

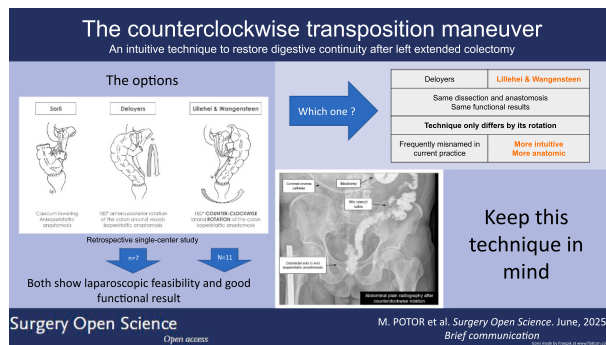


Brief Communication

Counterclockwise colonic transposition after left extended colectomy: an efficient and reproducible alternative to the Deloyers procedure

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GRAPHICAL ABSTRACT



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ABSTRACT

Reconstruction of the digestive tract after extended left colectomy is a common challenge for colorectal surgeons. The main difficulty lies in lowering the colon into the pelvis to achieve a tension-free and well-vascularized anastomosis. We report our 10-year retrospective experience, in which a counterclockwise colonic transposition according to Lillehei and Wangenstein was performed in more than half of the cases. This technique differs from the more widely known Deloyers procedure solely by its axis of rotation. It offers the advantage of being more anatomical, easily reproducible, and functionally equivalent.

Introduction

Restoration of digestive continuity after left extended colectomy is a common challenge for surgeons [1]. When the remaining colon and/or its mesentery is short and the future anastomosis is low, its full mobilization and transposition are often required. Once mobilized, three

techniques are helpful to restore digestive continuity: cecal translation (Sarli maneuver), anteroposterior rotation (Deloyers maneuver), and counterclockwise rotation of the right colon (Lillehei and Wangenstein maneuver) (Fig. 1). The Sarli maneuver is often used in near-total colectomies for refractory constipation. It consists of an anisoperistaltic cecorectal anastomosis, with the degree of descent depending on

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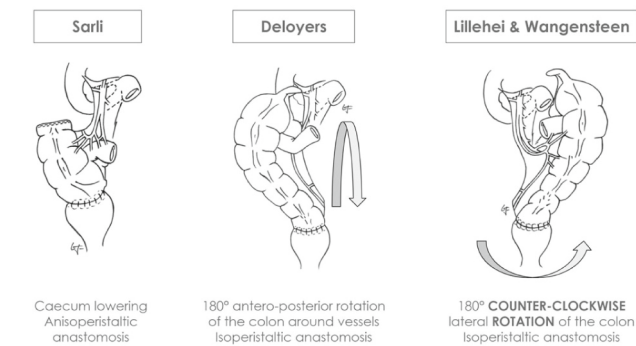


Fig. 1. Digestive reconstruction following extended left colectomy with right colon transposition.
A. Sarli: Cecum lowering. Anisoperistaltic anastomosis
B. Deloyers: 180° antero-posterior rotation around the vessels. Isoperistaltic anastomosis
C. Lillehei & Wangenstein: 180° counter-clockwise lateral rotation of the colon. Isoperistaltic anastomosis

cecal anatomy and the rectal remnant length [2]. The Deloyers maneuver is the most well-known. It creates an isoperistaltic anastomosis by rotating the right colon around the ileocecal vascular axis in a sagittal plane [3]. A theoretical drawback is venous ischemia due to possible vascular torsion. The Lillehei and Wangenstein technique, more natural, only differs by its counterclockwise rotation in the frontal plane [4].

Methods

From January 2010 to January 2024, we identified all patients who underwent transposition of the right colon to restore digestive continuity after extended left colectomy at our center. A descriptive database was created to record demographic information, procedural details, and outcomes. Due to the small sample size, no statistical comparisons were performed.

Results

We identified 18 patients who underwent right colonic transposition. These maneuvers aimed to restore continuity for various indications (Table 1). Both anteroposterior ($n = 7$) and counterclockwise ($n = 11$) rotations were used. Functional outcomes were similar and generally satisfactory, highlighting the importance of preserving the ileocecal valve (Table 2). It is worth noting that we report six coloanal anastomoses, the majority of which followed counterclockwise rotation ($n = 5$).

