Original article

Comparative anatomical study of division of the ileocolic pedicle or the superior mesenteric pedicle for mesenteric lengthening

P. Martel, P. Blanc, H. Bothereau, M. Malafosse and D. Gallot

Department of Digestive Surgery, Bichat Hospital, Paris VII University, Paris, France
Correspondence to: Dr P. Martel, Service de Chirurgie Digestive, Hôpital Bichat, 46 rue Henri-Huchard, 75877 Paris Cedex 18, France (e-mail: philippe.martel@bch.ap-hop-paris.fr)

Background: **Lengthening of the mesentery by vascular division may be necessary to perform an ileal pouch–anal anastomosis without tension. The aim of this study was to compare, in fresh cadavers, the increase in mesentery length after division of the ileocolic pedicle (ICP) and the superior mesenteric pedicle (SMP).**

Methods: **Total colectomy was performed in 12 fresh cadavers, which were then randomly divided into two groups. Pouch–anal anastomosis was performed with division of the ICP in one group of six cadavers and with division of the SMP in the other. The ileum was measured and the increase in length was recorded and compared statistically.**

Results: **The mean(s.d.) increase in length was 3·0(0·8) cm after ICP division and 6·5(1·1) cm after SMP division ($P < 0·001$). The distance between the end of the ileum and the point giving the greatest length was 25·5(5·0) cm in the ICP group and 46·8(4·2) cm in SMP group ($P < 0·001$).**

Conclusion: **In fresh cadavers, the increase in mesenteric length was greater after SMP division than after ICP division, but if pouch–anal anastomosis is performed a short segment of small bowel must be removed.**

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Introduction

Since its initial description in 1978[1], restorative proctocolectomy with ileal pouch–anal anastomosis has become the procedure of choice for patients with chronic ulcerative colitis or familial adenomatous polyposis. The J pouch is the most commonly used configuration[2], and only the choice between a stapled or handsewn anastomosis remains controversial[3,4].

Pouch–anal anastomosis may be difficult when the small bowel mesentery is too short. In such cases, several techniques for lengthening the mesentery have been proposed, including vascular division. Division of the ileocolic pedicle (ICP) is probably the most commonly used[5,6]. If the ileum did not initially reach the anal canal, the authors have divided the superior mesenteric pedicle (SMP) high in the mesentery, a manoeuvre previously shown to be safe with no effect on functional outcome after pouch–anal anastomosis[7].

The aim of this study was to compare, in fresh cadavers, the increase in length of the mesentery after division of the ICP and after division of the SMP.

Materials and methods

This study was performed in the Anatomical Laboratory of the Paris School of Medicine on 12 fresh cadavers. None of these cadavers had previously undergone abdominal surgery.

Surgical procedure

Total colectomy was performed through a midline and transverse laparotomy. The terminal ileum was divided close to the caecum and the ICP was preserved. The posterior attachment of the entire small intestinal mesentery was mobilized up to the third portion of the duodenum. The inferior part of the head of the pancreas was mobilized.

Methods of measurement (*Fig. 1*)

The point of the ileum that gave the greatest length, the best potential site for ileoanal anastomosis, was marked (I point). The distance between the end of the ileum (E point) and the I point was recorded (EI). The ileum was stretched towards the lower edge of the symphysis pubis (S point) and the distance between the S point and the I point was recorded (SI). If the ileum was above the lower edge of the symphysis pubis, then SI was negative, and if it was below the symphysis pubis SI was positive.

Vascular divisions

The cadavers were randomly assigned to one of two groups. In the first group of six the ICP was divided and in the second the SMP was divided. The ICP was divided at the midpoint between its origin and the marginal vascular arcade (*Fig. 2*). The SMP was divided 2–3 cm after the origin of the ICP (*Fig. 3*). In each group the mesentery was opened extensively beyond the vascular division.

After division of the vessels, the point of the ileum that gave the greatest length had changed; this new point was marked (I′ point). The new distance between the end of the ileum (E point) and the I′ point was recorded (EI′). The ileum was stretched and the distance between the lower edge of the symphysis pubis (S point) and the I′ point was recorded (SI′).

Statistical analysis

The Student's *t* test was used for statistical analysis. $P < 0{\cdot}05$ was considered to be statistically significant.

