

Anatomical Variation of the Abdominal Aorta Single Branch Arteries Using Contrast-Enhanced Multi-Slice CT Scan

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Abstract

Background: The single-branch arteries of the abdominal aorta; celiac trunk, superior mesenteric artery, and inferior mesenteric artery have been under continuous study by anatomists, surgeons, and radiologists. With contrast-enhanced CT scans being one of the commonly used techniques for detailed study of their variants, for diagnostic and interventional purposes.

Aim of Study: Thorough analysis of contrast enhanced CT scans of the abdomen and pelvis for variations in the single branch arteries of the abdominal aorta and correlating the obtained results with previous studies and classifications and finding possible clinical results implications.

Patients and Methods: We studied 401 contrast-enhanced CT scans of patients at the Radiology Department, Faculty of Medicine, Helwan University, retrospectively, studying the level of origin and various branches of the celiac trunk, the superior mesenteric artery was studied as regards the aortomesenteric level of origin, angle, and distance, as well as Inferior mesenteric artery level of origin.

Results: The celiac trunk was found to arise at the level of T 12 in 42.39%, with 77.7% of the study population following the normal pattern of celiac trifurcation. While the superior mesenteric was found to arise at the level of L1 in 67.3%, with aortomesenteric angle having a range=11°-126°, and the aortomesenteric distance having a range= 4-46mm, correlating those results to the proposed cut off values of angle 22°, a distance less than 6mm, as a predisposing factor for SMA syndrome was found inaccurate since the BMI of the patients was not put into consideration and it was proven as an important factor prior diagnosing the rare SMA syndrome. The inferior mesenteric artery was found to originate at L3 level in 93% of our study population.

Conclusion: A precise study of the abdominal aorta single branch arteries before any interventional procedure and during radiological studies reporting is of utmost importance in clinical practice and surgical settings owing to the wide variations in the arterial branching system.

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Key Words: Celiac trunk – SMA – IMA – Contrast-enhanced CT – Aortomesenteric angle and distance.

Introduction

THE celiac trunk is the first major abdominal branch of the aorta, originates at its ventral aspect, just after it crosses the diaphragmatic aortic hiatus, at the level of the 12th thoracic and first lumbar vertebrae [1], it has a classic branching classification of trifurcation into the common hepatic artery (CHA), left gastric artery (LGA) and splenic arteries, giving blood supply to the abdominal foregut derivatives, the liver, gallbladder, pancreas, and spleen [2].

Other classifications have been described since the first one by von Haller in 1756, giving diversity in describing the Celiac artery classification from an incomplete celiac trunk due to bifurcation, while the third branch originates from a different artery, as well as superior mesenteric artery (SMA) or inferior mesenteric artery (IMA) originating in combination with the previous variations, and even independent origins of the CHA, LGA and splenic artery, which is known as the absence of the celiac trunk [3].

The second single-branched artery of the abdominal aorta is the superior mesenteric artery, arising antero-inferior behind the neck of the pancreas anterior to the left renal vein, entering the

Abbreviations:

CT : Computed tomography.
LGA : Left gastric artery.
SMA : Superior mesenteric artery.
CHA : Common hepatic artery.
IMA : Inferior mesenteric artery.
BMI : Body mass index

root of the mesentery downwards and to the right, giving the jejunal and ileal branches at its left side and the ileocolic, right and middle colic at its right side [1].

The main variations of interest as regards the SMA in our study are the level of origin which is usually located 1cm below the origin of the celiac trunk from the anterior surface of the aorta at the level of the lower border of the body of the first lumbar vertebra (intervertebral disc between L1-L2) [4], as well as the angle of origin from the abdominal aorta; range 38-60°, being greater in individuals with a high Body mass index (BMI) [5], and the distance between the SMA and the aorta aortomesenteric distance: Having a normal range of 8-12mm [6].

The last single branch artery of the aorta is the Inferior mesenteric artery which originates from its anterior aspect usually at the L3 level, just below SMA, running obliquely downwards towards the pelvic brim, initially anterior and then to the left of the aorta [1].

