

Double Superior Mesenteric Vein—An often Underrecognized Entity of Surgical Significance: A Case Report

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ABSTRACT

Double superior mesenteric vein (DSMV) is a surgically underrecognized variant of the SMV having very few reports in surgical literature and even fewer intraoperative images. Due to increasing trend of right hemicolectomy with complete mesocolic excision and central venous ligation, exposure of the distal SMV is being performed more regularly. We describe the discovery of DSMV during an extended right hemicolectomy, with intraoperative photograph and preoperative computed tomography images. Being unaware of this variation can cause inadvertent injury to the SMV, significant bleeding and postoperative morbidity. We also review the current knowledge and provide a few clues for intraoperative identification.

Keywords: Double superior mesenteric vein, hemicolectomy, complete mesocolic excision

Introduction

Surgeons are familiar with the anatomy of the superior mesenteric vein (SMV) at the splenoportal junction.¹ However, anatomical variations of the more proximal SMV are rarely encountered, as exposure in this area is usually unnecessary in colonic surgery. Yet, with the recent concepts of complete mesocolon excision (CME) and central venous ligation (CVL) for colon cancers,^{2,3} this area is being exposed more frequently during surgery. Variations of the colonic vessels are well described in the literature,⁴ but reports of variations in the SMV using intraoperative imaging are limited. Here, we report such a case of a double SMV discovered intraoperatively and confirmed retrospectively on contrast-enhanced computed tomography (CECT) scan images. We also provide a brief overview of the surgical literature on anatomical variations of the proximal SMV. This research was conducted at a tertiary-care research and teaching institute. Informed written patient consent was obtained, and a waiver from the institutional ethics committee was sought for publication of anonymized patient data.

Case Report

A 48-year-old man presented with colicky abdominal pain lasting for 3 months, constipation, and passing blood in the stools. Abdominal CECT showed a colonic mass in the hepatic flexure. Pericolic lymph nodes were enlarged. Colonoscopy showed an ulceroproliferative growth causing luminal narrowing. Biopsy was reported as “signet ring cell adenocarcinoma”. Clinical staging was cT3N2M0. An extended right hemicolectomy using CME with CVL was planned.

Intraoperative Procedure

A midline incision was used. Following assessment of intraperitoneal spread, exposure of the SMV was initiated from the root of the mesentery. The main trunk of the middle colic artery was ligated very close to its origin, and the middle colic vein (MCV) was ligated at its draining point on the SMV. The SMV was gradually cleared distally, ligating venous tributaries. However, even after exposing the SMV for a good length, neither the almost constant ileocolic vein (ICV) nor the ileocolic artery (ICA) was found. At this stage, another rather large venous structure was identified to the right of the presumed SMV, and



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the possibility of a double SMV was considered. Thereafter, mesocolic clearance was performed along the medial (right) border of the new vein [right SMV (RSMV)], and the right colic vein (RCV) was identified and ligated. More caudally, the ICV drained into the RSMV, which was then ligated. The ICA was found to traverse beneath the RSMV, originate from the superior mesenteric artery (SMA) on the medial border of the left trunk of the SMV, and was ligated. Thereafter, the extended right hemicolectomy was performed according to standard procedure, and the specimen was delivered with a complete mesocolic envelope. The appearance of the SMV trunks following resection is shown in Figure 1. There was no intraoperative venous injury in this case.

A retrospective review of the preoperative CT images confirmed our finding that the SMV divides into two trunks just below the root of the mesentery, with the SMA running between them (Figure 2). This has been recently classified as a type IIa variant.⁵

The postoperative period was uneventful except for a minor superficial wound infection. The patient was discharged on postoperative day 7 and is undergoing regular follow-up, receiving adjuvant therapy.

Discussion

Although previously described in a few anatomical or radiological studies, anatomical variations of the proximal SMV are not commonly encountered by colorectal surgeons, as exposure of the trunk of the SMV lower down is rarely

required during operations such as right hemicolectomy with D2 lymphadenectomy.⁶ However, anatomical variations of the proximal SMV are not infrequent and are significant from a surgical perspective. Recently, more radical D3 lymphadenectomy, employing the concepts of CME² and CVL, is being performed more widely, as studies have shown it is associated with higher lymph node yield and improved survival.^{7,8} This newer technique of CME/CVL has led to renewed recognition of the not-infrequent presence of double SMV trunks. A search of the surgical literature in PubMed using the terms “double” and “superior mesenteric vein” did not yield many studies on this variant, although it has been reported in the anatomy literature.¹ One study⁹ from 2010 using three-dimensional (3D) portography reported the presence of two SMV trunks in 23.5% of patients. Another study¹⁰ estimated its presence in only 9.1% of patients. A recent series from China⁵ estimated that double SMVs are present in 19% of patients and classified them into four types: Ia, Ib, IIa, and IIb. In type Ia, the right and left SMVs drain independently into the portal vein. In type Ib, the MCV drains into the right SMV. In type IIa, the most common variation [as in our case (Figure 3)], two SMV trunks join to form a common trunk, with the main colonic branches draining into the right SMV. In type IIb, the MCV drains into the left SMV. It was also reported that in one case, the right SMV was inadvertently injured. Injury or ligation of one of the main draining vessels of the bowel is not without its significant consequences. In addition to intraoperative hemorrhage, venous congestion of the small bowel may occur postoperatively, leading to significant

