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## GASTRIC VOLVULUS IN CHILDREN

THESE

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# VOLVULUS GASTRIQUE CHEZ L'ENFANT

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## **But:**

Revoir les cas d'enfants ayant présenté des épisodes de volvulus gastriques au cours des dix dernières années.

## **Matériel et méthode :**

Les dossiers de tous les enfants ayant présenté un volvulus gastrique dans notre institution de 1992 à 2003 et subséquemment opérés pour cette pathologie ont été revus. 21 enfants étaient concernés, dont l'âge variait entre 0.2 mois et 4.3 ans.

## **Résultats :**

Les symptômes initiaux consistaient en des épisodes de douleurs abdominales postprandiales aiguës, des vomissements ou des épisodes de malaises aigus associés à une pâleur, une cyanose et une hypotonie. Le diagnostic a été établi par transit oesogastroduodéal, démontrant dans tous les cas un volvulus organo-axial dès le premier examen. Le traitement a consisté en une gastropexie antérieure et tubérositaire associées à une réfection de l'angle oesophago-gastrique de His réalisée par laparoscopie chez 13 enfants. Pour 8 autres, la même procédure a été réalisée de façon conventionnelle ouverte (1 laparoscopie convertie en technique conventionnelle). 3 enfants ont eu une correction de reflux gastro-oesophagien (RGO) d'emblée par chirurgie ouverte. Tous les enfants ont bénéficié d'un traitement médicamenteux anti-reflux pendant au moins 1 mois après l'intervention.

Le suivi post-opératoire s'étend de 4 mois à 4.8 ans. 2 enfants opérés par laparotomie ont été réopérés en raison de RGO persistant. Tous les enfants ne présentent plus aucun symptôme ni reflux résiduel.

## **Conclusion :**

Le volvulus gastrique est une réalité clinique et radiologique qui peut être traitée par une gastropexie. La réalisation d'un montage anti-reflux de première intention n'est pas une nécessité. La gastropexie laparoscopique est une bonne option, car elle suffit dans la majorité des cas et permet une fundoplication par laparoscopie itérative seulement en cas de nécessité.



# Gastric volvulus in children

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## Index words:

Children;  
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## Abstract

**Purpose:** The aim of the study was to review the records of all children who presented with gastric volvulus in the past 10 years.

**Methods:** The study group consisted of 21 children with an age range from 0.2 months to 4.3 years who were operated for gastric volvulus from 1992 to 2003.

**Results:** Initial symptoms included acute abdominal pain after meals, vomiting, and in 8 cases, acute apnea associated with pallor, cyanosis, and hypotonia. After the first episode, barium studies revealed an organoaxial gastric volvulus in all cases. The surgical procedure was an anterior gastropexy with reinforcement of the esophagogastric angle performed by laparoscopy in 13 cases and by laparotomy in 8 (1 converted laparoscopy). An associated antireflux fundoplication was done in 3 patients. All children received postoperative antireflux medication for at least 1 month. The follow-up ranged from 4 months to 4.8 years. Two children in the laparotomy group required reoperation (Toupet fundoplication) for persistent gastroesophageal reflux disease. All children are currently symptom-free and without treatment.

**Conclusions:** Gastric volvulus is a clinical and radiological reality, which can be treated by a gastropexy. Initial fundoplication is not mandatory. The laparoscopic gastropexy is a good option and allows a repeat laparoscopic procedure if needed.

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Acute gastric volvulus in newborns and infants is known as a rare but life-threatening emergency that requires prompt recognition and treatment. It may also present as subacute or chronic problem and may be underdiagnosed. Gastric volvulus can be defined as a torsion of more than 180° of the stomach around itself (Fig. 1).

Although successful results were reported with non-operative treatment, most studies recommend a surgical

approach to prevent recurrence. Different surgical procedures, including laparoscopy, have been described in adults and children.

