

ORIGINAL RESEARCH

Prevalence of variation of abdominal aortic branches in CT angiography: Prospective analysis

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Abstract

The abdominal aorta predominantly provides blood supply to the upper abdominal cavity and its contents. Its major branches include the celiac trunk, superior mesenteric artery, and inferior mesenteric artery. Abdominal aortic branch variants are relatively prevalent and can impact certain surgeries. During embryonic development, the 10th to 13th vitelline arteries (Primitive intestinal arteries) communicate between the aorta and a primitive ventral anastomotic artery. Typically the ventral anastomosis and the 11th and 12th vitelline arteries regress, while the 10th and 13th roots give origin to the celiac trunk and the SMA, respectively. The remaining segments regress before birth. If the 10th to 12th vitelline arteries regress but there is abnormal persistence of ventral anastomosis, a celiacomesenteric trunk occurs. The study aims to estimate the prevalence of abdominal aortic branch variants in our study population by analyzing CT angiogram images. The CTA is considered the modality of choice for the evaluation of arterial anatomy, with a diagnostic accuracy of 97%-98% for detection of arterial variations. The study was conducted in Department of Radiodiagnosis, Kanyakumari Government Medical College & Hospital, Asaripallam, during the period of September 2021-August 2022. All the abdominal CT Angiogram done during this period was included in the study except cases with motion artifacts and inadequate contrast opacification. CT images were analyzed by an independent Radiologist using axial source images and post processing techniques like maximum intensity projection and volume reconstruction images. Variants of abdominal aortic branches were seen in 93 patients (38.75%) of study population. Additional renal hilar artery was the commonest variant (8.12%), the next common was the early branching of renal artery (7.91%). The incidence of the variant in celiac trunk was (3.3%). The commonest celiac trunk variant was celiac mesenteric trunk (1.66%) and splenohepatic trunk (1.66%). Radiologists have to be familiar with these variants and report these variants whenever possible in order to guide the operating surgeon/interventionist for planning management and reducing the inadvert complications.

Keywords: Abdominal aorta, variants, CT angiography

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Introduction

The abdominal aorta begins at the aortic hiatus of the diaphragm at the level of the T₁₂ vertebra. It has several branches primarily subgrouped as ventral, lateral, dorsal, and terminal in accordance with the anatomic orientation of the branches. The ventral and lateral branches supply the abdominal viscera, and the dorsal branches supply the abdominal wall and the spinal canal and its contents⁸. Abdominal aortic branches are crucial arteries as they supply many vital organs. Recognition of abdominal aortic branches and its variants is significant in this context and it has

been facilitated with the advent of CT angiography.

This study aims to estimate the prevalence of abdominal aortic branch variants in the study population by CT angiography. Pre procedural mapping of vascular anatomy helps in planning the surgery, devising the technique and preventing inadvert intraoperative catastrophe and associated morbidity.

Materials and Methods

It is a descriptive, prospective cross sectional study conducted in the Department of Radiodiagnosis,

Kanyakumari Government Medical College & Hospital, Asaripallam, during the period of September 2021-August 2022. A total of 240 cases of CT abdominal angiograms were analysed. The CT Angiography was performed in 16 slice CT-Toshiba Aquilion lightning machine. Automatic power injector and 18-20 gauge intravascular cannula was used. Nonionic iodinated contrast at a rate of 4ml/s was used. A total of 70-100ml of contrast was used. Arterial phase imaging was acquired after 4-5 seconds delay, when threshold enhancement of abdominal aorta exceeded 100HU. All studies with motion artifacts and inadequate contrast opacification were excluded. The major branches of abdominal aorta like coeliac axis superior mesenteric artery, renal artery, inferior mesenteric artery were studied using axial source imaging and post processing techniques like Maximum Intensity Projection and volume rendering.

Results

Commonest age group in our study was 55-65 yrs. Males slightly outnumbered Female (Male-55% & Female-45%) in our study. Data from a total of 240 patients were analysed, commonest variants was found in renal artery

Renal Artery

Total number of analysed renal vessels were 480 in 240 patients.

The anatomical variants found were early branching of renal artery i.e. within 2 cm from its origin from aorta and presence of additional arteries like a) superior renal polar artery b) inferior renal polar artery c) Additional Hilar artery.

Table 1:

	n	R	L
Typical Single Renal artery	366(76.25%)	193	173
Early branching variant	38(7.91%)	17	21
Accessory renal artery			
Additional Hilar artery	39(8.12%)	23	16
Superior renal polar artery	16(3.33%)	9	7
Inferior renal polar artery	20(4.16%)	11	9
Superior & Inferior renal polar artery	1(0.20%)	1	0

The typical renal artery anatomy was found in 154 out of 240 patients (64.16%) total number of renal vessels analysed was 480 in 240 patients. The typical renal artery anatomy was found in 366 kidneys out of 480 kidneys (76.25%) Early branching of renal artery was observed in 38(7.91%) kidneys. Additional Hilar

artery found in 39 kidneys (8.2%), Superior renal polar artery were observed in 16 kidneys(3.3%), Inferior renal polar artery were observed in 20 kidneys(4.16%), Superior and Inferior polar artery was seen in 1 kidney(0.20%).

Table 2: Celiac Trunk

Variants	Number	%
Typical celiac trunk	231	96.25
Celiac mesentric Trunk	4	1.66
Spleno hepatic trunk	4	1.66
Posterior-Superior pancreaticoduodenal artery	1	0.416

Among the 240 patients the typical (vascular trunk present approximately 1cm above superior mesenteric artery and having three branches: left gastric artery, common hepatic artery & splenic artery) celiac trunk was found in 231 patients (96.25%). Common origin

of celiac trunk and superior mesenteric artery was found in 4 patients (1.66%). Spleno hepatic trunk was observed in 4 patients (1.66%). Posterior-Superior Pancreatic Duodenal Artery was found in 1 patient (0.416%).

Table 3: Superior mesenteric artery

Variants	Number	%
Common origin of superior mesenteric artery and celiac trunk	4	1.66
Common origin of superior mesenteric artery and hepatic artery	1	0.416

Typical superior mesenteric artery was found in 235/240 (98%) common origin with superior mesenteric artery and celiac trunk was found in 4 patients (1.66%), Common origin of superior

mesenteric artery and hepatic artery was found in 1 patient (0.416%).

Discussion

Variants of abdominal aortic branches was seen in 93 patients (38.75%) of study population. Additional renal hilar artery was the commonest variant (8.12%), the next common was the early branching of renal artery (7.91%). The incidence of the variant in celiac trunk was (3.3%). The commonest celiac trunk variant was celiac mesenteric trunk (1.66%) and splenohepatic trunk (1.66%).

Mapping of variation of abdominal aortic branches helped the surgeon in decision making in all cases which underwent operative /interventional procedures (100%). CT angiography was found to be highly accurate in delineating arterial anatomy and it also showed the relationship between the arteries and adjacent organs⁹⁻¹⁰. However, role of CT angiogram was limited in patients with renal failure and contrast allergy¹¹. The study recommends vascular mapping with CT angiography and reporting the variants before major surgical/interventional procedures.

Conclusion

Prevalence of abdominal aortic variants amounts to 40% in our study population and CT angiography was highly accurate in identifying these variants and provided vascular map to the operating surgeon.

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