

# Venous Anatomy of the Right Colon

## Precise Structure of the Major Veins and Gastrocolic Trunk in 58 Cadavers

Shigeki Yamaguchi, M.D.,\* Hiroya Kuroyanagi, M.D.,† Jeffrey W. Milsom, M.D.,† Richard Sim, F.R.C.S.(Edinb.),† Hiroshi Shimada, M.D.\*

From the \*Department of Surgery II, Yokohama City University School of Medicine, Yokohama, Japan, and

†Division of Colorectal Surgery, Department of Surgery, Mount Sinai Medical Center, New York, New York

**PURPOSE:** This study was designed to describe the precise venous anatomy of the right colon, which is especially important for laparoscopic right hemicolectomy. **METHODS:** Fifty-eight adult cadavers were dissected to define the three major venous tributaries of the right colon: the ileocolic vein, right colic vein, and middle colic vein. Two or three middle colic veins were often present, and the biggest one was designated as the main middle colic vein. The middle colic vein and the right colic vein occasionally formed a common trunk with the right gastroepiploic vein and/or the pancreaticoduodenal vein. This common trunk was defined as the gastrocolic trunk. **RESULTS:** All 58 cadavers had a single ileocolic vein. All of the ileocolic veins drained into the superior mesenteric vein. The right colic vein was absent in 56.9 percent (33/58), and the other 43.1 percent had a single right colic vein. The right colic vein joined the superior mesenteric vein directly in 56 percent (14/25) and the gastrocolic trunk in 44 percent (11/25). The middle colic vein was the most variable. A single middle colic vein was present in 37.9 percent (22/58), 2 middle colic veins were present in 50 percent (29/58), and 3 middle colic veins were present in 12.1 percent (7/58). The main middle colic vein drained into the superior mesenteric vein directly in 84.5 percent (49/58), whereas 12.1 percent (7/58) drained into the gastrocolic trunk. In two cadavers, there was anomalous drainage of the main middle colic vein to the splenic vein and the inferior mesenteric vein. Forty-three accessory middle colic veins were present in total. These drained into the superior mesenteric vein in 17 cadavers and into the gastrocolic trunk in 23. The gastrocolic trunk was present in 69 percent (40/58), being formed with the right colic vein in 27.5 percent (11/40; 1 was together with an accessory middle colic vein) and with the middle colic vein in 75 percent (30/40; 7 with the main middle colic vein, 23 with the accessory middle colic vein). **CONCLUSION:** Venous anatomy of the right colon is highly variable. It is especially important to recognize the lack of direct drainage of the right colic vein to the superior mesenteric vein and the high frequency of the presence of plural middle colic veins and the gastrocolic trunk. [Key words: Venous anatomy; Right hemicolectomy; Gastrocolic trunk]

Yamaguchi S, Kuroyanagi H, Milsom JW, Sim R, Shimada H.

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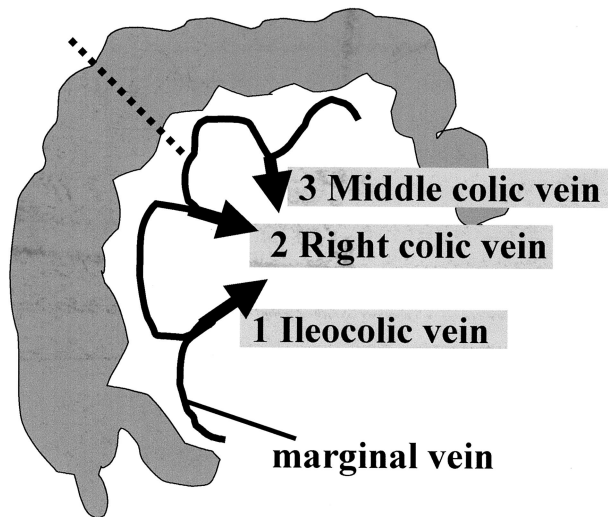
Address reprint requests to Dr. Yamaguchi: Division of Colon and Rectal Surgery, Shizuoka Cancer Center Hospital, 1007 Shimonagakubo, Nagaizumi, Shizuoka, Japan 411-8777.