In this retrospective study, the three single-branch arteries of the aorta are assessed using contrast enhanced CT scans of the abdomen and pelvis for the level of origin, and various branching of the celiac trunk as well as aortomesenteric angle and distance of the superior mesenteric artery.

Patients and Methods

A retrospective study of archived contrast-enhanced CT scans of the abdomen and pelvis done in the period between January 2016 December 2019, held at the radiology department of Helwan University Hospitals (Badr and 15th May).

All studies were included regardless of patients' age or gender, with the exclusion of the studies where the patients had a previous history of pelvi-abdominal surgical intervention, chemoembolization, or pathological conditions that distorted the normal vascular anatomy of the abdominal aorta main branches.

The CT scans were performed on Toshiba Prime Aquilion scanner, 160-slice (Badr hospital), and Toshiba 16-slice scanner (15 May Hospital), Then they were evaluated on a dedicated workstation, "Vatra".

The values for the study were acquired in the arterial phase using reformatted images: Maximum intensity projection and multiplanar reconstruction with selected axial and sagittal images.

The three signal-branch arteries of the aorta were evaluated:

- I- The Celiac trunk was evaluated for the origin vertebral level and various divisions of its main three branches: The LGA, splenic, and CHA, comparing the results with the previous classifications of the celiac trunk, mainly the Panagouli classification, and Ulfacker's classification.
- II- The SMA was evaluated for vertebral level of origin, the angle between the SMA origin and abdominal aorta, as well as the distance from the aorta.
- III- The IMA was evaluated for vertebral level of origin.

The vertebral level of each of the single branches of the abdominal aorta was determined at the sagittal images, the variations in the celiac trunk division, as well as that of the SMA, were determined using both axial and sagittal series, The angle between the SMA and aorta was measured at SMA origin, while the distance between them was measured at the location where the duodenum crosses at the sagittal series.

The readers of the CT images: 2 experienced radiologists (9-15 years experience in body imaging)

The collected data was revised, coded (to ensure patients' confidentiality since the study is retrospective and the patients could not be reached for consent anymore), and entered into a PC utilizing Statistical Package for Social Science (SPSS 20 for windows).

Data were evaluated according to the type of data obtained for each parameter. Mean and standard deviation was used to illustrate quantitative data. Qualitative data were presented in frequencies and percentages. Appropriate statistical analysis was done according to the type of data obtained for each parameter.

Using Chi-square test, student *t*-test, ANOVA, and Pearson correlation with 2-tailed $p < 0.05$ considered statistically significant.

Results

Our study included 401 patients, 223 females (55.6%), 178 males (44.4%), in different age groups, divided into three main categories, 148 patients in the childhood/adolescent group; 36.9% of cases, 179 patients in the adult group; 44.6% and 74 in the elderly group presented as 18.5% of

all cases, with mean age 35.94, maximum age 83 year and minimum 1-year-old.

Celiac trunk:

a- Variations of celiac trunk level of origin:

Celiac trunk origin was found to be more common at T12 level in 170 patients (42.39%), followed by L1 in 158 patients (39.4 %), then T12-L1 in 54 patients (13.47%), 8 patients (2 %) at the level of T11-T12, 5 patients (1.25%) L1-L2 ,2 patients (0.5%) at T11, 1 patient (0.25%) at L2 and 3 patients (0.75%) with absent celiac trunk (Table 1).

Associating the CT level with gender is proven to have no statistical significance (p -value=0.6) with the most common level in females being the T12 level, while the most common level in males is L1.

b- Variation in Celiac trunk branching system:

The most common celiac trunk branching variant was the LGA arising early on the celiac trunk followed by a hepatosplenic trunk in 186 patients (46.38%) (Fig. 1), this was followed by the second most common type of the celiac trunk branching, where all the three main branches of the celiac trunk trifurcate at the same time which is found in 126 patient (31.42%) (Fig. 2). The third type of celiac trunk branching was the hepatosplenic trunk with the LGA arising from the splenic artery which was found in 59 patients (14.71%) (Fig. 3).

