

Midgut volvulus: Value of multidetector computed tomography in diagnosis

Midgut volvulus: Tanıda çok kesitli bilgisayarlı tomografi'nin değeri

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Midgut volvulus is a rare complication of intestinal malrotation in adults. We present a case of intestinal malrotation with surgically proven midgut volvulus. Multidetector computed tomography with postprocessing of imaging data using three-dimensional reconstruction techniques provided better demonstration of the abdomen than other imaging modalities. To our knowledge, this is the first presentation of midgut volvulus on multidetector computed tomography in adults. The literature on midgut volvulus is also reviewed and imaging findings of this disease are discussed.

Midgut volvulus yetişkinlerde intestinal malrotasyonun nadir bir komplikasyonudur. Burada cerrahi olarak midgut volvulus olduğu doğrulanmış bir intestinal malrotasyon olgusunu sunuyoruz. Çok kesitli bilgisayarlı tomografi görüntüleme bilgisini üç boyutlu rekonstrüksiyon teknikleri ile işlemesi sonucunda diğer görüntüleme metodlarına göre abdomende daha iyi görüntüleme sağlamaktadır. Bilgilerimize göre bu olgu yetişkinde multidetektör bilgisayarlı tomografi ile gösterilmiş ilk midgut volvulus olgusudur. İlgili literatür de gözden geçirilerek midgut volvulusun görüntüleme bulguları tartışılmıştır.

Key words: Intestinal malrotation, midgut volvulus, whirl sign, barber pole sign, multidetector computed tomography

Anahtar kelimeler: Intestinal malrotasyon, midgut volvulus, fırlıdak bulgusu, barber poole bulgusu, çok kesitli bilgisayarlı tomografi

INTRODUCTION

Intestinal malrotation is the term used for those cases in which the normal rotation and fixation process of the intestine fails to take place during fetal development. It is usually detected in infants and children, but rarely in adults. The most important complication of malrotation is midgut volvulus, as it can result in bowel necrosis. Multidetector computed tomography (MDCT) appearances of midgut volvulus have not been reported in adults. We present imaging findings, particularly MDCT appearances, of a surgically proven case of midgut volvulus.

CASE REPORT

A 27-year-old woman presented with a four-week history of vomiting, abdominal distension, consti-

pation and weight loss. Abdominal X-ray film revealed air-fluid levels in the stomach and duodenum. Subsequent barium study demonstrated the malpositioned duodenojejunal junction located lower than the duodenal bulb in the right upper quadrant. An obstruction was also detected at this level (Figure 1). Abdominal ultrasound (US) revealed a whirl-like mass in the right upper quadrant of the abdomen. Color Doppler US demonstrated a clockwise whirlpool sign with rotation of the dilated superior mesenteric vein (SMV) around the superior mesenteric artery (SMA) (Figure 2). MDCT of the abdomen revealed findings suggestive of a midgut volvulus (Figure 3). The stomach and proximal part of the duodenum were distended and fluid-filled. MDCT angiography revealed abnormal arterial course and whirl-like

pattern of SMA, jejunal branches of celiac artery and an anastomosing vessel between the inferior mesenteric artery (IMA) and SMA called the arc of Riolan (Figure 4).

Surgery confirmed the diagnosis of midgut volvulus with obstruction of the small bowel at the level of the duodenojejunal junction. Normal peritoneal attachment of the small bowel was absent. The large bowel was shorter than normal and surrounded the displaced duodenum and jejunum. There was no evidence of bowel ischemia. After derotation of the midgut and division of the adhesions obstructing the duodenojejunal junction, the small bowel was placed in the right side of the abdomen and the colon in the left side. The patient was discharge from the hospital on the 5th postoperative day in good condition.

DISCUSSION

Plain films of the abdomen, barium studies, abdominal US, catheter angiography and CT scans can be used for the diagnosis of midgut volvulus. Pla-



Figure 1. Barium meal study shows the malpositioned duodenojejunal junction located lower than the duodenal bulb in the right upper quadrant. An obstruction can also be seen at this level.



Figure 2. Abdominal ultrasound shows a whirl-like mass (white arrow) in the right upper quadrant of the abdomen.

