

## Pediatric Gastric Volvulus

### —Experience with 7 Cases—

Woo-Hyun Park, M.D., Soon-Ok Choi, M.D., Soo-Jhi Suh, M.D.\*

Division of Pediatric Surgery, Department of Surgery  
Department of Diagnostic Radiology\*  
Keimyung University Dongsan Medical Center Taegu, Korea

*Gastric volvulus, organoaxial or mesenterioaxial, is a rare condition in infancy and childhood. We experienced 7 cases of pediatric gastric volvulus, consisting of 3 cases of secondary gastric volvulus due to left diaphragmatic eventration or paraesophageal hernia and 4 cases of idiopathic gastric volvulus. Of 7 cases, five were organoaxial in type and two were mesenterioaxial. The main symptoms of secondary gastric volvulus were vomiting and respiratory difficulty whereas those of idiopathic gastric volvulus were abdominal distension and weight loss with or without failure to thrive. It may be suspected on plain abdominal radiographs and usually confirmed by upper gastrointestinal series. Upper gastrointestinal series in organoaxial volvulus demonstrated characteristic findings such as reversal of the greater and lesser curvatures and two air-fluid levels. In mesenterioaxial volvulus, the stomach was rotated into inverted position with pyloroantral obstruction showing a beak appearance. The three patients with secondary volvulus underwent repair of associated defect with or without gastropexy and the 3 patients with idiopathic volvulus underwent anterior gastropexy or gastrostomy. In those with idiopathic gastric volvulus, there was no obvious cause such as laxity of the perigastric ligaments. The operative results were satisfactory except for the three patients with idiopathic gastric volvulus whose abdomen remained distended regardless of weight gain.*

Key Words: Pediatric gastric volvulus, Diaphragmatic eventration, Paraesophageal hernia

### INTRODUCTION

Most of the literature concerning gastric volvulus has dealt with this entity in adults. Recently, publications dealing with gastric volvulus in pediatric age group have increased gradually (Aoyama & Tateishi, 1986; Cameron & Howard, 1987; Honna et al., 1990). The symptoms of gastric volvulus depend on its type, the extent and degree of rotation and obstruction, and associated defects. The patients with acute volvulus

present usually with the symptoms of a high obstruction of the gastrointestinal tract such as vomiting and regurgitation, and symptoms of associated defect whereas those of chronic idiopathic volvulus present usually with abdominal distension, vomiting, and weight loss.

Preoperative diagnosis may be suspected on plain abdominal radiographs but usually confirmed by upper gastrointestinal series. Acute volvulus requires immediate surgical repair including correction of associated defect with or without gastropexy whereas chronic idiopathic volvulus usually requires some sort of gastropexy.

In Korea, 9 cases of pediatric gastric volvulus have been reported (Choi et al., 1986; Han et al., 1987). We herein report our experience with 7 pediatric cases of gastric volvulus with emphasis on clinical and radiological

Address for Correspondence: Woo-Hyun Park, Division of Pediatric Surgery, Department of Surgery, Keimyung University Dongsan Medical Center, 194 Dongsan Dong Taegu 700-310, Korea (Tel: 053-250-7317)

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features, and surgical outcome according to its type.

### MATERIALS AND METHODS

During the 4 years from 1985 to 1988, 7 children less than 10 years of age with a diagnosis of gastric volvulus have been managed at the Division of Pediatric Surgery Keimyung University Dongsan Medical Center.

Their medical records were carefully reviewed especially for clinical presentation, its type, associated defect, radiologic study, management, and surgical outcome.

Of 7 patients with gastric volvulus that was diagnosed radiologically and surgically, six were boys and one was girl. Their ages ranged from 5 days to 10 years. There were 3 patients with acute secondary gastric volvulus associated with left diaphragmatic eventration (Case 1 & 2) and one paraesophageal hernia (Case 3), and 4 patients with chronic idiopathic gastric volvulus. Of 7 cases, five were organoaxial in type and two were mesenterioaxial.

