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Compression of the Duodenum by the Root of the Mesentery

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Compression of the duodenum by the root of the mesentery is a rare pathological entity that has caused much controversy because it has been mistakenly identified as the "superior mesenteric artery syndrome" or the "vascular compression of the duodenum." We discuss the pathological anatomy and the diagnosis of the disease, and report an illustrative case. Some authors report many cases of the syndrome, while others doubt its existence. Before surgery is considered, the diagnosis should be established beyond doubt and a prolonged period of observation, medical treatment, and nutritional support should be provided. The barium contrast swallowing test combined with aortographic studies can pinpoint the compression site behind the root of the mesentery. Good surgical results have been reported with both dextroposition of the duodenojejunal junction and with duodenojejunostomy.

Compression of the duodenum by the root of the mesentery was recognized long ago (1-3), but because of the misnomer "superior mesenteric artery syndrome," there has been much controversy, misunderstanding, and misdiagnosis. Some authors even doubt that this condition exists. It is certain that the superior mesenteric artery does not compress the duodenum. Because of the controversies and reasonable doubts, the diagnosis of the condition has to be made with great accuracy.

Case Report

A 29-year-old man became paraplegic from a gunshot wound in 1971. Before the injury he was 170 cms tall and weighed 70 kgs. After the injury, he had a considerable weight loss. Since 1972, the patient had experienced episodes of nausea and vomiting, and he was first admitted to Henry Ford Hospital with similar complaints in 1977. His weight was 47 kgs. The patient had mild epigastric tenderness. Radiographs of the stomach, small and large bowel, and the gall bladder were normal. Gastroscopy revealed mild gastritis and superficial gastric erosion.

In April 1978, the patient was admitted again with weight loss, repeated episodes of nausea, and vomiting. There was a mild tenderness at the right side of the epigastrium. Gastroscopy was negative. The upper gastrointestinal x-ray examination showed a widening of the second, third, and fourth portion of the duodenum with a normal caliber of the upper jejunum (Fig. 1). Aortic angiogram showed a narrow angle of 15° between the aorta and the superior mesenteric artery. The artery ran parallel to the aorta with a narrow distance between the two (Fig. 2). The symptoms of the patient improved with nasogastric suction, and he was discharged.

In August 1978, he was readmitted with progressive weight loss, epigastric pains, and episodes of nausea and vomiting. He was moderately dehydrated. His weight was 39.5 kgs. The abdomen was scaphoid with mild tenderness in the right epigastrium. The bowel sounds were hyperactive. The upper gastrointestinal x-ray under fluoroscopy showed the widening of the second, third, and fourth portions of the duodenum with occasional antiperistalsis caused by a delay in the passage of barium from the duodenum to the upper jejunum. The small bowels were normal. Initially, the patient was treated with nasogastric suction and fluids and electrolytes, but this time he continued to have abdominal pains.

On August 31, 1978, a laparotomy was performed, and minimal adhesions in the abdomen were found. The second, third, and fourth portion of the duodenum was dilated up to the entry point behind the root of the mesentery, measuring 8 cm on the anterior surface. Peristalsis of the duodenum was extremely active. The jeju-

