Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Hepatic Arterial System- A Radioanatomical Analysis With Multidetector Computed Tomography.

Kalyanapanchakshari Poluri[1], S. K. Agarwal[2], R. P. Bansal[3]

[1]Research Scholar, Department of Anatomy, National Institute of Medical Science and Research, NIMS University, Jaipur, Rajasthan, India.
[2]Professor, Department of Anatomy, Research Guide, National Institute of Medical Science and Research, NIMS University, Jaipur, Rajasthan, India.
[3]Medical Superintendent and Professor, Department of Radiology, Research Co-Guide, National Institute of Medical Science and Research, NIMS University, Jaipur, Rajasthan, India.

Received: May 2018
Accepted: May 2018

ABSTRACT

Background: Aim: The aim of this study was to analyze the branching pattern of hepatic arterial system with Multi Detector Computed Tomography (MDCT). **Methods:** 100 patients who underwent Contrast Computed Tomography of abdomen for any medical reasons were evaluated retrospectively. **Results:** Out of 100 patients analyzed 38% shown variations in hepatic artery branching pattern. **Conclusion:** Knowledge about hepatic artery variations using MDCT provides valuable guidance particularly for hepatobiliary and liver transplant surgeons and radiologist to make appropriate diagnosis and treatment.

Keywords: Arterial variations, Coeliac artery variations, Hepatic artery variations, MDCT

INTRODUCTION

Liver hepatitis is one of the most common liver diseases, when untreated leads to cirrhosis of liver.[1] Due to advancement in treatment methods for liver diseases, these days cirrhosis liver can be replaced with normal functioning liver by the procedure called liver transplantation.[2] To perform liver transplantation successfully without complications, intense knowledge about hepatic arterial system anatomy and its variations are needed for liver transplant surgeons. Such anatomical analysis of hepatic arterial system can be studied in humans non invasively using Multi Dectector Computed Tomography (MDCT).[3] MDCT is considered as an excellent development in CT imaging that has direct implication in the imaging of various systems, in particular the vascular system. The advantages of MDCT are increase in imaging acquisition speed, more coverage of the patient, and high spatial resolution.[4] So the aim of this study is to analyze the hepatic arterial system and its variations with MDCT in humans.

Name & Address of Corresponding Author
Dr. Kalyanapanchakshari Poluri,
Research Scholar,
Department of Anatomy,
National Institute of Medical Science and Research, NIMS University, Jaipur, Rajasthan, India.

MATERIALS AND METHODS

A cross sectional study was conducted during the year 2017-2018 in the department of Radiology, National Institute of Medical Sciences and hospital, Jaipur, Rajasthan. This study was approved by Ethical committee. 100 patients of both sex (60 Male and 40 Female) with age group range from 18 to 75 years, who underwent contrast abdominal computed tomography (CT) of abdomen for any medical indications were enrolled in this study. Patients with history of Aortoarteritis, Collagen vascular disorder, previous abdominal surgery, Abdominal malignancy and allergy to drugs were excluded. Philips Brilliance CT scanner was used to obtain CT images. Scanning was performed using the following parameters: detector rows, 64; collimation, 0.625 mm; pitch, 0.92; gantry rotation time, 0.75 s; slice thickness 0.90 mm, slice increment, 0.45 mm; 250 mAs and 120 kV dose. A volume of 100 mL of non-ionic contrast medium was injected at 4.0 mL/s through an antecubital vein. Hepatic arterial system was focused to get CT images with respect to variations in its branching pattern by radiologist. Obtained CT images were analyzed using Radiant software and described using Michel's Classification.[5] [Refer Table 1].
LGA- Left Gastric Artery, CHA-Common Hepatic Artery, SMA- Superior Mesenteric Artery, LHA - Left Hepatic Artery, RHA -Right Hepatic Artery.

Table 1: Michel's classification

Type	Description
I	Normal anatomy: Hepatic artery originates from the CHA and bifurcates into the RHA and LHA
II	Replaced LHA origin from LGA
III	Replaced RHA origin from SMA
IV	Coexistence of type II and III
V	Accessory LHA origin from LGA
VI	Accessory RHA origin from SMA
VII	Accessory LHA origin from LGA and Accessory RHA origin from SMA
VIII	Accessory LHA origin from LGA and Replaced RHA origin from SMA
IX	CHA origin from SMA
X	CHA origin from LGA

RESULTS

Branching pattern variations [Refer Table 2]

According to Michel's classification, in this study Type I branching pattern [Figure 1] was observed in majority of patients (62%). Other branching patterns like Type II (Replaced LHA origin from LGA) [Figure 2], Type III (Replaced RHA origin from SMA) [Figure 3], Type IV (Coexistence of type II and III) [Figure 4], Type V (Accessory LHA origin from LGA) [Figure 5], Type VI (Accessory RHA origin from SMA) [Figure 6] and Type VIII (Accessory LHA origin from LGA and Replaced RHA origin from SMA) [Figure 7] were observed in 8%, 13%, 1%, 7%, 8%, and 1% of patients respectively.

