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Clinical report

Mirror-image gastroschisis in monochorionic female twins

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ABSTRACT

We report a case of "mirror-image" gastroschisis in female monochorionic twins. One of the twins presents a right-sided gastroschisis, the other a left-sided gastroschisis. Both twins have anteriorly placed anus and sacral dimple. To the best of our knowledge, this represents the first case of mirror image or discordant left and right gastroschisis in monochorionic twins reported in the literature. This observation may shed further light on the pathogenesis of gastroschisis.

1. Introduction

Gastroschisis is a herniation of abdominal content through a paramedian full-thickness abdominal defect [Jones et al., 2009]. During the past 30 years, its incidence has increased 10–20 fold worldwide, with clear regional variations [Bradnock et al., 2011; Valdèz et al., 2011].

The etiology of gastroschisis is still unclear. Five different theories have been proposed to explain the pathogenesis of this anomaly, but none of them is totally compatible with the current knowledge in human embryology [reviewed by Feldkamp et al., 2007; Valdèz et al., 2011]. Two main embryological hypothesis have been previously proposed: deVries [1980] suggested that abnormal involution of the right umbilical vein leads to adverse effects on the adjacent mesoderm, followed by the subsequent rupture of the body wall. In the second theory, Hoyme et al. [1981] suggest that gastroschisis results from an intrauterine interruption of the omphalomesenteric artery witch causes infarction and necrosis of the base of the umbilical cord, rupture of the body wall and intestinal herniation through the defect.

More recently, Feldkamp et al. [2007] suggested that gastroschisis could be considered as a ventral body wall malformation rather than a vascular disruption.

Right-sided gastroschisis is the most common form, the left-sided one being exceptional. In fact, only about 20 cases of left-sided gastroschisis were reported from 1988 to 2010 [Mandelia et al., 2013].

We report monochorionic female twins who both presented at birth a gastroschisis, but discordant regarding the right/left sided location.

2. Clinical report

Diamniotic monochorionic female twins were vaginally born at term and referred to us on day three for gastroschisis. The parents are not consanguineous, the father was 28 years old, the mother 19 years. They had an elder brother, alive and healthy. Family history is negative with regard to congenital malformations.

The mother denied substance abuse (alcohol or tobacco) and there were no infections during pregnancy. However, the mother did not have any prenatal consultation during pregnancy nor did she receive the required periconceptional folic acid supplementation. On clinical examination, both twins were small for date, with weight 1900 g (−2, 7 SD − CDC growth chart), length 49 cm (P50) and head circumference 35 cm (P50). There was no facial

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dysmorphism. A large abdominal wall defect was noted in both twins (Fig. 1). In the first twin, the abdominal wall defect was situated on the right side, 2 cm from an intact umbilical cord and there was a herniation of the liver together with oedematous and thickened small bowel loops. In the second twin, the defect was left-sided, about 2.5 cm from the umbilical cord with evisceration of oedematous small bowel loops. The clinical examination also revealed an anteriorly placed anus (Fig. 2). A lumbosacral dimple was observed in both of them, possibly indicating an underlying lumbosacral spine defect. No radiographs could be obtained (Fig. 3). They died on day 4 and day 6, respectively, before any surgery could be performed because they were in a very poor medical condition, with already seriously affected small bowel.

3. Discussion

We here report the unique observations of female monochorionic twins who were concordant for a gastroschisis, but discordant regarding the left or right sided position. Whereas in one twin the defect was right sided, as most commonly seen, in the other it was on the left side, which is exceptional. Thus the monochorionic twins presented a “mirror-image” gastroschisis.

This observation may shed light on the pathogenesis of gastroschisis. Currently, the exact etiology of gastroschisis is not well understood. The first report of a gastroschisis in twins reported a male and female dizygotic twins concordant for a right-sided gastroschisis [Sarda and Bard, 1984]. More recently, Bugge et al. described for the first time a pair of monozygotic female twins discordant for a right-sided gastroschisis [Bugge et al., 1994].

In a twin study, Schultz et al. [2012] found that the concordance rate was not significantly different amongst dizygotic twins (4 out of 8 twins) compared to monozygotic twins (2 out of 5 twins reported). If we include our case with concordant gastroschisis, 3 out of 6 monozygotic twins are concordant, which is equal the concordance observed in dizygotic twins. However, it should be noted that the number of reported twins with gastroschisis is very small so we cannot evaluate the relative contribution of genetic versus environmental factors. One of the non-genetic factors identified is young maternal age, with an increased risk (7 times) for the mothers between the ages 14 and 19. In our case, the young maternal age (19 years) might have contributed to the gastroschisis [Valdéz et al., 2011]. How young maternal age may influence the risk is not known, but some studies reported an association with life-style factors, e.g. consuming alcohol, cocaïne and tobacco [Polifka and Friedman, 1999], medication such as misoprostol and cyclooxygenase inhibitors like aspirin and Ibuprofen and pseudoephedrine during pregnancy. [Polifka and Friedman, 1999; Werler, 2006; Werler et al., 2002].

The world-wide increase in incidence of gastroschisis during the last ten years may be related to unknown risk factors related to the lifestyle in young mothers. This association with vasoactive agents supports a vascular disruption pathogenesis, at least in a subset of cases [Torfs et al., 1996].

A vascular disruption would also explain the frequent association of gastroschisis with intestinal atresia and stenosis, also thought to have a vascular disruption origin [Werler et al., 2002]. There was no history of exposure to any of these substances in our case. However, the mother did not receive periconceptional folic acid supplementation. Some authors consider this supplementation as having a protective effect [Paranjothy et al., 2012].

Beside those non-genetic factors, a multifactorial origin of gastroschisis is suggested by the existence of familial cases, with an empiric recurrent risk of 3, 5%, and the observed positive association between gastroschisis and variants in genes linked to angiogenesis [Feldkamp et al., 2007]. Feldkamp et al. [2007] suggested an unifying hypothesis on the origin of most ventral wall defects, including gastroschisis, cloacal exstrophy or ectopia cordis. These authors furthermore suggested that the different processes that impact ventral wall closure might also contribute to neural tube closure [Feldkamp et al., 2007].

This could explain the concomitant presence of gastroschisis and sacral dimples in both monozygotic twins in our observation.

One intriguing observation is the “mirror-image” position of the gastroschisis in these monochorionic twins. This has not been reported before. Several monozygotic twins have been reported with mirror-image unilateral malformations in other organs or regions of the body (see Table 1). This may suggest a pathogenic

Fig. 1. (A) large anterior abdominal wall defect on patient’s the right side of the umbilical cord with an eviscerated, oedematous and thickened liver and part of the small bowel loops for the first twin. (B) In the second twin, the abdominal wall defect was on patient's left side of the umbilical cord with eviscerated and oedematous small bowel loops.