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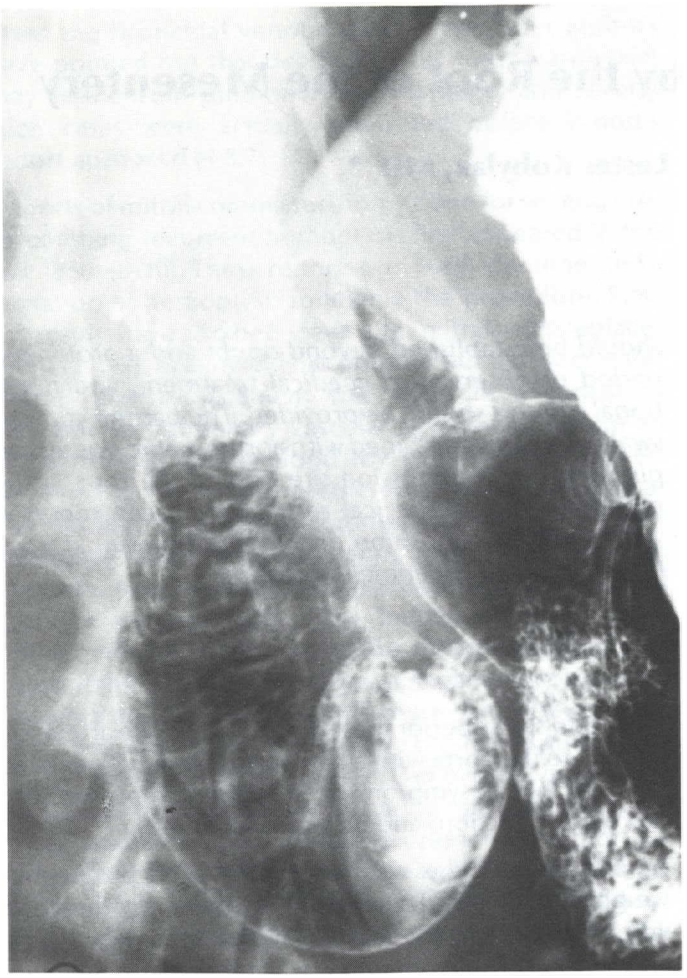

Fig. 1

Widening of the second, third, and fourth portion of the duodenum. Oblique view. Normal caliber of the upper jejunum.

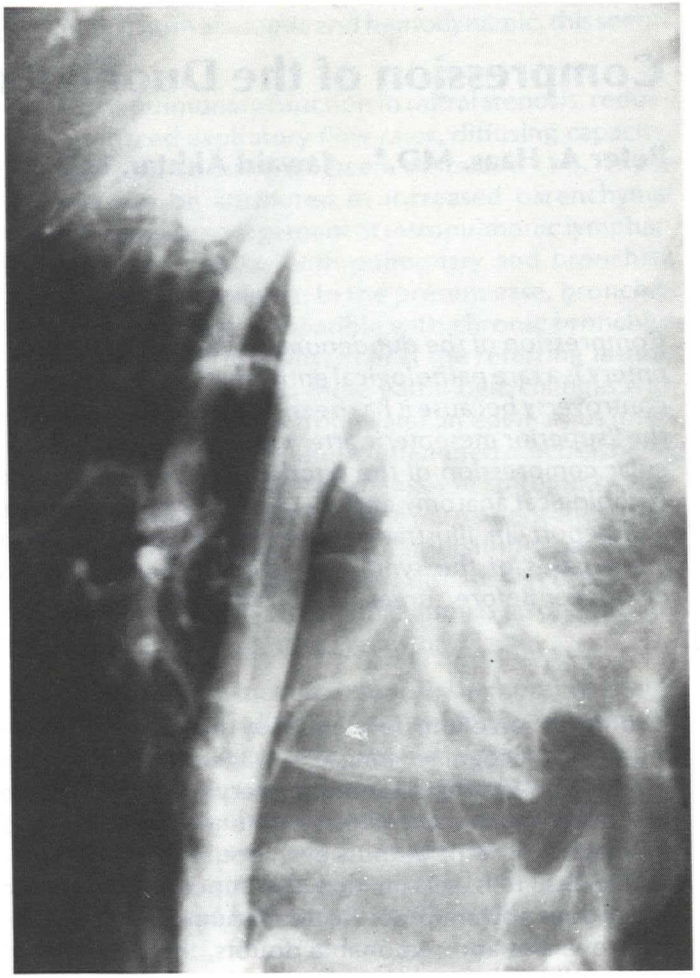

Fig. 2

Aortic angiogram. Lateral view. Narrow angle of 15° between the aorta and the superior mesenteric artery.

num was normal. The peritoneal reflection of the ascending colon and hepatic flexure was divided. The ligament of Treitz was transected, and the duodenum was mobilized. The duodenum and the upper 20 cm of the jejunum were then pulled to the right side of the root of the mesentery. The proximal jejunum was fixed to the right paracolic gutter and to a more distal point under the root; at that point, the jejunum then crossed behind the mesentery from right to left. The very short vessels which supply the duodenojejunal junction were preserved.