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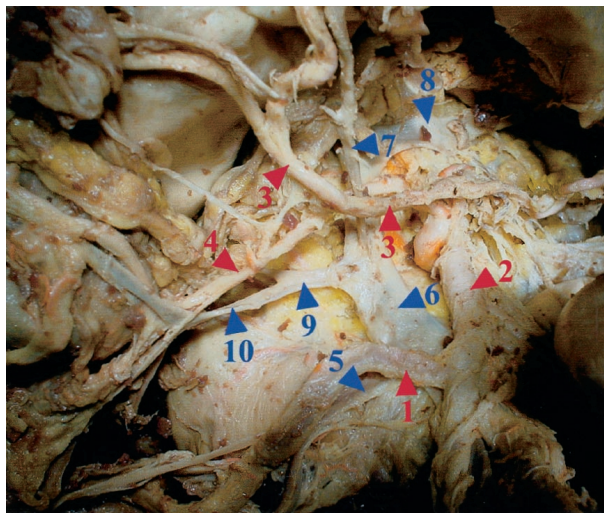
There have been many studies about arterial anatomy of the right colon.<sup>1-3</sup> However, precise description of tributaries of the mesenteric vein is lacking in the literature. Accurate knowledge of vascular anatomy is especially important for oncologic resection or when severe inflammatory disease makes surgery difficult. Oncologic resection requires wide excision of the mesocolon close to the pancreas, and bleeding around the pancreas is sometimes difficult to arrest. Therefore, colorectal surgeons should know precise venous anatomy. The purpose of this study was to describe the various types of venous anatomy of the right colon.

### MATERIALS AND METHODS

Fifty-eight adult cadavers were carefully dissected at the anatomy laboratories of the Mount Sinai Medical Center and Yokohama City University (29 at each laboratory) to display the veins of the right colon. Three major tributaries (the ileocolic, the right colic, and the middle colic veins) were checked in each case. The ileocolic vein (ICV) was defined as the tributary from the ileocecal marginal veins to the superior mesenteric vein (SMV). The right colic vein (RCV) and the middle colic vein (MCV) were defined respectively as the veins that drained from the marginal veins of the ascending colon and the transverse colon to the SMV (Fig. 1). When two or three MCVs were present, the biggest was designated as the main MCV, and the smaller MCVs were defined as accessory MCVs. The MCV and the RCV occasionally formed a common trunk with the right gastroepiploic vein and/or the pancreaticoduodenal vein. This common trunk was defined as the gastrocolic trunk (GCT; Fig. 2).



**Figure 1.** Definition of veins of the right colon. 1 = ileocolic vein from terminal ileum; 2 = right colic vein from ascending colon; 3 = middle colic vein from transverse colon to superior mesenteric vein or gastrocolic trunk.



**Figure 2.** Gastrocolic trunk. 1 = ileocolic artery; 2 = superior mesenteric artery; 3 = middle colic artery; 4 = right colic artery; 5 = ileocolic vein; 6 = superior mesenteric vein; 7 = middle colic vein; 8 = splenic vein; 9 = gastrocolic trunk; 10 = right colic vein.

## RESULTS

The root of the ICV was located on the duodenum, and stems of the RCV and MCV were located on the pancreatic head. The veins of the right colon drained in two or three directions. One of them was seen from the ileocolic part in all cadavers. The ascending colon was drained by an independent vein in 43.1 percent (25/58) of cases, and in most of the others, it drained to MCVs with the proximal transverse colon.

Table 1 shows the number of veins. All 58 cadavers had a single ICV. Thirty-three cadavers (56.9 percent) lacked the RCV; the other 25 (43.1 percent) had a single RCV. Twenty-two cadavers (37.9 percent) had a single MCV, 29 (50 percent) had 2 MCVs, and 7 (12.1 percent) had 3 MCVs. As a result, 62.1 percent (36/58) had accessory MCVs, and there were 43 accessory MCVs in total. All of the ICVs drained into the SMV (Table 2).

The RCV entered into the SMV directly in 14 cadavers (56 percent) and into the GCT in 11 (44 percent). The main MCVs of 49 cadavers (84.5 percent) drained into the SMV directly, whereas in 7 (12.1 percent), they formed the GCT. Two had anomalous drainage to the splenic vein and the inferior mesenteric vein.

There were 43 accessory MCVs in 36 cadavers. The accessory MCVs were drained by the SMV in 17 and by the GCT in 23. Unusual accessory MCVs drained into the splenic vein in 2 and the inferior mesenteric vein in 1.

The GCT was present in 40 cadavers (69 percent). The colonic tributaries were formed with 11 RCVs and 30 MCVs. In one cadaver, the GCT was formed from both the RCV and an accessory MCV. Seven main MCVs and 23 accessory MCVs entered into the GCT (Table 3). These results are summarized in Figure 3.

## DISCUSSION

Although it is well known that venous anatomy can vary widely, there has been no study about mesenteric venous anatomy apart from some reports by pancreatic surgeons.<sup>4,5</sup> In general, textbooks of colorectal surgery have depicted the veins of the right colon as joining the SMV along their corresponding arteries. There is no description given about the numbers of each major vein and their relation with the GCT.<sup>6,7</sup> The present study documented a highly variable venous structure of the right colon and presents important knowledge for colorectal surgery, especially laparoscopic surgery.