This is followed by other less common types as follows (Table 2):

- LGA arising from the abdominal aorta with hepatosplenic trunk arising after it in 7 patients (1.75%).
- Hepatosplenic trunk with the LGA arising from CHA in 7 patients (1.75%).
- LGA arising from celiac trunk followed by the hepatosplenic trunk with hepatic branch formed by left hepatic artery, while the right hepatic artery arises from SMA in 8 patients (2%).
- Absent celiac trunk with CHA and splenic artery arising directly from the aorta while the LGA is a branch from the splenic artery in 3 patients (0.75%).
- Gastrosplenic trunk with the hepatic artery (CHA or right and left hepatic arteries) arising from SMA in 2 patients (0.5%).
- Celiacomesenteric trunk in 2 patients (0.5%).
- Common origin of LGA, left hepatic artery and splenic artery with right hepatic artery arises separately from the abdominal aorta in 1 patient (0.25%).

According to the chi-square test, an association of the different types of the celiac trunk with gender shows no statistical significance with a p -value of 0.613.

I- Superior mesenteric artery:

a- Level of origin:

The most common level of origin of the SMA was at the level of the body of the first lumbar vertebra from the anterior surface of the aorta in 270 patients (67.3%), followed by 39 patients (9.7%) at the L2 level, 33 patients (8.2%) L1-L2, 32 patients (8%) T12-L1 and 27 patients (7%) at T12 (Table 3).

The most common level in both female/male groups of our study is L1 with no statistical significance as regards SMA level with Gender (p -value=0.09), yet it was found significant as regards age (p -value=zero) using the chi-square test (Table 4).

Table (1): Variations in the vertebral level of origin of the celiac trunk.

Vertebral level	Count
Absent CT	3 (0.75%)
L1	158 (39.4)
L1-L2	5 (1.25%)
L2	1 (0.25%)
T11	2 (0.5%)
T11-T12	8 (2%)
T12	170 (42.39%)
T12-L1	54 (13.47%)

Table (2): Variations in the branching system of the celiac trunk.

Celiac trunk type	Count
<i>Trifurcation of celiac trunk:</i>	
- Left gastric 1 st branch from CT, then HST	186 (46.3%)
- Tripus Hillari	126 (31.4%)
<i>Bifurcation:</i>	
- Left gastric from splenic, HST	59 (14.71%)
- Left gastric from CHA, HST	7 (1.75%)
- Left gastric from AA, HST	7 (1.75%)
<i>Other variations:</i>	
- Left gastric 1 st from CT, then left hepatic/ splenic, Right hepatic from SMA	8 (2%)
- Absent CT, CHA/splenic from AA, left gastric from splenic	3 (0.75%)
- Gastrosplenic trunk, CHA from SMA	2 (0.5%)
- Celiacomesenteric trunk	2 (0.5%)

Table (3): Level of origin of Superior mesenteric artery.

SMA Level	Count
L1	270 (67.3%)
L2	39 (9.7%)
L1-L2	33 (8.2%)
T12-L1	32 (8 %)
T12	27 (6.7%)

Table (4): Association between SMA level with age using chi-square test.

	Age									p-value
	Childhood			Adult			Geriatrics			
	Count	Row N %	Column N %	Count	Row N %	Column N %	Count	Row N %	Column N %	
<i>SMA level:</i>										
T12	21	77.78%	14.19%	4	14.81%	2.23%	2	7.41%	2.70%	Zero
T12-L1	17	53.13%	11.49%	13	40.63%	7.26%	2	6.25%	2.70%	
L1	99	36.67%	66.89%	125	46.30%	69.83 %	46	17.04%	62.16%	
L1-L2	8	24.24%	5.41%	16	48.48%	8.94%	9	27.27%	12.16%	
L2	3	7.69%	2.03%	21	53.85%	11.73%	15	38.46%	20.27%	

p-value = Zero.

b- Aortomesenteric angle and distance:

Assessing the aortomesenteric angle and distance between the SMA and the abdominal aorta, the mean SMA angle was found to be 54.76mm with a maximum angle of 126mm and a minimum of 1 mm, as for the distance it was found to be of mean 15.51mm, maximum distance of 46mm and minimum distance of 4mm.

