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A Case of Intractable Vomiting Due to Superior Mesenteric Artery Syndrome

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Abstract

Superior Mesenteric Artery Syndrome (SMAS) is a chronic mechanical obstruction of the duodenum due to compression of the superior mesenteric artery (SMA) at the level of the duodenum, with corresponding symptoms that can be improved with postural changes. Gastrointestinal symptoms may improve with positional changes. This kind of disease is very rare in clinic, we now review a case of intractable vomiting caused by superior mesenteric artery syndrome in our hospital, and report the details as follows.

Keywords: superior mesenteric artery syndrome, intractable vomiting, case report

1. Case Information

A 29-year-old female was admitted to the hospital with vomiting, reflux, heartburn and epigastric pain for 10 hours. The patient began to vomit 10 hours ago after eating cold food, initially with stomach contents, then bile, the exact number of times is unknown, each time about 100-200 ml, and took "Huo Xiang Zheng Qi capsule, Radix Rehmanniae Pill, Metoclopramide tablets" orally on her own for a few minutes, and then vomited again, accompanied by acid reflux, heartburn, and epigastric colic, but did not experience any vomiting. The above symptoms could be relieved after stopping defecation and changing the body position to squatting or standing position, the second bowel movement could be done, and there was no significant change in body weight. Gastroscopy showed chronic non-atrophic gastritis and gastroptosis, and upper gastrointestinal imaging showed no abnormality; he complained of duodenal stasis at an outside hospital. He had no special medical history and no history of smoking or alcohol consumption. Admission: vital signs: temperature: 36.7℃; heart rate: 76 beats/min;

respiratory rate: 19 beats/min; blood pressure: 124/83mmHg, height: 160cm, weight: 46kg. Examination: emaciated body type, painful face, fair mental state, autonomous position, clear breath sounds in both lungs, dry and wet rales were not heard. The heart boundary was not large, no pathological murmurs were heard in the valves, no pericardial friction was heard, the abdomen was soft, the epigastric pressure was positive, no rebound pain, no abnormal masses were touched, no oedema in the lower limbs, the physiological reflexes were normal, and no pathological signs were elicited. He was admitted to the hospital and given acid suppression, mucosal protection, antispasmodic, antiemetic, intravenous nutritional support and other treatments.

Admitted to the hospital to improve the relevant examination: blood routine, liver and kidney function, CRP, PCT, electrolytes did not show any abnormality. Electrocardiogram showed ST-T changes. Combined with the patient's medical history, symptoms, signs, long and thin body type and previous examination results, the patient was admitted to the hospital mainly because of vomiting, and the vomiting symptom could be relieved after taking the sitting or standing position, and previous gastroscopy suggested chronic gastritis and gastric prolapse, and the diagnosis of "duodenal stasis" was clear. Superior Mesenteric Artery Syndrome (SMAS) was highly suspected. The patient was instructed to take the knee-chest position or prone position after eating, and the patient's vomiting symptoms could be relieved, but the above symptoms still appeared repeatedly, and the results of the CTA of the abdominal aorta were further improved, and the angle between the superior mesenteric artery and the abdominal aorta was small (see Figure 3), and the corresponding duodenal horizontal portion was under compression, so the patient was considered to have SMAS. In conclusion, the diagnosis of Superior Mesenteric Artery Syndrome combined with duodenal stasis was confirmed, and the patient continued to be treated by internal medicine, and was given absolute fasting, antidiuresis and aesthetic treatment for each episode. After the onset of each episode, absolute fasting, antispasmodic, antiemetic, nutritional support to maintain homeostasis of the internal environment, the patient is a young woman, each time after the above treatment plan vomiting symptoms can be relieved, so the patient was asked to eat less and more meals, seizures can be taken to the left side of the lying position, the knee-chest position, or the prone position, appropriate exercise, increase body weight, and if necessary, surgical treatment. The patient was discharged from the hospital after improvement, and the number of vomiting episodes was significantly reduced compared with the previous one in the monthly follow-up outside the hospital, and there was no special discomfort in the rest of the patient.

