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Managing Patients with Gastroschisis Through Early Elective Caesarean Delivery

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ABSTRACT

Objective: Early elective caesarean (EEC) for patients with gastroschisis is controversial. Our objective was to compare gastroschisis complications in full-term patients and EEC-managed patients.

Methods: Ambispective study (2016-2021) of patients undergoing gastroschisis surgery in our centre. Data were collected on demographics, prenatal and perinatal factors, therapeutic approach, surgical technique, intraoperative and postoperative complications, and follow-up of all patients with prenatal or perinatal gastroschisis diagnoses.

Results: 3 EEC and 4 full-term interventions were performed on patients with gastroschisis. In the full-term group, mean birth weight was 2440 g [range 1800-2680] and APGAR score was 9 [range 8.5-9]. Peel was identified in all cases and intestinal content re-introduction was not possible due to excessive abdominal pressure, requiring silo use. Abdominal wall closure was completed at mean 11 days [range 8-15]. Respiratory support with mechanical ventilation was maintained for a mean 20 days [range 15-25]. Enteral feeding was started at mean 23 days [range 22-24], and parenteral nutrition was withdrawn in mean 55 days [range 45-72]. Mean hospital stay was 64 days [range 56-74]. In the EEC group, EEC was performed between weeks 34 and 36 (mean 34.75). Mean weight at birth was 2320 g [range 1700-2980] and APGAR score was 9.125 [range 9-9.5]. A single case of mild peel developed in an exteriorized intestinal loop. Primary defect closure was successful in all cases. Respiratory support with mechanical ventilation was maintained for mean [SD] 2 days [1-7]. Enteral feeding started at mean 2.75 days [range 2-4], and parenteral nutrition was withdrawn at mean 19 days [range 10-27]. Mean hospital stay was 26 days [range 14-34]. Overall survival in both groups was 100%.

Conclusion: EEC to treat gastroschisis seems to reduce perinatal complications, allows an early start to enteral nutrition, reduces the need for parenteral nutrition, and reduces hospital stay.

Keywords: Pathology; Pediatrics; Surgery; Nicu; Gastroschisis; Lung; Spontaneous; Polyhydramnios; Ultrasound; Omphalomesenteric

Abbreviations: APGAR: Activity-Pulse-Grimace-Appearance-Respiration; EEC: Early Elective Caesarean; NICU: Neonatal Intensive Care; SD: Standard Deviation

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Introduction

Gastroschisis is a prenatal abdominal wall defect in which the intestines exit the body from a hole in the abdomen, usually located to the right of the umbilical cord. Incidence as described in the literature is 2-5/1000 live births, and overall survival is 90% [1]. Embryologically, in gestation week 3, the digestive tube begins to form from the endo-dermal lamina and the yolk sac, and in week 5, intestinal expansion due to the cranio-caudal growth direction leads to stomach formation, then 90º counterclockwise rotation of the stomach and growth of the dorsal mesentery to create the greater omentum. Around week 6, the duodenum fuses to the dorsal wall and the omental sac forms. In week 7, the primitive loop begins to herniate in the navel, undergoing a first 90º rotation counterclockwise, then a second 180º rotation counterclockwise, facilitating intestinal content return to the abdominal cavity and reducing herniation by weeks 10-11. In week 12, the intestine is fixed to parietocolic gutters in the ascending and descending colon [1,2]. Among the most accepted theories explaining gastroschisis are failure of embryonic (so-matopleural) mesenchyme differentiation and intestinal fixation, anomalous involution of the right umbilical vein, disruption of the right vitelline (omphalomesenteric) artery in the umbilical region, and rupture of the amniotic membrane at the base of the umbilical cord. Gastroschisis can be complicated by intestinal atresia, by ischaemia, or by infarction of the intestine externalized by intestinal stenosis due to extrinsic defect compression, known as "vanishing gastroschisis" or "closed gastroschisis" [3,4].