There is an association between aortomesenteric angle, as well as distance, and the Gender as per the student *t*-test with a *p*-value of 0.03 for angle and *p*-value of 0.02 for distance (Table 5)

The correlation test between SMA angle, SMA distance, and age show a statistical significance with a *p*-value = zero (Table 6).

II- IMA:

As regards the inferior mesenteric artery, our only variable was the level of origin from the anterolateral surface of the abdominal aorta, with the most common level at L3 in 373 of our study population (Table 7).

There is no statistical significance as regards the IMA level with either gender or age according to the Chi-square test.

Table (5): SMA angle-distance with gender by student *t*-test.

	Gender				p-value*
	Female		Male		
	Standard Mean	Deviation	Mean	Standard Deviation	
SMA angle	52.46	21.84	57.65	26.04	0.034#
SMA distance	14.74	7.05	16.48	8.30	0.027#

p-value for SMA angle = 0.03.

p-value for SMA distance = 0.02.

Table (6): Correlation between age and SMA angle and distance by Pearson correlation test

	Age	
	r	p-value*
SMA angle	0.2	0.000#
SMA distance	0.5	0.000#

p-value = Zero.

Table (7): IMA level of origin.

Level	Count
L3	373
L4	12
L3-L4	6
L2	5
L2-L3	4
L1-L2	1

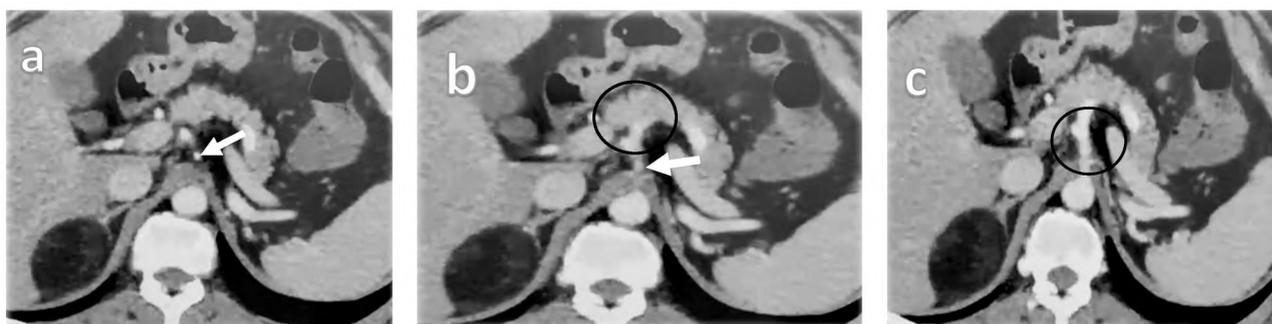


Fig. (1): Axial contrast- enhanced CT scan of the abdomen and pelvis showing LGA (white arrow) arising first from celiac trunk (A) followed by hepatosplenic trunk (circle) (B,C).