Surgical technique

The counterclockwise transposition is presented for its intuitive, reproducible, and anatomically consistent characteristics.

1. Surgical approach

As in any colorectal procedure, the surgical approach depends on multiple factors, including the type, extent, and location of the disease, patient-related characteristics and medical history, the available technical resources and the surgeon's experience. The counterclockwise mobilization maneuver can be performed entirely laparoscopically; however, a small periumbilical laparotomy over the mesenteric root may facilitate vessels ligation at their origin and ensure appropriate colon positioning.

2. Extended left colectomy

Table 1
Patient characteristics, surgical indications, and procedures performed between 2010 and 2024 at our institution.

	Sex	Age	ASA	Indication	Procedure
1	M	65	3	Sigmoid colon cancer	Left extended colectomy due to poor remnant vascularization
2	F	85	3	Dual colonic tumor (left and transverse colon)	Subtotal colectomy
3	M	82	3	Extended diverticulosis with bleeding	Subtotal colectomy
4	M	82	2	Sigmoid colon cancer	Left extended colectomy due to poor remnant vascularization
5	F	57	2	Extended diverticulosis	Subtotal colectomy
6	M	64	2	Occlusive cancer of the left colon	Subtotal colectomy
7	M	68	2	Left colonic stenosis after low anterior resection	Subtotal colectomy
8	F	35	2	Colonic ectasia	Subtotal colectomy
9	M	43	2	Extended diverticulosis	Subtotal colectomy
10	M	56	2	Colorectal anastomosis stenosis	Proctectomy and left extended colectomy due to poor remnant vascularization
11	M	63	2	Dual colonic tumor (rectum and left colon)	Proctectomy and left extended colectomy
12	M	72	2	Triple colonic tumor (sigmoid, left colon and right colonic angle)	Subtotal colectomy
13	M	73	2	Acute diverticulitis	Left extended colectomy due to vascular injury
14	M	78	2	Reversal after Hartmann's procedure	Subtotal colectomy
15	F	78	2	Dual colonic tumor (left colon and right colonic angle)	Proctectomy and left extended colectomy
16	F	79	3	Crohn's disease	Low anterior resection and left extended colectomy
17	F	82	3	Recto-vesico-vaginal fistula	Proctectomy and left extended colectomy
18	M	89	3	Dual colonic tumor location (rectum and left colonic angle)	

ASA: American Society of Anesthesiologists

Extended left colectomy may be planned in selected cases such as multifocal tumor involvement or extensive diverticular disease. It may also be required unexpectedly, for example in the event of inadvertent injury to the marginal artery (artery of Drummond), resulting in devascularization of the distal colon. The colectomy is performed according to standard principles; in our practice, proximal division of the left colic artery and vein is preferred to improve visualization of the planes. Colonic transection is carried out in healthy, well-vascularized tissue. The specimen is sent for histopathological examination. At this stage, the proximal colic segment may vary in length and has to reach the distal segment, which can be at any level of rectum or the anal verge, depending on the procedure performed. Either a transmesenteric or lateromesenteric approach can be considered to achieve a tension-free anastomosis while avoiding right colon mobilization (Fig. 2). When colonic length is insufficient, a right colon transposition becomes necessary.

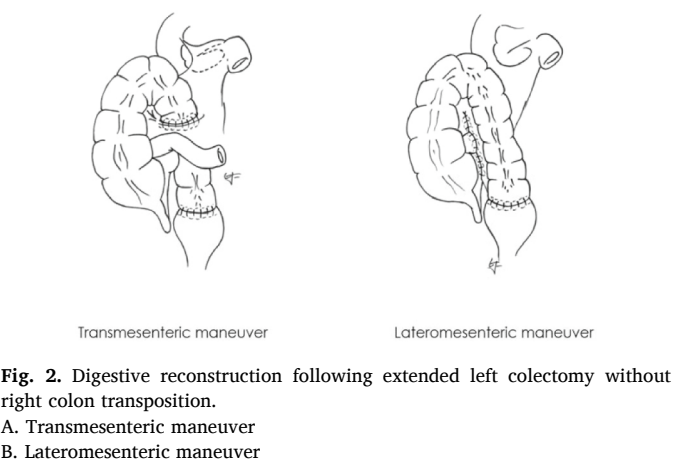
3. Right colon mobilization

The right colon is completely mobilized. The root of the mesocolon is dissected off the duodenopancreatic block, exposing the retroperitoneal

Table 2
Surgical details and functional outcomes after right colonic transposition (2010–2024).