Figure 1. Abdominal aorta CTA

Figure 2. CTA of the abdominal aorta

Figure 3. The angle between the superior mesenteric artery and the abdominal aorta is 16.8°

2. SMAS Overview

2.1 Pathogenesis

The pathogenesis of SMAS is based on the narrowing of the angle between the superior mesenteric artery (SMA) and the aorta (AO), which leads to the compression of the horizontal duodenum and thus the occurrence of acute or chronic intestinal obstruction. (Sinagra E, Raimondo D, Albano D, et al., 2018) Patients may manifest nausea, vomiting, epigastric distension, abdominal pain, and even malnutrition, and other clinical symptoms. Under normal anatomical structure, the angle between the two is 25-60° (Pasumarthy LS, Ahlbrandt DE, & Srour JW., 2010), when the angle between the two is <22°, i.e., forming an acute angle, the duodenum can be compressed horizontally, which leads to SMAS (Ahmed AR & Taylor I., 1997). The pathogenesis of this disease is the loss of mesenteric fat pads, which is most common in women with thin body shape, people with rapid fat loss, children and adolescents, etc. Okamoto (2019) et al. found that it can be quickly caused in people in the rapid growth period, puberty and adolescence. Okamoto et al. found that the disease can start rapidly in adolescents who are undergoing rapid growth and development, which should be taken seriously.

2.2 Clinical Presentation

SAMS can occur at any age, but it is more common in middle-aged and young people with long and thin body types, and the incidence rate is higher in women. SAMS can be classified into acute and chronic according to the course of the disease, and the chronic course of the disease is often seen clinically. The main manifestations are postprandial epigastric distension and discomfort, accompanied by nausea and vomiting, and the vomitus is often gastric contents and bile, but does not contain blood, which is intermittent, and accompanied by mild abdominal pain, which is usually tolerated by the patients, and the discomfort can be further alleviated or even disappeared after the vomitus. And the above clinical manifestations are related to the position, the patient can usually change the position to achieve the purpose of reducing pain, such as the patient puts the hand under the umbilicus upward and pushes backward, which can make the root of the mesentery move backward, or to take the left lateral position, prone position, leaning forward position, chest-knee position, and put the knees under the jaws, etc., which can increase the angle between the SMA and the AO, in order to alleviate the pressure of the superior mesenteric artery on the level of the duodenum, thus relieving the discomfort. On the contrary, supine position will further aggravate the disease. There may be gastrointestinal peristaltic waves and epigastric pressure and pain signs during the exacerbation phase, and no obvious positive signs during the remission phase. As the course of the disease progresses, emaciation, dehydration, electrolyte disorders, and further reduction of fat pads can further aggravate the compression symptoms, leading to a vicious circle of the disease, resulting in malignant disease and even death. Currently, complications of SMAS include intestinal necrosis, duodenal perforation, acute gastric dilatation, upper gastrointestinal bleeding, portal vein thrombosis, portal vein pneumatosis (MA Xiangtao, YU Liwei, ZHANG Fang et al., 2006; Kandil E, Alabbas H, Harbin AC, et al., 2009; Rod J, Sarnacki S, Petit T, et al., 2010; Tsai CL, Chen MJ, Tan CK, et al., 2007), and related literature reports that 25% of

patients can be complicated by peptic ulcer, but the relationship between the two is not clear (JI Haofeng & ZHENG Shusen, 2006).

2.3 Diagnosis

This disease should be highly considered in patients who suffer from intermittent episodes of postprandial epigastric holding discomfort, abdominal pain, nausea, and vomiting, and whose symptoms may be relieved with a change in body position. In diagnosis, the anatomical relationship between SMA and AO should be clarified firstly, whether the angle between the two becomes smaller leading to duodenal compression and thus causing duodenal obstruction, and it should also be differentiated from gastrointestinal tract tumours, tuberculosis, intestinal obstruction, duodenal torsion, and congenital mega duodenopathy. In the early stage of the disease, SMAS patients are often misdiagnosed as upper gastrointestinal ulcer, chronic cholecystitis, chronic pancreatitis, etc. due to atypical symptoms, or even missed! Although the detection rate of this disease is high, there is still a certain rate of underdiagnosis. Zhu Bo (2020) et al. in the diagnosis and treatment of a case of traumatic brain injury, after routine dehydration, gastric protection and nutritional support, the patient was suddenly high intestinal obstruction, and then carried out gastrointestinal imaging and emergency surgical caesarean section, found that the angle between the SMA and the AO is 10°, and it directly compressed the third section of the duodenum, thus confirming the patient's diagnosis of acute traumatic brain injury combined with SMAS, which can be seen that a single clinical judgement is very easy to miss the diagnosis of SMAS, thereby delaying the optimal treatment. This shows that it is very easy to miss the diagnosis of SMAS based on a single clinical judgement, thus delaying the optimal treatment of exchange. In conclusion, early detection, early diagnosis and early treatment are urgent problems faced by frontline clinicians. Therefore, for patients who are long and thin, with recurrent postprandial vomiting and symptoms that may change with body position, we need to be highly vigilant for the possibility of SMAS, and further relevant ultrasound and imaging examinations should be performed in a timely manner to clarify the diagnosis.