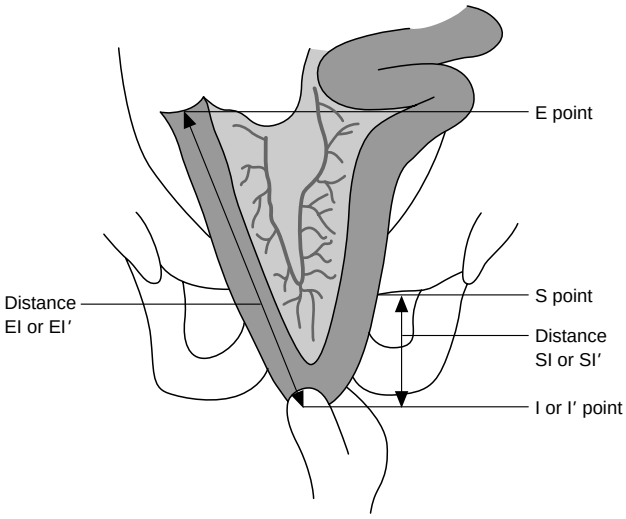

Fig. 1 Stretching of the ileum towards the symphysis pubis

Results

The two groups of cadavers had a similar mean age at the time of death, sex ratio and mean post-mortem delay (*Table 1*).

Before vascular division

The mean(s.d.) distance between the point of the ileum giving the greatest length (I point) and the extremity of the

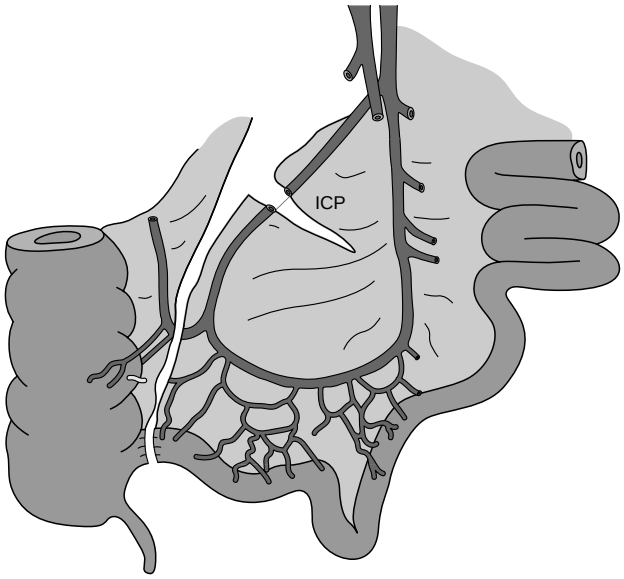

Fig. 2 Division of the ileocolic pedicle (ICP)

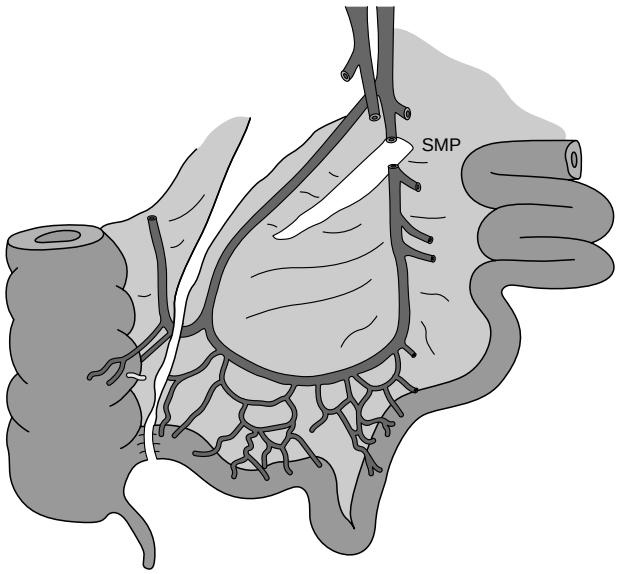

Fig. 3 Division of the superior mesenteric pedicle (SMP)

Table 1 Comparison of cadavers undergoing division of the ileocolic pedicle or superior mesenteric pedicle

	ICP	SMP	*P**
Sex ratio (M : F)	3 : 3	3 : 3	
Age at time of death (years)	84(16)	86(6)	0·8
Post-mortem delay (days)	5(1)	6(3)	0·5

Values are mean(s.d.). ICP, ileocolic pedicle; SMP, superior mesenteric pedicle. *Student's *t* test

Table 2 Changes in measurements after division of the ileocolic pedicle or superior mesenteric pedicle

	ICP	SMP	*P**
EI (cm)	27·3(3·5)	22·0(7·0)	0·13
SI (cm)	0·2(2·7)	1·5(2·8)	0·4
EI′ (cm)	25·5(5)	46·8(4·2)	< 0·001
SI′ (cm)	3·2(2·3)	8·0(2·6)	< 0·01
Increase in length (cm)	3·0(0·8)	6·5(1·1)	< 0·001

Values are mean(s.d.). ICP, ileocolic pedicle; SMP, superior mesenteric pedicle. EI and EI′, distance between the end of the ileum and the point of the ileum giving the maximum length; SI and SI′, distance between the point of the ileum giving the maximum length and the lower edge of the symphysis pubis. *Student's *t* test

ileum (E point) was 27·3(3·5) cm in the ICP group and 22·0(7·0) cm in the SMP group (*Table 2*). The mean distance between the I point and the lower edge of the symphysis pubis (S point) was 0·2(2·7) and 1·5(2·8) cm respectively (*Table 2*).

