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Vascular Anatomical Variants of Abdominal Vessels on Computed Tomography with its clinical significance

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Abstract

Vascular anatomic variants are quite common in general population. Evaluation of the arteries arising from the abdominal aorta and its variations is very important for minimally invasive or laparoscopic surgery as well as for few abdominal disorders. The study was done over a duration of 4 months. Total 70 patients were included in the study. It was concluded that precise vascular anatomical knowledge is very important for minimally invasive or laparoscopic surgery. Although DSA is the gold standard for vascular studies, since it is invasive contrast CT scan is preferred to study vascular anatomical variations.

Key words: Anatomical variation, Abdominal vessels, Computed tomography

INTRODUCTION

Vascular anatomic variants are quite common in general population. Evaluation of the arteries arising from the abdominal aorta and its variations is very important for minimally invasive or laparoscopic surgery as well as for few abdominal disorders. The use of contrast enhanced computed tomography or CT angiography plays a very crucial role in the assessment of various vascular anatomy. It helps in pre operative evaluation to plan laparoscopic surgery which allows limited visualization during surgery. It also helps to avoid various intra operative problems that may arise due to rare variants.[1- 3]

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Abdominal arteries demonstrate extensive variability in their origins and course, along with variations in the form of common origins of multiple arteries, and accessory or additional arteries. Most of such variant vascular anatomy is incidentally depicted at CT, MR angiography, or conventional angiography. The abdominal aorta develops from the fusion of paired dorsal aortae. The vitelline arteries later combine to develop into the celiac trunk and superior and inferior mesenteric arteries. The lateral aortic branches develop into suprarenal, renal, and gonadal arteries. Inferior vena cava embryogenesis is more complex and involves regression, anastomosis, and replacement of three pairs of embryonic venous channels: the posterior cardinal, subcardinal, and supracardinal veins.[4- 6]

AIMS AND OBJECTIVE:

- To evaluate different vascular variants on CT
- Its prevalence
- Clinical significance

MATERIALS AND METHODS:

It is a time bound observational study.

The study was done over a duration of 4 months from June 2023 to september 2023.

Total 70 patients were included in the study.

The study was done using a 128 slice CT scan after contrast administration.

Iodinated contrast was used and examination done from diaphragm to pelvic bone.

Inclusion criteria:

All patients referred to department of Radiology, MGM Aurangabad for contrast enhanced CT of abdomen and pelvis

Exclusion criteria:

Non contrast CT.

Creatinine more than 1.6

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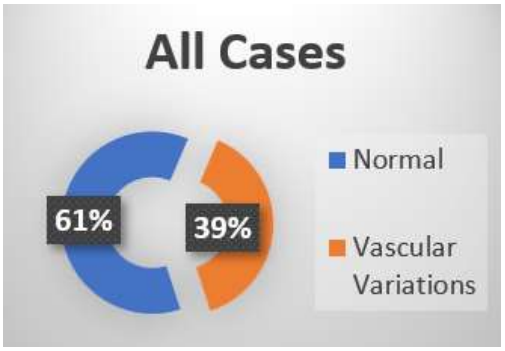
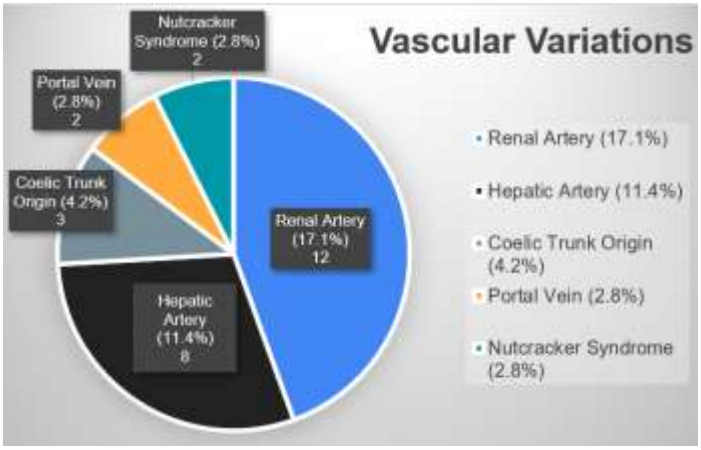
RESULTS

In our study of 70 patients, a total of 27 (39%) patients had vascular variations.





