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CASE REPORT

A Rare Case of Aneurysm of Arc of Riolan Artery and Gastroduodenal Artery

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ABSTRACT

Arc of Riolan is a collateral channel that connects the proximal superior mesenteric artery (SMA) or its middle colic branch and the proximal inferior mesenteric artery or its left colic branch in case of stenosis of either of the arteries. A 65-year-old diabetic female presented with vague abdominal pain. Ultrasonography showed a large aneurysm within the abdomen in the left lumbar region. Computed tomography (CT) angiography done showed severe diffuse atherosclerotic calcification of the abdominal aorta with complete occlusion of the celiac trunk and mild stenosis of SMA origin. The arc of Riolan was seen between the middle colic artery and the ascending branch of the left colic artery, with a large saccular aneurysm in its mid section. No evidence of rupture or hematoma was visible. Another saccular aneurysm was also seen involving the gastro-duodenal and the pancreatico-duodenal collateral arcade. As far as we know, this is the first case of arc of Riolan artery aneurysm to be reported in English literature.

Key words: Aneurysm, arc of Riolan, computed tomography

INTRODUCTION

Jean Riolan (1580–1657), a French anatomist, was the first to describe the mesenteric arterial connection between the superior and inferior mesenteric arteries. Later in 1743, Albrecht von Haller described in detail the anatomy of the mesenteric arteries and named the arc of Riolan artery.[1] This is also called as meandering mesenteric artery or central anastomotic mesenteric artery. The arc of Riolan artery connects the proximal superior mesenteric artery (SMA) or its middle colic branch and the proximal inferior mesenteric artery (IMA) or its left colic branch. It forms an important collateral channel between the SMA and IMA in case of stenosis of either of the arteries.

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CASE REPORT

A 65-year-old diabetic female presented with loss of weight and vague abdominal pain which increased after food intake. Endoscopy was done and found to be normal. The blood investigations showed mildly elevated levels of random blood glucose and total cholesterol. The patient was referred for ultrasound (USG) examination, which showed a large aneurysm within the abdomen in the left lumbar region. Color Doppler showed

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swirling blood flow within it [Figure 1]. No thrombus was seen within. Following USG, the patient underwent a computed tomography (CT) angiography which showed severe diffuse atherosclerotic calcification of the abdominal aorta with occlusion of the ostia of celiac trunk [Figure 2a] and (~50% diameter reduction) stenosis of SMA origin [Figure 2b]. The IMA was dilated and showed no stenosis. Celiac artery was reformed by the gastro-duodenal and the inferior pancreatico-duodenal collateral arcade. A prominent tortuous collateral vessel was seen in the central part of the mesentery connecting the middle colic artery and ascending branch of the left colic artery well away from the colon, consistent with arc of Riolan. Incidentally, the arc showed a large saccular aneurysm (~30 × 30 mm) in its mid portion [Figures 3a, b and 4]. No evidence of rupture, dissection, or hematoma was present. Another saccular aneurysm (~15 × 5 mm) was seen involving the distal gastroduodenal artery [Figure 3a and b]. The abdominal organs and the bowel loops were normal. Radiological investigations revealed occlusion of the celiac trunk and significant stenosis of the SMA with an aneurysm involving the arc of Riolan and another aneurysm involving the gastroduodenal artery. Since the patient did not want any surgical or interventional procedures, she was only given conservative treatment. Unfortunately, the patient succumbed due to rupture of the aneurysm.

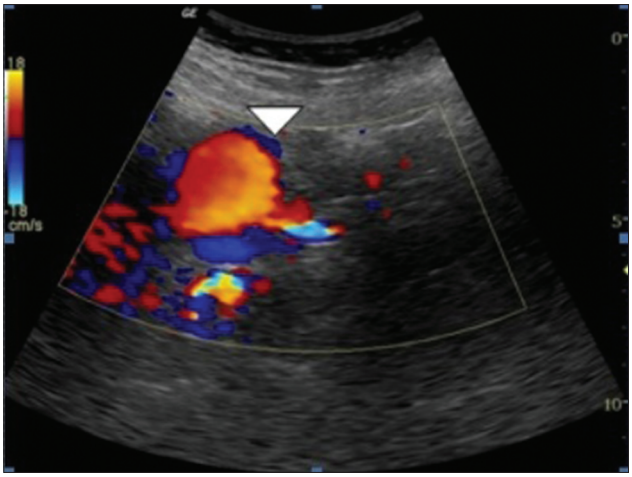

Figure 1: 65-year-old woman with pain in the abdomen diagnosed due to arc of Riolan aneurysm. Ultrasound of the abdomen with color Doppler shows a large saccular aneurysm (arrowhead) within the abdomen in the left lumbar region. Color Doppler shows swirling blood flow within it. No thrombus was seen.