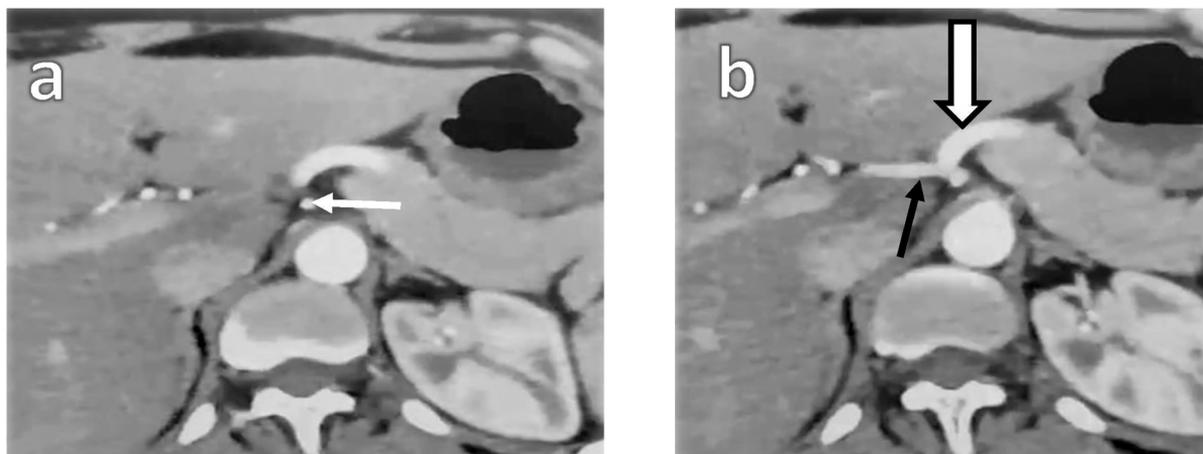


Fig. (2): Axial contrast-enhanced CT scan of the abdomen and pelvis showing LGA (white arrow), splenic artery (white arrow with black outline), and CHA (black arrow) arise at the same time from the celiac trunk; True tripus hillari.

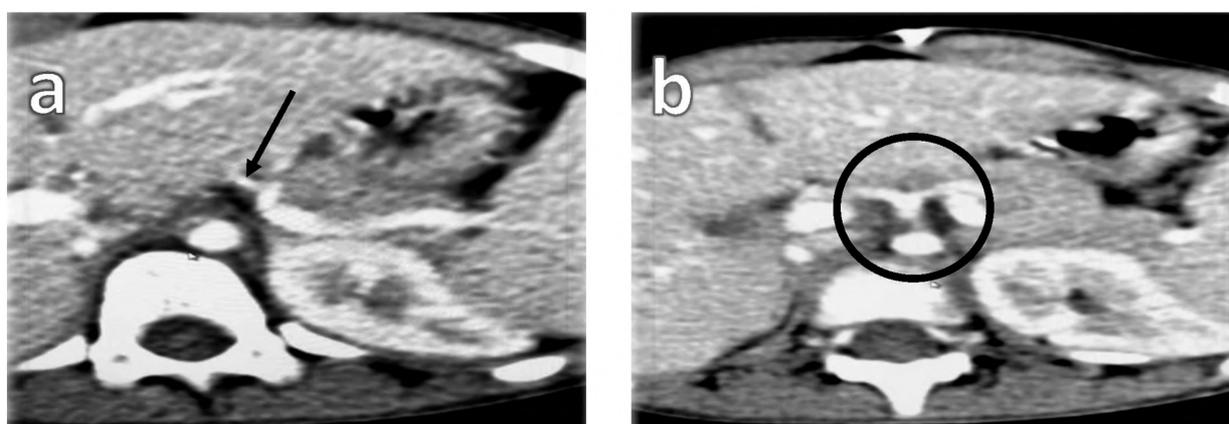


Fig. (3): Axial contrast-enhanced CT scan of the abdomen and pelvis showing LGA (black arrow) arising from the splenic artery (A) followed by hepatosplenic trunk (black circle) (B).

Discussion

The gastrointestinal tract arterial supply has been a topic of interest in different branches of medicine, being under continuous research for a long time owing to the wide range of branching variants and levels of origin.

The celiac trunk or the artery of the foregut had the largest share of studies by anatomists, surgeons as well as radiologists to come up with a classification, to sum up, all its different variants.

The anatomical level of celiac trunk origin is found at the level of T12 (1) similar to our study, where 170 patients (42.39%) have the celiac trunk arising at T12, followed by 158 patients (39.4%) at the L1 vertebral level, our results differ from Osman A and Abdrabu A (7), and by K. Torres et al., [8], describing the celiac trunk origin to be at the level of T12-L1, which coincides with only 57 patients (13.47%).

