

PREVALENCE, MANAGEMENT AND OUTCOME OF GASTROSCHISIS : A COMPREHENSIVE SYSTEMATIC REVIEW

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ABSTRACT

Background: Gastroschisis (GS) is a congenital abdominal defect that is usually located on the right side of the umbilical cord, characterized by the discharge of the intraperitoneal tube and other abdominal contents into the amniotic cavity, and ultrasonography reveals that the foetal bowel floats in the amniotic fluid. GS develops in the early embryonic period, and the cause of most gastroschisis cases is unknown.

The aim: The aim of this study to show about prevalence, management and outcome of gastroschisis.

Methods: By the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, this study was able to show that it met all of the requirements. This search approach, publications that came out between 2014 and 2024 were taken into account. Several different online reference sources, like Pubmed, SagePub, and Google Scholar were used to do this. It was decided not to take into account review pieces, works that had already been published, or works that were only half done.

Result: In the PubMed database, the results of our search get 7 articles, whereas the results of our search on SagePub get 128 articles, on Google Scholar 685 articles. Records remove before screening are 820, so we get 352 articles for screening. After we screened based on record exclude, we compiled a total of 10 papers. We included five research that met the criteria.

Conclusion: Basic management of neonates with gastroschisis entail wrapping the herniated viscera, either with a plastic/cling wrap or a homemade silo from a saline intravenous bag in institutions where preformed silo bags are not freely available. If the neonate is haemodynamically stable, not in respiratory distress and presents early to the facility, the reduction of herniated viscera and primary fascial closure would be attempted.

Keyword: Gastroschisis, congenital, abdominal, defect.

INTRODUCTION

Gastroschisis is a congenital malformation that causes the herniation of the intestines and other abdominal organs outside of the fetal abdominal cavity. The pathophysiology of this defect is not entirely understood and is attributed to a potential developmental disruption of the omphalomesenteric artery. Previous epidemiological studies attempted to determine the etiology of this defect. The most consistently identified risk factor is young maternal age (<20 years old). Additional established risk factors are maternal low education level, poverty, nulliparity, and low prepregnancy body mass index (BMI).^{1,2}

Rising rates of gastroschisis have been reported worldwide, with a well-recognized higher prevalence in younger women. From an incidence of 0.06–0.8 per 10,000 in the 1960s, gastroschisis has become more prevalent over the last few decades to its current rates of 4.5–5.13 per 10,000 pregnancies. Global variations in incidence have been reported, with 10.9 per 10,000 in Greenland and 29.9 per 10,000 in Mexico. Ethnic variations in incidence and evidence of regional or geospatial clustering have also been described. Controversy and conflicting reports have existed about the influence of terminations and misdiagnosis or incomplete data capture on reporting of the incidence of gastroschisis.^{3,4}

The reason for a higher prevalence of gastroschisis in the babies of a younger maternal age group is not clear. Studies investigating its association with factors such as maternal drug use, smoking, nutritional factors, paternal age, maternal infection, pesticide use and other environmental agents have not been conclusive, except that an association with smoking has been consistent.³

Gestational age and maternal smoking were found to be predictors of adverse neonatal outcomes. However, 28% of preterm infants were delivered following spontaneous preterm labor. The underlying etiology for spontaneous preterm labor is typically unknown, and may account in part for the worse outcomes observed in lower gestational age infants. Biologic plausibility for an association between smoking and gastroschisis include carbon monoxide exposure, vascular injury, and inflammatory changes.⁵

Prenatal ultrasound scans can diagnose gastroschisis as early as 12 weeks of gestation. Routine preterm delivery or elective cesarean section have not been shown to improve outcomes. Postnatal surgical management is directed towards reduction of the herniated viscera and closure of the abdominal wall. While the overall survival rates are well over 90%, prognosis depends on the condition of the bowel at birth. Infants with significant bowel damage at birth are “at-risk” for early death or adverse long-term outcomes.⁶

In the delivery room, it is critical to protect the herniated bowel by covering it in warm, saline-soaked gauze, placing it in a central position on the abdominal wall and covering with a plastic wrap or a plastic bag to decrease evaporative heat and fluid losses. The infant should preferably be positioned in the right lateral decubitus position to prevent vascular damage because of twisting of the mesenteric vascular pedicle.⁶

METHODS

Protocol

By following the rules provided by Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, the author of this study made certain that it was up to par with the requirements. This is done to ensure that the conclusions drawn from the inquiry are accurate.