	Takedown technique	Anastomosis type	Approach	Distal vascular root	ICG	App	Time of follow-up (months)	Bowel movements per day
1	Deloyers	Colorectal	Lap	Right colic artery	+	–	24	2
2	Deloyers	Colorectal	Converted	Ileocecal artery	+	–	8	2
3	Deloyers	Colorectal	Open	Right colic artery	–	–	12	- (unk)
4	Deloyers	Colorectal	Converted	Right colic artery	+	–	1,5	1
5	Deloyers	Colorectal	Converted	Middle colic artery	–	–	6	1
6	Deloyers	Colorectal	Open	Unknown	–	–	24	1
7	Deloyers	Stapled coloanal with protective ileostomy	Open	Middle colic artery	–	+	72	1
8	Counterclockwise transposition	Colorectal	Lap	Ileocecal artery	+	–	24	1
9	Counterclockwise transposition	Colorectal	Lap	Ileocecal artery	+	+	24	2
10	Counterclockwise transposition	Stapled coloanal anastomosis with protective ileostomy	Open	Ileocecal artery	+	+	3	3
11	Counterclockwise transposition	Stapled coloanal anastomosis with protective ileostomy	Open	Ileocecal artery	+	+	1,5	Ileostomy
12	Counterclockwise transposition	Colorectal	Lap	Ileocecal artery	–	+	3	5(chemotherapy)
13	Counterclockwise transposition	Colorectal	Open	Ileocecal artery	–	+	–	(lost sight)
14	Counterclockwise transposition	Colorectal	Converted	Ileocecal artery	+	+	1	1
15	Counterclockwise transposition	Colorectal	Lap	Ileocecal artery	+	–	2	2
16	Counterclockwise transposition	Stapled coloanal anastomosis with protective ileostomy	Open	Right colic artery	+	+	24	2
17	Counterclockwise transposition	Stapled coloanal anastomosis with protective ileostomy	Open	Ileocecal artery	+	+	–	(pall)
18	Counterclockwise transposition	Delayed coloanal anastomosis	Open	Ileocecal artery	–	–	12	3

ICG: Indocyanine Green; Lap: laparoscopy; App: appendectomy; +: performed; –: not performed; unk: unknown; pall: palliative care unit.



structures (Fig. 3). This mobilization is a prerequisite for colonic transposition techniques, including the Sarli maneuver and, more commonly, the Deloyers maneuver (Fig. 1). These options may be assessed intraoperatively to determine the most appropriate strategy. Both techniques have their own limitations. In the procedure described by Sarli, the anastomosis depends on the anatomic position of the cecum and is therefore limited by the length of the ileocolic vessels. In the Deloyers procedure, the axis of rotation is anteroposterior, which may lead to vascular torsion, and appears less intuitive than the technique we propose.

4. Vascular management

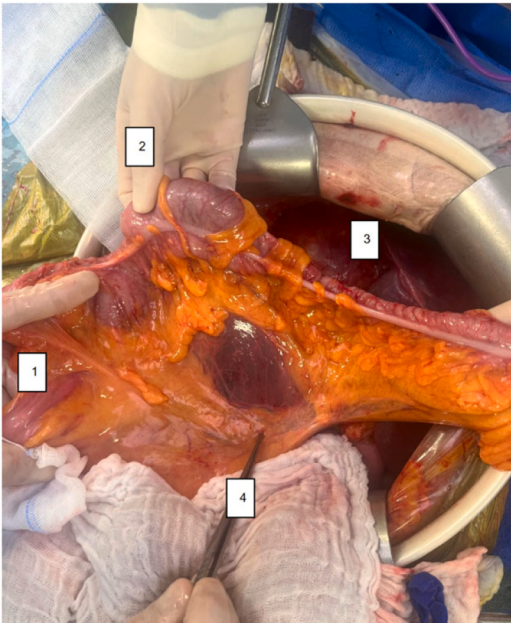


Fig. 3. Complete mobilization of the right colon and its mesentery.
1. Ileocecal junction
2. Right colon angle
3. Transverse colon and stump
4. Mesenteric root

The middle and right colic vessels are usually divided to allow mesenteric transection up to the ileoceco-appendicular branch (Fig. 4). In rare cases, if there is already enough colonic length, the right colic vessels may be preserved. Perfusion should be assessed before anastomosis, either by direct inspection or by fluorescence with indocyanine green. Limited devascularization of the distal colon is common and may require a short additional resection.

