbilical cord, early estrogenic thrombophilia, and interference of thrombotic by-products with developmental signaling[10]. Gastroschisis commonly presents as a single defect, in

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which usually the intestine remains intact, individualizing the length of the intestine and remembering that all of them present intestinal malrotation. In addition, it can present: ischemia, atresia, necrosis and perforation. If any of these complications occur, it is known as "complex gastroschisis"[11].

The medical-surgical approach is well described, it needs to be multidisciplinary and the current criterion is to correct the defect once the newborn (NB) has achieved thermal, respiratory and hemodynamic stability, which can be primary or staged. Classically, the usual method was to cover the intestine with gauze moistened with physiological solution, vaseline or lactated Ringer's solution[12]. It is currently described that covering the gauze with a plastic cover (Vita-film) is sufficient to protect the gauze and prevent exposure and injury to the gauze.

The surgical techniques previously described in the literature for abdominal wall repair were three: primary closure, delayed closure after silo placement and Simil-Exit[13]. Currently, the correction of the defect is based on closure without sutures, which can be primary or deferred in stages, where a preformed silo is placed (flexible wound retractor), and when all the loops are inside the cavity, they are covered with a colloid patch (hydrocolloid inclusive dressing). This technique allows the reduction of associated mortality, the need for ventilatory assistance and prolonged fasting, resulting in cost improvement for the medical institution, which is why it is important to reduce the demographic factors related to the risk of gastroschisis[14].

There is little bibliographic evidence compared to other pathologies, being gastroschisis one of the most common congenital defects. This pathology is associated with a high morbimortality rate in newborns and it is necessary to highlight that its frequency is increasing according to different bibliographies throughout the years. Different risk factors may be hidden by unavoidable biases in the research already carried out, finding vulnerabilities that this research seeks to overcome in order to minimize the increase of cases.

The aim of the present study was to obtain information on the medical-surgical approach to this congenital anomaly, identify aspects of probable risk in the demographic areas where the pregnant women reside, pathological and non-pathological personal history, drug addictions of the mothers of newborns with gastroschisis attended from January 2018 to January 2022.

It is a retrospective cohort study that provides high feasibility because it does not require high costs or many resources.

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2.Method

The study design was epidemiological, descriptive cohort, retrospective, cross-sectional and observational, carried out at the Antiguo Hospital Civil de Guadalajara Fray Antonio Alcalde. The population of interest were patients attended at that institution with a diagnosis of gastroschisis.

The inclusion criteria were patients with a diagnosis of gastroschisis, having been attended at the Antiguo Hospital Civil de Guadalajara Fray Antonio Alcalde from January 2018 to January 2022, and meeting more than four qualitative variables. Clinical records of patients with a diagnosis of omphalocele, incomplete records with less than four qualitative variables, being the product of a pregnant woman with gastroschisis before 2018 and after January 2022, and having been treated in another hospital outside the Antiguo Hospital Civil de Guadalajara Fray Antonio Alcalde were excluded.

Data collection was performed during the months of July and August 2023. Due to patient confidentiality, no data that could identify the patient was recorded.

The sample size was obtained by analyzing the clinical records of the Antiguo Hospital Civil de Guadalajara Fray Antonio Alcalde, in which 104 cases were derived (n=104), from which those that met the inclusion and exclusion criteria were selected. The type of sampling was by consecutive inclusion, in which the final sample was composed of 48 cases (n=48).

Once the total sample size was defined (n=48), a database was created using Excel office, in which quantitative variables were included, such as gestational age, sex of the newborn, live or stillborn, delivered alive or dead, age of the parents, time of diagnosis of the pregnancy (weeks of gestation), time of diagnosis of the gastroschisis type abdominal defect (weeks of gestation), number of normal ultrasounds reported, duration with assisted ventilation, duration with orogastric tube, weight at birth and at discharge (kg), height at birth (cm), size of the abdominal defect (cm) and number of gestations.

On the other hand, the qualitative variables considered were: place of origin of both parents, factories, polluting industries or exposure to insecticides, education and employment of both parents, drug addictions of both parents, socioeconomic level, place of birth, admission diagnosis, birth mode (vaginal or abdominal), prenatal complications, genitourinary infections during pregnancy, direct cause of death, content of the abdominal defect, medical approach after birth (advanced neonatal resuscitation maneuvers, days of intubation, parenteral nutrition and presence of sepsis), type of surgical management for closure of the abdominal defect (primary or staged sutureless closure), medications required (use of antibiotics as prophylactic management, NSAIDs and opioids), type of feeding (parenteral nutrition, exclusive or mixed breastfeeding), requirement of orogastric tube, complications during the newborn's hospital stay (hemodynamic, gastrometabolic, ventilatory, neurologic or infectious), complications and subsequent recurrent pathologies.