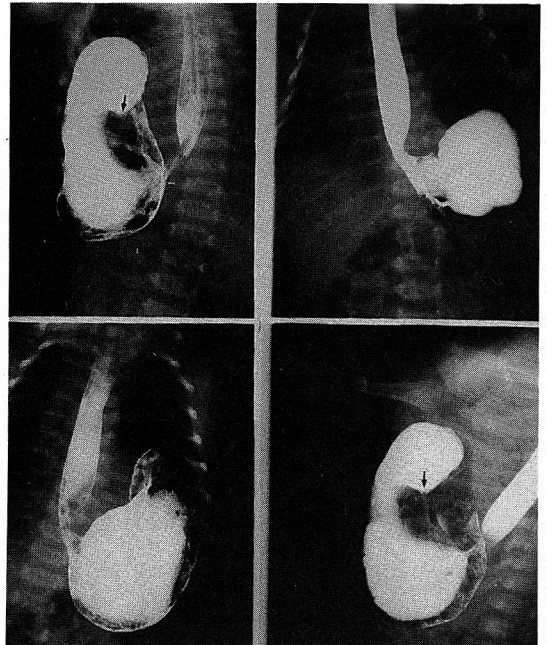


**Fig. 1a.**—Case 1. Supine abdominal radiograph reveals eventration of the left hemidiaphragm with shift of the mediastinum to the right. The stomach is distended with air immediately beneath the left hemidiaphragm.

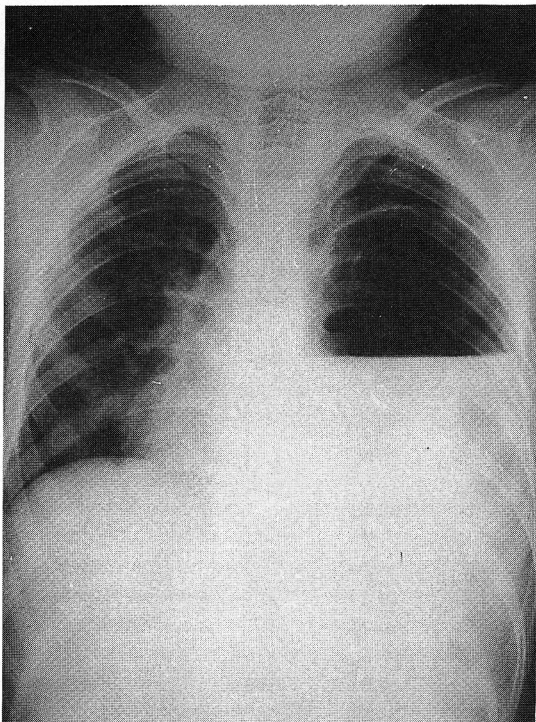
### RESULTS

The main symptoms were vomiting and respiratory difficulty in patients with acute gastric volvulus whereas those were abdominal distension and weight loss with or without failure to thrive in patients with chronic idiopathic gastric volvulus. The two patients (Case 4 & 7) were mentally retarded. There was no difficulty to put down nasogastric tube in those with acute gastric volvulus.

In patients (Case 1 & 2) with acute gastric volvulus, plain abdominal radiographs showed that the stomach was distended with air beneath the elevated left hemidiaphragm in the supine view (Fig. 1a), and with single air-fluid level on erect view (Fig. 2). Upper gastrointestinal series demonstrated that the stomach was rotated into an inverted position with pyloroantral obstruction showing a beak appearance superiorly, compatible with mesenterioaxial rotation (Fig. 2b). On the erect view of upper gastrointestinal series, single air-fluid level was demonstrated as well. In the patient (Case 3) with acute organoaxial volvulus, chest radiograph revealed a large air-fluid level above the liver



**Fig. 1b.**—Case 1. Upper gastrointestinal series demonstrates that the stomach is rotated into an inverted position with pyloroantral obstruction showing a beak appearance (arrows) superiorly—typical features of mesenterioaxial volvulus.

