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Hand-Assisted Laparoscopic (HAL) Multiple Segmental Colorectal Resections: Are They Feasible and Safe?

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The objective of this study was to evaluate the short-term outcomes of synchronous hand-assisted laparoscopic (HAL) segmental colorectal resections. The surgical options for synchronous colonic pathology include extensive colonic resection with single anastomosis, multiple synchronous segmental resections with multiple anastomoses, or staged resections. Traditionally, multiple open, synchronous, segmental resections have been performed. There is a lack of data on HAL multiple segmental colorectal resections. A retrospective chart review was compiled on all patients who underwent HAL synchronous segmental colorectal resections by all the colorectal surgeons from our Group during the period of 1999 to 2014. Demographics, operative details, and short-term outcomes are reported. During the period, 9 patients underwent HAL synchronous multiple segmental colorectal resections. There were 5 women and 4 men, with median age of 54 (24–83) years and median BMI of 24 (19.8–38.7) kg/m^2. Two patients were on long-term corticosteroid therapy. The median operative time was 210 (120–330) minutes and median operative blood loss was 200 (75–300) mLs. The median duration for return of bowel function was 2 days and the median length of stay was 3.5 days. We had 2 minor wound infections. There were no deaths. Synchronous segmental colorectal resections with anastomoses using the hand-assisted laparoscopic technique are safe. Early conversion to open and use of stomas are advisable in challenging cases.

Key words: Hand assisted laparoscopic surgery – Synchronous – Colorectal anastomoses

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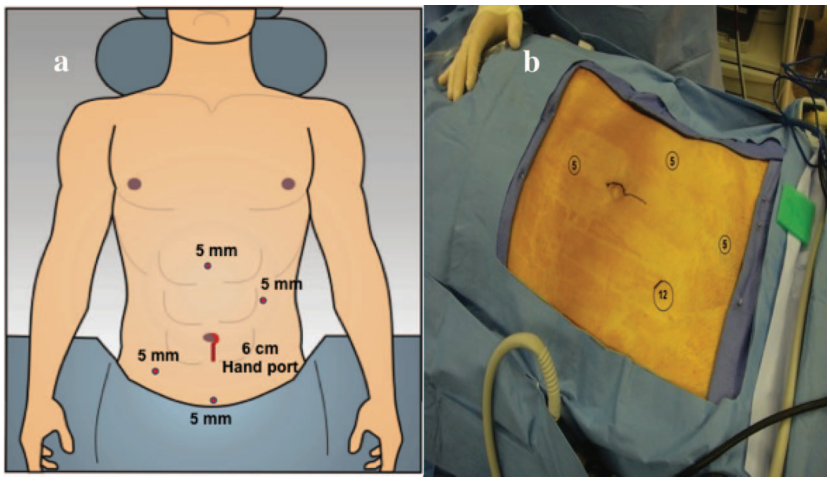

Fig. 1 (a) Diagrammatic representation of port placement for HAL synchronous segmental colorectal resections. (b) Operative photo with sites marked for port placement. The patient's head is at the left side of the picture.

Synchronous colonic pathology affecting distant colonic segments, although uncommon, poses a management dilemma. The surgical options include extensive resections with single anastomosis or multiple segmental resections with synchronous multiple anastomoses. Extended colonic resections may alter bowel function and affect quality of life.[1] On the other hand, the risk of anastomotic leak maybe increased with multiple colonic anastomoses. Studies have shown that open synchronous multiple colonic anastomoses are safe.[2,3]

Traditionally, multiple segmental resections have been performed with open surgery. Hand-assisted laparoscopic (HAL) colectomy has an edge over open surgery with decreased postoperative pain, length of stay and wound, and pulmonary complications.[4] The aim of this study is to evaluate the short-term outcomes in a cohort of patients who underwent synchronous HAL multiple segmental colorectal resections.

Materials and Methods

Using the medical group database, all patients who underwent synchronous segmental colonic resections by hand-assisted laparoscopy were identified. These surgeries were performed by all colorectal surgeons from a single group during the period 1999 to 2014. Patients were excluded if they received a diverting stoma or end colostomy.

For the surgical technique, a periumbilical midline incision of 4 to 5 cm is used for the hand port. For right-sided colonic resections, 2 further 5-mm ports are placed, one at the midline in the epigastric region, and the other in the left upper quadrant. For the left-sided colorectal resections, further ports include a 5-mm port in the midline in the suprapubic region and a 12-mm port in the right lower quadrant (port placements as shown in Fig. 1). Both medial to lateral and lateral to medial colonic dissections were carried out, at the discretion of individual surgeon.

Patient demographics, operative techniques, and outcomes were obtained by retrospective chart review. A case was defined as an emergency if it was necessary within 12 hours of the colorectal surgical consultation. Patient factors that can influence anastomotic complications, such as BMI and steroid use, were included. Operative details included operative time in minutes and blood loss. Postoperative outcomes examined included time to bowel function in days and hospital length of stay.