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Finally, for the descriptive analysis of the quantitative and qualitative variables, a database was created in Excel and SPSS 22, from which measures of central tendency were obtained to represent a centralized set of quantitative data. The main measures reported were mean, median and mode. On the other hand, for qualitative variables, measures of association were used, such as odds ratio, prevalence, incidence and incidence rate; the Google maps locator was used to determine whether the pregnant women live in demographic areas with risk factors; in addition, the Odds Ratio formula was used to calculate fathers and mothers exposed and not exposed to drug addiction before and during pregnancy. The results are presented in bar and pie charts depending on the type of variable (quantitative or qualitative), as well as tables to summarize the data.

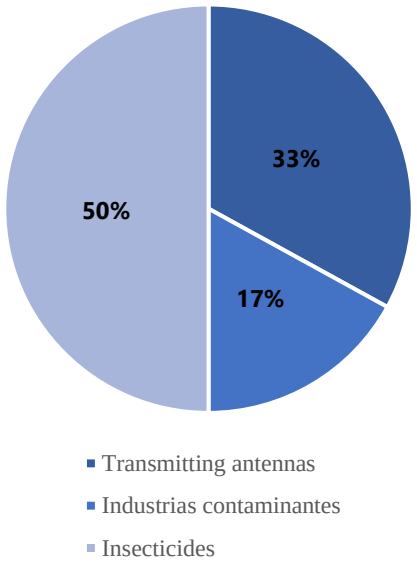

Figure 1. Environmental risk factors as a percentage within the demographic zone of parents of children with congenital gastroschisis.

In Figure 2, the place of origin of the parents of the patients admitted with congenital gastroschisis is shown. Of the total sample (n=48), the origin of only 12 pregnant women is unknown, however 36 came from different areas of Jalisco (n=12+36=48) such as Tlajomulco (n=6), Guadalajara (n=4), Tepatitlán de Morelos (n=3), La barca (n=1), El Salto (n=2), Zapotlanejo (n=2), Tizapan (n=2), San Miguel el Alto (n=1), Tenamaxtlan (n=1), Puerto Vallarta (n=1), Jalostotitlán (n=1), Ayutla (n=1), Cihuatlán (n=1), Unión de Tula (n=1), Tolimán (n=1), Tlaquepaque (n=1), Arandas (n=1), Chapala (n=1), Zapotlán del Rey (n=1), Michoacán (n=3) and finally Tlacuitapa (n=1).

Within these places of origin, risks were identified by demographic zone according to their exposure and locality. 50% of exposure to insecticides corresponds to Tlajomulco, Tizapan, Tepatitlán de Morelos, Jalostotitlán, and El Cantón. The 33% of telephone antennas corresponds to El Carmen, Zapopan, El Campesino, Tlajomulco, Tolimán, Tepatitlán de Morelos, Tizapan, Cihuatlán, El Salto, Ayutla, Zapotlanejo, El Cantón, and San Miguel el Alto. Finally, 17% of polluting industries correspond to Tonalá, Guadalajara, Tlajomulco, El Cantón, Tenamaxtlan, Michoacán, Zapotlanejo, and La Barca.

Another noteworthy variable was the age of the patients, since, as described in the literature, it was verified by performing the same Odds ratio method, which yielded a result of 2, whereby those women who have an adolescent pregnancy are approximately twice as likely to have their children develop

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gastroschisis compared to those who decide to gestate above 20 years of age. Figure 3 shows that the sample size (n=48) ranges from 13 to 42 years of age, with most of the values at the low end, the mean is 18 years of age, pregnant women 13 years of age (n=3), 14 years of age (n=5), 15 years of age (n=3), 16 years of age (n=3) and 16 years of age (n=3), 16 years of age (n=3), 17 years of age (n=7), 18 years of age (n=9), 19 years of age (n=3), 20 years of age (n=2), 21 years of age (n=5), 22 years of age (n=3), 24 years of age (n=1), 26 years of age (n=1), 27 years of age (n=1), 32 years of age (n=1), 42 years of age (n=1).