5. Counterclockwise rotation

The cecum is then rotated counterclockwise from the right iliac fossa to the left hypochondrium, creating a common mesentery with the colon positioned on the left and the small bowel on the right. The duodenojejunal angle remains to the left of the aorta (Fig. 5).

6. Anastomosis

The choice of anastomotic technique - hand-sewn or stapled, end-to-end or end-to-side- is left to the surgeon's discretion. In selected non-obese patients, a delayed coloanal anastomosis (pull-through technique) may be considered.

7. Mesenteric defect

The mesenteric defect is closed in order to prevent internal herniation.

8. Prophylactic appendectomy

Because of its displacement during the rotation and the risk of future diagnostic confusion, a prophylactic appendectomy is routinely performed.

9. Protective ileostomy

In cases of low anastomosis or in high-risk patients, a diverting ileostomy is created. Prior to stoma closure, a contrast enema is performed to exclude anastomotic leakage. The contrast study shows the final anatomical positioning of the descended colon (Fig. 6).

Discussion

We aimed to evaluate our own experience with right colon transposition and found that counterclockwise rotation was performed in more than half of the cases, particularly in situations involving very low anastomoses.

Functional outcomes, regardless of the direction of rotation, were unsurprisingly similar, but underscore the importance of preserving the ileocecal valve. It was with this goal in mind that Lillehei and Wangenstein published their technique in 1955. They demonstrated significantly better results in 13 patients who underwent colorectal anastomosis compared to 73 patients with ileorectal anastomosis [4]. Following its initial description in 1955, Rosi and Cahill published a 15-patient case series in 1962 with favorable outcomes [5].

Although the counterclockwise rotation of the right colon is used in clinical practice, it is mostly passed down through mentorship and seldom referred to by its correct name. This highlights a common pitfall among the multiple rotational variants: the frequent misuse of their nomenclature and the multitude of terms employed in literature, contributing to the confusion. For example, Dumont et al. demonstrated better arterial preservation compared with the Deloyers maneuver in what they termed “complete intestinal derotation”, which in fact corresponds to a clockwise rotation and involved colorectal but not coloanal anastomoses [6].

In conclusion, whether referred to as the counterclockwise transposition technique or the Lillehei–Wangenstein maneuver, this intuitive approach, particularly suitable for very low anastomoses, deserves greater recognition and clearer description. Wider dissemination would support standardized teaching and adoption, particularly among younger surgeons.

CRediT authorship contribution statement

Margot Potor: Formal analysis, Data curation, Conceptualization, Writing – review & editing, Writing – original draft. **Marie-Céline Schraepen:** Data curation, Conceptualization. **Julien Lemaire:** Supervision, Conceptualization. **Julien LEMAIRE:** Writing – review & editing, Writing – original draft. **Marie-Céline SCHRAEPEN:** Writing – review & editing, Writing – original draft.