Table 2: Hepatic artery-Branching pattern variations.

Type	Males n=60	Females n=40	Total n=100	Percentage (%)
I	41	21	62	62
II	3	5	8	8
III	5	8	13	13
IV	1	0	1	1
V	4	3	7	7
VI	6	2	8	8
VII	0	0	0	0
VIII	0	1	1	1
IX	0	0	0	0
X	0	0	0	0

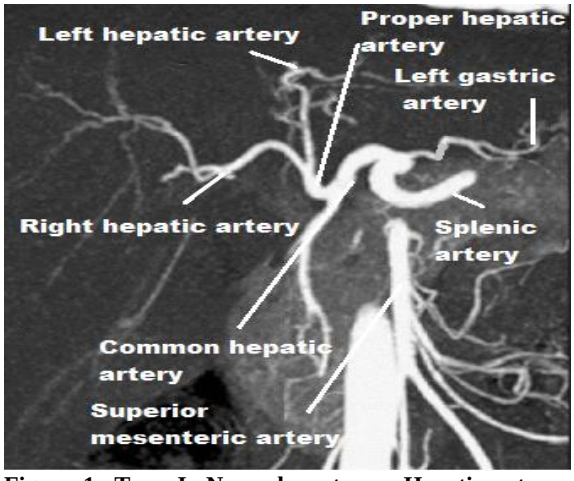

Figure 1: Type I- Normal anatomy- Hepatic artery originates from the CHA and bifurcates into the RHA and LHA