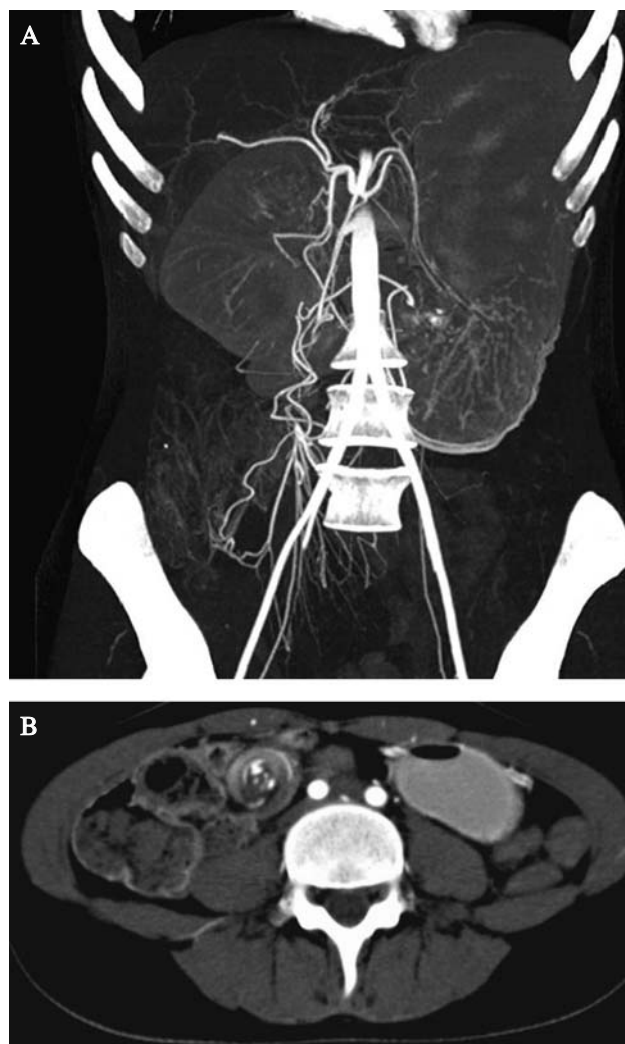


Figure 3. A) Thick-slab volume-rendered image of contrast-enhanced MDCT in the arterial phase demonstrates small bowel obstruction through the level of the duodenojejunal junction. Dilated and fluid-filled duodenum and stomach and twisted mesenteric vessels can also be seen. B) Axial contrast-enhanced MDCT images in the arterial phase show the "whirl sign".

in films are useful in assessing the level of the obstruction. Air-fluid levels in the stomach and duodenum (double-bubble sign), an important finding of acute duodenal obstruction, can also be seen on plain films. Barium meal studies have been reported to have facilitated the diagnosis of midgut volvulus with 100% accuracy (1). They can de-

monstrate an abnormally positioned duodenojejunal junction below the level of the duodenal bulb and a dilated duodenum, as well as the level of the obstruction. These findings were also detected on barium meal study in our case. However, the walls of the bowel loops distal to the obstruction, mesenteric vessels, and adjacent structures cannot be assessed.

The “whirl sign” is the term used to describe encircling of the bowel loops and the SMV around the SMA. It was first described by Fisher (2) in a patient with midgut volvulus on CT. Later, this term was used as “whirlpool sign” to describe similar findings on US. The sensitivity and specificity of the clockwise “whirlpool sign” for midgut volvulus were found as 92% and 100%, respectively, in a study of Shimanuki et al. (3). However, they concluded that the counterclockwise pattern of the SMA and SMV might be a normal variant. The clockwise “whirlpool sign” was also demonstrated on color Doppler US in the case presented herein. Although US has been reported to be helpful in the diagnosis of midgut volvulus (4), it has some disadvantages, such as being operator-dependent and having low sensitivity in the presence of gas distension.

The appearance of the twisted mesenteric vessels has been described as the “barber pole sign” in the catheter angiography of midgut volvulus. It was first described by Buranasiri et al. (5) as a counterclockwise twisting of the mesenteric vessels seen with catheter angiography. In addition to this finding, tapering or abrupt termination of mesenteric vessels, prolonged contrast transit time, absent venous opacification, or dilated SMV can also be detected on catheter angiography. However, it is an invasive and time-consuming imaging modality. Moreover, the wall of the bowel loops, adjacent organs, and the presence of free intraabdominal gas or fluid cannot be assessed with this technique.