No statistical significance was found comparing the celiac level with gender in our study, while there was no mention of this correlation previously.

The celiac trunk usually follows the normal pattern of trifurcation, either as a true tripod where the three branches arise at the same time (Tripus Hillari) or a false tripod where one of the three branches arises before the other two, which is the same in Lipshutz (1917) [13], Adachi (1928) [14], Morita (1953) [15], Michels (1955) [16], Ulfacker (2007) [17], Higashi (2009) [18], Venieratos et al (2012) [19], Osman A and Abdrabu A (2016) [7] and Panagouli et al. (2013) classifications [11].

Most of our patients; 212 (77.7%) follow the normal pattern of trifurcation into three main branches, being similar to all previous studies (87.7% Adachi, 75% Lipshutz, 90.9% Venieratos et al., 89.42% Panagouli et al.), of which 186 patient (46.3%) having the LGA arise early on the celiac

trunk followed by common hepatic and splenic arteries, and 126 patient (31.4%) showed the true tripod pattern.

Those results were similar to Uflacker type I [7] that included both classic pattern (Tripus Hillari) and non-classic pattern of celiac trunk formed of the common hepatic artery, splenic artery, and LGA demonstrating variable points of origin, as well as two other forms found under the bifurcation group in our study (17.71% collectively); the celiac trunk in both was formed by both CHA and splenic artery, with LGA arising as a branch from the splenic artery in the first type (59 patients, 14.71%), and as a branch from CHA (7 patients, 1.75%) in the second type.

Thus collectively 94.16% of our study population follow Uflacker's type I which is close to the results obtained by Osman A. and Abd Rabu A (2016) of 90.5% [7].

The third type of celiac trunk bifurcation was formed by the hepatosplenic trunk with LGA arising directly from the abdominal aorta (Uflacker type II, Morita's type II, Adachi type II, Lipshutz type II) which was found in 1.75% of the study population, near results of Osman A and Abd Rabu A of 2.8%.

The bifurcation of the celiac trunk in our study was found to be comparable to Michels' classification type II.

Other variants were detected in our study, with the most common one (2%, 8 patients) was the variant in which the hepatic artery's right branch arising from SMA (replaced right hepatic artery), mentioned by Osman A and Abd Rabu A as Michel's classification of hepatic artery type III, followed by absence of celiac trunk (0.75%, 3 patients), with splenic and CHA arising directly from the abdominal aorta and LGA arising from splenic artery (Panagouli type VII 0.38%, Uflacker's type VIII, Morita's type V).

A gastrosplenic trunk with CHA arising from SMA was found in 2 patients (0.5%); Lipshutz type IV (4%), Adachi type VI (2%), Panagouli classification type II form 5, Uflacker type V and Michel's type V. Celiacomesenteric trunk was also found in 0.5% of our study population (2 patients) near the results found by Osman A and Abd Rabu of 0.6% (Uflacker type VI, Panagouli type IV 0.68% "type IV Adachi, type VI Michel's").

The least common variant in our study was that of the common origin of left gastric artery, splenic

artery, and left hepatic artery while the right hepatic artery originated from the aorta in only one patient 0.25%, this variant of replaced right hepatic artery was nonclassified in any of the previous classifications, although it could be roughly classified under Panagouli type V indicating the variable origin of CHA.

The superior mesenteric artery, the second single branch artery of the abdominal aorta, and the arterial supply of the midgut had certain points of interest which included its level of origin, aortomesenteric angle, and distance.

The superior mesenteric artery was found to arise at the level of L1 in 67.3% of our study population which differs from Santos PVD et al., [4] indicating the SMA to arise at the level of L1-L2 intervertebral disc, which coincides with 8.2% of our study population, yet the difference could be explained by the anatomical fact that superior mesenteric artery usually arises 1cm below the celiac trunk [1], and since in our results the majority of population study had the celiac trunk at the level of T12, the SMA consequently arise at the level of L1.

