

# Replaced Right Hepatic Artery- A Case Report

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## **Abstract**

### **Aim**

*The aim of the study is to note the variation in the origin of right hepatic artery.*

### **Case report**

*Variations in the arterial supply of liver and extrahepatic biliary apparatus are known to exist. In a study done on 30 cadavers at Seth G.S. Medical College and K.E.M. Hospital, Mumbai, India, during the period 2011–2012, it was found that right hepatic artery was originated from coeliac trunk in an adult male cadaver.*

### **Conclusion**

*Variation in the origin of the artery may make it prone to injuries during surgical procedures including laparoscopic cholecystectomy, liver transplantation, etc., if due care is not taken.*

**Keywords:** *Replaced right hepatic artery, Coeliac trunk, Liver transplantation, Cholecystectomy*

## **INTRODUCTION**

Right hepatic artery is a branch of proper hepatic artery which usually courses posterior to the common hepatic duct. Before entering into the porta hepatis, it gives off cystic artery which enters into the Calot's triangle to supply gall bladder.

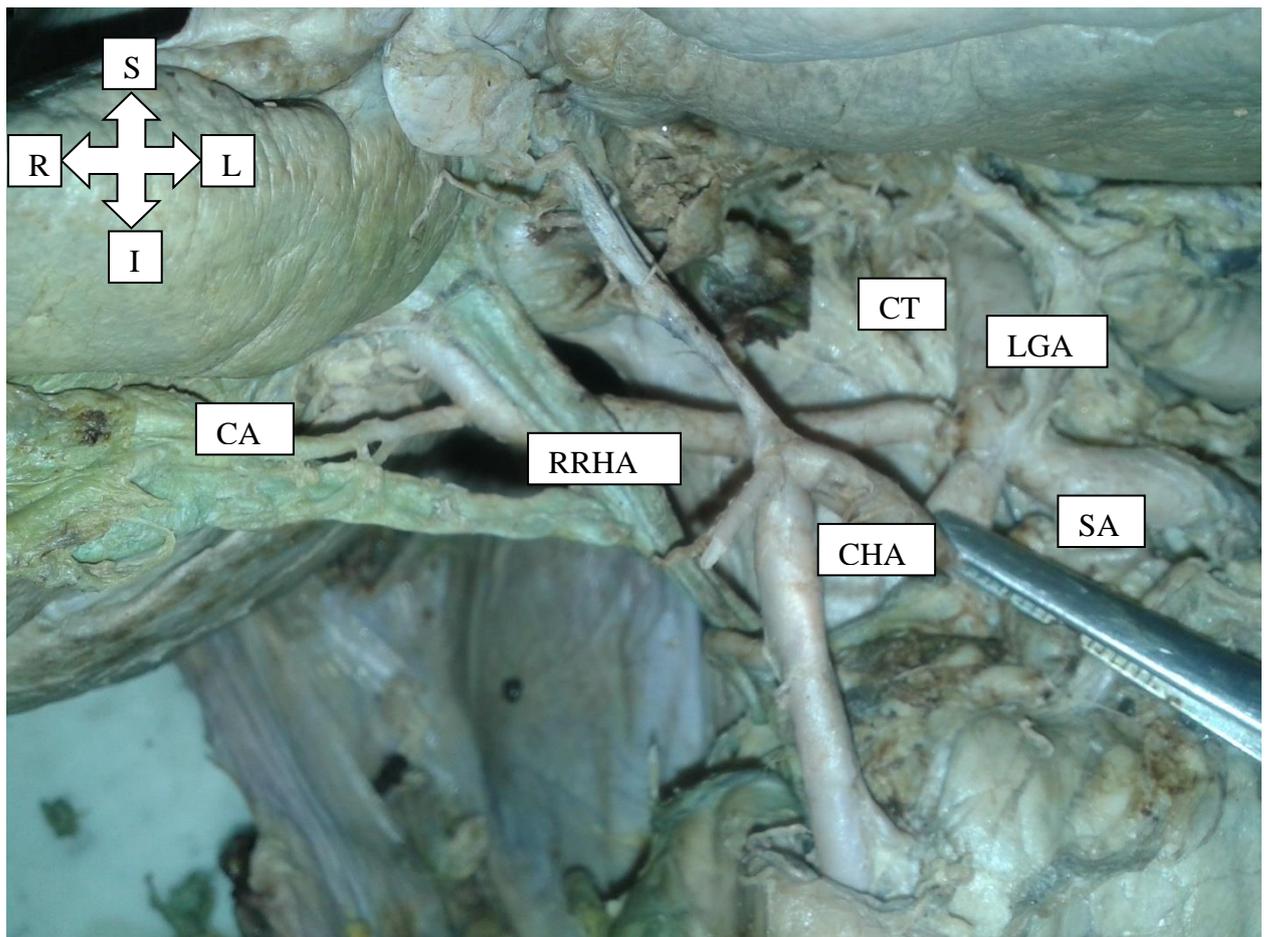
Numerous variations in origin and branching pattern of right hepatic artery have been reported. A small number of normal variants are important to demonstrate angiographically because they may influence surgical and interventional radiological procedures. A vessel that supplies a lobe in addition to its normal vessel is defined as an accessory artery. A replaced hepatic artery (RRHA) is a vessel that does not originate from an orthodox position and provides the sole supply to that lobe. More commonly a replaced right hepatic artery or an accessory right hepatic artery arises from the superior mesenteric artery and can be identified at surgery by pulsation behind the portal vein. The accessory right hepatic artery may be injured during resections of the pancreatic head because the artery lies in close proximity to the portal vein. Occasionally, a replaced left hepatic artery or an accessory branch arises from the left gastric artery: these vessels provides a source of collateral arterial circulation in cases of occlusion of the vessels in

