GASTROSCHISIS: PRETERM OR TERM DELIVERY?

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ABSTRACT

Aim: The main objective of this study was to evaluate the association between prematurity and the time to achieve full enteral feeding in newborns with gastroschisis. The second objective was to analyze the associations between length of hospital stay and time to achieve full enteral feeding with mode of delivery, birth weight and surgical procedure.

Methods: The medical records of newborns with gastroschisis treated between 1997 and 2007 were reviewed. Two groups were considered: those delivered before 37 weeks (group A) and those delivered after 37 weeks (group B). The variables of gestational age, mode of delivery, birth weight, time to achieve full enteral feeding, length of hospital stay and surgical approach were analyzed and compared between groups.

Results: Forty-one patients were studied. In Group A, there were 14 patients with a mean birth weight (BW) of 2300 g (range=1680-3000) and a mean gestational age (GA) of 36 weeks (range=34-36). In group B, there were 24 patients with a mean BW of 2700 g (range=1500-3550) and a mean GA of 38 weeks (range=37-39). The mean time to achieve full enteral feeding was 30.1±6.7 days in group A and 17.0±2.5 days in group B (p=0.09) with an OR of 0.82 and a 95% CI of 0.20-3.23 after adjustment for sepsis and BW. No statistical difference was found between low BW (<2500 g), mode of delivery and number of days to achieve full enteral feeding (p=0.34 and p=0.13, respectively). Patients with BW over 2500 g had fewer days in the hospital (22.9±3.1 vs. 35.7±5.7 days; p=0.06).

Conclusion: The results of this study do not support the idea of anticipating the delivery of fetuses with gastroschisis in order to achieve full enteral feeding earlier.

Key words: gastroschisis, preterm, newborn, enteral feeding, perinatal outcome

INTRODUCTION

Gastroschisis is a rare congenital abdominal wall defect occurring in approximately one in 4000 live births. (10) This defect is usually situated to the right of the umbilicus. Infants with gastroschisis require surgical correction soon after birth to minimize abdominal fluid losses and infections, as well as to prevent further damage to the exposed bowel and other viscera. The modern era of treatment is one of the most remarkable success stories of medicine, in which advances in neonatal critical care, parenteral nutrition and pediatric surgical techniques have contributed to a documented survival rate of over 90% in patients with the condition. (2)

Gastroschisis may occur either as an isolated defect or can occur in association with other gastrointestinal anomalies, such as intestinal atresia, perforation, necrosis or volvulus. (2) These anomalies are likely secondary to prenatal bowel damage and are indicative of a worse prognosis. Recent studies have reported that several factors may adversely influence the outcome of these patients, such as vaginal delivery, lack of prenatal diagnosis, presence of other congenital anomalies, such as intestinal atresia, evolution to necrotizing enterocolitis (NEC) and surgical silo closure. (3,5,6,12) The major cause of morbidity in newborns with gastroschisis is related to the delay in the onset of intestinal functioning after surgical treatment. Although the mechanisms by which gastroschisis results in intestinal dysmotility and malabsorption are not completely understood, some authors suggest that the presence of an inflammatory peel on the surface of the bowel and a foreshortened mesentery may be related to bowel injury. (6)

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Recent studies suggest that amniotic fluid containing inflammatory mediators can be harmful to the developing bowel and that this effect may be dependent on the level and time of exposure to the amniotic fluid. This finding has led to the consideration of the early delivery of fetuses with gastroschisis, to minimize intestinal damage and improve outcomes. Nevertheless, this issue remains unproved and the data concerning it are inconsistent. (6,7)

The main purpose of this study was to evaluate the association between preterm birth and time to full enteral feeding in newborns with gastroschisis. As a secondary objective, we evaluated the association between time to full enteral feeding and length of hospital stay and other variables, such as prematurity, mode of delivery, birth weight and type of surgical procedure.