After vascular division

The new point of the ileum giving the greatest length (I′ point) was very close to the original I point after ICP division (EI′ = 25·5(5) cm). In contrast, the I′ point was further than the I point from the S point after SMP division (EI′ = 46·8(4·2) cm) ($P < 0·001$) (*Table 2*). The distance between the I and I′ points was 3·5(2·7) cm after ICP and 24·8(4·5) cm after SMP division.

After vascular division, the mean distance between the I′ point and the lower edge of the symphysis pubis (S) was 3·2(2·3) cm after ICP division and 8·0(2·6) cm after SMP division ($P < 0·01$) (*Table 2*). The mean increase in mesentery length was 3·0(0·8) cm after ICP and 6·5(1·1) cm after SMP division ($P < 0·001$) (*Table 2*).

Discussion

The blood supply of the terminal ileum arises from the terminal branches of the superior mesenteric vessels. These terminal branches classically form anastomoses with the marginal vascular arcade of the right colon, which itself originates from the ileocolic artery and the right colic pedicle, and forms anastomoses with branches of the inferior mesenteric pedicle. If there is sufficient flux and the marginal vascular arcade is preserved, vascularization of the terminal ileum may theoretically be achieved by only one of the pedicles or by the arcade itself.

During pouch–anal anastomosis, simple manoeuvres to increase the length of the mesentery are performed, such as moving the posterior attachment of the entire small bowel mesentery up to the third portion of the duodenum, exposure of the inferior portion of the head of the pancreas and division of the peritoneum of the mesentery on the anterior and posterior sides[8]. If such manoeuvres are insufficient to achieve anastomosis without tension, vascular division is necessary. This is particularly true if the mesentery is short, as in an obese patient with a narrow pelvis, or if there is a desmoid tumour in the mesentery.

Division of two or three distal branches is thought to be hazardous owing to the risk of segmental necrosis of the terminal ileum[6,9]. Proximal division is therefore favoured. Division of the ICP and the right colic pedicle at their origins, with division of the distal third of the SMP and preservation of the marginal vascular arcade of the right colon have been performed in an anatomical study, resulting in a 36·5 per cent increase in the length of the mesentery[10]. The right colic pedicle is not usually preserved during colectomy; the technique most frequently used to lengthen the mesentery is division of the ICP. The authors prefer division of the SMP high in the mesentery, 2–3 cm beyond the origin of the ICP, because in most patients in whom the terminal ileum is stretched at the anus the axis of tension corresponds to the SMP. This manoeuvre is safe if the colour of the ileum remains unchanged after clamping of the SMP for at least 15 min before division, and has no effect on functional outcome after pouch–anal anastomosis[7].

This study shows that in cadavers the increase in length of the mesentery is greater after division of the SMP high in the mesentery than after division of the ICP. However, two points must be emphasized if division of the SMP is to give a true increase in mesentery length: first, the mesentery must be divided extensively around the vascular division and, second, the point of the ileum giving the greatest length must be systematically recalculated (I′ point).

The I point is generally further away from the end of the ileum after division of the SMP. In this anatomical study, the mean distance between the end of the ileum and the I point was 22 cm, whereas after SMP division the distance between the end of the ileum and the I′ point was 47 cm. If the 18 cm of one limb of the future J pouch is subtracted from the 47 cm, this leaves about 30 cm of ileum that must

be removed. This resection is, of course, open to criticism because the overall length of small bowel has a major effect on the quality of function after pouch–anal anastomosis. In real surgical conditions (living patients), the overall length of the small bowel is variable owing to contraction of the muscular intestinal wall. However, it is usually less than 5 m, whereas the length of the small bowel in cadavers is generally between 6 and 7 m. After clinical pouch–anal anastomosis with division of the SMP, the length of small bowel removed never exceeds 20 cm.

The volume of stool may be increased in patients with a terminal ileostomy if 20 cm of terminal ileum is lost. In the authors' clinical experience, there was no difference in stool frequency after pouch–anal anastomosis with division of the SMP and the procedure without pedicle division[7]. This was explained partly by the short segment of small bowel that was removed, but also by the function of the pouch, which probably reduced the consequences of the loss of intestine.

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