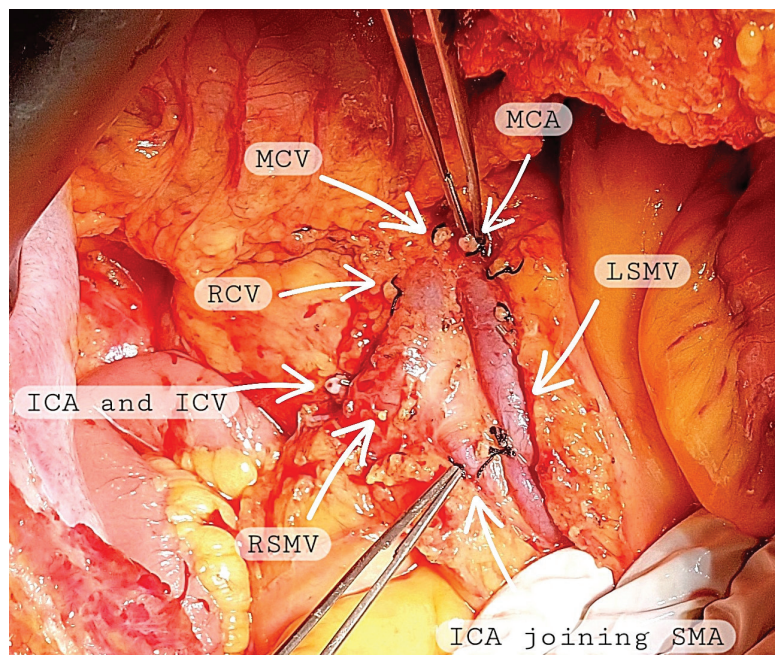


Figure 1. Intraoperative photograph showing double superior mesenteric veins after resection of the specimen
MCV: Middle colic vein, MCA: Middle colic artery, RCV: Right colic vein, ICA and ICV: Ileocolic artery and ileocolic vein, RSMV: Right superior mesenteric vein, LSMV: Left superior mesenteric vein, SMA: Superior mesenteric artery