Criteria for Eligibility

For the purpose of this literature review, we compare and contrast prevalence, management and outcome of gastroschisis. It is possible to accomplish this by researching or investigating prevalence, management and outcome of gastroschisis. As the primary purpose of this piece of writing, demonstrating the relevance of the difficulties that have been identified will take place throughout its entirety.

In order for researchers to take part in the study, it was necessary for them to fulfil the following requirements: 1) The paper needs to be written in English, and it needs to determine about prevalence, management and outcome of gastroschisis. In order for the manuscript to be considered for publication, it needs to meet both of these requirements. 2) The studied papers include several that were published after 2014, but before the time period that this systematic review deems to be relevant. Examples of studies that are not permitted include editorials, submissions that do not have a DOI, review articles that have already been published, and entries that are essentially identical to journal papers that have already been published.

Search Strategy

We used "prevalence, management and outcome of gastroschisis." as keywords. The search for studies to be included in the systematic review was carried out using the PubMed and SagePub databases by inputting the words: ("Gastroschisis"[MeSH Subheading] OR "Risk factor of gastroschisis"[All Fields] OR "Epidemiology of gastroschisis"

[All Fields]) AND ("Prevalence"[All Fields] OR "Management of gastroschisis"[All Fields]) AND ("Treatment"[All Fields]) OR ("Outcome of gastroschisis" [All Fields])) used in searching the literature.

Data retrieval

After reading the abstract and the title of each study, the writers performed an examination to determine whether or not the study satisfied the inclusion criteria. The writers then decided which previous research they wanted to utilise as sources for their article and selected those studies. After looking at a number of different research, which all seemed to point to the same trend, this conclusion was drawn. All submissions need to be written in English and cannot have been seen anywhere else.