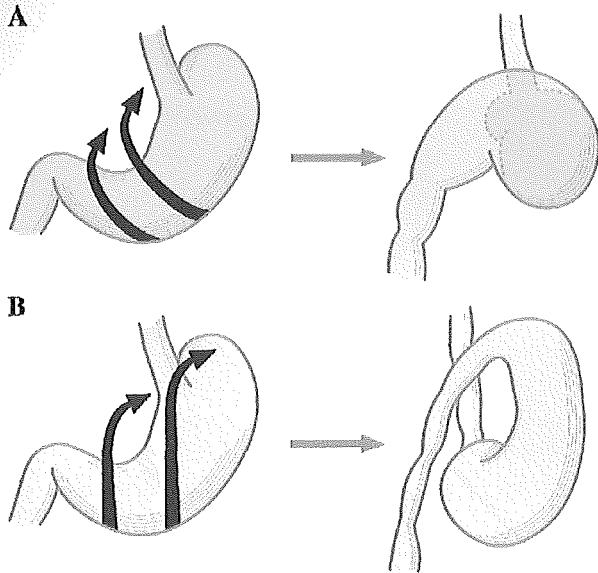
The aim of this retrospective study is to define the modalities leading to an early diagnosis of gastric volvulus and to present its operative management in children.

## 1. Subjects and methods

Between 1992 and 2003, 21 children presenting with an acute gastric volvulus were admitted and subsequently treated in the Department of Pediatric Surgery of the University Hospital of Lausanne (CHUV), County of Vaud,

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**Fig. 1** Organo-axial (A) and mesenteroaxial (B) gastric volvulus.

Switzerland. Their medical records were reviewed regarding age, sex, initial presentation of the disease, diagnostic criteria, treatment, and follow-up.

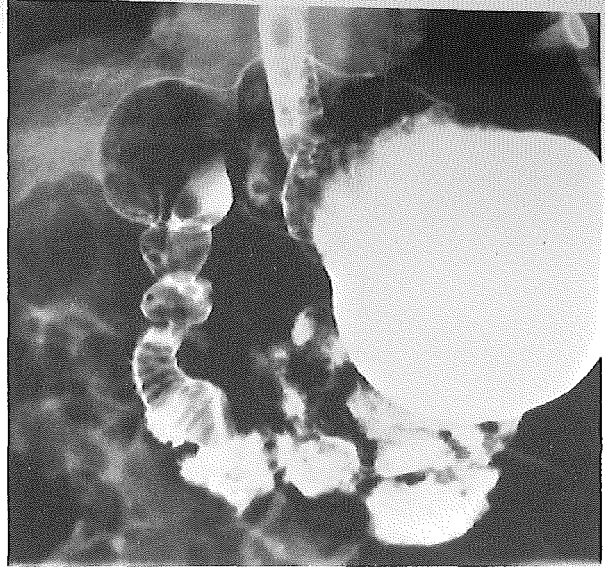
## 2. Results

Over the 10-year period, the age at admission varied between 1 week and 4.3 years with an average of 6.3 months and a median of 3 months. The male/female ratio observed in this cohort was 16:5.

Clinical presentation included postprandial abdominal pain with crying (13/21); repeated vomiting (12/21); painful bloating (3/21); acute neurovegetative crisis with pallor, hypotonia, and ocular revulsion (8/21); and even a cardiorespiratory arrest in a 3-month-old patient.

Diagnosis was done by upper gastrointestinal contrast studies. The radiological signs observed in all cases included horizontalness of the stomach, the greater curvature being above the lesser one and crossing in front of the lower esophagus with the pylorus looking downward. All reported cases presented with an organoaxial volvulus type (Figs. 2 and 3).