On the other hand, the least common level of origin for SMA was the level of T12 in 6.7% of cases.

There was no statistical significance as regards SMA level of origin and Gender (p -value=0.09), and no prior mention in previous studies.

The angle of SMA origin from the aorta is usually acute (mean=45°, range=38-60° (1) being greater in individuals with a high BMI), with the artery surrounded by fat tissue, lymphatics, and neural tissue thus widening the angle/distance of the SMA at its origin, Radiologically the SMA angle ranges from 25-60° (5) While in our study the mean=54.76°, range =11°-126°.

As for the aortomesenteric distance in our study, it was found to have a mean= 15.51 mm, range=4-46mm while the normal range was found to be 8-12mm according to Salehzadeh F et al., [6].

Although angles lesser than 22°, distances less than 6 mm were considered radiologically as a predisposing factor for the rare SMA syndrome [6], where the left renal vein or duodenum might be compressed by the unusually acute angle of SMA, the study done by Arthers OJ et al., in 2012 [12] proved that there was a wide range of SMA angle in normal children, which correlated with BMI, thus it was found that using the definite range of SMA angle <25° would diagnose 9.3% of asymp-

tomatic children with SMA syndrome, and using an aortomesenteric distance precise range of <8mm would diagnose 20% with SMA compression, thus it was suggested to take great caution when attributing these rare syndromes to an absolute SMA angle or distance value.

This was proven in our study with the positive statistical correlation between the SMA angle, SMA distance, and the age as well as the gender of our study subjects, thus proving the need for extreme caution in setting a cut off value for a range of angle and distance of the SMA with other factors, namely the BMI of the patient, that should be taken into consideration before diagnosing SMA syndrome.

The third branch of the abdominal aorta supplying the hindgut is the IMA, arising at the ventral surface of the aorta, at the level of L3 [9,10] which coincided with our results of 93% of study subjects having the IMA arise at L3 vertebral body level.

No statistical significance was found as regards IMA level correlation with age or gender, and it was not mentioned previously.

Conclusion:

Precise study of the single-branch arteries of the abdominal aorta, before any interventional procedure, and during radiological studies reporting (as regards noting the uncommon branching of the celiac trunk, measuring the aortomesenteric angle and distance and correlating them to BMI of the patients), is at utmost importance in clinical practice, to avoid undue vascular injuries during surgical and interventional procedures, as well as misdiagnosis of rare SMA related syndromes.

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الاختلافات التشريحية للشرايين ذات الفرع الواحد الناشئة عن الشريان الأورطي البطنى باستخدام الأشعة المقطعية متعددة الشرائح بالصبغة

تظل الاختلافات التشريحية للشرايين ذات الفرع الواحد الناشئة من الشريان الأورطي (الأبهر) البطنى تحت الدراسة المستمرة من أجل دقة التقييم فى إعدادات ما قبل التدخلات الجراحية ودقة تقارير الأشعة التشخيصية.

حيث يعتمد إمداد الجهاز الهضمى بالدم على الشرايين الفرعية المفردة للشريان الأورطي البطنى (الابهر)، وهم الشريان البطنى، الشريان المساريقي العلوى والشريان المساريقي السفلى وفى هذه الدراسة تم مشاهدة ومراجعة فحوص الأشعة المقطعية متعددة الشرائح بالصبغة على البطن والحوض لمرضى مستشفيات جامعة حلوان لدراسة الاختلافات التشريحية للشرايين سابق ذكرها.