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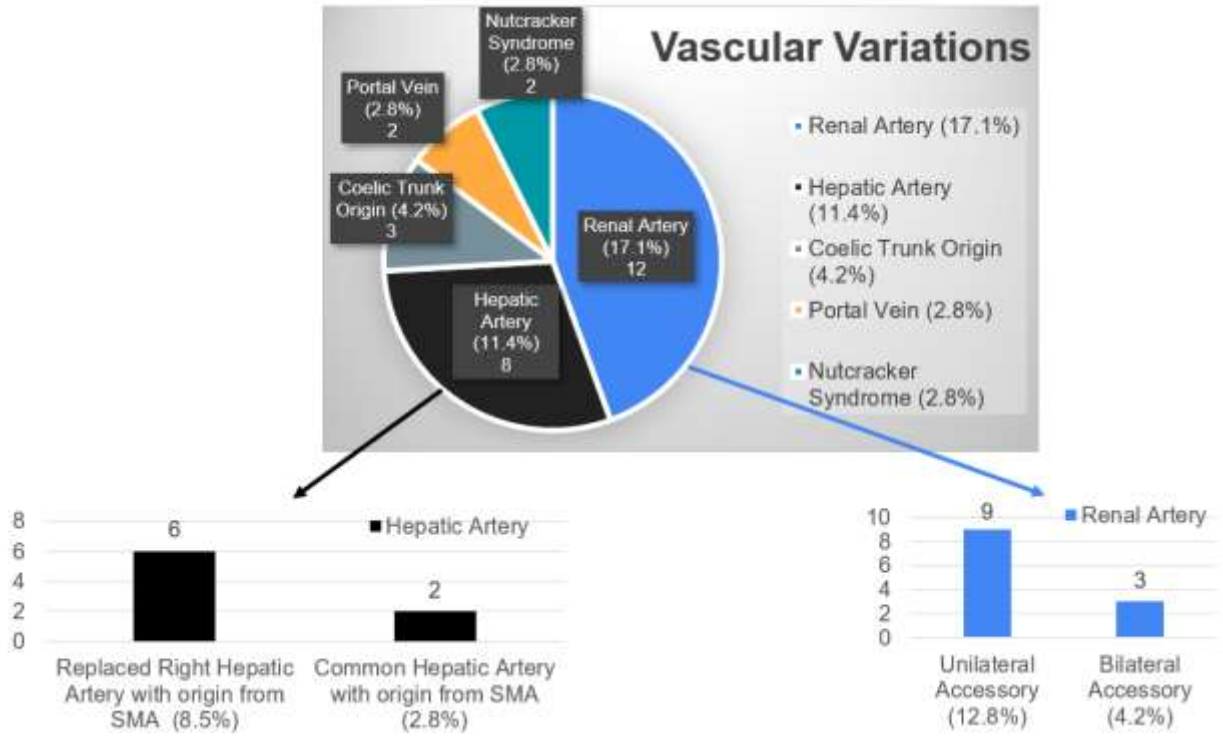

DISCUSSION

Renal arteries variations: Most common - accessory renal artery (12 patients - 17.1%). Unilateral accessory renal artery was seen in 9 cases (12.8%) Bilateral accessory was seen in 3 patients (4.2%). The inferior polar accessory artery - important variation - might cause extrinsic compression of ureter and lead to hydronephrosis, also its ligation during any intervention can lead to ischemic damage to the supplied portion of kidney. Other variation included: Early branching of renal artery (within 2 cm of origin).

Hepatic variations were seen in 8 cases (11.4%); Replaced right hepatic artery with origin from SMA in 6 patients (8.5%) and common hepatic artery origin from SMA in 2 patients (2.8%).

Other variations:

- Replaced left hepatic artery with origin from left gastric artery.
- Accessory right or left hepatic artery.
- Common hepatic artery origin from aorta.