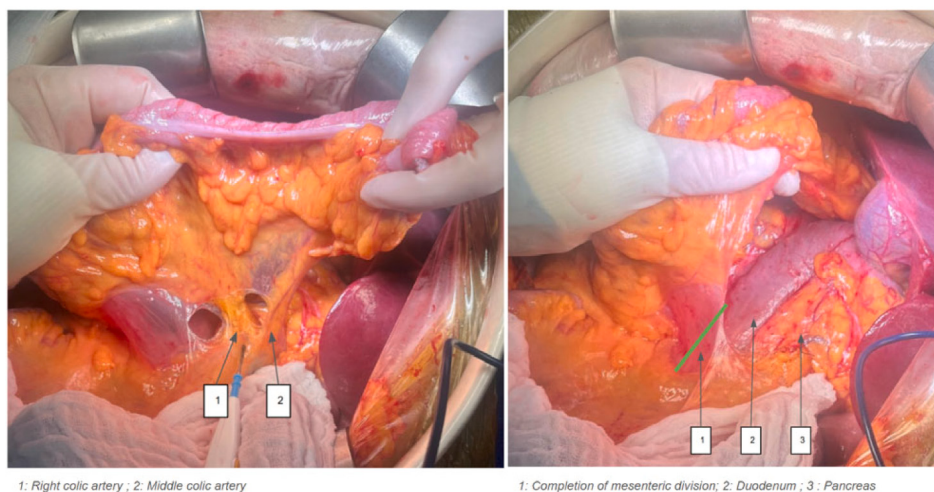


Fig. 4. Division of the right and middle colic arteries with exposition of the duodenopancreatic block.

A. Division of the right and middle colic arteries

1. Right colic artery
2. Middle colic artery

B. Exposition of the duodenopancreatic block

1. Completion of mesenteric division
2. Duodenum
3. Pancreas

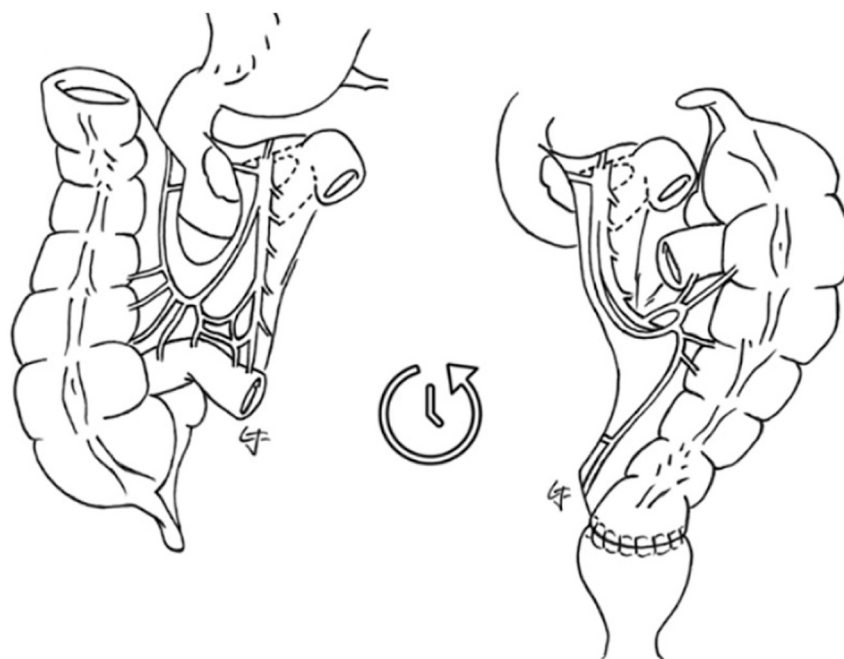


Fig. 5. Counterclockwise rotation of the right colon after mobilization and mesenteric division up to the iléocolic vessels.

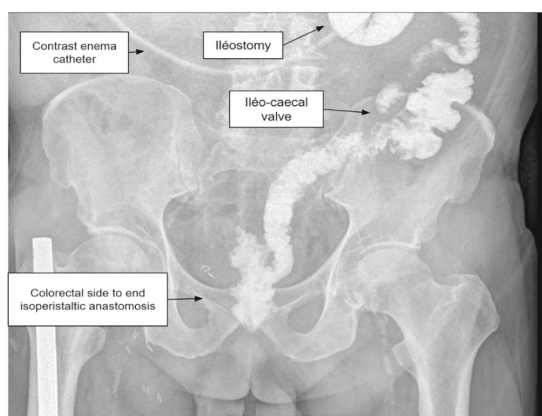


Fig. 6. Contrast enema through the ileostomy following counterclockwise colonic transposition and side to end colorectal anastomosis.

- A. Contrast enema catheter
- B. Ileostomy
- C. Ileo-cecal junction
- D. Colorectal side to end isoperistaltic anastomosis.

Ethics approval

Ethical approval was granted for this study by the medical ethical committee of University Hospital CHU UCL Namur Mont-Godinne.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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