بداية من الشريان البطنى الذى وجد أنه ظهر فى معظم حالات الدراسة عند مستوى الفقرة الصدرية الثانية عشر، مع وجود اختلافات فى تقسيماته إلى الفروع الثلاثة الرئيسية، شريان المعدة الأيسر، شريان الطحال، والشريان الكبدى حيث وجدنا أن معظم حالات الدراسة تتبع النمط الطبيعى للتشعب الثلاثى ويتبعها تشعب الشريان البطنى إلى جذع شريان الكبد والطحال مع ظهور شريان المعدة الأيسر كفرع من شريان الطحال، والمتغير الآخر الأكثر شيوعاً كان ظهور الشريان البطنى المكون من شريان المعدة الأيسر، شريان الطحال والشريان الكبدى الأيسر بينما يظهر الشريان الكبدى الأيمن كفرعاً من الشريان المساريقي العلوى.

أما بالنسبة للشريان المساريقي العلوى، فقد ظهر فى معظم الحالات عند مستوى الفقرة القطنية الأولى، مع وجود نطاق واسع لقياسات قيمة الزاوية ومشافة خروجه من الشريان الابهر، والتي وجد لها فى دراستنا دلالة إحصائية فى ارتباطها مع العمر والجنس مما يتطلب الحذر فى تطبيق معايير التشخيص لمرض متلازمة الشريان المساريقي العلوى وخاصة عند صغار السن .

وختاماً وجدنا أن الشريان المساريقي السفلى يظهر عند مستوى الفقرة القطنية الثالثة فى معظم حالات الدراسة مع عدم وجود أى دلالات إحصائية عند مقارنة مستوى المنشاء مع كلا من العمر والجنس.

الهدف من الدراسة: نهدف فى دراستنا هذه إلى مقارنة الاختلافات التشريحية فى أفرع الأوعية الدموية الخاصة بالشريان الأورطي البطنى ذات الفرع الواحد بالإضافة إلى قياس زاوية خروج الشريان المساريقي العلوى وما يتضمنه اختلاف الزاوية من صور إكلينيكية مختلفة.

المنهجية:

طرق الدراسة ومكانها: دراسة استيعادية بمستشفيات جامعة حلوان (مستشفى بدر ومستشفى ١٥ مايو).

الوقت: جميع حالات فحص الأشعة المقطعية بالصبغة فى الفترة من بداية ٢٠١٦ وحتى نهاية ٢٠١٩.

الفئات المستهدفة: المرضى الذين تردوا على قسم الأشعة لعمل فحص الأشعة المقطعية بالصبغة على البطن والحوض.

معايير الانضمام للدراسة: المرضى بجميع الأعمار المترددين لعمل فحص الأشعة المقطعية بالصبغة على البطن والحوض.

معايير الإقصاء من الدراسة: المرضى الذين خضعوا لى عمليات جراحية أو انصمام كيميائى فى منطقة البطن والحوض قبل طلب فحص الأشعة المقطعية، أو المرضى الذين يعانون من حالات مرضية تغير فى الشكل التشريحي المعروف للشريان الأورطي البطنى.

حجم العينات: المرضى الذين تردوا على قسم الأشعة لعمل فحص الأشعة المقطعية بالصبغة على البطن والحوض فى الفترة من بداية ٢٠١٦ وحتى نهاية ٢٠١٩، بإجمالى ٤٠١ حالة.

الاعتبارات الأخلاقية: نظراً لصعوبة الوصول للمرضى تم ضمان سرية البيانات عن طريق إبدال بيانات المرضى باكواد.

أدوات الدراسة: أجهزة الأشعة المقطعية متعددة الشرائح فى كلا من مستشفى بدر ومستشفى ١٥ مايو.

توصيات: نظراً لوجود دلالات إحصائية عند مقارنة زاوية خروج الشريان المساريقي العلوى والمسافة من الشريان الابهر مع عمر المريض وجنسه، مما يتماشى مع ما أنمت عنه الدراسات السابقة من أن تحديد قيمة قطعية لزاوية ظهور الشريان المساريقي العلوى والمسافة من الشريان الابهر يمكن أن يعطينا نتائج إيجابية خاطئة عن نسب تشخيص متلازمة الشريان المساريقي العلوى. لذا يجب تحرى الدقة عند تشخيص متلازمة الشريان المساريقي العلوى وخاصة فى سن الطفولة.