The postoperative course was uneventful, and the patient was discharged free of symptoms. An upper gastrointestinal radiograph indicated that the duodenum was not dilated, and the upper jejunum lay in the right side of the upper abdomen (Fig. 3). He was followed for more than a year, and there were no further symptoms of duodenal obstruction. He gained weight. He was treated for emotional problems, drug-related problems, and he had physiotherapy for paraparesis.

Anatomical Considerations

The fourth portion of the duodenum lies between the fat, lymphatics and connective tissue of the upper part of the mesenteric root and the connective tissue surrounding the aorta. Under normal circumstances, the healthy fat and connective tissue protect the duodenum from compression by the root of the mesentery. The superior mesentery artery arises from the aorta at an angle of 45°-60° (4) and enters the mesentric root in front of the fourth portion of the duodenum.

If a person loses weight (5), the amount of supportive tissue in the mesentery shrinks; and if the lumbar lordosis becomes exaggerated from treatment of vertebral fractures, the space between the aorta and the root narrows; and the mesentery compresses the duodenum,

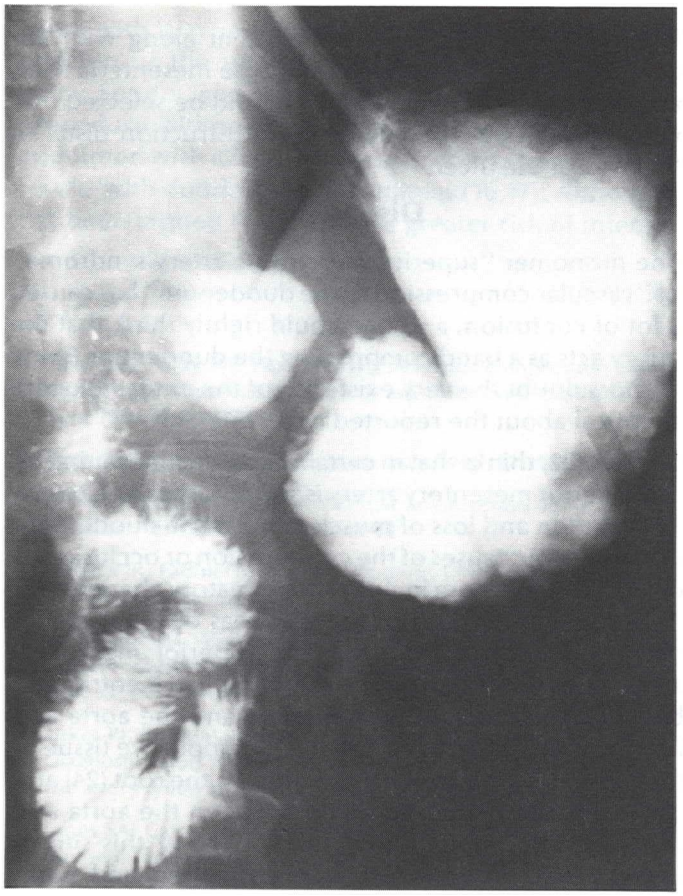

Fig. 3

Postoperative radiograph. A-P view. Normal duodenum and upper jejunum lying in the right side of the upper abdomen. Bowel has the shape of a reversed figure 3.

causing partial or complete occlusion of the lumen. However, this problem does not occur in everybody who loses weight. Predisposing anatomical factors may include a high, tight ligament of Treitz, and an abnormally high position of the third and fourth portion of the duodenum. Peptic ulcer may be present in about 25% of patients. Failure to recognize the coexistence of the syndrome may cause the symptoms to persist after surgery for peptic ulcer disease, or it may aggravate the symptoms because of changes in duodenal movement (6,7). Of 32 cases of distal duodenal compression, Anderson (8) reported five gastric and 14 duodenal ulcers.

