A rare variation of the inferior mesenteric vein with clinical implications

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Several variations of the inferior mesenteric vein have been previously described. However, this report presents a rare variation that has not yet been noted. In this case, the small inferior mesenteric vein drained into a tributary of the marginal vein, which joined the superior mesenteric vein via the middle colic vein. The superior mesenteric vein then united with the splenic vein to become the hepatic portal vein. Awareness of this uncommon anatomy of the inferior mesenteric vein is important in planning a successful gastrointestinal surgery.

Key Words: *Inferior mesenteric vein; Marginal vein; Middle colic vein; Superior mesenteric vein*

INTRODUCTION

The portal venous system consists of four large veins: the hepatic portal, splenic (SV), superior mesenteric (SMV) and inferior mesenteric (IMV). The SMV collects the venous return from the small intestine, stomach, pancreas, cecum, ascending colon and proximal portion of the transverse colon. The SMV tributaries include the small intestine, right gastro-omental, inferior pancreaticoduodenal, ileocolic, right colic, middle colic (MCV) and marginal (MarV) veins. The IMV receives the blood from the superior rectal, sigmoid and left colic veins, which cover the distal portion of the transverse colon, descending colon, sigmoid colon and superior rectum. According to the description by Thompson in 1890, the portal vein tributaries are categorized into four types [1]. It is most common that the IMV drains into the SV, which then meets the SMV to form the hepatic portal vein. The IMV may also empty directly into the SMV or join the confluence of the SV and SMV [1-3]. These typical portal vein tributaries were described by other studies as well and observed during our routine gross dissection over the past years [4-8]. In addition, some uncommon variations were reported, such as the IMV drained into the first jejunal trunk or ileal trunk of the SMV [5,8]. However, this is the first time that the IMV is found to enter the MarV, one of the SMV tributaries. Besides, the IMV tapers gradually along the ascending course to accommodate its termination at the MarV. Awareness of a rare variation like this could help clinicians choose an appropriate surgical plane to minimize likelihood of bleeding during gastrointestinal surgery and postoperative complications.

CASE REPORT

On a 94-year-old male cadaver, the SMV ran adjacent to the superior mesenteric artery (SMA) behind the neck of the pancreas. Both vessels and their branches seemed normal. However, the course of the IMV was unique. The superior rectal and sigmoid veins united and ascended for a short distance before joined by the left colic vein to become the IMV (Figure 1). The IMV ran along with the inferior mesenteric artery (IMA) to its left and continued beyond the origin of the IMA. After coursing anterior to both the SMV and SMA perpendicularly, the IMV entered the MarV, which drained into the SMV via the MCV (Figure 2). The SMV and SV then converged to form the portal vein to enter the liver as illustrated in Figure 3. The diameter of the IMV varied, ranging from 1.5 mm to 3.0 mm. It gradually became narrower while it ran superiorly before its termination. The IMA arose from the abdominal aorta. It had a constant diameter, but looked a slight smaller. It was of interest to note that the colon was constricted and muscular with barely any adipose tissue of this case. The cause of death was attributed to arteriovascular sclerotic disease and chronic mesenteric artery insufficiency with episodic acute mesenteric artery insufficiency. No surgical reconstruction was noted on this cadaver.

DISCUSSION

Anatomical variation of the portal vein tributaries was initially described by

Figure 1) *The small IMV is formed by the union of the SRV and SigV, and then LCV. It ascends to the left of the IMA. After passing anterior to the SMV and SMA, it continues to terminate into the MarV.*

Abbreviations: IMA Inferior mesenteric artery; IMV Inferior mesenteric vein; LCV Left colic vein; MarV Marginal vein; PV Portal vein; SA Splenic artery; SigV Sigmoid vein; SMA Superior mesenteric artery; SMV Superior mesenteric vein; SRV Superior rectal vein; SV Splenic vein

Thompson [1]. The portal vein is formed by the union of the SV and SMV. The IMV drainage, however, follows one of the three common patterns: 1) it often drains directly into the SV, 2) it may empty into the SMV, and 3) it may join the confluence of the SV and SMV [1-8]. Multi-detector row computed tomography venography of 213 patients showed the prevalence of each pattern as 53%, 31% and 12%, respectively [5]. Recent meta-analysis further revealed consistent results [8]. In addition, the uncommon patterns of the IMV draining into the first jejunal trunk or ileal trunk of the SMV were also documented [5,8]. To the best of our knowledge, this report is the first time to present a rare variation, in which the IMV joins the MarV that in turn drains into the SMV via the MCV.

