

# Sonographic findings of superior mesenteric artery syndrome causing massive gastric dilatation in a young healthy girl

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## ABSTRACT

**Acute gastric dilatation due to superior mesenteric artery syndrome in healthy individuals is extremely rare. A 17-year-old girl who complained of epigastric pain for two days following excessive eating was admitted to our hospital. She was nauseated but was unable to vomit. Succussion splash was positive. Bedside ultrasonography revealed a hyperactive duodenum, a distended stomach compressing on the inferior vena cava and a narrowed angle between the superior mesenteric artery (SMA) and the aorta. Abdominal computed tomography imaging confirmed the above findings. The angle between the aorta and SMA was only eight degrees. Gastrograffin follow-through showed complete obstruction of the third part of the duodenum. 3,500 ml of fluid was immediately drained through the nasogastric tube. Another gastrograffin study conducted five days later showed normal results. Bedside ultrasonography thus proved to be useful for both the diagnosis and management of superior mesenteric artery syndrome.**

**Keywords: duodenal obstruction, stomach, superior mesenteric artery, syndrome, ultrasonography**

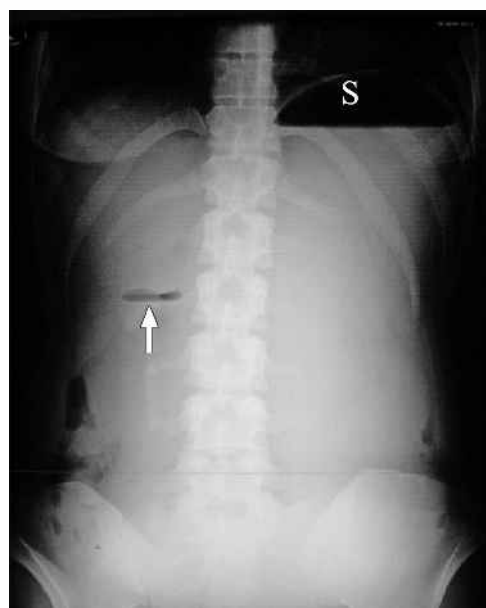
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## INTRODUCTION

Superior mesenteric artery syndrome (SMAS) is the result of compression of the third part of the duodenum between the superior mesenteric artery (SMA) anteriorly and the aorta and vertebral column posteriorly.<sup>(1)</sup> Acute presentation is commonly associated with gastric dilatation.<sup>(2)</sup> We report a rare case of a 17-year-old girl with massive gastric dilatation due to SMAS, with well-documented diagnostic sonographic findings.

## CASE REPORT

A 17-year-old healthy girl was admitted to the Surgical Department of Al-Ain Hospital for complaints of epigastric



**Fig. 1** Erect plain abdominal radiograph shows central high density opacity, an air bubble in the stomach (S) and an air fluid level in the right upper quadrant of the abdomen (arrow).

pain for two days following an excessive eating episode. She was nauseated but was unable to vomit. Four years earlier, the patient had a similar attack, for which she was admitted to the hospital as a case of intestinal obstruction. However, her condition improved within a short period of time, and she left against medical advice before the completion of her workup. She had no past history of surgery and was not on any medication. Her elder sister had a similar attack that was treated conservatively.

On examination, the patient was in pain, dehydrated and afebrile. Her pulse was feeble and her blood pressure was 90/60 mmHg. The abdomen was soft with mild guarding and tenderness at the epigastric area with positive succussion splash. The patient was resuscitated with intravenous fluid until her blood pressure increased to 120/80 mmHg and her pulse was 90 beats per minute. Blood investigation revealed a total white blood cell count of  $15.8 \times 10^9/l$  and haemoglobin at 15.1 g/dl. The patient's blood chemistry and serum amylase were normal except for hypokalaemia (serum potassium 3 mmol/l). Liver and kidney function tests were normal. Erect plain abdominal radiograph revealed central high-