Importance: Liver transplant

Celiacomesenteric trunk in 3 patients (4.2%).

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CELIAC TRUNK VARIATIONS: Other:

- Splenohepatic trunk
- Posterosuperior pancreaticoduodenal artery (celiac trunk with 4 branches)
- Gastrosplenic trunk
- Hepatogastric trunk
- Hepatosplenomesenteric trunk
- Splenomesenteric trunk

Portal vein variations:

Trifurcation Seen in 2 cases (2.8%).

Here three branches - RAPV, RPPV, LPV

Others:

2) RPPV originates as the first branch of portal vein PV,

3) RAPV originates from the left portal vein LPV

4) Absence of portal vein bifurcation (the portal vein gives only a single right portal branch in the liver hilum) and by the presence of a large vein coming from segment VIII and entering the distal segment of the left portal vein

Imp- Liver surgery , radiological interventional procedures like embolization, living donor transplantation or complex hepatectomy.

NUTCRACKER SYNDROME

- Anterior nutcracker syndrome (classical): occurs at the branching of the SMA off of the aorta
- Posterior nutcracker syndrome (rare): a retroaortic left renal vein (or retroaortic part of circumaortic vein) is compressed between the aorta and vertebrae. Leads to renal venous hypertension and hematuria.

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Figure 1: Unilateral accessory renal artery

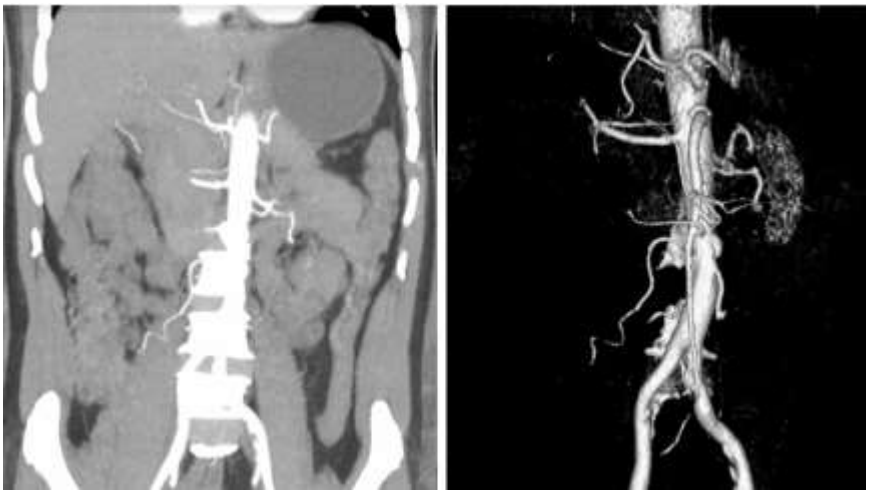

Figure 2: Bilateral accessory renal artery

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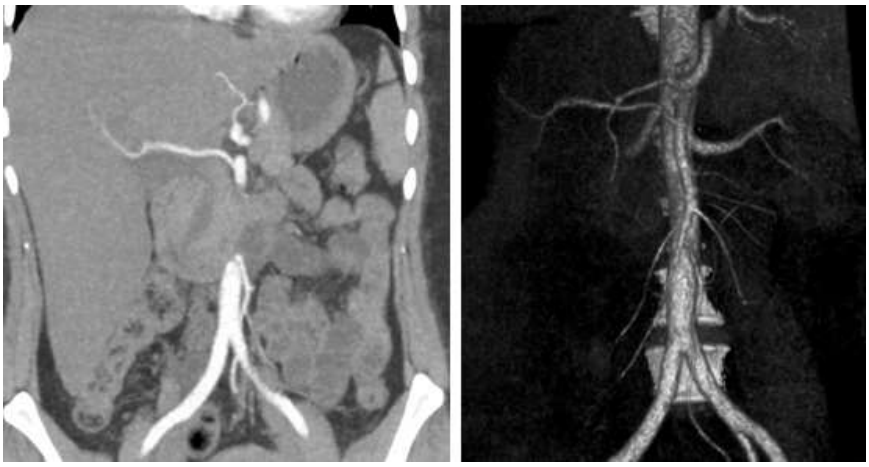