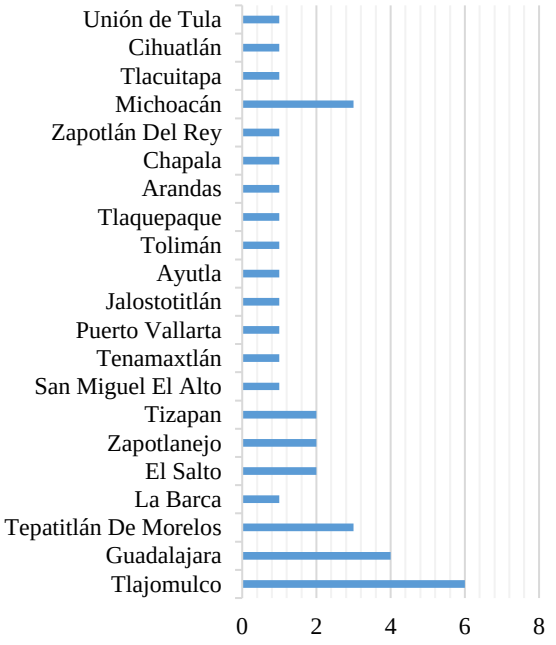

Figure 2. Place of origin of parents of patients admitted with congenital gastroschisis.

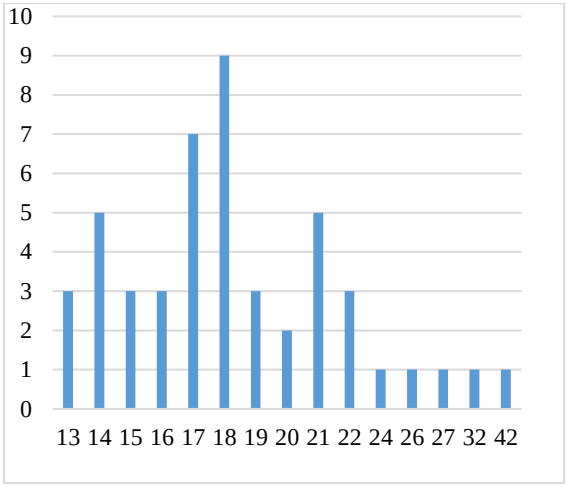

Figure 3. Age of pregnant women.

The diagnosis in the gestational weeks goes from the fourth week of gestation to the 32nd week of gestation, of these the highest diagnostic moment of pregnancy was at 8 weeks of gestation in 32.3%. The gestational week in which the diagnosis of the abdominal defect was found and reported goes from the 16th week of gestation to the 32nd week, where "not reported" has a higher value than the majority for the diagnostic moment, followed by being found at 28 weeks of gestation. Number of gestations of the mothers with patients admitted for congenital gastroschisis 53.8% reported having been primigravida, 33.3% had their second gestation, 7.7% went through their fourth gestation and 5.1% went through their third gestation. The number of normal ultrasounds reported prior to delivery of the pregnant women ranged from 1 to 12 ultrasounds, with a mean of 4.

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The presentation of prenatal complications was highest for adolescent pregnancy, being positive in 25 cases, and in second place was exposure to polycyclic aromatic hydrocarbons with 23 cases (none of the cases is exclusive to each pregnant woman, since on different occasions there were more than one complication accompanying the mothers). The diagnosis of this malformation was made in 47% in the second trimester, 28% in the first trimester and 23% in the third trimester.

Among the pathological and non-pathological personal histories of the parents of the patients studied, the following were recorded: abortion (n=1), congenital heart disease (n=1), cervicovaginitis (n=1), glycemic uncontrol (n=1), diabetes mellitus (n=1), endocarditis (n=1), hyperthyroidism (n=1), leiomyomas (n=1), abdominal tumor (n=1), human papillomavirus (n=1), and the rest of the population denied any other type of history.

In surgical management, two surgical techniques were performed, which were deferred closure with 59.2% (n=25) and primary closure in 40% (n=17). In the medical management, 100% required orogastric tube with an average time of 14 days, the patients who required the administration of antifungal agents (n=5), opioids (n=39), NSAIDs (n=29) and antibiotics (n=42). Mechanical ventilation was required in (n=16) patients, with an average of 4 days. And an average hospital stay of 37 days.