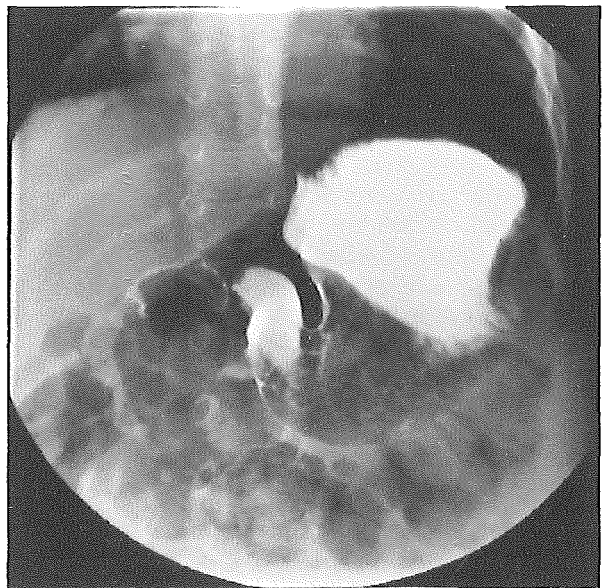
The surgical procedure for each case involved 3 steps: an esophagocardiopexy, followed by a phrenofundopexy and an anterior gastropexy (Fig. 4). A midline laparotomy was used in 7 children. For the other 14 patients, the laparoscopic approach was chosen, using 3 ports with 3-mm instruments and a 4-mm × 25° telescope. In this group, 1 procedure was converted to laparotomy because of anesthetic problems. Gastrocolic ligament laxity (17/21) and even its complete absence (4/21) were observed during intervention. Three funduplications were performed during the same procedure related to a gastroesophageal reflux



**Fig. 2** Boy, 1 month old. Upper gastrointestinal series showing a gastric volvulus. Notice the great curvature in front of the lower esophagus and the pylorus facing downward.

disease (GERD); 2 of them for severe esophagitis and 1 after a previous repair of a posterior diaphragmatic hernia with left crus defect.

After surgery, all patients were treated with antacids and prokinetics during 1 to 2 months. The follow-up period ranged from 10 months to 5.4 years. To date, 3 of the 18 children who did not have an associated fundoplication at the time of the surgery needed laparoscopic reoperation to treat persistent GERD, 1 of them with a paraesophageal



**Fig. 3** Same patient, 1 month postoperative.

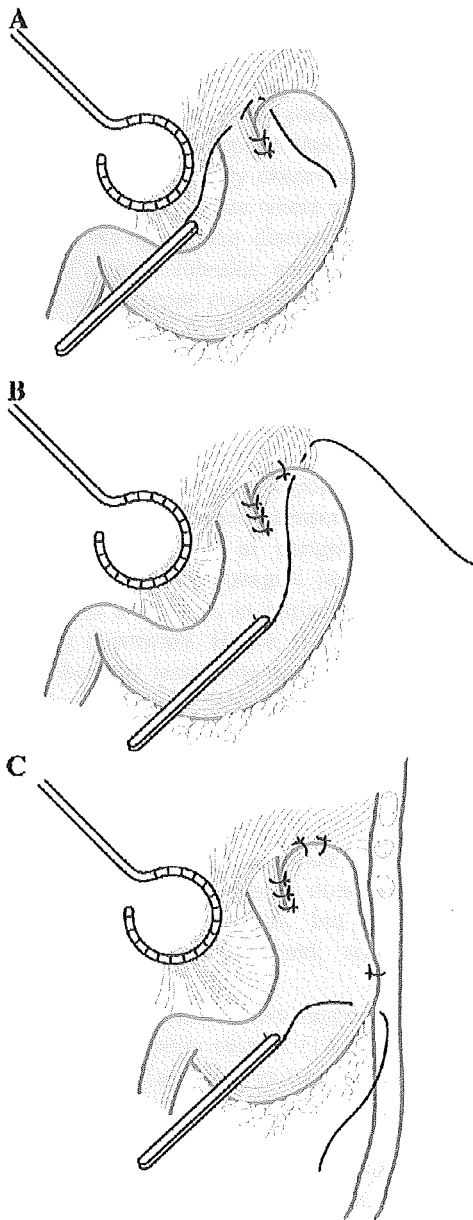


Fig. 4 Surgical procedure: esophagocardiopexy (A), phrenofundopexy (B), and anterior gastropexy (C).

hernia. All children are currently free of symptoms without medical treatment.

### 3. Discussion

Gastric volvulus is a rare disease, especially among the pediatric population. The first description of this condition was made in 1866 by Berti [1] based on the autopsy of a 61-year-old woman. Oltmann [2] described the first pediatric patient in 1899. To date, more than 150 gastric volvulus in children have been described [3-6].