the porta hepatis. Rarely, accessory left or right hepatic arteries may arise from the gastroduodenal artery or aorta. The presence of replaced arteries can be lifesaving in patients with bile duct cancer: because they are further away from the bile duct they tend to be spared from the cancer, making excision of the tumour feasible. Knowledge of these variations is also important in planning whole and split liver transplantation.<sup>1</sup>

It is said that anatomical variations in the hepatic arterial supply are due to variant embryological development of the ventral arteries of the foregut and failure of these vessels to regress.<sup>2</sup>

### Case Report

In the study done on 30 embalmed cadavers at Seth G.S. Medical College and K.E.M. Hospital, Mumbai during the period 2011–2012, a variant origin of the right hepatic artery was found in an adult male cadaver. The coeliac trunk was dissected and its branches were traced. There was a quadrifurcation of coeliac trunk which is a rare occurrence. RRHA was originated from coeliac trunk in addition to splenic artery, left gastric artery and common hepatic artery. It was observed that the replaced right hepatic artery was passing posterior to the common hepatic duct and gave cystic artery within the Calot's triangle as shown in figure. It finally ran posterior to reach the right lobe of the liver. Common hepatic artery after giving gastroduodenal and right gastric artery continued as middle hepatic artery while left hepatic artery originated from left gastric artery.



**Figure: Replaced right hepatic artery (RRHA) originating from the coeliac trunk (CT). (CA- Cystic artery, CHA- Common hepatic artery, SA- Splenic artery, LGA- Left gastric artery S- Superior, I- Inferior, R- Right, L- Left)**

## Discussion

Literature reveals few reports of variant origin of the right hepatic artery.

In 2013 Ford A. et al, reported a case of replaced right hepatic artery (RRHA) which was originated from the coeliac trunk as a trifurcation immediately posterior to the emergence of the common hepatic artery and splenic artery and distal to the left gastric artery.<sup>3</sup>

Michel's classic autopsy series of 200 dissections in 1966 defines 10 basic anatomic variations in hepatic arteries. It was modified to 6 types by Hiatt et al. in 1994. The RRHA found in this study is not classifiable in either system as it is given that it should emerge from the superior mesenteric artery or left gastric artery.<sup>4,5</sup>

In 2006, Abdullah et al., have reported the variations in the origin of hepatic arteries in 31.9% of cases. In their study involving 932 patients, the variations were divided into three groups having 48 common hepatic artery variations, 236 left or right hepatic artery variations and 13 rare variations including one case of right hepatic artery originating from the inferior mesenteric artery.<sup>6</sup>

In a study conducted by Ugurel et al., a hepatosplenomesenteric trunk was seen in 1% and a splenomesenteric trunk was present in 1% patients.<sup>7</sup>

Nayak S. et al in 2012, reported a case of quadrifurcation of the coeliac trunk into the common hepatic, splenic, left gastric and left hepatic arteries.<sup>8</sup>

Miyaki T in 1989, stated that the aberrant hepatic artery, if present, arises from the leftgastric artery or from the superior mesenteric artery in 38.5% of the human foetal livers.<sup>9</sup>