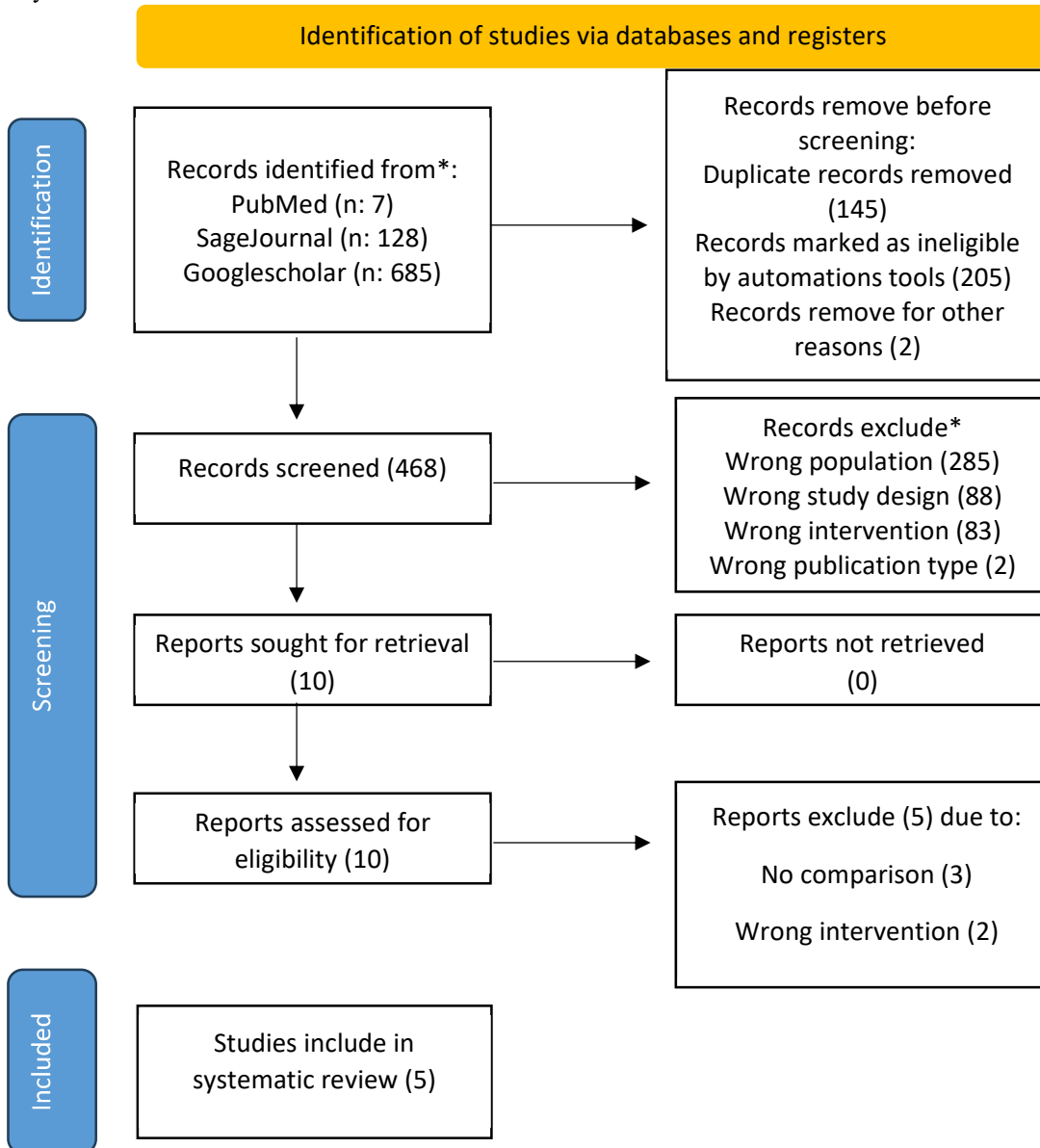


Figure 1. Article search flowchart

Only those papers that were able to satisfy all of the inclusion criteria were taken into consideration for the systematic review. This reduces the number of results to only those that are pertinent to the search. We do not take into consideration the conclusions of any study that does not satisfy our requirements. After this, the findings of the research will be analysed in great detail. The following pieces of information were uncovered as a result of the inquiry that was carried out for the purpose of this study: names, authors, publication dates, location, study activities, and parameters.

Quality Assessment and Data Synthesis

Each author did their own study on the research that was included in the publication's title and abstract before making a decision about which publications to explore further. The next step will be to evaluate all of the articles that are suitable for inclusion in the review because they match the criteria set forth for that purpose in the review. After that, we'll

determine which articles to include in the review depending on the findings that we've uncovered. This criteria is utilised in the process of selecting papers for further assessment. In order to simplify the process as much as feasible when selecting papers to evaluate. Which earlier investigations were carried out, and what elements of those studies made it appropriate to include them in the review, are being discussed here.

RESULT

From the PubMed database, the results of our search get 7 articles, whereas the results of our search on SagePub get 128 articles, on Google Scholar 685 articles. Records remove before screening are 820, so we get 352 articles for screening. After we screened based on record exclude, we compiled a total of 10 papers. We included five research that met the criteria.

Rasanen, L & Lilja, HE (2022)⁷ showed the management of gastroschisis according to our protocol was successful with high survival, no deaths in neonates born after 2005, and favourable results in LOS, duration on PN, and time on mechanical ventilation compared to other reports. Low GA, staged closure, sepsis, and intestinal atresia were independent predictors of impaired outcome measured by LOS and duration on PN. In addition, male sex was an independent predictor of LOS. The results from this study could contribute to further knowledge to the management and outcome in gastroschisis. Multicentre registry with long-term follow-up is required to establish the best management of gastroschisis.

Machaea, SS et al (2023)⁸ showed the majority of the neonates in this study were outborn and female. Although their mortality rate was higher than reported in high-income countries, it was much improved from what is reported in the low to middle income countries.

Table 1. The literature include in this study

Author	Origin	Method	Sample Size	Result
Rasanen, L & Lilja, HE., 2022 ⁷	Sweden	A retrospective observational study of neonates with gastroschisis born between 1999 and 2020 was undertaken.	114	In total, 114 patients were included. Caesarean section was performed in 105 (92.1%) at a median gestational age (GA) of 36 weeks (range 29–38) whereof (46) 43.8% were urgent. Primary closure was achieved in 82% of the neonates. Overall survival was 98.2%. One of the deaths was caused by abdominal compartment syndrome and one patient with intestinal failure–associated liver disease died from sepsis. None of the deceased patients was born after 2005. Median time on mechanical ventilation was 22 h. Low GA, staged closure, intestinal atresia, and sepsis were independent predictors of longer LOS and duration on PN. In addition, male sex was an independent predictor of longer LOS.
Machaea, SS et al., 2023 ⁸	South Africa	A retrospective observational study on all neonates with gastroschisis, presenting to a tertiary facility offering paediatric surgical services within the Eastern Cape Province from 1 January 2016 to	37	Thirty-seven neonates were included in the study. The prevalence of gastroschisis ranged from 0.07% to 0.18% throughout the 3-year study. The majority (81%) of the neonates were outborn and delivered by mode of caesarean section. Nearly 60% (n = 22) were female. 54% (n = 20) of neonates died within the neonatal period.