Gastric volvulus can be defined as a torsion of more than  $180^\circ$  of the stomach around its short or long axis [7]. The normal stomach is fixed and prevented from rotation by its ligaments: the gastrophrenic ligament, the gastrohepatic ligament, the gastrosplenic ligament, the gastrocolic ligament, and the peritoneal fixation of the duodenum. Absence or loosening of these anatomic attachments results in abnormal mobility of the stomach. Gastric volvulus is related to the absence or laxity of the gastrocolic and gastrosplenic ligaments as demonstrated on cadavers by Dalgaard [8]. The etiology can be a primary defect of these attachments. Congenital diaphragmatic hernia, paraesophageal hernia, or a wandering spleen are the main secondary causes for this condition [6,9,10]. Most patients (17/21) in this study presented a gastric volvulus caused by elongation of gastric ligaments. Complete absence of gastrocolic ligament was found in 4 of them, 1 with congenital diaphragmatic hernia and 1 with paraesophageal hernia.

Three types of gastric volvulus have been described depending on the rotation axis: organoaxial volvulus, mesentericoaxial volvulus, and the combination of both types [3,9]. Most of mesentericoaxial volvuluses in children are secondary to diaphragmatic hernia or wandering spleen [9,11]. The organoaxial type is more often found in primary conditions [12]. All children in our series had the organoaxial type, even those with a congenital diaphragmatic hernia and paraesophageal hernia. These findings do not correlate with the 5 cases reported by Mayo and the literature review done by Miller [3] in which the majority of the children had a mesentericoaxial volvulus. This could be explained by the fact that all had a defect or even a complete lack of the gastrocolic attachment, which predisposes to this type of volvulus.

Both chronic recurrent and acute gastric volvuluses have been reported. Clinical findings appear to be related to the degree of rotation and subsequent gastric obstruction. Symptoms of chronic volvulus are nonspecific and include recurrent abdominal pain, vomiting, and gastric distension. Episodic sudden pain instantly relieved when the child is taken in the upright position can often be found in the patient history. The chronic form is therefore probably associated with spontaneous devolvulation of the stomach until it becomes acute and irreversible. Borchardt triad described for acute gastric volvulus in adult and consisting of severe epigastric distension, intractable retching (nausea or vomiting), and inability to pass a nasogastric tube was not verified in this pediatric study [13]. Like other pediatric reports in the literature, nasogastric tube placing was always possible [14,15]. An association of recurrent abdominal pain with nonbiliary vomiting and hematemesis was reported by Samuel [16]. This was not substantiated in our study, probably because these clinical findings are often isolated. Furthermore, hematemesis appears only in a late stage of the disease as a consequence of ischemia [15]. Eight children seen at our institution had acute vegetative symptoms with hypotonia, pallor, and ocular revulsion associated to a more

classical picture of the disease. This may be correlated with GERD symptoms induced by gastric volvulus as reported by Samuel [16]. These findings suggest a vagal reflex triggered by direct irritation of the parasympathetic nervous system during volvulus. It appears that these acute clinical findings were more frequently observed in newborns and infants, particularly in the case where prompt resuscitation was needed. This opens the discussion to the possible association of gastric volvulus and sudden infant death syndrome, in which prone position has been recognized to be a predisposing factor. In infants with gastric attachments defects, prone position may lead to a gastric volvulus and subsequently trigger a parasympathetic stimulation.

Subacute or chronic gastric volvulus have nonspecific symptoms, as seen in our patients. Such repeated symptoms should lead to radiological upper gastrointestinal studies [14,15]. Whereas mesentericoaxial volvulus is revealed by a stomach in upright position with a pylorus above the gastroesophageal junction, the organoaxial type shows a stomach in horizontal position with a pylorus facing downward. Hence, the greater curvature is seen higher than the lesser one and in front of the lower portion of the esophagus. Because of its high specificity, this imaging technique should be promptly used to achieve diagnosis and therefore avoid any further complications such as bronchoaspiration, vagal manifestations, or gastric ischemia [1,2,17]. The same radiological signs need to be searched with suspected chronic volvulus. Absence of radiological evidences does not exclude the possibility of recurrent volvulus, but as soon as the diagnosis is objectively confirmed, surgical treatment should be performed.

