

## LETTER

# Surgical Relevance of Liver Arterial Blood Supply Reconstruction by CT Scan before a Whipple Procedure

Offir Ben-Ishay, Yoram Kluger

Department of General Surgery B, Rambam Health Care Campus. Haifa, Israel

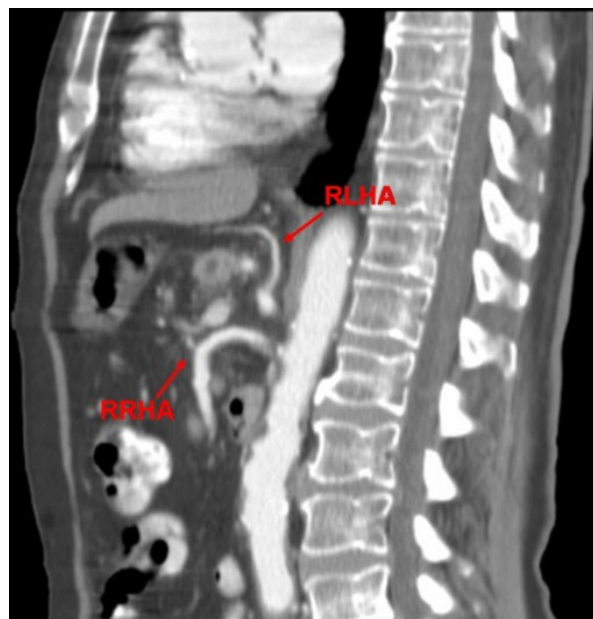
Dear Sir:

Anatomical arterial vascular supply to the liver is varied [1]. Establishing the exact variant of this blood supply is important before pancreatic surgery. Identifying the exact vascular anatomy may help in decision-making during surgery.

In 1955, Michels [2] published a study on hepatic arterial anatomy which was based on 200 autopsies. The classification was revised in 1966 by Michels and then modified by Hiatt *et al.* in 1996 [3]. According to Michels' findings, 10 anatomical variations of the hepatic arteries were identified and classified.

In most cases, the right and left hepatic arteries arise (55%) from the main hepatic artery which derives in turn from the celiac trunk (Type I). The middle hepatic artery which supplies segment IV may arise from the right or the left hepatic artery. Ten percent will present as a separate branch of the main hepatic artery. The left hepatic artery can arise from the left gastric artery (10%; Type II) and the right hepatic artery can arise directly from the superior mesenteric artery (Type III). In both variations, the mid-hepatic artery will arise from the non-replaced branch. Coexistence of replaced right and left arteries can occur in 1% of cases (Type IV). Accessory arteries can arise from the left gastric artery (8%; Type V) and from the superior mesenteric artery (7%; Type VI). The coexistence of accessory arteries and replaced arteries either left (Type VII) or right (Type VIII) can occur in 2% of cases. In 10% of cases the entire hepatic trunk is derived from the superior mesenteric artery (Type IX) or from the left gastric artery in 0.5% of cases (Type X).

We present the case of a 75-year-old patient who was referred for a pancreaticoduodenectomy due to adenocarcinoma of the head of the pancreas. The initial presentation was of painless obstructive jaundice. Physical examination was unremarkable. Bilirubin levels were elevated. Abdominal sonography revealed a hypo-echoic lesion of the head of the pancreas with a dilated common bile duct. Abdominal CT scan showed a hypodense lesion of 3.5 cm in the head of the pancreas leading to dilatation of the intra- and extra-hepatic bile ducts and the pancreatic duct. The superior mesenteric artery, superior mesenteric vein and portal vein showed no tumoral involvement but the course of the main hepatic artery was suspected to be encased by the tumor. Markers showed elevated CA 19-9 levels of 179.3 U/mL (reference range; 0-28 U/mL; borderline: 28-45 U/mL) while CEA was within normal limits. The Michels type IV anatomical variant with a replaced right and left hepatic artery (Figure 1) and a remnant



**Figure 1.** Point of origin of the replaced right hepatic artery (RRHA) from the superior mesenteric artery and point of origin of the replaced left hepatic artery (RLHA) from the left gastric artery.