Unlike what happens with an omphalocele, the gastroschisis abdominal wall defect is small (usually <4 cm). The herniated material is not covered by membrane and peel formation in intestinal loops in contact with amniotic fluid is typical. Hepatic herniation is infrequent, whereas intestinal prolapse and association with other malformations such as amniotic band syndrome. are 10%-15% (less than omphalocele) [4]. Gastroschisis is diagnosed prenatally in 90% of pregnancies controlled by ultrasound (normally conducted at around 14 weeks). Prenatal ultrasound factors associated with complicated gastroschisis include abnormal amniotic fluid volume, increased intestinal diameter, decreased intestinal motility, intrauterine growth retardation, and increased Doppler velocity of the superior mesenteric artery [5-9]. Perinatal factors associated with gas-troschisis are a first pregnancy, young maternal age, low socioeconomic status, vasoactive drug use, and maternal malnutrition [10,11]. Intestinal peel is an alteration of the intestinal wall that is produced by the chemical action of amniotic fluid in contact with the exposed intestinal loops [11]. Digestive enzymes dis-solved in the amniotic fluid irritate the intestinal loops, damaging the serosa and eventually the entire intestinal wall. Since these changes have been reported to normally appear from gestation week 34, premature birth via early elective caesarean (EEC) could prevent peel and improve perinatal patient prognosis [12-15]. However, the indication of EEC for patients with gastroschisis is controversial. Our objective was to compare gastroschisis complications in full-term patients and patients managed by EEC.

Material and Methods

We performed an ambispective study (2016-2021) of patients with gastroschisis operated on in our centre. The retrospective cohort (2016-2018) was composed of cases of gastroschisis and full-term delivery, and the prospective cohort (2019-2022) was composed of cases of gastroschisis and EEC at 34-36 weeks of gestation, except when an earlier EEC was indicated for obstetric reasons (severe foetal growth restriction, abnormal umbilical artery Doppler, sudden polyhydramnios, or spontaneous labour dynamics). For patients scheduled for EEC, foetal lung maturation was induced by administering ma-ternal intramuscular betamethasone in the days prior to surgery In both study groups, once gastroschisis was diagnosed, the pregnant mothers were monitored at 4-week intervals up to week 30. Thereafter, once weekly obstetric ultrasounds were performed until delivery. Monitoring by ultrasound mainly aimed to identify prognostic factors of foetal compromise, such as intestinal loop dilation, abnormal amniotic fluid volume, increased Doppler flow of the superior mesenteric artery, and intrauterine growth retardation. After birth, externalized loops were protected with non-contrast gauze and a protective ultrasound bag. After transfer to an incubator and stabilization in the neonatal intensive care (NICU), general Anaesthesia was administered prior to surgical repair. The procedure was performed in the neonatal operating room incubator, located in the NICU.

If, after introduction of intestinal content, increased abdominal pressure (intra-abdominal pressure >15 millimeters of mercury measured through the bladder catheter), respiratory distress, or poor perfusion was observed, a silo was used to defer abdominal surgical closure. Demographic data, prenatal factors, perinatal factors, therapeutic approach, surgical technique, intraoperative and postoperative complications, and outpatient follow-up of all patients with prenatal or perinatal diagnosis of gastroschisis were analyzed. The descriptive statistical analysis was carried out using SPSS V22.0. Results below are reported as means with range in square brackets except where otherwise indicated.

Results

During the study period, a total of 7 patients underwent surgery for gastroschisis, 3 in the full-term group and 4 in the EEC group.

Full-Term Group

A total of 3 patients underwent caesarean between weeks 36 and 38 [mean 37.1]. Weight at birth was 2440 g [range 1800-2680] and activity-pulse-grimace-appearance-respiration (APGAR) score was 9 [range 8.5-9]. Surgery was performed 9 hours after birth [6-15], and duration was 1.75 hours [range 1.5-2]. For all 3 patients in this group, intestinal review identified peel (1 in the

small intestine, and 1 inflammation of the cecum and appendicular area). The excessive increase in abdominal pressure and ventilation difficulties prevented intestinal content re-introduction, and so it was first necessary to widen the defect by means of a wide midline laparotomy and silo placement with the Alexis wound retractor XS (Applied Medical). The abdominal wall was closed at 11 days [range 8-15]. Maximum operative abdominal pressure in the first 48 hours exceeded 15 millimeters [range 14-20] of mercury in 2 cases. 1 case of complicated gastroschisis with multiple intestinal perforations in the small intestine required intestinal resection and primary end-to-end anastomosis. No case of entero-colitis was observed. Hospital stay was 64 days [range 56-74]. Respiratory support with mechanical ventilation was maintained for 20 days [range 15-25]. Enteral feeding was started at 23 days [range 22-24], and parenteral nutrition was withdrawn after 55 days [range 45-72]. During the hospital stay, bacteraemia due to infection of central catheters was reported in all 3 patients. During outpatient follow-up, no patient was readmitted due to symptoms of intestinal obstruction and no umbilical hernia was observed in any physical examination. Follow-up was 5.3 years [range 4-6.6]. Overall survival was 100% and no further surgical interventions was required during admission or follow-up.