2.3.1 Digestive Tract Imaging

Since the results of GI imaging can be an important reference for the subsequent determination of surgical methods, this examination plays an important role in the diagnosis of SMAS. Gastrointestinal imaging manifestations are as follows: (1) the typical "pencil sign" appears when the contrast agent passes through the obstructed horizontal duodenal segment; (2) the contrast agent passes smoothly above the pylorus and the gastric lumen is enlarged; (3) the duodenal segment is dilated above the site of the obstruction and strong peristalsis waves in the forward and reverse directions or alternating forward and backward waves of the contrast agent may appear; (4) the contrast agent may be retained in the gastro duodenum, and may be returned to the stomach; and (5) the contrast agent may be retained in the gastro duodenum. (6) the duodenum is dilated above the site of obstruction, and there may be repeated strong peristaltic waves in the cis-transverse direction or cis-contradictory waves, and the contrast agent may flow back into the stomach; (7) the contrast agent may be retained in the gastro duodenum, and the rate of emptying is slowed down; (8) the contrast agent may be passed through (Chang J, Boules M, Rodriguez J, et al., 2017) without any problem when the position is changed to prone or chest-knee.

2.3.2 Endoscopy

Endoscopy is divided into electronic gastroscopy and ultrasound endoscopy. Because gastroscopy can only reach the descending part of the duodenum, it is difficult to directly observe the specific situation of the obstruction, but gastroscopy can exclude other gastrointestinal lesions and show the changes in the digestive tract proximal to the obstruction so that further treatment measures can be formulated. Ultrasound endoscopy can observe the GI tract, display and measure the SMA and AO angles, and identify the cause of duodenal compression, and is a practical and rapid method for diagnosing children and patients with decreased body mass index. (Di Matteo F, Picconi F, Sansoni I, et al., 2010) Bronswijk (2021) et al. have reported in the literature that the diagnostic rate of ultrasound endoscopy is higher than that of barium meal imaging.

2.3.3 Abdominal Colour Ultrasound Doppler

Abdominal ultrasound is economical, convenient, non-invasive, and can clearly show

the anatomical relationship between SMA and AO, which can help clinicians diagnose SMAS. The ultrasound characteristics of SMAS are as follows: (1) the angle between AO and SMA measured by ultrasound probe is <15°; (2) the duodenum shows a "bucket" or "gourd shape"; (3) the maximum width of the duodenal tube located within the angle between SMA and AO is <10 mm; (4) the maximum width of the duodenal tube in the cross section is <10 mm after drinking water triggered intestinal peristalsis. The duodenum shows a "bucket shape" or "gourd shape"; (5) the maximum width of the duodenal tube in the cross section within the angle between the SMA and the AO is <10 mm when the patient triggers intestinal peristalsis after drinking water; (6) the descending duodenum is dilated, with an internal diameter of >30 mm. (FU Zhonghua, NIU Dianying, & LIU Fangfang, 2016).

2.3.4 Abdominal Plain Film

Abdominal radiographs show the presence of a plane in the duodenal bulb and a plane in the stomach, which is the typical "double fluid plane sign" or "double bubble sign", which is a unique abdominal radiographic manifestation of duodenal obstruction.