Received August 16<sup>th</sup>, 2009 - Accepted August 28<sup>th</sup>, 2009

**Key words** /abnormalities; Hepatic Artery; Pancreaticoduodenectomy; Tomography, X-Ray Computed

**Correspondence** Offir Ben-Ishay

Department of Surgery B, Rambam Health Care Campus, POB

9602, Haifa, 31096, Israel

Phone: +972-50.206.3177; Fax: +972-4.854.7228

E-mail: o\_ben-ishay@rambam.health.gov.il

**Document URL** <http://www.joplink.net/prev/200911/05.html>

hepatic artery (Figure 2) from which the mid-hepatic artery arises was identified on CT scan vascular reconstruction. Due to this favorable vascular anatomy we elected to operate on the patient. During surgery, the main hepatic artery encased by the tumor was resected leaving the liver supplied by the replaced arteries. The patient recovered unremarkably and was discharged for further chemotherapy treatment. During his entire postoperative course, the liver function tests were normal.

Vascular invasion by a pancreatic head tumor often renders the tumor non-resectable. A favorable vascular aberrance may encourage the surgeon to elect a more aggressive approach even if vascular invasion is revealed [4, 5, 6, 7].

We conclude that pre-operative vascular assessment is imperative and recommend a CT scan with meticulous vascular evaluation before surgery for a tumor of the head of the pancreas, especially in patients in whom the vasculature is found to be involved in the tumor and before a proclamation of non-resectability.

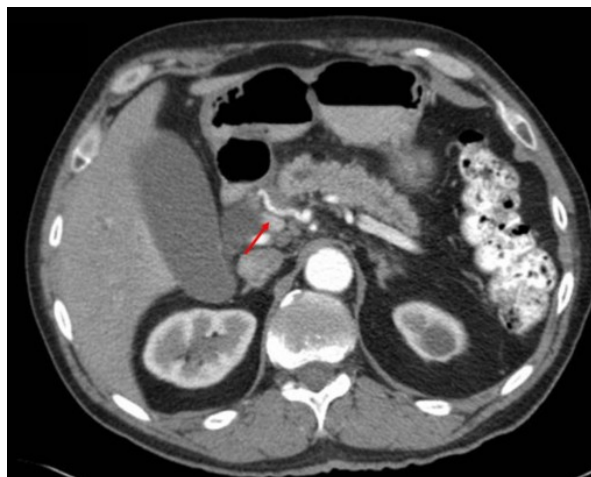
---

**Conflict of interest** The authors have no potential conflicts of interest

---

#### References

1. Netter FH. Atlas of Human Anatomy 4th edition. Saunders Elsevier 2006.
2. Michels NA. Blood Supply and Anatomy of the Upper Abdominal Organs with a Descriptive Atlas. Philadelphia, PA, USA:Lippincott, 1955.



**Figure 2.** Remnant hepatic artery encased by the tumor.

3. Hiatt JR, Gabbay J, Busuttil RW. Surgical anatomy of the hepatic arteries in 1000 cases. *Ann Surg* 1994; 220:50-2. [PMID 8024358]
4. Jah A, Jamieson N, Huguet E, Praseedom R. The implications of the presence of an aberrant right hepatic artery in patients undergoing a pancreaticoduodenectomy. *Surg Today* 2009; 39:669-74. [PMID 19639433]
5. Polguy M, Gabryniak T, Topol M. The right accessory hepatic artery; a case report and review of the literature. *Surg Radiol Anat* 2009 Aug 8. [PMID 19669076]
6. Adamthwaite JA, Pennington N, Menon KV. Anomalous hepatic arterial anatomy discovered during pancreaticoduodenectomy. *Surg Radiol Anat* 2007;269-71. [PMID 17406967]
7. Yang F, Long J, Fu DL, Jin C, Yu XJ, Xu J, Ni QX. Aberrant hepatic artery in patients undergoing pancreaticoduodenectomy. *Pancreatol* 2008; 8:50-4. [PMID 18230918]