EEC Group

A total of 4 patients underwent EEC, which was planned in all cases for between weeks 34 and 36 [mean 34.75]. Weight at birth was 2320 g [range 1700-2980] and the APGAR score was 9.125 [range 9-9.5]. Surgery started 3.25 hours [range 3-4] after birth, and duration was 1.35 hours [range 1-1.5]. Intestinal review identified a mild degree of peel in an exteriorized intestinal loop in only 1 case. Intestinal content was re-introduced without difficulty through the juxta-umbilical hole. Primary closure of the defect was successful in all cases. Maximum operative abdominal pressure in the first 48 hours of life did not exceed 15 millimeters [range 11-13] of mercury. Abdominal wall closure was achieved without tension and with a satisfactory aesthetic result. No complications with intestinal atresia or multiple perforations were identified. Hospital stay was 26 days [range 14-34]. Respiratory support with mechanical ventilation was maintained for 2 days [range 1-6]. No respiratory complication associated with gas-troschisis or with prematurity was observed, nor was enterocolitis observed. Oral feeding started at 2.75 days [range 2-4], and parenteral nutrition was withdrawn after 19 days [range 10-27]. During the hospital stay, bacteraemia due to central catheter infection developed in 1 patient. During outpatient follow-up, no patient was readmitted due to symptoms of intestinal obstruction and no umbilical hernia was observed in any physical examination. Follow-up of the patients was 2.5 years [range 1.6-3.8]. Overall survival was 100% and no further surgical intervention was required during admission or follow-up.

Discussion

Gastroschisis, a prenatal abdominal wall closure defect, is of unknown aetiology and has increased in incidence in the last decade.15 The literature describes different surgical approaches to this pathology. In our centre, EEC has been performed since 2019 and primary closure of the abdominal defect is attempted on the day of birth in the NICU. However, EEC as a standard treatment for gastroschisis is controversial. Several studies advocate full-term caesarean section as offering a better prognosis for patients with gastroschisis.11-14 Other studies, in contrast, advocate EEC at gestation weeks 34 to 36, since it reduces intestinal loop inflammation and peel formation.16-17 In our study, compared to the full-term group, peel formation was reduced in the EEC group (1 mild case) Possible benefits with EEC are that intestinal content can be re-introduced to the abdominal cavity during the same surgical procedure and the need for a silo is reduced. In all our EEC patients, re-introduction and primary defect closure were performed without difficulty, corroborating evidence reported elsewhere [16-18]. EEC reduces the risk of intestinal atresia and multiple intestinal perforations, allowing primary anastomosis to be performed in selected cases, with delayed closure of the abdominal wall [19-22]. In our study, 1 patient in the full-term group and no patient in the EEC group developed multiple intestinal perforations. EEC also reduces the period of intestinal hypoperistalsis, which means that oral feeding can start quickly and the number of days on parenteral nutrition can be reduced.

EEC also reduces the need for respiratory support, hospital stay duration, and hospital cost all parameters corroborated by our study [16-18]. From the diagnosis (mainly in the first trimester of pregnancy) of gastroschisis, our patients are assessed in a multidisciplinary manner by a Prenatal Anomalies Committee com-posed of professionals from the Gynaecology and Obstetrics Service and the Department of Neonatal Intensive Care, Genetics, and Paediatric Surgery. EEC planning by the committee ensures individualized and coordinated care focused on maternal and child safety. The committee establishes the best moment for the administration of maternal corticosteroids to induce lung maturation and reduce intestinal inflammation, allowing for rapid and efficient NICU transfer and pre-surgical preparatory work, and ultimately, an early approach to surgery under optimal conditions in the NICU incubator. The main limitation of this study is the small sample size due to the low incidence of this pathology.

Conclusion

EEC as a treatment strategy for patients with gastroschisis reduces intestinal loop inflammation and peel formation and facilitates intestinal content re-introduction to the abdominal cavity in the same surgical procedure without the need for silo placement. It also seems to allow an early start to oral feeding and achievement of full enteral

feeding, and reduces the days of parenteral nutrition, the number of total complications, and overall hospital stay.

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