Diagnosis

In many cases, there is a reasonable doubt in the diagnosis of the so-called superior mesenteric artery syndrome. In a young person who has lost weight rapidly or grown rapidly, in patients wearing a body cast, in paraparetics, in patients with extensive burns, or in those who have had long-term nursing care in a supine position, the symptoms of intermittent high small bowel obstruction can raise the suspicion of the compression of the duodenum by the root of the mesentery. No obese patient with these symptoms has ever been reported(1). Other causes of the compression of the distal duodenum can be an intrinsic tumor, tumor of the body of the pancreas, retroperitoneal tumors, adhesions, adjacent inflammatory conditions, or scleroderma.

On upper gastrointestinal x-ray examination, the patient's proximal duodenum is dilated, and the flow of barium is obstructed at the midpart of the transverse portion of the duodenum; but the obstruction usually disappears if the patient is placed in a prone position (6). At fluoroscopy the barium appears to churn in the duodenum and may pass the duodenojejunal junction if the patient turns to knee-elbow position. However, many consider these signs nonspecific (9). Hypotonic duodenography is also recommended (6).

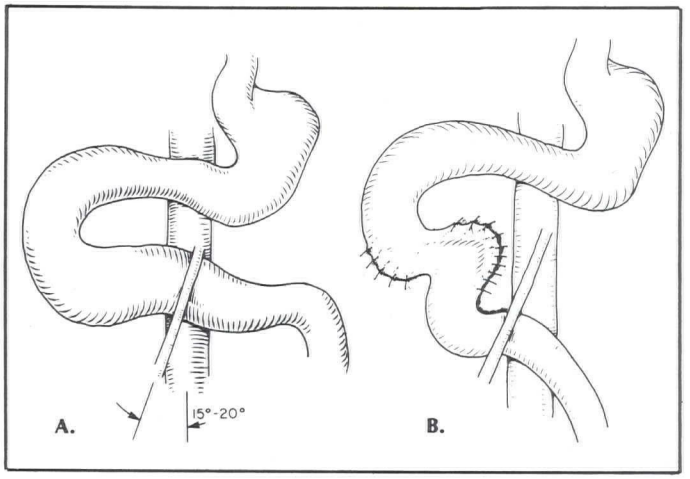

Fig. 4

A. Narrow angle betwen aorta and superior mesenteric artery. B. Duodenum and proximal jejunum at the right side of the mesentery. The bowel crosses from right to left at a lower point than in A.

Angiographic studies combined with barium swallow may confirm the diagnosis. A narrow angle of 15° (10,11) or even 6°-10° (6) between the aorta and the superior mesenteric artery can be characteristic (Fig. 4) (normal: 45°-65°) (4). The artery runs parallel to the aorta instead of running obliquely to the right, and the distance between the two vessels is 2-5 mm (6,12). The normal distance is 7-20 mm, when measured 7 cm below the origin of the superior mesenteric artery (13). Together, the arteriogram and barium study indicate that the site of duodenal compression is the point at which the artery crosses the duodenum.

Treatment

In most cases, since obstruction is not complete, the pain can be relieved by vomiting, by reducing the amount of food eaten, by nasogastric suction, or by changing the body's position to a prone or knee-elbow position, or lying on the left side. Some form of enteral or parenteral nutritional support may be helpful, but so far there is no report in the literature that hyperalimentation has relieved symptoms.

Surgery should be considered only if the diagnosis is established beyond doubt, and medical treatment has failed. Because this syndrome is controversial, surgery is indicated only if: 1) the patient meets all the radiographic and clinical criteria for the diagnosis; 2) a thorough radiographic, endoscopic, and psychologic evaluation rules out other causes; 3) the symptoms do not disappear spontaneously after a prolonged period of observation and medical therapy; and 4) in cachectic or thin individuals, an attempt at weight gain is unsuccessful.