Sethi M et al in 2014, reported a case of accessory right hepatic artery which originated from the coeliac trunk along with its usual three branches namely splenic artery, left gastric artery and common hepatic artery.<sup>10</sup>

Variation in origin and importance of accessory and replaced hepatic arteries are well documented by Michels NA<sup>4</sup>, Niederhuberet al.<sup>13</sup>, Kemeny et al.<sup>11</sup>, Brems et al.<sup>14</sup>, Hiatt et al.<sup>5</sup>, and Braun et al.<sup>15</sup>

Knowledge of this variation is important in case of liver transplantation, hepatic artery infusion chemotherapy and transarterialchemoembolisation. Due to presence of an aberrant vessel, there is incomplete embolisation of liver tumours and it can also damage normal liver parenchyma during hepatic artery infusion chemotherapy and chemoembolisation.<sup>11,12</sup>Few of the related studies were reviewed<sup>16-20</sup>. Related studies on hepatic system was reported by Bawankule et al 21 and Kirnake et al.<sup>22</sup>

After going through extensive review of literature it was found that the present quadrifurcation of RRHA is unique as it was originated from coeliac trunk in addition to splenic artery, left gastric artery and common hepatic artery.

## CONCLUSION

It is important for the surgeons to appreciate variant origin of the right hepatic artery during laparoscopic cholecystectomies, vascular radiological procedures, while carrying out a pancreaticoduodenectomy procedure or dissecting out the porta hepatis during resection of the liver and during both right lobe liver living donor and split graft transplantation. Since it is an end artery, its presence must be recognized so as to prevent damage to the artery. This is essential to avoid excessive bleeding from the injured right hepatic artery during surgery and prevent postoperative complications.

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## REFERENCES

1. Standing S, ed. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 40th Ed., Edinburgh, Elsevier Churchill Livingstone. 2008; 1169–1170.
2. Chen H, Yano R, Emura S, Shoumura S. Anatomic variation of the celiac trunk with special reference to hepatic artery patterns. *Ann Anat.* 2009; 191: 399–407.
3. Ford A., Parson S. Replaced right hepatic artery in cadaveric specimen. *Int J Anat Var.* 2013;6: 24–25.
4. Michels NA. Newer anatomy of the liver and its variant blood supply and collateral circulation. *Am J Surg.* 1962;112:337-47.
5. Mansour, M. and Ahmedana, S.E. “ Assessment of Post Exposure Prophylaxis (PEP) in Omdurman Voluntary Counselling and Testing Center (OVCTC). *Journal of Medical Research and Health Sciences.* 3, 1 (Jan. 2020), 836-849. DOI:<https://doi.org/10.15520/jmrhs.v3i1.145>.
6. Hiatt JR, Gabbay J, Busuttill RW. Surgical anatomy of the hepatic arteries in 1000 cases. *Ann Surg.* 1994; 220: 50–52.
7. Abdullah SS, Mabrut JY, Garbit V, De La Roche E, Olagne E, Rode A, Morin A, Berthezene Y, Baulieux J, Ducerf C. Anatomical variations of the hepatic artery: study of 932 cases in liver transplantation. *SurgRadiol Anat.* 2006; 28: 468–473.
8. Ugurel MS, Battal B, Bozlar U, Nural MS, Tasar M, Ors F, Saglam M, Karademir I. Anatomical variations of hepatic arterial system, coeliac trunk and renal arteries: an analysis with multidetector CT angiography. *Br J Radiol.* 2010; 83: 661–667.
9. Thakur Sudarshan K., TakAnjna, Bajaj Nisha (2018) NavayasLauh; Justification to use as Primary medicine for treating Anaemia; Under “Anaemia control Programme through Ayurveda” *International Journal Of Scientific Research And Education.* 06,02 (Feb-18) 7858-69
10. WiworoHaryani, Nova Winta, DwiEniPurwati (2018) Correlation of Pregnancy Stage And Gingiva Status of Pregnant Woman Who Visited RsudLebong-Bengkulu *International Journal Of Scientific Research And Education.* 06,07 (July-18) 7986-93
11. NayakS et el. Unusual branching pattern of coeliac trunk – a case report. *Int J Anat Var.* 2012;5 : 134–136.
12. Miyaki T. Patterns of arterial supply of the human fetal liver. The significance of the accessory hepatic artery. *ActaAnat Basel* 1989; 136(2):107-111.
13. Sethi M, Rangrej SB, Kakar S. An unusual origin and branching pattern of accessory hepatic artery from celiac trunk with its significance in hepatobiliary surgeries. *OA Anatomy* 2014 Jun.
14. Saccomanni, B. “ Some words about fractures of radial head. *Journal of Medical Research and Health Sciences.* 3, 10 (Oct. 2020), 1106-1108. DOI:<https://doi.org/10.15520/jmrhs.v3i10.261>.
15. Kemeny MM, Hogan JM, Goldberg DA, et al. Continuous hepatic artery infusion with an implantable pump: problems with hepatic arterial anomalies. *Surgery.* 1986;99:501-4.
16. Todo S, Makowka L, Tzakis AG, Marsh JW Jr, Karrer FM, Armany M, Miller C, Tallent MB, Esquivel CO, Gordon RD, Iwatsuki S, Starzl TE. Hepatic artery in liver transplantation. *Transplant Proc.* 1987; 19: 2406–2411.
17. Niederhuber JE, Ensminger WD. Surgical considerations in the management of hepatic neoplasia. *Semin Oncol.* 1983;10:135-47.
18. BremsJJ, Millis JM, Hiatt JR, et al. Hepatic artery reconstruction during liver transplantation. *Transplantation.* 1989;47:403-6.
19. Braun MA, Collins MB, Wright P. An aberrant right hepatic artery from the right renal artery: anatomical vignette. *CardiovascInterventRadiol.* 1991;14:349-51.
20. James, Spencer L, Chris D Castle, Zachary V Dingels, Jack T Fox, Erin B Hamilton, Zichen Liu, Nicholas L S Roberts, et al. “Global Injury Morbidity and Mortality from 1990 to 2017: Results from the Global Burden of Disease Study 2017.” *Injury Prevention* 26, no. Supp 1 (October 2020): i96–114. <https://doi.org/10.1136/injuryprev-2019-043494>.
21. Murray, Christopher J L, Cristiana Abbafati, Kaja M Abbas, Mohammad Abbasi, Mohsen Abbasi-Kangevari, FoadAbd-Allah, Mohammad Abdollahi, et al. “Five Insights from the Global Burden of Disease Study 2019.” *The Lancet* 396, no. 10258 (October 2020): 1135–59. [https://doi.org/10.1016/S0140-6736\(20\)31404-5](https://doi.org/10.1016/S0140-6736(20)31404-5).
22. Murray, Christopher J L, Aleksandr Y Aravkin, PengZheng, Cristiana Abbafati, Kaja M Abbas, Mohsen Abbasi-Kangevari, FoadAbd-Allah, et al. “Global Burden of 87 Risk Factors in 204

- Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019.” *The Lancet* 396, no. 10258 (October 2020): 1223–49. [https://doi.org/10.1016/S0140-6736\(20\)30752-2](https://doi.org/10.1016/S0140-6736(20)30752-2).
23. Vos, Theo, Stephen S Lim, Cristiana Abbafati, Kaja M Abbas, Mohammad Abbasi, Mitra Abbasifard, Mohsen Abbasi-Kangevari, et al. “Global Burden of 369 Diseases and Injuries in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019.” *The Lancet* 396, no. 10258 (October 2020): 1204–22. [https://doi.org/10.1016/S0140-6736\(20\)30925-9](https://doi.org/10.1016/S0140-6736(20)30925-9).
24. Bawankule, S., S. Kumar, A. Gaidhane, M. Quazi, and A. Singh. “Clinical Profile of Patients with Hepatic Encephalopathy in Cirrhosis of Liver.” *Journal of Datta Meghe Institute of Medical Sciences University* 14, no. 3 (2019): 130–36. <https://doi.org/10.4103/jdmimsu.jdmimsu.88.18>.
25. Mehta, S., Vyaasini, C. S., Jindal, L., Sharma, V., & Jasuja, T. (2020). Toothbrush, its design and modifications : An Overview. *Journal of Current Medical Research and Opinion*, 3(08), 570. <https://doi.org/10.15520/jcmro.v3i08.322>
26. Kirnake, V., A. Arora, P. Sharma, M. Goyal, R. Chawlani, J. Toshniwal, and A. Kumar. “Non-Invasive Aspartate Aminotransferase to Platelet Ratio Index Correlates Well with Invasive Hepatic Venous Pressure Gradient in Cirrhosis.” *Indian Journal of Gastroenterology* 37, no. 4 (2018): 335–41. <https://doi.org/10.1007/s12664-018-0879-0>.