		31 December 2018.		
Benjamin, A et al., 2021⁹	UK	A secondary analysis was conducted of data collected 2006–2008 using the British Association of Pediatric Surgeons Congenital Anomalies Surveillance System, and 2005–2016 using the Canadian Pediatric Surgery Network.	341	Data from 341 British and Irish infants (27%) and 927 Canadian infants (73%) were used. 671 infants (42%) underwent PC and 597 (37%) underwent SR. The effect of SR on outcome varied according to the presence/absence of intestinal perforation, intestinal matting and intestinal necrosis. In infants without these features, SR was associated with fewer gastrointestinal complications [aIRR 0.25 (95% CI 0.09–0.67, $P = 0.006$)], more operations [aIRR 1.40 (95% CI 1.22–1.60, $P < 0.001$)], more days PN [aIRR 1.08 (95% CI 1.03–1.13, $P < 0.001$)], and a higher infection risk [aOR 2.06 (95% CI 1.10–3.87, $P = 0.025$)]. In infants with these features, SR was associated with a greater number of operations [aIRR 1.30 (95% CI 1.17–1.45, $P < 0.001$)], and more days PN [aIRR 1.06 (95% CI 1.02–1.10, $P = 0.003$)].
Calderon, MG et al., 2019¹⁰	Brazil	This is a population-based study with time trend, using official microdata of all cases of gastroschisis identified by the Live Births Information System (SINASC – Sistema de Informação sobre Nascidos Vivos) in São Paulo state, Brazil, from 2005 to 2016 and using data from the Unified Health System Department of Informatics (D ATASUS – Departamento de Informática do Sistema Único de Saúde),	1576	Trends of prevalence were evaluated for the specific subgroups using the Prais–Winsten regression model, and the Durbin–Watson test was used, to estimate the regression coefficient, the annual percent change (APC), and 95% confidence interval (CI). We observed 1576 cases of gastroschisis among 7,317,657 live births (LB), a prevalence of 2.154 (95% CI: 2.047–2.260) per 10,000 LB which included, 50.6% males, 67.4% Caucasians, 53.4% preterm births, and 80.9% caesarean births. The prevalence of gastroschisis significantly increased by 2.6% (95% CI: 0.0–5.2) per year, and this trend was higher in mothers aged 30–34 years (APC: 10.2, 95% CI: 1.4–19.4) than in mothers of other age groups. Between 2011 and 2016, we identified the existence of seasonality based on the date of conception in the middle months of the year ($p = 0.002$).

		maintained by the Ministry of Health of Brazil.		
Witt, RG et al., 2018¹¹	USA	A single-center cohort review was performed of all consecutive patients (n = 97) who underwent gastroschisis repair from February 1, 2007, to April 30, 2017, at the University of California, San Francisco.	97	In total, 97 patients (47 [48%] were female and 50 [52%] were male with a mean [SD] age of 2.8 [2.8] days) underwent gastroschisis repair, of which 7 were excluded for incomplete medical record. Of the 90 patients included in the study, 50 (56%) underwent sutured closure and 40 (44%) underwent sutureless closure. No statistical difference was found between the sutured and sutureless groups in length of hospital stay (mean [SD] days, 43.9 [40.4] vs 36.7 [21.2]; P = .71), time to full enteral feeds (mean [SD] days, 31.4 [20.2] vs 27.9 [17.3]; P = .22), total parenteral nutrition duration (mean [SD] days, 33.5 [29.8] vs 27.4 [18.2]; P = .23), wound infection rates (14 [28%] vs 10 [25%]; P = .81), and readmission rates (5 [10%] vs 7 [18%]; P = .36). The sutureless group, compared with the sutured group, had substantially fewer days receiving antibiotics (mean [SD], 7.2 [6.4] vs 12.4 [13.2]; P = .003), fewer days intubated (mean [SD], 2.8 [3.3] vs 6.8 [1.3]; P = .001), fewer days receiving intravenous analgesia (mean [SD], 4.2 [4.0] vs 7.1 [4.5]; P = .003), and fewer patients that required silo reduction (25 [63%] vs 48 [96%]; P < .001). Sutureless closures, compared with the sutured technique, had considerably more umbilical hernias requiring surgical repair (5 [13%] vs 0; P = .02).