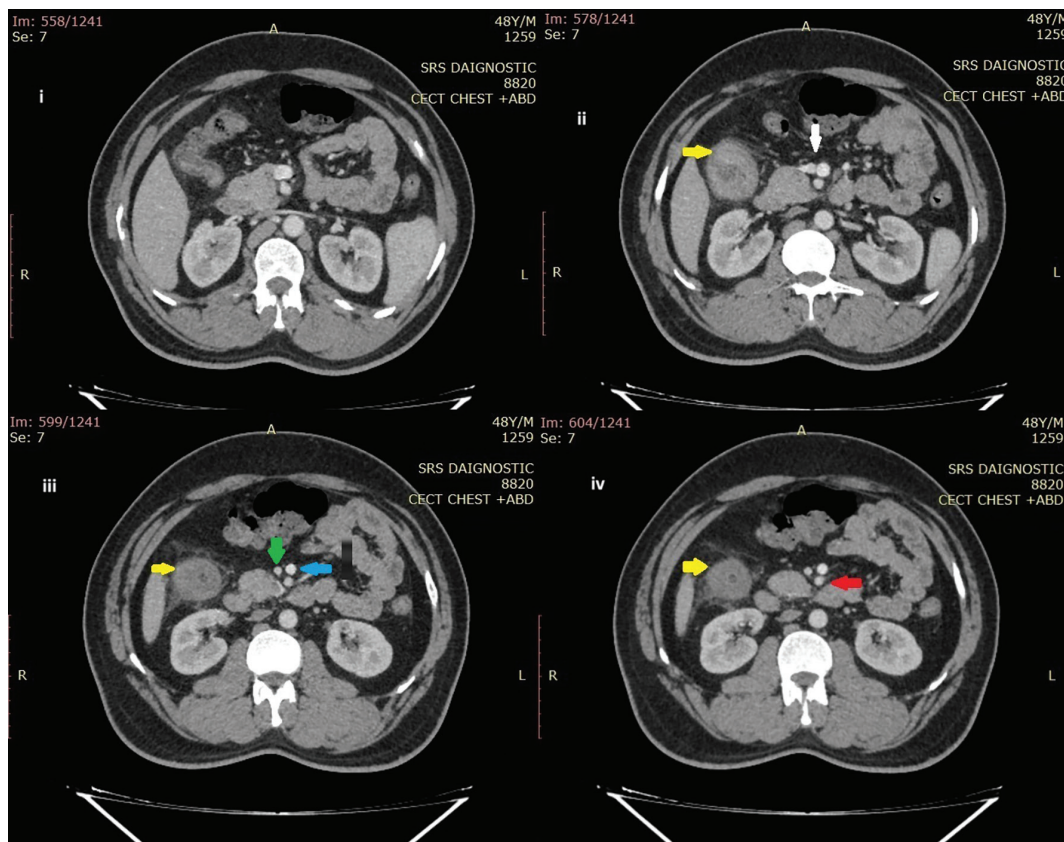


Figure 2. (i-iv) Sequential axial abdominal computed tomography sections showing division of the superior mesenteric vein (SMV) into two trunks and their relationship with the superior mesenteric artery (SMA). Yellow arrow: Colonic mass at hepatic flexure. White arrow: Bifurcation of the SMV into right and left trunks. Light green arrow: Right branch of SMV. Light blue arrow: Left branch of SMV. Red arrow: SMA running between and posterior to the right and left SMVs

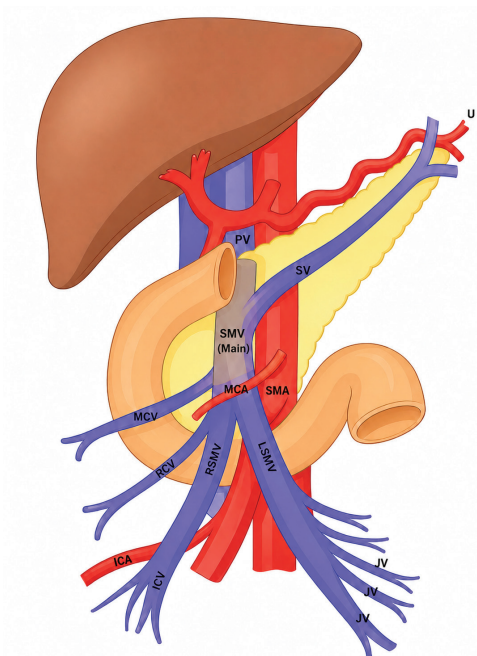


Figure 3. Schematic of the most common variant
MCV: Middle colic vein, MCA: Middle colic artery, RCV: Right colic vein, ICA and ICV: Ileocolic artery and ileocolic vein, RSMV: Right superior mesenteric vein, LSMV: Left superior mesenteric vein, SMA: Superior mesenteric artery

morbidity and even mortality.¹¹ Such incidences can occur more frequently if the left SMV trunk is mistaken for the main SMV trunk. In such a case, the right trunk, when present, falls inside the mesocolic excision boundary and is highly liable to injury during mesocolic excision. In our case, the recognition of another large venous trunk, with the RCV and ICV draining into it and the ICA passing beneath it, facilitated its discovery and prevented injury. The fact that the variation was not detected on the preoperative CT scan also indicates that preoperative CT scans must be evaluated effectively. Based on our experience, we summarize a few intraoperative clues that can alert the surgeon to the possibility of the presence of double SMV trunks if discovered intraoperatively:

Intraoperative findings indicating the possibility of double SMV trunks:

1. Ileocolic artery passing under a large venous trunk and traced on both sides,
2. Not finding the constant ICV even after exposure of a significant length of the SMV,
3. Middle colic vein crossing the presumed SMV and draining toward the left (type IIb),

4. Another large venous tributary draining into the presumed SMV on the left side.

In such cases, we recommend intraoperative review of the CT scan to confirm the findings. Preoperatively, these variations can be well ascertained in a good-quality triphasic CT scan. Preoperative vascular mapping with 3D reconstruction images may further help in proper delineation of this variant whenever required.

Conclusion

The presence of double trunks of the SMV is an underrecognized finding, present in 9.1-23.5% of patients, and of surgical significance. Unfamiliarity with this variation can lead to inadvertent injury during mesocolic excision, with significant consequences. We recommend paying greater attention to imaging to identify this variation preoperatively. Preoperative vascular mapping may further help delineate this anatomical abnormality.

Ethics

Informed Consent: Written informed consent was obtained from the patient for presentation and publication of all patient-related material.

Footnotes

Authorship Contributions

Surgical and Medical Practices: R.R., T.D.B., S.G., M.R., Concept: R.R., S.G., M.R., Design: R.R., T.D.B., S.G., Data Collection or Processing: R.R., T.D.B., S.G., M.R., Analysis or Interpretation: R.R., T.D.B., S.G., M.R., Literature Search: R.R., T.D.B., M.R., Writing: R.R., T.D.B., S.G., M.R.

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