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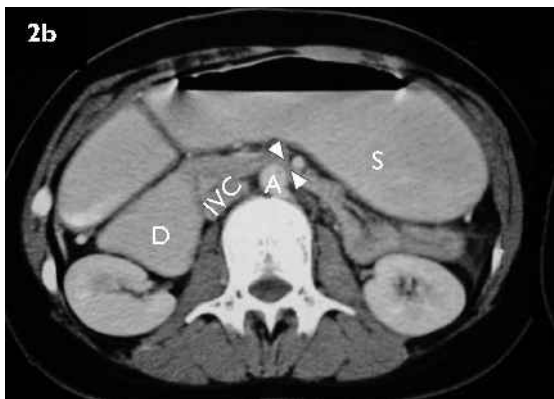
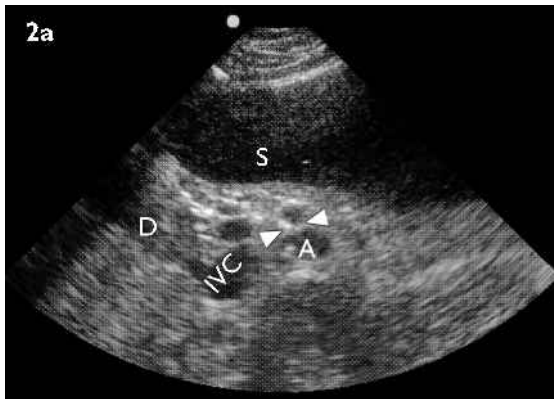
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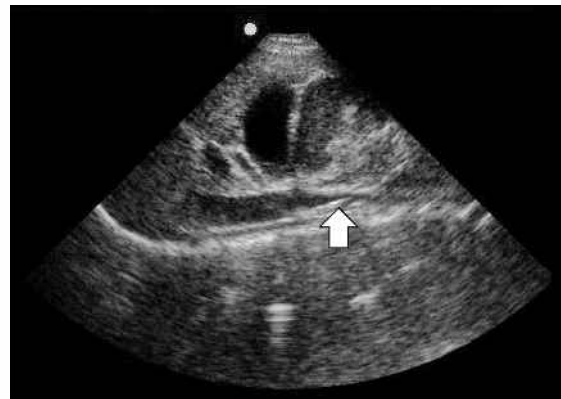
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**Fig. 2** Cross-section of the upper abdomen. (a) Ultrasonography image and (b) CT image with intravenous and oral contrast show the narrow space (arrowheads) between the superior mesenteric artery and aorta, as the third part of the duodenum passes between these two structures as shown by the CT image. D: duodenum, S: stomach, IVC: inferior vena cava, A: aorta.

density opacity, an air bubble in the stomach and an air fluid level in the right upper quadrant of the abdomen (Fig. 1). Bedside ultrasonography revealed a hyperactive duodenum, a distended stomach (Fig. 2) compressing on the inferior vena cava (IVC) (Fig. 3), and a narrowed angle ( $8.5^\circ$ ) between the superior mesenteric artery and the aorta (Fig. 4). No free intraperitoneal fluid was observed. These findings were confirmed by abdominal computed tomography (CT) imaging (Figs. 2 & 4). Gastrograffin follow-through, which was performed immediately before the CT imaging (Fig. 5), showed a markedly distended stomach occupying almost the whole abdomen and reaching down to the pelvis. Contrast media was seen reaching up to the third part of the duodenum, with a minimal amount passing to the proximal jejunum.

Conservative management was adopted with fluid and electrolyte replacement, and nasogastric tube drainage. 3,500 ml of yellowish fluid was immediately drained using the nasogastric tube. The patient's condition improved on conservative therapy. A repeat gastrograffin follow-through study performed on the fifth day of admission showed passage of the dye to the small intestine, with a significant reduction in the stomach size. The patient was



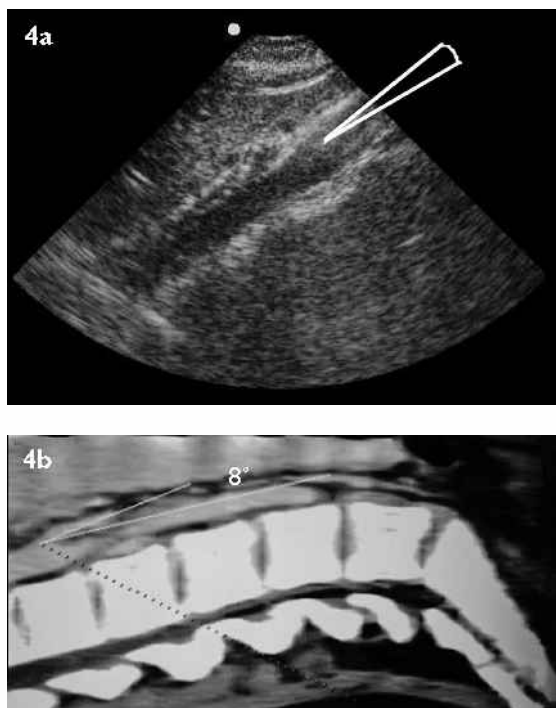
**Fig. 3** Sagittal abdominal ultrasonography image shows compression of the inferior vena cava (arrow) by the stomach and the duodenum. This explains the shocked status of the patient.

allowed to have oral fluid followed by a normal diet, and she was discharged home in good condition.