Benjamin, A et al (2021)⁹ showed in infants without intestinal perforation, matting, or necrosis, the benefits of SR outweigh its drawbacks. In infants with these features, the opposite is true. Treatment choice should be based upon these features.

Calderon, MG et al (2019)¹⁰ showed an increasing trend of prevalence in São Paulo state in recent years, being higher in older mothers and in São Paulo city. The highest overall prevalence was in the Central–South cluster, and the lowest was in Taubaté administrative region. Significant seasonal variation of gastroschisis prevalence was found, being higher, when conceptions occurred during the winter months of the year during 2011–2016.

Witt, RG et al (2018)¹¹ showed sutureless repair of gastroschisis appears to be associated with a statistically significant reduction in mechanical ventilation duration and pain medication requirements but may increase umbilical hernia risk. Multicenter randomized clinical trials are necessary to determine the true advantages of the sutureless approach.

DISCUSSION

Gastroschisis is a paraumbilical abdominal wall defect associated with protrusion of the abdominal content through a defect which cause is not completely elucidated, but there is evidence of an abnormality in the formation and development of the ventral body wall during embryogenesis, resulting in bowel herniation. Patients with gastroschisis are associated with malformations outside the gastrointestinal tract in around 10% of the cases, and with abnormalities related to the gastrointestinal tract in up to 25% of cases.^{12,13}

Prenatal ultrasound can easily identify gastroschisis in a foetus, with the bowel floating in the amniotic membrane without covering the membrane. Neonates with gastroschisis are usually born mildly premature, but the overall survival rate for patients with gastroschisis is significant thanks to multidisciplinary treatment (MDT) by the antenatal ultrasound, neonatal intensive care, surgery, quality care, anaesthesiology, and obstetrics departments. However, there is no consensus on the timing of pregnancy termination, the prognosis of the foetus, or the modalities of surgical closure for gastroschisis, resulting in differences in procedures for the diagnosis and treatment of foetal gastroschisis.¹⁴

The higher burden of death is occurred in low- and middle-income countries (LMIC). In the LMIC, major congenital abdominal wall abnormalities (gastroschisis and omphalocele) accounted for up to 21% of emergency neonatal interventions. However, etiologic factors contributing to the development of these defects are unknown. Gastroschisis is a birth defect in which an infant's viscera stick out of the body through a defect, which is characterized by a diameter of less than 4 cm, the absence of a covering membrane or sac, and the presence of only the small intestine, sometimes with the stomach or gonad. It is almost always found to the right of the umbilical cord. Patients with gastroschisis, unlike those with omphalocele, are more likely to have bowel abnormalities, such as atresia but do not typically have associated congenital anomalies.¹⁵

Early management includes passage of a nasogastric (NG) tube to decompress the stomach and protect the airway, adequate fluid resuscitation, and bowel protection. In some units, the use of warm-saline soaked gauze is traditional although this in itself may promote heat loss after the warm saline cools. Nursing the neonate in a controlled thermal environment is important. To prevent further damage of the bowel by kinking of the mesenteric vessels prior to surgery, the baby is nursed in the right lateral position. Associated anomalies should intentionally be sought for.¹⁶

CONCLUSION

Basic management of neonates with gastroschisis entail wrapping the herniated viscera, either with a plastic/cling wrap or a homemade silo from a saline intravenous bag in institutions where preformed silo bags are not freely available. If the neonate is haemodynamically stable, not in respiratory distress and presents early to the facility, the reduction of herniated viscera and primary fascial closure would be attempted. A staged reduction would be done in those who are deemed not suitable candidates for closure with disproportion between the herniated bowel and abdominal cavity. Early primary fascial closure is the treatment of choice for gastroschisis and has been shown to decrease hospital stay total parenteral nutrition dependence and ultimately improve survival.

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