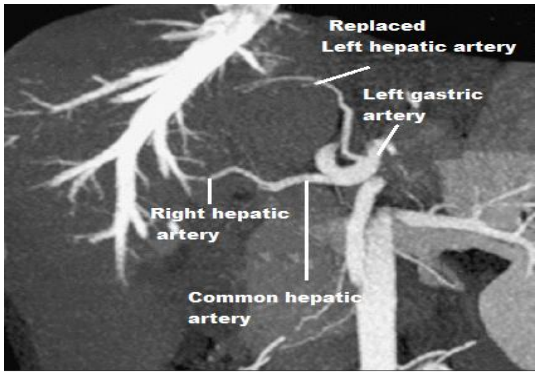

Figure 2: Type II- Replaced LHA origin from LGA

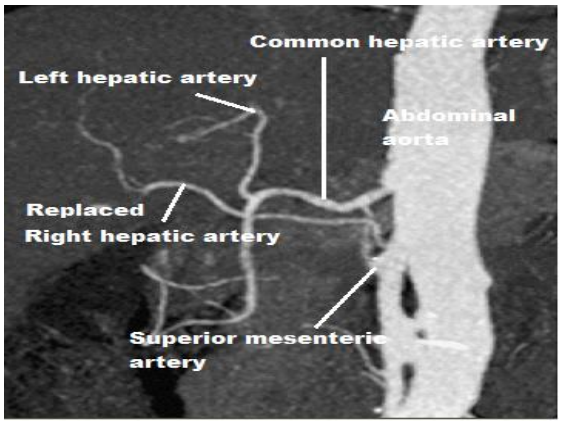

Figure 3: Type III-Replaced RHA origin from SMA

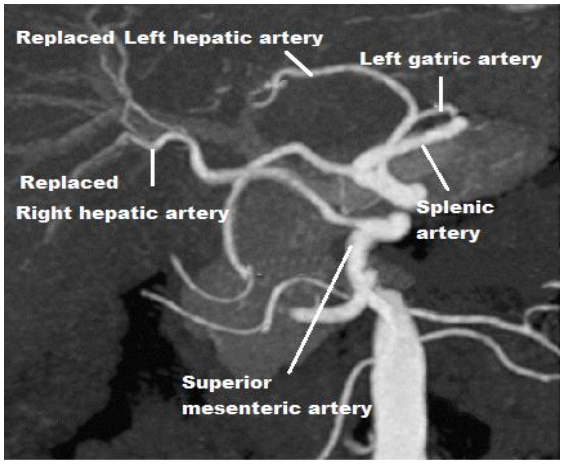

Figure 4: Type IV-Coexistence of type II and III

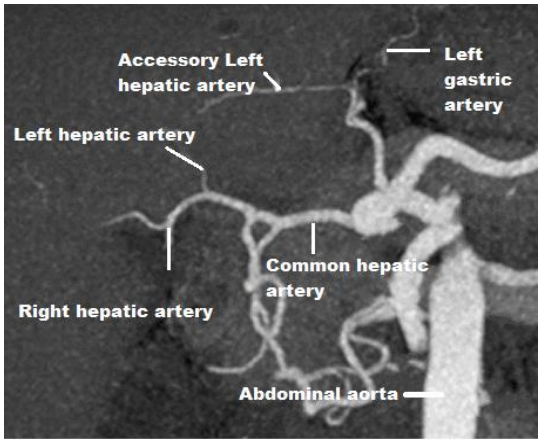

Figure 5: Type V-Accessory LHA origin from LGA

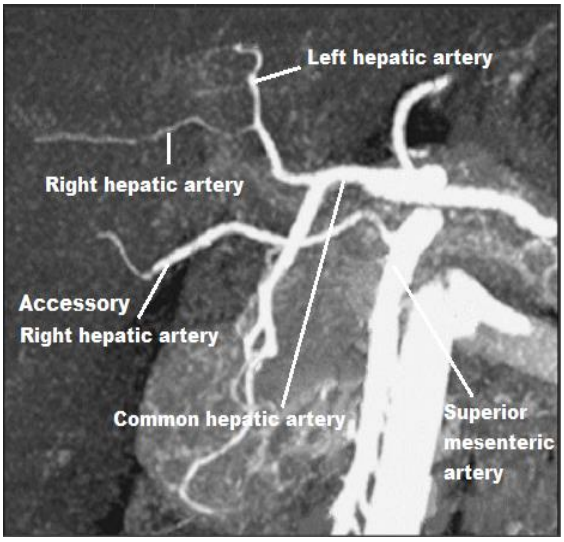

Figure 6: Type VI-Accessory RHA origin from SMA

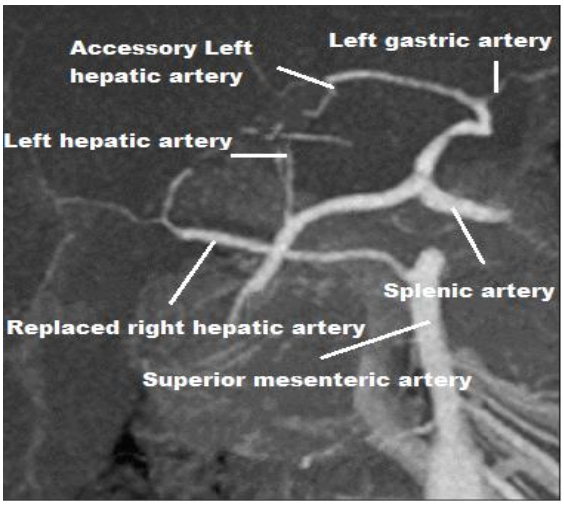

Figure 7: Type VIII- Accessory LHA origin from LGA and Replaced RHA origin from SMA

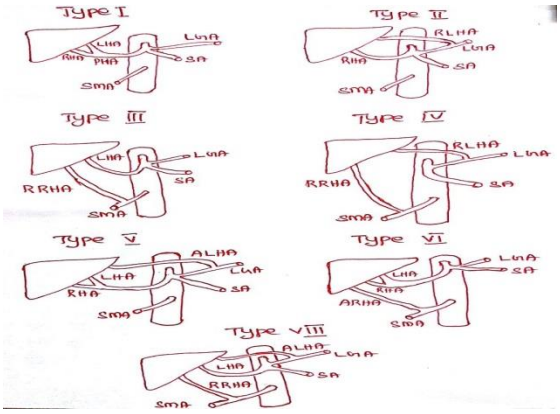

Figure 8: Diagrammatic representation of Michel's classification of hepatic artery variations found in this study

RLHA-Replaced Left Hepatic Artery, RRHA-Replaced Right Hepatic Artery, ALHA- Accessory Left Hepatic Artery, ARHA- Accessory Right Hepatic Artery, SA-Splenic Artery, PHA-Proper Hepatic Artery.

DISCUSSION

Since few decades medical experts concerned about the arterial system and its variations to treat patients without complications. Before planning the treatment, appropriate diagnosis is vital. To acquire this clinicians, particularly surgeons and radiologist uses MDCT these days. Previous empirical evidences stated that classical branching pattern of hepatic artery (Michels Type 1) range from 50% to 80%.[6-11] 62% of Type 1 pattern was found in this study. Moreover other branching pattern variations observed was 38% which was close to A.El-Badrawy et al,[3] study. But A.M Osman et al,[5] noticed 25.7% of cases with hepatic artery variations which was relatively less than this study. Though patient's demographics were different when compared to previous studies, there were differences in prevalence ratio of branching pattern of hepatic artery.

Second common variations observed was Type III (13%), with replaced RHA origin from SMA which was almost similar (12.5%) to the study of Koops et al,[12] De Cecco et al and Gumus et al.[13,14]. In this study Type IV and VIII was observed in 1% case. Type VII, IX, and X were not reported in this study which was similar to Coskun et al,[15] but observed by stemmler et al in low incidence.[16] Knowledge about variations of hepatic artery is extremely important for experts to plan management of patients keeping these variations in perspective. Thus these aberrations have become focused for present researchers.