## DISCUSSION

SMA arises from the abdominal aorta at a  $25^\circ$ – $60^\circ$  angle. The angle is maintained in part by mesenteric fat that normally envelops the SMA.<sup>(3)</sup> Factors causing collapse of the aorto-SMA angle predispose to SMAS. When the aorto-SMA angle becomes more acute, the duodenum, which is suspended by the ligament of Treitz, is entrapped between the aorta and SMA, causing mechanical obstruction.<sup>(2)</sup> Loss of the mesenteric pad of fat that surrounds the SMA (in malignancy, malabsorption syndrome and anorexia nervosa) may lead to SMAS.<sup>(1)</sup> Congenital short ligament of Treitz may pull the duodenum up into the root of the aorto-SMA angle and predispose to SMAS.<sup>(4)</sup> Patients may present with acute or chronic forms of SMAS. The acute presentation usually occurs in young, thin women and is commonly associated with massive gastric dilatation.<sup>(1)</sup>

Our patient was healthy and had a normal body built, and the gastric dilatation was precipitated by an excessive eating episode.<sup>(5)</sup> She had previously experienced a similar attack and had a positive family history of the same condition. The massively dilated stomach usually causes abdominal pain and vomiting, but some patients, as in the present case, may not be able to vomit.<sup>(3)</sup> Our patient had epigastric pain that was associated with dehydration, and positive succussion splash indicated proximal mechanical bowel obstruction. CT imaging of the abdomen confirmed the sonographic findings and revealed massive gastric dilatation. Reconstruction of the abdominal CT image enabled us to measure the aorto-SMA angle, which was  $8^\circ$  in our patient, thus supporting the diagnosis of SMAS.<sup>(3)</sup> Gastrograffin follow-through showed that the obstruction was located at the level of the third part of the duodenum, with passage of minimal amount of the contrast to the



**Fig. 4** (a) Sagittal view of the abdominal ultrasonography image and (b) reconstruction abdominal CT image with intravenous contrast show the measured angle between the superior mesenteric artery and the aorta.

jejunum, thus ruling out complete obstruction or volvulus.

Ultrasonography of the abdomen is less hazardous than CT imaging, and in our patient, it revealed the short distance and the narrow angle between the aorta and SMA. It also showed the compression of the IVC by the dilated stomach. This explains the shocked status of the patient, which is similar to that experienced by pregnant women who undergo compression of the IVC by the enlarged uterus during resuscitation of trauma.<sup>(6)</sup> In some patients, the symptoms may improve by assuming the knee chest or the left lateral decubitus position.<sup>(4)</sup> Massive gastric dilatation may compromise the ventilation and cause respiratory failure due to diaphragmatic splinting. Ischaemic necrosis of the stomach can also occur if the intra-gastric pressure exceeds 20 cm H<sub>2</sub>O.<sup>(5,7)</sup>

The results of ultrasonography will depend on the patient's body stature, the experience of the operator and the specifications of the ultrasonography machine. The ultrasonographic images in this case were obtained in a relatively thin patient, by an experienced operator using a high quality hand-held ultrasonography machine. It may be argued that more evidence is required for generalisation of the findings in this case. Nevertheless, it has to be stressed that clinical decision-making may involve the management of a unique problem in a specific patient. This is evident in our case, a finding that may be different from group results reported in clinical trials.<sup>(8)</sup>



**Fig. 5** Gastrograffin follow-through shows a massively distended stomach reaching down to the pelvis (arrowheads) and dilated duodenum in its second and proximal third parts (arrow).

Early diagnosis, prompt decompression of the stomach, fluid and electrolyte replacement therapy, and close monitoring are essential for successful conservative therapy. Weight gain, by increasing fat deposition in the mesentery, appears to be an important factor in preventing further episodes of SMAS.<sup>(4)</sup> Surgery may be required in cases of failure of conservative therapy (e.g. division of ligament of Trietz or a gastrojejunostomy). In summary, SMAS is a rare condition, and bedside ultrasonography has proven to be useful for its early diagnosis and management.

## REFERENCES

- Unal B, Aktaş A, Kemal G, et al. Superior mesenteric artery syndrome: CT and ultrasonography findings. *Diagn Interv Radiol* 2005; 11:90-5.
- Adson DE, Mitchell JE, Trenkner SW. The superior mesenteric artery syndrome and acute gastric dilatation in eating disorders: a report of two cases and a review of the literature. *Int J Eat Disord* 1997; 21:103-14.
- Luncă S, Rikkers A, Stănescu A. Acute massive gastric dilatation: severe ischemia and gastric necrosis without perforation. *Rom J Gastroenterol* 2005; 14:279-83.
- Bandres D, Ortiz A, Dib J Jr. Superior mesenteric artery syndrome. *Gastrointest Endosc* 2008; 68:152-3.
- Powell JL, Payne J, Meyer CL, Moncla PR. Gastric necrosis associated with acute gastric dilatation and small bowel obstruction. *Gynecol Oncol* 2003; 90:200-3.
- American College of Surgeons Committee on Trauma. *Advanced Trauma Life Support Program for Doctors*, 7th ed. Chicago: American College of Surgeons 2004: 275-82.
- Lee LS, Lim NL. Severe acute gastric dilatation causing respiratory failure. *Singapore Med J* 2006; 47:716-8.
- Mant D. Can randomised trials inform clinical decisions about individual patients? *Lancet* 1999; 353:743-6.