2.3.5 Abdominal CT

Abdominal CT examination has a high accuracy rate in diagnosing SMAS. Abdominal CT can show dilatation of the stomach and part of the duodenum, and three-dimensional reconstruction of enhanced CT can clearly show the relationship between the SMA, AO, and duodenum, as well as whether the duodenum is compressed. Zhai Shujun et al. (2023) reported that multislice spiral CT scanning can measure the clamp angle of the superior aortoenteric artery and the distance of the superior aortoenteric artery in most of the patients, as well as assessing the presence of dilatation and insufflation of the proximal duodenum at the horizontal segment, which can help in the early diagnosis of SMAS, and improve the accuracy of the diagnosis of SMAS, which is of clinical value.

2.3.6 Abdominal Magnetic Resonance

Abdominal MRI has greater resolution of abdominal tissue compared to CT. It can clearly show the anatomical relationship between SMA and AO and the compression status of duodenum. Ni Jiaqi (2021) et al. pointed out that the accuracy of abdominal magnetic resonance examination is similar to that of previous angiography, but this examination has the disadvantages of high cost, long time-consuming, and the influence of metallic foreign bodies on the image, so it is generally not used as the preferred examination method.

2.3.7 Angiography

Although angiography can accurately show the relationship between the angle between SMA and AO, this test requires a high degree of specialisation and standardisation, and is not usually used as a routine test.

3. Treatment

3.1 Conservative Treatment

SMAS is a benign disease and is usually treated conservatively. The literature reports that absolute fasting, gastrointestinal decompression, antispasmodic, intravenous nutritional support, and position changes to left lateral, knee-chest, and prone positions can be used during exacerbations, with an effective remission rate of up to 83% (WU Chu-Tian, & TANG Shaohui, 2019). Nutritional support is preferred to enteral nutrition (Civan HA, Gülcü D, Erkan T. et al., 2018), by improving the patient's nutritional status, increasing the abdominal fat content, reinforcing the fat pads, increasing the angle of the SMA and the AO, in order to achieve the purpose of relieving the clinical symptoms due to the horizontal part of the duodenum's obstruction. Yang Yingbiao's study of early enteral nutritional support in 40 patients with SMAS concluded that the duodenal obstruction condition of the included patients improved significantly, clinical symptoms improved, and the angle of the superior mesenteric artery increased significantly, thus concluding that the value of early enteral nutrition in the superior mesenteric artery syndrome is significant and worthy of further promotion.

3.2 Surgical Treatment

Surgical treatment should be given to SMAS patients with long duration and severe symptoms who are not effectively treated by conservative therapy, in order to alleviate clinical discomfort and restore gastrointestinal patency. If surgical contact with intestinal obstruction is not performed in time, clinical symptoms will recur for a long period of time, which greatly affects the quality of life of the patients. It has been reported that about 75% of SMAS patients require surgical treatment

(ZHANG Tong, SUN Liang, ZENG Yu Jian, et al., 2015). Commonly used surgical procedures include duodenojejunal anastomosis, Treitz ligament release, anterior duodenal vascular transposition, major gastrectomy, Billroth II gastrojejunal anastomosis, gastrojejunal anastomosis and duodenal loop drainage (LIU Yong, & LUO Yu-Hong, 2011). In a retrospective report of 4 patients with SMAS treated with laparoscopic duodeno-jejunal manual lateral anastomosis by Wang Hui (2022) et al, it was noted that the patients had small surgical incisions, short hospital stay, rapid postoperative recovery, and no serious postoperative complications, which further suggests that laparoscopic duodeno-jejunal manual lateral anastomosis for the treatment of SMAS is effective, safe, and worthy of further clinical promotion.

3.3 Intervention

Au-Yong et al. (2010) reported for the first time the successful interventional treatment of a trauma-induced rupture of an SMA pseudoaneurysm secondary to SMAS, which is a rare case in the clinic.

4. Discussion

Although this disease is rare in clinical practice, with the progress of modern medical technology, SMAS is no longer a difficult disease. Frontline clinical workers should focus on the collection of patient history, careful physical examination and the improvement of relevant auxiliary examinations, and think differently to improve the diagnosis and treatment rate of the disease. This case is reported in order to provide a certain reference for clinical doctors in the recognition, diagnosis and timely intervention and treatment of SMAS.

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