The ICV is an invariable structure. All cadavers had only one vein that invariably joined the SMV. It is very similar to the ileocolic artery.<sup>1,8</sup> The ileocolic artery was always accompanied by the ICV. This constant structure is very important for laparoscopic right colectomy, because the first step is grasping and dividing the ileocolic pedicle before mobilization of the mesocolon. This fact underscores the safety and feasibility of laparoscopic right colectomy by a medial to lateral approach.<sup>9</sup>

**Table 1.**  
Numbers of Veins

	Number of Veins			
	0	1	2	3
Ileocecal vein	0	58 (100)	0	0
Right colic vein	33 (56.9)	25 (43.1)	0	0
Middle colic vein	0	22 (37.9)	29 (50.0)	7 (12.1)

Figures are n (%).

**Table 2.**  
Drainage of the Veins

	SMV	GCT	Others
Ileocolic vein	58 (100)	0	0
Right colic vein*	14 (56.0)	11 (44.0)	0
Main MCV	49 (84.5)	7 (12.1)	1 SV, 1 IMV
Accessory MCV†	17	23	2 SV, 1 IMV

SMV = superior mesenteric vein; GCT = gastrocolic trunk; MCV = middle colic vein; SV = splenic vein; IMV = inferior mesenteric vein.

Figures are n (%).

\* Thirty-three cadavers lacked the right colic vein.

† Thirty-six cadavers had 43 accessory middle colic veins.

The RCV is often absent, as is the corresponding artery.<sup>1,3,8</sup> Incidence of the RCV was 43.1 percent, and all of these veins were single. This means the RCV was more likely to be absent. Direct drainage by the SMV was seen in only 56 percent, and 44 percent drained by the GCT. These two patterns should be recognized with similar frequencies.

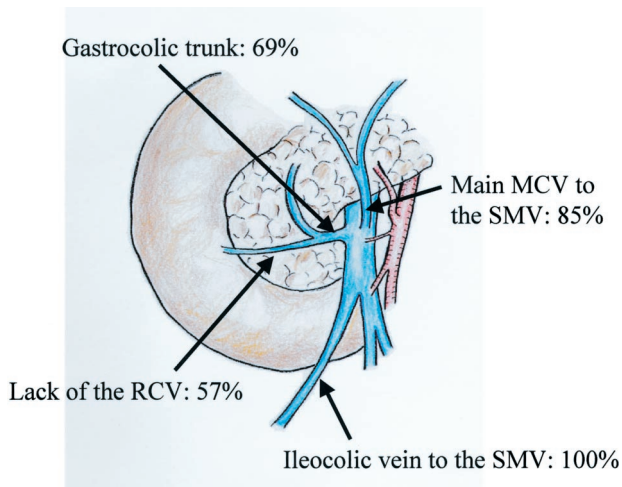
The MCV was the most variable in the present study. There were often 2 or more MCVs (62.1 percent), and the biggest drained directly to the SMV in 84.5 percent of cases. On the other hand, it should be recognized that the main MCV drained by the GCT in 12.1 percent of cases. There were two other interesting cases. One of them drained into the splenic vein, and the other entered into the inferior mesenteric vein. Although rare, such cases had been reported previously.<sup>10</sup> The accessory MCV drained into the SMV or the GCT with similar frequency (17 *vs.* 23). Accessory MCVs were usually small but need to be reckoned with, because inevitably, they must be divided during resection of the mesocolon. The description was that the gastroepiploic vein was joined in all cases by the anterior superior pancreaticoduodenal and one or more colic veins.<sup>4</sup> For colorectal surgeons, it is important to know which vein of the colon joins the GCT. This is one of the most important parts of the present study. Sixty-nine percent of cadavers had a GCT, of which 75 percent came from the transverse colon and the other 27.5 percent from the ascending

**Table 3.**  
Gastrocolic Trunk

	n/N	Percent
Presence	40/58	69
Right colic vein (1 with accessory MCV)	11/40	27.5
MCV	30/40	75
Main MCV	7/40	17.5
Accessory MCV	23/40	57.5

colon. Most of the accessory MCVs were small veins, but venous bleeding can be disastrous, especially around the pancreas. Only knowledge of precise anatomy can prevent this. The middle colic artery was also variable. At the level of the marginal vessels and peripheral parts of the MCVs, the arteries were accompanied by their corresponding veins. However, central parts of the middle colic vessels ran in different directions. The MCVs drained to the SMV or the GCT at a short distance and often separately, whereas the middle colic arteries came off from the superior mesenteric artery with a relatively greater length.

Laparoscopic colectomy offers great advantage for patients in terms of cosmesis, minimal access trauma, and good visualization. Although the anatomy is the same in both open and laparoscopic surgery, the laparoscopic surgeon needs to appreciate precise anatomy even more to compensate for the lack of tactile feedback during mobilization of tissue planes



**Figure 3.** Summary of the veins of the right colon. MCV = middle colic vein; SMV = superior mesenteric vein; RCV = right colic vein.

and division of vessels. In the laparoscopic era, more than before, knowledge of precise anatomy is mandatory to avoid complications and to perform efficient surgery.

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