MATERIAL AND METHODS

Between January 1st, 1997 and June 30st, 2007, a retrospective study of all patients with gastroschisis treated at our Neonatal Intensive Care Unit (NICU), which is a tertiary referral centre for pediatric and neonatal surgery cases in the north of Portugal. Data were collected from medical records and included the following: gestational age at prenatal diagnosis, gestational age at delivery, mode of delivery, birth weight, surgical procedure, associated intestinal atresia or other congenital defects, development of necrotizing enterocolitis, time needed to achieve full enteral feeding, surgical complications, day of death and cause of death. The patients were separated into two groups: those delivered before (group A) and after (group B) 37 weeks of gestation. Both groups were compared using Student's t-test and the $\chi 2$-test. $P<0.05$ was considered to be statistically significant. The effect of birth weight and sepsis on the selected primary outcome was analyzed with logistic regression. The outcomes of the deceased newborns were excluded from this analysis.

RESULTS

Demographic data and data related to the treatment

During the study period, there were 41 patients with gastroschisis who were alive on admission to the NICU. The diagnosis of gastroschisis was made during the prenatal period in 38 patients (93%). The mean gestational age at diagnosis was 24.5 weeks (range=14-28 weeks). In this sample, 21 newborns were male (51%) and 20 were female (49%). The mean gestational age at delivery was 36.8 weeks (34-39 weeks), and the mean birth weight was 2485 g (range=1500-3550 g). Cesarean section was performed in 38 cases (93%), and vaginal delivery occurred in three cases (7%). Nine patients (22%) were affected by other congenital anomalies (Table 1). Primary closure was performed in 34 patients (83%), and silo closure was used in seven patients (17%). The mean number of surgical interventions was 1.4 (range=1-4). Two interventions were made in nine patients (seven of which were less than 2500 g), and three patients were submitted to three surgical interventions (two of which were less than 2500 g).

***TABLE 1**. Congenital anomalies (nine patients)*

	n
Intestinal	
Jejunal atresia	2
Heart	
Ventricular septal defect	2
Atrial septal defect	1
Urinary	
Pyelic dilatation	2
Others	
Palatine cleft	1¥
Retrognathia	1¥
Hand hypoplasia	1
Talipes equinovarus	1

¥ Same patient

Out of 41 patients, 4 presented with serious surgical complications, necrotizing enterocolitis (n=4) and surgical wound breakdowns (n=1). Of these, all had a birth weight of less than 2500 g. The mean period of mechanical ventilation was 4.6±1.7 days, and the mean period of parenteral nutrition was 22.8±3.5 days. The mean period of NICU stay was 29.5±3.7 days. Three patients died from multi-organ failure, with two being born before 37 weeks gestation. The survival rate at discharge was 92.6%.

Outcomes

Group A (n=14 patients, 37% of sample) had a mean birth weight of 2300 g (range=1680-3000 g) and a mean gestational age of 36 weeks (range=34-36 weeks); and group B (n=24 patients, 63% of the sample) had a mean birth weight of 2700 g (range=1500-3550 g) and a mean gestational age of 38 weeks (range=37-39 weeks). Data regarding time to total enteral feeding and NICU length of stay are shown in Tables 2 and 3, respectively. The mean time to achieve full enteral feeding was 30.1±6.7 days in group A and 17.0±2.5 days in group B (p=0.09). The logistic regression analysis of the effects of sepsis and birth weight on the primary outcome resulted in an odds ratio of 0.821 and a 95% confidence interval of 0.20-3.23.

TABLE 2. *Total enteral feeding and NICU length of stay*

	Group A (n=14)	*Group B (n=24)*	*p*
Parenteral nutrition Mean± SD (days)	30.1 ± 6.7	17.0 ± 2.5	0.09
NICU stay Mean± SD (days)	37.1 ± 6.9	24.3 ± 3.0	0.12

TABLE 3. *Association between mode of delivery, birth weight, and type of surgery with days of parenteral nutrition and NICU stay*

	Group	*n*	*Parenteral nutrition Mean ± SD (days)*	*p*	*NICU stay Mean ± SD (days)*	*p*
Mode of delivery	Vaginal	3	52.0 ± 21.7	0.34	57.5 ± 23.8	0.40
	Cesarean	35	19.2 ± 2.3		26.6 ± 2.6	
Birth weight	<2500 g	18	27.2 ± 5.6	0.13	35.7 ± 5.7	0.06
	≥2500 g	20	17.2 ± 2.7		22.9 ± 3.1	
Type of surgery	Primary closure	32	18.0 ± 3.0	0.01	24.7 ± 3.4	0.01
	Silo	6	42.5 ± 6.5		52.5 ± 3.9	

No statistical difference was found between low birth weight (<2500 g), mode of delivery and number of days to full enteral feeding. Patients delivered by C-section and those with birth weight over 2500 g had fewer days in the NICU (26.6±2.6 vs. 57.5±23.8; p=0.40 and 22.9±3.1 days vs. 35.7±5.7; p=0.06, respectively). Sepsis was more frequent in group A, although the difference was not statistically significant (10/14, 71.4% vs. 12/24, 50%; p=0.25).