MDCT is a fast and technically easy way to fully assess patients with midgut volvulus. As traditional axial images are used to detect the presence of a “whirl sign” on spiral single-detector CT, it may be missed if the axis of the twisted bowel and mesentery is not vertical to the scanning plane (6). However, it is possible to assess patients in multiplane with reconstructed images on MDCT. Moreover, MDCT provides additional information about the surrounding anatomic structures such as the level of the obstruction, displacement of the

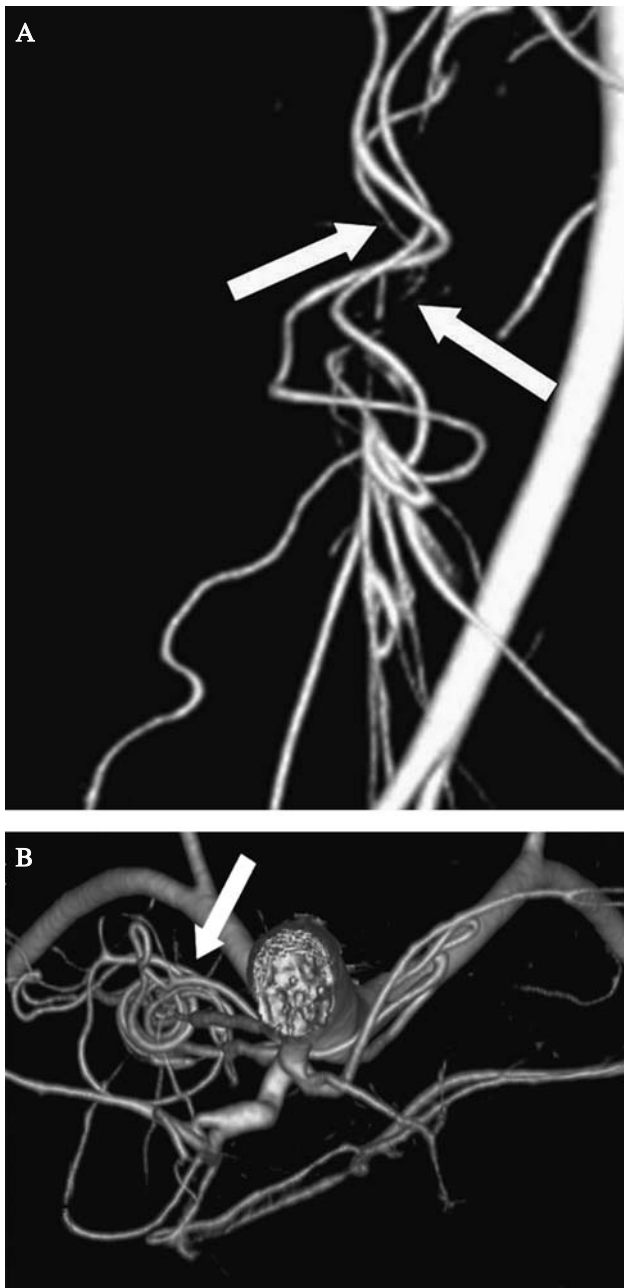


Figure 4. **A)** Magnified three-dimensional volume-rendered MDCT image shows the thin-caliber superior mesenteric artery (white arrows) at the level of the obstruction due to the compression of volvulated bowel loops. **B)** Superior volume-rendered image shows whirl-like pattern of mesenteric arterial vessels (white arrow).

duodenojejunal junction, interchange of SMV to the left of SMA, the degree of bowel infarction, free intraabdominal gas or fluid, and associated congenital or acquired anomalies. In our patient, intestinal obstruction at the duodenojejunal junction, dilated duodenum and stomach, displacement of the small bowel to the right side of the abdomen, and whirl-like pattern of the mesenteric vessels and small bowel loops were detected on MDCT. No signs of ischemia were present, which was also confirmed surgically. MDCT angiography is well suited for noninvasive imaging of the abdominal arteries. It provides similar or even better demonstration of mesenteric vasculature than conventional angiography. Abnormally coursed and twisted vessels can easily be visualized with

proper post-processing techniques as in the case presented herein. Collateral intestinal perfusions supplied by the IMA via a hypertrophic Riolan arc and by the jejunal branches of the celiac artery were seen in our case due to the chronic hypoperfusion in the vascular territory of SMA resulting from the encircling bowel loops.

In conclusion, midgut volvulus is a serious complication of intestinal malrotation. Although rare in adults, the possibility of midgut volvulus should be kept in mind in assessing a patient with abdominal pain and vomiting. Many radiological methods are available; however, MDCT seems to be more effective in the overall assessment of midgut volvulus.

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