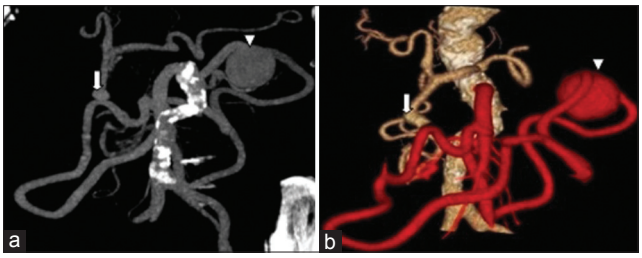

Figure 3: 65-year-old woman with pain in the abdomen diagnosed with arc of Riolan aneurysm. a) CT scan – coronal maximum intensity projection (MIP) in the arterial phase of abdomen shows the arc of Riolan with aneurysm (arrowhead) and gastroduodenal artery aneurysm (down arrow). b) CT scan volume-rendered imaging in arterial phase shows the arc of Riolan with aneurysm (arrowhead) and gastroduodenal artery aneurysm (down arrow).

DISCUSSION

The stomach and bowel loops are supplied by an extensive network of anastomotic vessels that protect the bowel from ischemia and infarct. The celiac artery arises from the aorta at the level of T12 and commonly divides into left gastric, splenic, and common hepatic arteries. The common hepatic artery gives off the gastroduodenal artery. The gastroduodenal artery divides into superior pancreatico-duodenal and right gastroepiploic arteries. The former anastomoses with the inferior pancreatic duodenal branches of the SMA to form an important collateral network between the celiac artery and the SMA around

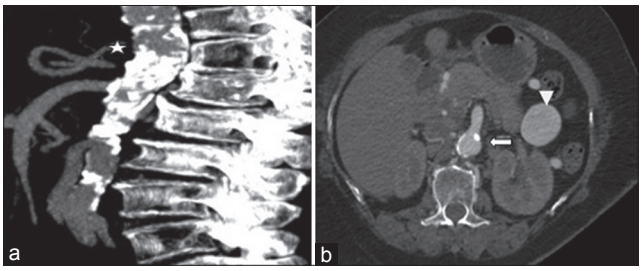

Figure 2: 65-year-old woman with pain in the abdomen diagnosed with arc of Riolan aneurysm. (a) CT scan – sagittal maximum intensity projection (MIP) in arterial phase shows occlusion of the celiac origin (asterix) with diffuse atherosclerotic calcifications in the abdominal aorta. (b) CT scan – axial section in the arterial phase at the level of SMA origin shows a calcific plaque at the origin causing ~50% diameter stenosis (left arrow). Also seen is the arc of Riolan aneurysm (arrowhead).

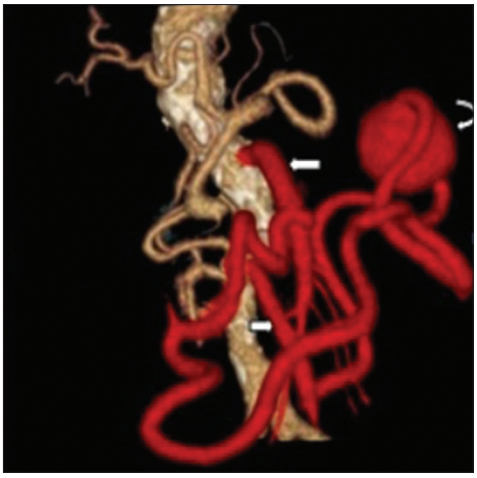

Figure 4: 65-year-old woman with pain in the abdomen diagnosed due to arc of Riolan aneurysm. CT scan arterial phase volume-rendered imaging shows the arc of Riolan (red shaded) between the SMA (left arrow) and the IMA (right arrow), with an aneurysm seen in its mid part (curved arrow).

the head of the pancreas. The latter anastomoses with the left gastroepiploic artery along the greater curvature of the stomach and gives rise to the omental branches.[2]

The SMA arises from the aorta at the level of L1–L2 and about 1–2 cm below the celiac artery. It supplies the distal duodenum, entire small bowel, and the colon up to the mid-transverse colon through inferior pancreatico-duodenal, jejunal, ileal branches, ileocolic, right and middle-colic arteries. The SMA finally terminates as ileocolic artery.[2]