The complex anatomy of the SMV and IMV is largely attributed to technical difficulties in colon and pancreaticoduodenal surgeries [9,10]. This is particularly true for the laparoscopic procedure, a less invasive and more preferred alternative to open surgery for colectomy. As laparoscopic surgery often uses the mesenteric vessels as surgical landmarks of dissection, it is essential to understand the vascular structure preoperatively [11,12]. Although the modern diagnostic imaging, such as computed tomography and magnetic resonance imaging, can provide a tool to visualize the vascular anatomy, it is still a big challenge to identify

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Figure 2) *The IMV joins the arcade of the MarV. The MarV then anastomoses with the MCV to empty into the SMV*

IT Intestinal tributary; MCA Middle colic artery; MCV Middle colic vein; RCV Right colic vein

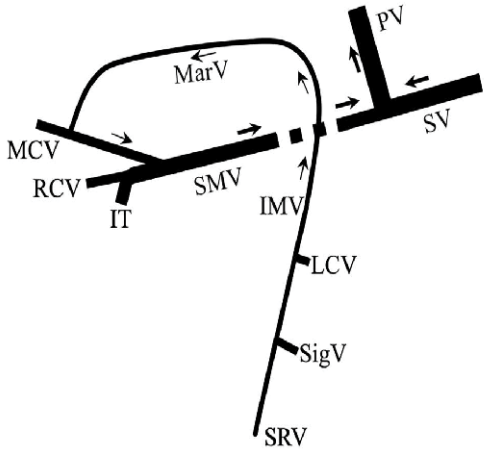

Figure 3) *TIllustrative drawing of a rare variation of the IMV drainage into the portal venous system*

the major vasculature during surgery in order to avoid massive bleeding [13]. The uncommon mesenteric vein variation such as this case would add another layer of complexity, which often results in bleeding and extended operative time. Awareness of the vascular variation is important in planning a safe and successful surgery.

In most cases, the IMV conveys blood from the left portion of the colon and superior rectum to the portal venous system. Its average diameter has been reported as 3.2 mm [2]. This case presents with a relatively small IMV. Its caliber tapers before it empties into the MarV. This might reflect its adaptation to the termination, as the MarV is a small vessel which anastomoses with the MCV to drain into the SMV. Giving the fact that the size and course of the SMV and its tributaries look normal, the adaptation could help to reduce the blood load to the SMV. The cadaver had arteriovascular sclerosis that affected both the SMA and IMA. The sclerotic vessel wall and the smaller IMA might have resulted in chronic mesenteric artery insufficiency with acute episodes. The aberrant IMV with a small caliber, on the other hand, might have been another contributing factor to the mesenteric vascular insufficiency, as both the arterial and venous impairment could disturb the blood supply to the small intestines and colon, which gradually leads to the ischemic changes [14]. In addition, it might have also led to the constricted colon with little adipose tissue.

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REFERENCES

1. Thompson WH. Formation of the portal vein. Collective investigation in the anatomical department of Trinity College, Dublin. Tr Roy Acad Med Ireland. 1890;8:516-9.
2. Douglass BE, Baggenenstross AH, Hollinshead WH. The anatomy of the portal vein and its tributaries. Surg Gynecol Obstet. 1950;91:562-75.
3. Gilfillan RS. Anatomic study of the portal vein and its main branches. Arch Surg. 1950; 61:449-61.
4. Graf O, Boland GW, Kaufman JA, et al. Anatomic variants of mesenteric veins: depiction with helical CT venography. Am J Roentgenol. 1997;168:1209-13.
5. Kim HJ, Ko YT, Lim JW, et al. Radiologic anatomy of the superior mesenteric vein and branching patterns of the first jejunal trunk: evaluation using multi-detector row CT venography. Surg Radiol Anat. 2007;29:67-75.
6. Sakaguchi T, Suzuki S, Morita Y, et al. Analysis of anatomic variants of mesenteric veins by 3-dimensional portography using multidetector-row computed tomography. Am J Surg. 2010;200:15-22.
7. Khamanarong K, Woraputtaporn W, Amarttayakong P, et al. Classification of portal vein tributaries in Thai cadavers including a new type V. Surg Radiol Anat. 2016;38:735-39.
8. Negoi I, Beuran M, Hostiuc S, et al. Surgical anatomy of the superior mesenteric vessels related to pancreaticoduodenectomy: a systematic review and meta-analysis. Sci Rep. 2018;8:4184-98.
9. Katz MH, Fleming JB, Pisters PW, et al. Anatomy of the superior mesenteric vein with special reference to the surgical management of first-order branch involvement at pancreaticoduodenectomy. Ann Surg. 2008;248:1098-102.
10. Chen Y, Wang X, Ke N, et al. Inferior mesenteric vein serves as an alternative guide for transection of the pancreatic body during pancreaticoduodenectomy with concomitant vascular resection: a comparative study evaluating perioperative outcomes. Eur J Med Res. 2014;19:42-51.
11. Lacy AM, García-Valdecasas JC, Delgado S, et al. Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomised trial. Lancet. 2002;359:2224-9.
12. Pigazzi A, Hellan M, Ewing DR, et al. Laparoscopic medial-to-lateral colon dissection: How and why. J Gastrointest Surg. 2007;11:778-82.
13. Alsabilah J, Kim WR, Kim NK. Vascular Structures of the Right Colon: Incidence and Variations with Their Clinical Implications. Scand J Surg. 2017;106:107-15.
14. Wolloch Y, Dintsman M. Mesenteric vascular insufficiency: mechanism, diagnosis and treatment. Am J Proctol Gastroenterol Colon Rectal Surg. 1979;30:14-6.