DISCUSSION

There are several controversies concerning the ideal management of patients with gastroschisis, namely the optimal time to delivery. Prenatal diagnosis has emerged as an important tool, as it allows for the scheduling of procedures after birth. The number of patients who had received prenatal diagnosis in this series is in line with the literature and is dependent on the level of prenatal care received by the mother (4). Delivery by Cesarean section, followed by primary closure of the abdominal wall defect, whenever possible, is the most used approach and was indicated for a majority of our patients.

Our experience did not show significant differences with respect to time to achieve full enteral feeding in newborns born before or after 37 weeks of gestational age. Although limited by the small sample size, we were able to verify the association between primary surgical closure and a shorter time to achieve full enteral feeding. This finding may be due to the fact that patients in this group were simple cases (absence of intestinal associated anomalies) and presented with complications that were easily corrected. Patients who require the use of a silo are those in which a bulky gastroschisis does not allow for primary closure. In these cases, the herniation is precociously present in fetal life and results in significant bowel damage and a longer and more complicated postoperative period that is marked by closure of the abdominal wall defect several days after the silo construction. Abdullah et al. established two risk categories, simple and complex. These categories were based on the absence or presence of intestinal anomalies (e.g., intestinal atresia, stenosis, perforation, necrosis or volvulus). They demonstrated that patients classified as being complex had a longer hospital stay, required extensive hospital resources and had diminished survival. (2) A logistic regression analysis by Armord et al. concluded that the presence of other co-existing diagnoses, such as intestinal atresia, necrotizing enterocolitis, congenital heart defects and pulmonary hypoplasia, is associated with an unfavorable outcome. (3) A Canadian study demonstrated that gestational age, birth weight and conformity to an antenatal birth plan are predictors of outcome in gastroschisis. (11) In our study, three mortalities were secondary to multi-organ failure (two were sepsis related and one was associated with acute renal failure); of these, two were born before 37 weeks. Two patients with intestinal atresia died after multiple aggressive surgical interventions that resulted in intestinal resection.

In these two groups of patients, prematurity, mode of delivery and birth weight did not influence

the period of parenteral nutrition or the length of NICU stay. Our data are in accordance with several published studies, (1,8,9) although some controversy related to prematurity and low birth weight remains. (8) Further research in larger samples of babies born before 34 weeks should be conducted. This research would allow us to reach conclusions with higher statistical power and to take into account the biological plausibility of exposure of the herniated bowel to amniotic fluid.

Sepsis is a complication associated with significant morbidity in premature newborns. (10) In our series, as expected, a higher rate of sepsis was diagnosed in group A. Although without statistical power, this characteristic was not only dependent on the age of members of the group, but also on the fact that this group was a more complex group that required more complex surgical interventions. We must emphasize that this retrospective study has some limitations, such as a lack of ultrasound diagnosis of fetal wellbeing or signs of bowel compromise before birth and a lack of a precise evaluation of the obstetrical indications for the termination of pregnancy. Moir et al. prospectively studied 16 fetuses with gastroschisis on high resolution ultrasound. They scanned fetuses on a weekly schedule, beginning at a gestational age of 26 weeks, with well defined criteria based on characteristics of the fetal bowel and established indications for preparing for an early delivery. They concluded that signals of fetal bowel compromise were evident after 30 weeks and that the indication for elective C-section based on these criteria was associated with improved quality of postnatal surgical results without significantly increasing the morbidity related with prematurity. (7)

Despite the limitations and possible information bias, it is possible to conclude from our study that patients that require less invasive surgical techniques and have lower complication rates are those that may present with a favourable final outcome. Contrary to some published studies, we could not conclude from our results that anticipating delivery in these patients would result in a better outcome.

This study demonstrated no significant association between preterm delivery and time to achieve full enteral feeding. The results of this study do not support early delivery of fetuses with gastroschisis.

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