Finally, the odds ratio formula of this study was carried out to look for a relationship between the blood serotype of the progenitors of the product. This formula gave us a value of 1.29, which indicates a positive association between the ORH+ blood group and the risk of developing a pregnancy with problems in the embryological period, thus ending up with a defect of the abdominal wall of the gastroschisis type.

Research was conducted in different databases to reinforce that exposure to non-ionized radiation, which is the source emitted by antennas and pesticides, can have significant impacts during embryogenesis, which can end up triggering functional congenital malformations, such as gastroschisis, as well as other types of damage to the health of both pregnant women and the general population.

Telephone antennas use non-ionized radiation, which is electromagnetic energy ranging from 30 to 300 kHZ. This type of radiation is characterized because it uses a low energetic charge, which has been documented that it is not enough to generate cellular alterations, however, there are different sources that show contrary results in which harmful effects for health are exposed; these can alter hormonal production, DNA, immune system, among others[16].

The increase in demand for mobile devices has led the industry responsible for these services to generate more antennas to improve coverage17 .
Cases have been reported of genetic damage in people living in areas close to mobile stations compared to healthy controls[18].

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According to the University Environment and Health Network, as the development of wireless communication systems, cell phones and the number of antennas installed between dwellings has increased, it has been reported in epidemiological research journals and in experimental laboratory models that radio frequency radiation (RFR) at non-thermal levels affects health. These non-thermal exposure levels have resulted in biological effects in humans, animals and cells.[19].

Exposure to RRF generates oxidative stress in biological systems, caused by an increase in free radicals and changes in defense systems. Evidence of free radical damage has been repeatedly documented in humans, plants, animals and microorganisms for both extremely low frequency electromagnetic fields and radiofrequency radiation (non-ionized).

Regarding pesticides and their relation to congenital malformations, pesticides can be defined as chemical substances used in the agricultural area or at home for the elimination or control of pests; continuous exposure to these biochemicals in pregnant women during the first month can cause congenital anomalies[20].

According to a study on the prevalence and risk of congenital malformation in women exposed to pesticides, paternal exposures may directly produce germ cell mutation, which would be expressed in subsequent generational malformations due to the presence of toxins in seminal fluids and contamination of work clothes that may cause secondary exposure to the mother[21,22].

Most disorders are caused by changes in genetic information or originate from a variety of factors23. Exposure of pregnant women to pesticides in rural areas is associated with the occurrence of cases in the mother and the baby. In the pregnant woman, research indicates a relationship between intrauterine exposure to pesticides and the onset of congenital malformations[24].

Currently, all this information is of great impact to consider antennas and pesticides as possible risk factors, however, it would be ideal to search for prospective studies in which the amount, duration and frequency of exposure are taken into account, this would also be convenient to relate it to biomarker measurements to more accurately estimate exposure and risk[16].

However, despite the above results, it is necessary to consider other factors and perform more detailed analyses to reach stronger conclusions about the association between these possible risk factors and the outcome under study, as there may be confounding factors or biases affecting the outcome that have not been taken into account in this analysis.

4. Conclusion

In conclusion, this study highlights that the obtained information from the reviewed cases of patients diagnosed with gastroschisis is a challenge for public health, public awareness and education, because positive associations were found between risk factors, such as the age of the pregnant person, medical

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history of the parents, drug addiction, drugs, poor diet, socioeconomic status, prenatal control and evolution of pregnancy, all related to a higher risk of developing problems in the embryological period with the probability of an abdominal wall defect of the gastroschisis type. It is recommended to strengthen timely family planning campaigns with the objective of preventing the consumption of toxic substances before pregnancy to prevent this type of embryological defects.

Management approaches and available treatment options, such as the development of surgical techniques, type of nutrition, respiratory and hemodynamic care are essential to improve outcomes and support for newborns affected by this congenital defect, as well as to reduce complications and mortality rates. Due to the size of the sample, statistically significant results cannot be inferred; however, according to the results obtained, the need for continued research with multidisciplinary approaches to address this congenital malformation and its associated challenges is highlighted, as well as the need to create awareness in pregnant women to receive adequate prenatal care to achieve a pregnancy with normal evolution to culminate with a healthy newborn and avoid possible problems of congenital defects such as gastroschisis.

5.Statements

5.1 Conflict of interest

The authors declare no conflict of interest.

5.2 Funding

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5.3 Acknowledgments

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