The operation must confirm the diagnosis: the jejunum is normal in size or collapsed, the duodenum is markedly distended to the point at which it crosses the root of the mesentery, and there is a vigorous peristalsis and antiperistalsis on the duodenum.

Many authors report good results by dividing the Treitz ligament and relocating the duodenum at a lower position behind the root of the mesentery (1,14,15). The results of duodenojejunostomy are better (16,18) than those of gastrojejunostomy.

The procedure we performed was described by Louw and co-workers (19) and later recommended by Wayne and Burrington (20). The duodenum should be freed from the lateral attachments after the hepatic flexure is mobilized. The opening between the aorta and the root of the mesentery caudal from the duodenum should be enlarged by blunt dissection, the ligament of Treitz divided, and a 20-30 cm long portion of the proximal jejunum brought behind the root of the mesentery to the right side. Although the vessels supplying the duodenojejunal flexure are very short, this portion of the bowel can be rotated around the longitudinal axis to the right, relieving it from the pressure of the root. At this point, the bowel is shaped like a reversed figure 3 (Figs. 3,4). The bowel will cross to the left between the mesentery and the aorta at a lower point, where the space is wider and there is less tension. It is better to fix the small bowel to the peritoneum of the right paracolic gutter and to the mesentery where the bowel crosses from right to left in order to prevent it from slipping back to its original position.

If peptic ulcer disease is also present along with the compression of the duodenum by the mesenteric root, an appropriate ulcer operation should be selected that will also alleviate the mechanical obstruction distal to the area of the ulcer.

Discussion

The misnomer "superior mesenteric artery syndrome" or "vascular compression of the duodenum" has caused a lot of confusion, and one could rightly think that the artery acts as a band compressing the duodenum. Some authors doubt the very existence of the entity (9) or are skeptical about the reported cases (21).

Gondos (22) thinks that in certain cases the imprinting by the superior mesentery artery is secondary as a response to dilatation and loss of muscle tone of the duodenum. Other organic causes of the compression or occlusion of the distal duodenum include inflammatory changes (23) or tumors of the body of the pancreas or other malignancies (3). It is certain that the superior mesentery artery does not compress the duodenum. It is entrapped between the root of the mesentery and the aorta and lumbar spine. Most likely the loss of supportive tissue in the mesentery increases the tension on the root (24) and decreases the space and angle between the aorta and the root. The duodenum is firmly fixed at this site: it cannot slide downwards; it is entrapped and compressed. Contributing to the loss of supportive tissue and decreased space are rapid weight loss, rapid growth, prolonged supine position with exaggeration of the lumbar lordosis, or external compression.

The doubts in the diagnosis seem reasonable (9,21). Periodically, large numbers of cases are reported in the literature (1,3,7,8), sometimes from one geographical location. Lee and Mangla (16), found an incidence of 0.01-0.05 per 1,000 admissions, and Anderson, et al (8) found 32 cases per 24,000 gastroduodenal x-ray examinations.

Although the superior mesentery artery is not a constricting band, it is a useful landmark in the diagnosis. The barium contrast swallowing test combined with aortographic studies can pinpoint the compression site behind the root of the mesentery. The barium contrast study in itself can be useful but not specific (7,9). It seems from our aortograms that the critical feature is not the angle of the origin of the superior mesentery artery; it is, rather, the inclination of the artery after it originates. The space between the artery and the aorta at this point is narrowed (Fig. 2).

Operation is indicated only if the diagnosis seems to be certain, and conservative measures have failed. We

agree with Wayne and Burrington (20) that the dextroposition of the upper jejunum, as recommended by Louw, Sender, and Shandling (19), is an effective, simple procedure, although Shandling (21) seemed to be disappointed with it later. There are recent reports of good results with duodeno-jejunostomies (16,17). Although it has been argued that there is a greater risk of infection with this procedure, we do not feel that this argument is valid.

The main controversy seems to stay with us: are there more cases than reported (17), or are more cases reported than exist (21)?

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