Although previous authors have suggested nonoperative treatment with nasogastric suction [12,15], most of them recommend a surgical approach in case of acute volvulus to avoid recurrences and complications [3,4]. Operative treatment includes reduction, correction of underlying predisposing factors, and gastropexy. Several procedures have been described in adults, including minimal invasive surgery by laparoscopy with good results. Some authors recommend an associated fundoplication because of the frequency of GERD encountered when gastropexy was performed alone. The operating procedure used in our study was a triple gastropexy (anterior, phrenofundopexy, esocardiopexy) without a fundoplication (Fig. 4). The aim of the esocardiopexy is to prevent the opening of the His angle induced by the 2 previous steps of the procedure, which could provoke or worsen a GERD. Three children in this cohort had an initial fundoplication, and 3 others underwent further surgery with Toupet fundoplication because of persisting GERD. The other 15 patients had normal upper gastrointestinal studies 1 or 2 months postoperatively. In view of these results, it appears that a primary gastropexy

without fundoplication seems to be a good option, although parents have to be informed of the risk of an additional operation to perform a fundoplication in case of persisting reflux disease. When the initial procedure is done by laparoscopy, subsequent intestinal adhesences are less likely.

#### 4. Conclusions

Gastric volvulus is a clinical emergency which can be life-threatening for children. Prompt diagnosis is of major importance to avoid any further complication as seen in the acute form of the disease. Repeated upper gastrointestinal studies are the gold standard in case of suspicion aroused by sudden vomiting, acute vegetative manifestation, intractable retching, and acute abdominal pain. Gastropexy is the key to definitive treatment and need not be combined with an antireflux procedure in the first intention. This procedure can be done by open or laparoscopic approach, the latest being a minimal invasive surgical procedure that would not hinder further surgical procedures.

#### References

- [1] Berti A. Singolare attortigliamento dell'esofago col duodeno seguito da rapida morte. *Gazz Med Ital* 1866;9:139-41.
- [2] Oltman H. Kiel, inaugural discussion; 1899. Reported in [5].
- [3] Miller DL, Pasquale MD, Seneca RP. Gastric volvulus in the pediatric population. *Arch Surg* 1991;126:1146-9.
- [4] Youssef SA, Di Lorenzo M, Yazbeck S, et al. Gastric volvulus in children. *Chir Pediatr* 1987;28:39-42.
- [5] Mayo A, Erez I, Lazar L, et al. Volvulus of the stomach in childhood: the spectrum of the disease. *Pediatr Emerg Care* 2001;17:344-8.
- [6] Karande TP, Oak SN, Karmarkar SJ, et al. Gastric volvulus in childhood. *J Postgrad Med* 1997;43:46-7.
- [7] Tanner NC. Chronic and recurrent volvulus of the stomach. *Am J Surg* 1968;115:105-9.
- [8] Dalgaard JB. Volvulus of the stomach. *Acta Clin Scand* 1952;103:131-6.
- [9] McIntyre RC, Bensard DD, Karrer FM. The pediatric diaphragm in acute gastric volvulus. *J Am Coll Surg* 1994;178:234-8.
- [10] Spector JM, Chappell J. Gastric volvulus associated with wandering spleen in a child. *J Pediatr Surg* 2000;35:641-2.
- [11] Uc A, Co SC, Sanders KD. Gastric volvulus and wandering spleen. *Am J Gastroenterol* 1998;93:1146-8.
- [12] Honna T, Kamii Y, Tsuchida Y. Idiopathic gastric volvulus in infancy and childhood. *J Pediatr Surg* 1990;25:707-10.
- [13] Borchardt M. Zur pathologie und therapie des magen. *Arch Klein Chir* 1904;74:243-60.
- [14] Cameron AE, Howard ER. Gastric volvulus in childhood. *J Pediatr Surg* 1987;22:944-7.
- [15] Elhalaby EA, Mashaly EM. Infants with radiological diagnosis of gastric volvulus: are they over-treated? *Pediatr Surg Int* 2001;17:596-600.
- [16] Samuel M, Burge DM, Griffiths DM. Gastric volvulus and associated gastro-oesophageal reflux. *Arch Dis Child* 1995;73:462-4.
- [17] Carter R, Brewer LA, Hinshaw DB. Acute gastric volvulus. A study of 25 cases. *Am J Surg* 1980;140:99-104.