Figure 3: Replaced right hepatic artery having origin from SMA

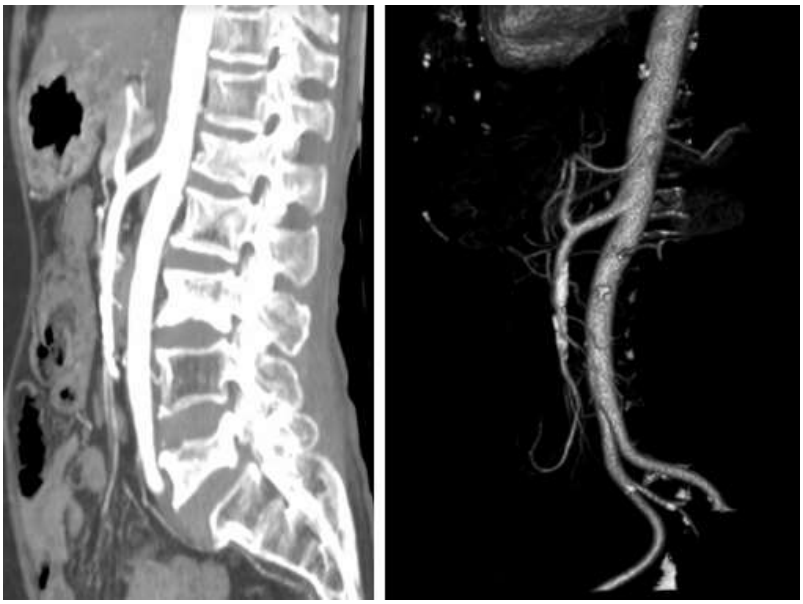

Figure 4: Celiacomesentric trunk

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Figure 5: Trifurcation of Portal vein

Figure 6,7: Anterior and posterior nutcracker syndrome

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Given the extended use of computed tomography (CT) for the evaluation of the most varied symptoms and/or pathologies, and the use of intravenous contrast in these studies, the evaluation of the different vascular anatomic variants has become routine for radiologists. A proper analysis of a CT scan requires knowledge of the vascular anatomy of the scanned area. Furthermore, it is important to check the correct arrangement of vessels and their filling defects in the case of intravenous contrast-enhanced CT scans, both for future surgery planning and to account for symptoms reported by the patient. At the time of interpretation of CT findings, it is not only necessary to consider the various anatomic variants that may occur, but also to have the knowledge of their different classifications, relationship with different symptoms and their association with other anomalies.[6-9] Jalamneh, B et al investigated the prevalence of variations in some branches of the abdominal aorta and to identify the most frequent variants as well as any rare variants not previously classified in the existing classification systems. The retrospective study included 550 abdominal computed tomography (CT) angiographic scans for patients (51.5% males, 48.5% females) performed. Variations were most common in the hepatic arteries (34.7%), followed by the renal arteries (31.3%). Variations in the celiac trunk were the least frequent (9.8%). The gastro-splenic trunk (type V) was the most common celiac trunk variant. The most common hepatic artery variant was the replacement of the right hepatic artery (type III). Accessory renal arteries were more frequent on the left side and among males (P = 0.01). The celiac trunk variations had a significant association with the hepatic artery variations (P = 0.001) and the renal artery variations (P = 0.011), respectively. There is a high prevalence of anatomical variations in the described vessels, and it matches the results in the reported literature. Their findings also suggest the possible coexistence of variants.[10]

CONCLUSION

Vascular variation is quite common in population, mostly seen involving renal arteries. The knowledge of these variations is extremely important in pre operative situation. Some variations can lead to vascular diseases. Precise vascular anatomical knowledge is very important for minimally invasive or laparoscopic surgery. Although DSA is the gold standard for vascular studies, since it is invasive contrast CT scan is preferred to study vascular anatomical variations.

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