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Segmental volvulus in the neonate: A particular clinical entity

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ABSTRACT

Background: Complete intestinal volvulus is mainly related to congenital anomalies of the so-called intestinal malrotation, whereas segmental volvulus appears as a distinct entity, mostly observed during the perinatal period. Because these two situations are still lumped together, the aim of this study was to describe the particular condition of neonatal segmental volvulus.
Study design: We analyzed the circumstances of diagnosis and management of 17 consecutives neonates operated for segmental volvulus more than a 10-year period in a single institution. During the same period, 19 cases of neonatal complete midgut volvulus were operated.
Results: Prenatal US exam anomalies were observed in 16/17 (94%) of segmental volvulus, significantly more frequently than in complete volvulus ($p = 0.003$). Intestinal malposition was described peroperatively in all cases of complete volvulus, but also in 4/17 segmental volvulus (23%). Intestinal resection was performed in 88% of segmental volvulus when only one extensive intestinal necrosis was observed in complete volvulus. Parenteral nutrition was required in all patients with segmental volvulus with a median duration of 50 days (range 5–251).
Conclusion: Segmental volvulus occurs mainly prenatally and leads to fetal ultrasound anomalies. This situation, despite a limited length of intestinal loss, is associated to significant postnatal morbidity.
Type of the study: Treatment study.
Level of evidence: Level IV.

Anomalies of gut development (i.e. "malrotation", or rather *malposition* according to Kluth et al.) causing a narrowed small bowel mesenteric root result in an unstable position of the gut which is considered as the major cause of volvulus, with a risk of extensive intestinal necrosis [1]. Complete midgut volvulus can then lead to irreversible intestinal necrosis and extensive resection may be needed. Thus, it is recognized as one of the three most common causes of short bowel syndrome in the pediatric population, after necrotizing enterocolitis and intestinal atresia [2,3]. In 80% of cases, complete volvulus occurs before the first year of age and among them, 60% are diagnosed before the end of the first month of life [4].

Segmental volvulus is currently considered as a distinct entity. In children, small bowel volvulus is found to be secondary: congenital or postoperative bands, duplication cyst, internal herniation, … [5,6]. In the neonatal period, the intestinal obstruction is usually associated to intestinal atresia, that appears to be the consequence of the ischemia, and the epidemiology of the volvulus is poorly known [7]. In the neonatal period, the clinical presentation of complete and segmental forms is quite similar apart the fact that abdominal distension is usually absent in complete volvulus [8].

In the literature, midgut volvulus often recovers different clinical entities, which are not well identified and may lead to confusion in the prenatal counseling and postnatal management [9]. Segmental and complete volvulus is still lumped together, with numerous examples of authors using the term of *midgut volvulus* for segmental forms [10]. The objective of this study was to assess the clinical features associated with segmental volvulus. The specificity of this condition was

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Table 1
Comparison of complete and segmental volvulus characteristics.

	Complete volvulus	Segmental volvulus	
	$N = 19$	$N = 17$	$N = 36$
Abnormality on prenatal US	2 (10%)	16 (94%)	$P = 0.003$
Bowel dilation	0	9 (53%)	
Polyhydramnios	1 (5%)	5 (29%)	
Abdominal mass	0	3 (18%)	
Hyperechogenic bowel	1 (5%)	0	
Mesenteric vessels anomaly	0	0	
Whirpool sign	0	0	
Preoperative characteritics			
Gestational age	37 WG (31–40)	34 WG (30–40)	$P = 0.01$
Birth weight	3265 ± 565 g	2615 ± 680 g	$P = 0.007$
Genders	$M = 12$; $G = 7$	$M = 8$; $G = 9$	
Onset of instestinal symptoms	6.4 days (0–31)	0.6 days (0–3)	$P = 0.001$
Abdominal distension	4 (21%)	11 (68%)	$P = 0.01$
Surgery without postnatal imaging	0	9 (53%)	
Postnatal imaging	19 (100%)	8 (47%)	
US	17	4	
Whirpool sign	11 (64%)	0	–
Mesenteric vessels inversion	1 (6%)	0	–
Abdominal mass	0	2 (50%)	–
Inconclusive or normal	5 (26%)	2 (50%)	–
Upper gastrointestinal contrast	14	4	
Duodenojejunal obstruction	3 (22%)	1 (25%)	–
Abnormal duodenojejunal junction	11 (78%)	1 (25%)	–
Normal	0	2 (50%)	–
Postoperative outcome			
Death	1 (6%)	0	–
Patients requiring parenteral nutrition	4 (21%)	17 (100%)	
Duration of parenteral nutrition	1.5 (0–28)	50 (5–251)	$P < 0.001$
Length of stay (days)	10 (5–54)	59 (8–341)	$P = 0.001$

discussed by comparing the prenatal data, management and outcome with a population of neonates operated in the same period for a complete midgut volvulus.

1. Methods

1.1. Population

The medical records of all the patients who underwent surgery for intestinal volvulus within the first month after birth in our pediatric surgery department from 2004 to 2014 were retrospectively reviewed.

Inclusion criteria were: infants admitted to our surgical unit, surgery performed by one of the senior physician of our surgical team and confirmed volvulus based on peroperative anatomical descriptions. Exclusion criteria were: infants with abdominal wall defects or diaphragmatic hernia and infants operated in another hospital or unit.

1.2. Data collection

Information for the pre- and postnatal periods was retrieved from the medical records by two persons (BM and NKD). Gestational age was defined as number of weeks of gestation based on early US examination or date of last menstrual period.

During the surgical procedure, reduction of volvulus was associated to mesenteric position assessment. When small bowel infarction was present, intestinal resection was performed and either followed by immediate anastomosis or not. Two different types of volvulus were described based on peroperative description: complete midgut volvulus involving the entire intestine from duodenojejunal junction to distal ileum linked to intestinal malposition, and segmental volvulus that involved only a part of the small bowel, irrespective of the mesenteric pattern.

1.3. Ethics

Our institutional review board has approved the study.

1.4. Statistical analysis

Statistical analyses were performed with Statview 5.0 software (SAS Institute Inc., NC). Qualitative variables were expressed as percentages and quantitative variables as medians and extremes. We considered the two types of volvulus (i.e. complete and segmental) as two separates entities and compared prenatal features, management and outcome between these two groups. Discontinuous data were

Fig. 1. Segmental midgut volvulus. Peroperative view. The mesenteric root and the intestinal position are normal. A jejunal loop is involved in a segmental volvulus with intestinal necrosis.