The IMA arises from the aorta at the level of L3–4 on the left side, supplies the colon from the mid-transverse colon to the rectum through left colic and sigmoidal arteries, and finally terminates as superior rectal artery which anastomoses with middle and inferior rectal arteries from the internal iliac artery.[2]

An important collateral pathway between celiac artery and SMA is the pancreatico-duodenal arcade between the superior and inferior pancreatico-duodenal arteries. In rare cases, a persistent direct embryologic connection between the celiac trunk and SMA may be seen. This is called as the arc of Buhler. Anastomotic connection between the right gastroepiploic artery (from the gastroduodenal artery) and the left gastroepiploic artery (from the splenic artery) is called the arc of Barkow.

The left branch of middle colic artery anastomoses with the ascending branch of the left colic artery and forms an important collateral channel between the SMA and the IMA near the splenic flexure of colon and is called marginal artery of Drummond.

The arc of Riolan is a collateral channel which connects the proximal SMA or its middle colic branch and the proximal IMA or its left colic branch in case of stenosis or occlusion of either of the arteries.[3] It is also seen in case of occlusion of celiac artery with associated stenosis of SMA. Since the SMA cannot compensate for celiac artery occlusion, it starts recruiting blood from the IMA through the arc of Riolan, which was seen in our case. The arc of Riolan is prominent and tortuous in course and runs close to the root of mesentery in comparison to the marginal artery of Drummond which is close to the colon.

The common cause for occlusion of celiac artery, SMA, or IMA is acute embolism or chronic atherosclerotic disease. Acute embolism is commonly seen in SMA, which has a cardiac origin in nearly 95% of patients due to atrial fibrillation or myocardial infarction. The patient usually presents with severe acute abdominal pain.[4]

In chronic atherosclerotic occlusive disease, two of the three splanchnic arteries (celiac, SMA, and IMA) are severely diseased to produce clinical symptoms. The symptoms are gradual with progressive development of postprandial pain. Since the occlusion is usually at the origin of the arteries, collateral formation occurs.[4]

In our case, aneurysm involving the arc of Riolan artery and the gastroduodenal artery was probably due to medial degeneration caused by hyperdynamic flow. The other possible causes of splanchnic artery aneurysm are atherosclerosis, trauma, septic emboli, intravenous drug abuse, vasculitis like polyarteritis nodosa, and pancreatitis.[4]

The goal of the clinician should be treating the underlying cause of aneurysm with appropriate interventional management to avoid rupture.

Multidetector CT (MDCT) is a fast, inexpensive, and routinely practiced modality to visualize aneurysm and abdominal vessels. It also helps to study abdominal viscera and bowel loops. Multiplanar reconstruction (MPR) with maximum intensity projection (MIP) and volume rendering (VR) imaging helps in easy identification of aneurysm and vascular stenosis.

The limitations of MR angiography (MRA) are increased scanning time, motion artifacts due to the respiration and bowel peristalsis, and also poor spatial resolution compared to MDCT. Also, time-of-flight (TOF) MRA overestimates the stenosis and causes signal loss due to turbulent flow.

Digital subtraction angiography (DSA) helps to plan treatment, to visualize advancement of collateral vessels, and to study the inflow and outflow zones of an aneurysm. Endovascular management can also be done in the same sitting.

In the present case, considering the advaced age of the patient and the co-morbid conditions like diabetes mellitus and hypercholesterolemia, endovascular management was a safe option. Before coil embolization of the gastroduodenal artery aneurysm and the Riolan artery aneurysm, careful assessment of the collateral flow is critical and if sacrifice of the collaterals is regarded not to be safe, angioplasty or surgical reconstruction of the celiac artery and SMA is needed.

CONCLUSION

The arc of Riolan artery usually develops in case of chronic atherosclerotic occlusion of proximal SMA, proximal IMA, or

distal abdominal aorta. It can also be seen in patients with celiac artery occlusion and stenosis of proximal SMA, as in our case. Aneurysm involving the gastroduodenal artery and the arc of Riolan artery is extremely rare and to our knowledge has not been reported in English literature. The probable cause of aneurysm could be the hyperdynamic flow causing medial degeneration. MDCT is a relatively easy, fast, and inexpensive technique to detect splanchnic aneurysms. Timely diagnosis and intervention avoids fatal complications like rupture.

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