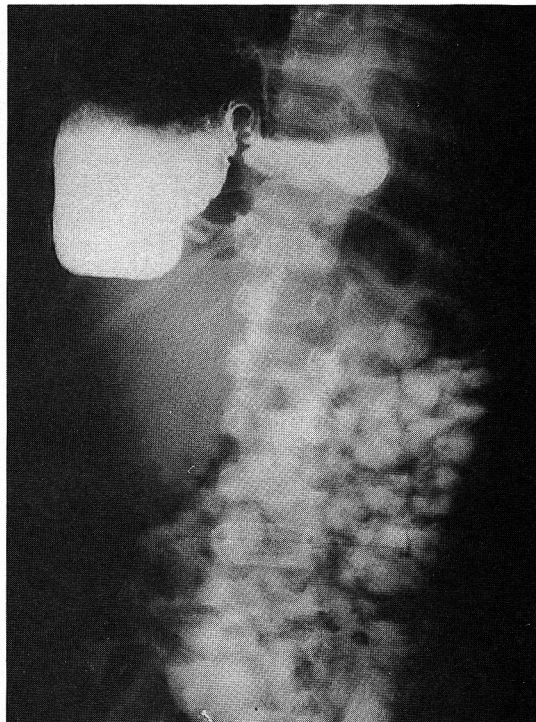


**Fig. 2—Case 2.** With acute mesenterioaxial volvulus. Chest radiograph reveals eventration of the left hemidiaphragm with an underlying large air-fluid level in the stomach. The mediastinum is shifted to the right.

and upper gastrointestinal series demonstrated paraesophageal hernia with intrathoracic stomach, showing reversal of the greater and the lesser curvatures with two air-fluid levels, compatible with organoaxial rotation (Fig. 3).

In the patients (Case 4-7) with chronic idiopathic volvulus, plain abdominal radiographs showed two air-fluid levels in the upper abdomen and the entire gastrointestinal tract was distended with air (Fig. 4a). Upper gastrointestinal series demonstrated horizontal stomach and reversal of the greater and lesser curvatures with two air-fluid levels, compatible with organoaxial rotation and there was a high position of the transverse colon, anterior and superior to the stomach (Fig. 4b).

At surgery in the patients (Case 1 & 2), the stomach was rotated mesenterioaxially and anteriorly about 180 degrees with antral obstruction whereas in the patients (Case 3-6) the stomach was rotated organoaxially and anteriorly about 90-110 degrees without outlet obstruction. In those (Case 3-6) with idiopathic volvulus, there was no obvious cause such as laxity of the gastric ligaments.



**Fig. 3—Case 3.** Upper gastrointestinal series demonstrates paraesophageal hernia with intrathoracic stomach, showing reversal of the greater and lesser curvatures with two air-fluid levels, compatible with organoaxial rotation.

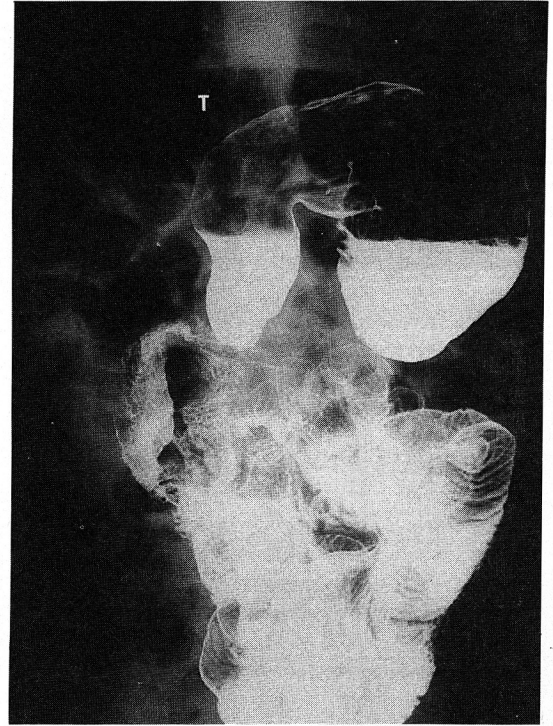
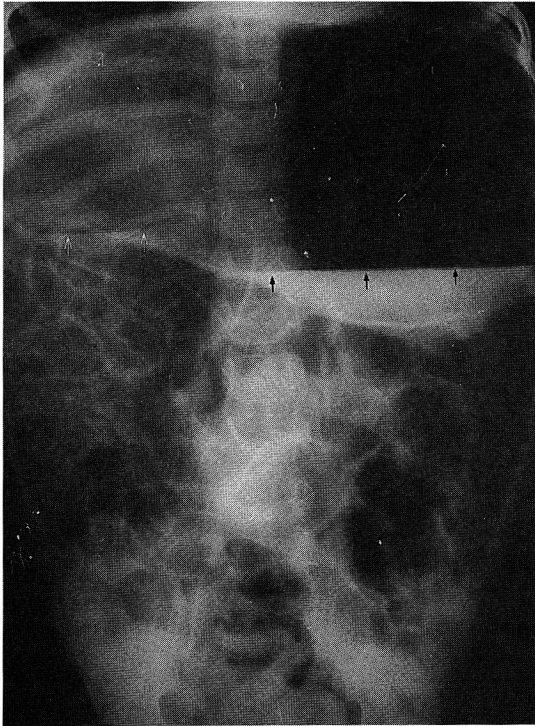
In the patients with secondary volvulus, associated defects were repaired with or without gastropexy while gastropexy or gastrostomy was carried out in the patients with idiopathic volvulus except for Case 7.