CONCLUSION

Hepatic artery variations are natural and asymptomatic. But Knowledge about hepatic artery anatomy and its variations are important for surgeons particularly hepatobiliary and liver transplant surgeons and radiologist to make correct diagnosis. So that ideal treatment can be given at appropriate time.

REFERENCES

1. Wiegand J, Berg T. The Etiology, Diagnosis and Prevention of Liver Cirrhosis. Dtsch Arztebl Int. 2013; 110(6):85-91.
2. Dultz G, Graubard BI, Martin P, Welker M-W, Vermehren J, Zeuzem S, et al. Liver transplantation for chronic hepatitis C virus infection in the United States 2002–2014: An analysis of the UNOS/OPTN registry. PLoS One.2017; 12(10):e0186898.
3. El-Badrawy A, Denewer A, Kandiel T, Roshdy S, El-Etreby S, El-Badrawy, et al. 64 Multidetector CT angiography in preoperative evaluation of hepatic artery. Egyptian J Radiol Nuclear Med. .2011; 42,133-137.
4. Al-Azzazy MZ, Nasr MS, Shoura MA. Multidetector computed tomography (MDCT) angiography of thoracic aortic coarctation in pediatric patients: Pre-operative evaluation. Egyptian J Radiol Nuclear Med. 2014;45,159-167.

5. Osman AM, Abdrabou A. Celiac trunk and hepatic artery variants: A retrospective preliminary MSCT report among Egyptian patients.The Egyptian Journal of Radiology and Nuclear Medicine 47;2016; 1451–1458.
6. Winston CB, Lee NA, Jarnagin WR, Teitcher J, DeMatteo RP, Fong Y, Blumgart LH. CT angiography for delineation of celiac and superior mesenteric artery variants in patients undergoing hepatobiliary and pancreatic surgery. AJR 2007;188:W13–9.
7. Stemmler BJ, Paulson EK, Thornton FJ, Winters SR, Nelson RC, Clary BM. Dual-phase 3D MDCT angiography for evaluation of the liver before hepatic resection. AJR 2004;183:1551–7.
8. De Cecco CN, Ferrari R, Rengo M, Paolantonio P, Vecchietti F, Laghi A. Anatomic variations of the hepatic arteriesin 250 patients studied with 64-row CT angiography. Eur Radiol 2009;19:2765–70.
9. Coskun M, Kayahan EM, Ozbek O, Cakir B, Dalgic A, Haberal M. Imaging of hepatic arterial anatomy for depicting vascular variations in living related liver transplant donor candidates with multidetector computed tomography: comparison with conventional angiography. Transplant Proc 2005;37:1070–3.
10. Koops A, Wojciechowski B, Broering DC, Adam G, Krupski Berdien G. Anatomic variations of the hepatic arteries in 604 selective celiac and superior mesenteric angiographies. Surg Radiol Anat 2004;26:239–44.
11. Covey AM, Brody LA, Maluccio MA, Getrajdman GI, Brown KT. Variant hepatic arterial anatomy revisited: digital subtraction angiography performed in 600 patients. Radiology 2002;224:542–7.
12. Koops A, Wojciechowski B, Broering DC. Anatomic variations of the hepatic arteries in 604 selective celiac and superior mesenteric angiographies. Surg Radiol Anat. 2004;26:239–44.
13. De Cecco CN, Ferrari R, Rengo M. Anatomic variations of the hepatic arteries in 250 patients studied with 64-row CT angiography. Eur Radiol. 2009;19:2765–70.
14. Gumus H, Bukte Y, Ozdemir E. Variations of the celiac trunk and hepatic arteries: a study with 64-detectors computed tomography angiography. Eur Rev Med Pharmacol Sci.2013;17:1636–41.
15. Coskun M, Kayahan EM, Ozbek O, Cakir B, Dalgic A, Haberal M. Imaging of hepatic arterial anatomy for depicting vascular variations in living related liver transplant donor candidates with multidetector computed tomography: comparison with conventional angiography. Transplant Proc. 2005;37:1070–3.
16. Stemmler BJ, Paulson EK, Thornton FJ, Winters SR, Nelson RC, Clary BM. Dual-phase 3D MDCT angiography for evaluation of the liver before hepatic resection. AJR 2004;183:1551–7.

How to cite this article: Poluri K, Agarwal SK, Bansal RP. Hepatic Arterial System- A Radioanatomical Analysis With Multidetector Computed Tomography. Ann. Int. Med. Den. Res. 2018; 4(4):AT22-AT25.

Source of Support: Nil, **Conflict of Interest:** None declared