Postoperative course in the patients with acute secondary volvulus was uneventful whereas the three patients (Case 4, 5 & 7) with chronic idiopathic volvulus continue to have the abdomen distended regardless of weight gain.

The summary of the 7 patients is in Table 1.

### DISCUSSION

The stomach is relatively fixed at the esophageal hiatus and at the pylorus and is prevented from abnormal rotation by the four gastric ligaments. Most cases of gastric volvulus are secondary to deficient fixation in the majority of the pediatric age group. Absence or attenuation of these anatomical anchors results in the abnormal mobility of the stomach and the potential for gastric volvulus, especially if predisposing conditions such as diaphragmatic hernia, eventration, hiatal hernia or splenic anomalies are present (Aoyama &



**Fig. 4a.**—Case 4. Plain abdominal radiograph shows two air-fluid levels in the upper abdomen (arrows) and the entire gastrointestinal tract is distended with air.

**Fig. 4b.**—Case 4. Upper gastrointestinal series demonstrates horizontal stomach and reversal of the greater and lesser curvatures with two air-fluid levels—typical features of organoaxial volvulus. There is a high position of the transverse colon (T), anterior and superior to the stomach.

**Table 1.** Summary of 7 children with gastric volvulus

Case No.	Age/Sex	Symptoms	Type	Associated defects	Treatment
1 CEW	5 days M	vomiting dyspnea	MA Acute	Lt. diaphragmatic eventration	Plication Gastropexy
2 CMS	10 yr. M	abdominal pain vomiting, dyspnea	MA Acute	Lt. diaphragmatic eventration	Plication
3 KBS	1y. 9mo. M	vomiting dyspnea	OA Acute	Paraesophageal hernia	Fundoplication
4 OYM	4yr. M	abdominal distension failure to thrive	OA Chronic	No	Gastropexy
5 BJH	7y. 6mo. M	abdominal distension dyspnea, weight loss	OA Chronic	No	Gastropexy
6 WJH	2mo. M	abdominal distension vomiting, diarrhea	OA Chronic	No	Gastrostomy
7 LKR	6y. 6mo. F	abdominal distension failure to thrive constipation	OA Chronic	No	Colostomy

Abbreviations: MA, mesenterioaxial; OA, organoaxial

Tateish, 1986; Campbell, 1979; Cameron & Howard, 1987; Choi et al., 1986; Cole & Dickinson, 1971; Idowu et al., 1980).

Idiopathic gastric volvulus without predisposing anomalies occurs more frequently than ever mentioned, especially in children with vomiting, abdominal distension and/or weight loss (Honna et al., 1990; Ziprkowski & Teele 1979).

Three types of gastric volvulus may occur.: (1) Organoaxial, in which the stomach rotates around an axis joining the esophagogastric junction and pylorus. (2) Mesenterioaxial, in which the rotation occurs around and axis joining the lesser and greater curvatures. (3) Mixed, in which the rotation occurs around both axes. Of our 7 cases, five were organoaxial and two were mesenterioaxial.

The clinical symptoms depend upon the extent or degree of rotation, obstruction, and associated defect. Acute volvulus in adults may result in the clinical triad, first described by Borchardt: (1) acute or localized distension of the epigastrium associated with pain, (2) nonproductive attempts at vomiting, and (3) inability to pass a tube into the stomach. In comparison, the clinical features in childhood with acute volvulus are nonspecific but suggest a high obstruction of the gastrointestinal tract. The patients are first seen with acute onset of vomiting that usually occurs shortly after feeding. The upper abdomen is often distended or scaphoid. Nasogastric intubation is quite often possible in infants (Cole & Dickinson, 1971). Acute gastric volvulus in adults is most commonly seen with paraesophageal hernia, whereas eventration of the diaphragm most often accompanies this condition in infants and children (Carter et al., 1980).

The clinical features of idiopathic gastric volvulus are usually vomiting, abdominal distension and weight loss with or without failure to thrive. Gastric distension in patients with hypertrophic pyloric stenosis or aerophagia may have been a predisposing factor (Cameron & Howard, 1987; Honna et al., 1990) and an overdistended large bowel with gas, usually the transverse colon, has been considered to be also an important predisposing factor (Honna et al., 1990; Mizrahi et al., 1988; Tanner 1968) because the distended transverse colon encourages volvulus of the stomach on its long axis. Idiopathic gastric volvulus may be more common than is recognized in mentally retarded patients. (Honna et al., 1990; Ziprkowski & Teele, 1979). Three patients with idiopathic volvulus in our reports (Case 4&7) were retarded and/or aerophagic. In patient (No. 7) with organoaxial volvulus, it is not clear whether the volvulus was predisposed by the transverse colonic dis-

tension secondary to Hirschsprung's disease and/or by gastric distension due to aerophagia.

It may be suspected on plain abdominal radiographs and usually confirmed by upper gastrointestinal series. Organoaxial volvulus is not easy to diagnose on plain radiographs. The stomach lies rather horizontally on plain radiographs with single or two air-fluid levels (Han et al., 1987; Honna et al., 1990; Ziprkowski & Teele, 1979). On barium examination, the characteristic findings are 1) esophagogastric junction lying lower than normal, 2) reversal of the greater and lesser curvatures, 3) pylorus pointing downward, 4) greater curvature crossing the esophagus, 5) two air-fluid levels, and 6) lowering of the gastric fundus (Honna et al., 1990). In mesenterioaxial volvulus associated with diaphragmatic anomaly, the pyloroantral area may be seen beneath eventration with single or two air-fluid levels on erect radiograph (Campbell, 1979; Han et al., 1987; Honna et al., 1990; Ziprkowski & Teele, 1979). On barium examination the cardioesophageal junction is in normal position. The stomach is seen to be rotated into an inverted position with pyloroantral obstruction showing a beak appearance (Campbell, 1979; Han et al., 1953).

Acute volvulus requires immediate surgical repair after appropriate resuscitation. Any associated defect should be repaired and the stomach must be fixed. Anterior gastrostomy is recommended in the infant cases for maintaining decompression, providing anterior gastric fixation and postoperative feeding. In chronic idiopathic volvulus, anterior gastropexy can be usually and satisfactorily employed. Recently Honna et al. (1990) suggested that the infants under 6 months with chronic idiopathic volvulus should be initially treated by conservative method by keeping them in prone position because they thought that the prone position seemed to promote quick passage of the milk and physiologic development of the distal part of the stomach. The three patients (Case 4, 5&7) with idiopathic gastric volvulus whose abdomen remained distended regardless of weight gain, need further follow-up investigation.

The complications of acute gastric volvulus include acute gastric necrosis, peritonitis, shock, and death (Aoyama & Tateishi, 1986; Carter et al., 1980), while those of chronic idiopathic gastric volvulus may include failure to thrive and dyspnea on exertion due to abdominal distension.

Our 7 cases show different aspects of the cause and presentation of this unusual condition. We report them to increase awareness of this condition since early diagnosis and management are essential to avoid com-

plications and to promote normal growth and development.

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