We examined 30-day morbidity and mortality. Complications were defined and classified based on standard criteria,[5] and were graded according to the Clavien grading system.[6] Accordingly, complications were graded from 1 to 5 based on the management of the complication. Minor complications that require no intervention (e.g., wound infections, which are opened at the bedside without need for antibiotics) were grade 1; those that require pharmacotherapy were grade 2; those that require surgical, radiologic, or endoscopic intervention were grade 3 under local (3a) or general (3b) anesthesia; those that require intensive care unit management were grade 4 for single (4a) or multiple (4b) organ failure; and those that result in death, grade 5.

Results

During the study period, 9 patients underwent synchronous colonic segmental resections by hand-

Table 1 Patient demographic and operative characteristics

Variable	n = 9 Median (range)
Age in years[a]	54 (24–83)
Gender	
Male	4
Female	5
BMI (kg/m^2)[a]	24 (19.8–38.7)
Corticosteroids (>20 mg/d)	2
Emergency surgery	0
Operative time in minutes[a]	210 (120–330)
Estimated blood loss in mL[a]	200 (75–300)

[a]Numbers in parentheses reflect the range.

assisted laparoscopic technique. The demographics of these patients and the operative characteristics are presented in Table 1. The majority of our patients were nonobese. There were 5 women and 4 men. We had no emergency surgical resections.

The indications for each of the resections and the type of resections are shown in Table 2. The most common indications were recurrent diverticulitis with polyp in another segment and Crohn's disease. Patients with Crohn's disease had complicated Crohn's with fistulae (Fig. 2). We had 1 conversion. This was in Patient 3, with severe Crohn's, with dense adhesions and inflammation between the ileum, sigmoid colon, and the bladder. The anatomy was unclear and hence the procedure was converted and completed via a mini laparotomy.

Postoperative outcomes including complications are shown in Table 3. The median duration to return of bowel function was 2 days, and the median length of stay was 3.5 days. We had 1 patient who stayed for 9 days. This was Patient 1, who had multiple comorbidities, including coronary artery disease, atrial fibrillation, chronic obstructive pulmonary disease, arthritis, and chronic kidney disease. In the postoperative period, he had persistent tachycardia, without any sepsis, and needed optimization of his cardiac medications. Furthermore, he needed physical rehabilitation in a subacute rehabilitation facility and stayed in the hospital longer, due to need for placement in appropriate facility.

We had 2 minor wound infections, which needed opening the wound at the bedside. We had 1 anastomotic leak, in Patient 3. He had recovered well from initial surgery and was discharged home on the fifth postoperative day. He presented on the ninth postoperative day with severe abdominal pain. A CT scan of the abdomen and pelvis showed some free fluid with no free air. He had leukocytosis of 26,000. During explorative laparotomy, there was turbid ascitic fluid. There was no evidence of any feces, or succus entericus in the peritoneal cavity. There was no clear evidence of anastomotic leak at either of the anastomoses. However due to the presence of most inflammatory changes surrounding the ileocolonic anastomosis, a leak was suspected. A proximal diverting loop ileostomy was performed. He underwent reversal of loop ileostomy 3 months later and made a full recovery with no additional complications.

Discussion

The simultaneous presence of 2 or more synchronous colonic pathology needing resection is not

Table 2 Indications and type of resections performed in each case

	Indications		Proximal colonic anastomosis	Distal colonic anastomosis
	1st resection	2nd resection		
Patient 1	Adenoma with HGD	Sigmoid colon diverticular disease	Right hemicolectomy	Sigmoid resection
Patient 2	Adenoma with HGD	Sigmoid colon diverticular disease	Right hemicolectomy	Sigmoid resection
Patient 3	Crohn's ileal stricture	Crohn's sigmoid vesical fistula	Ileocecectomy	Low anterior resection
Patient 4	Ascending colon diverticulitis	Sigmoid colon diverticular disease	Right hemicolectomy	Sigmoid resection
Patient 5	Ascending colon diverticulitis	Sigmoid colon diverticular disease	Right hemicolectomy	Sigmoid resection
Patient 6	Crohn's ileovaginal fistula	Ileosigmoid fistula	Ileocecectomy	Sigmoid resection
Patient 7	Tubular adenoma 3.5 cm	T3N0M0 sigmoid colon cancer	Right hemicolectomy	Sigmoid resection
Patient 8	Sessile adenoma 3cm	Tubulovillous adenoma 4.5 cm	Right hemicolectomy	Low anterior resection
Patient 9	Tubulovillous adenoma 4 cm	Rectosigmoid stricture due to endometriosis	Right hemicolectomy	Low anterior resection

HGD, high-grade dysplasia; TNM: tumor, node, metastasis, as per TNM staging.

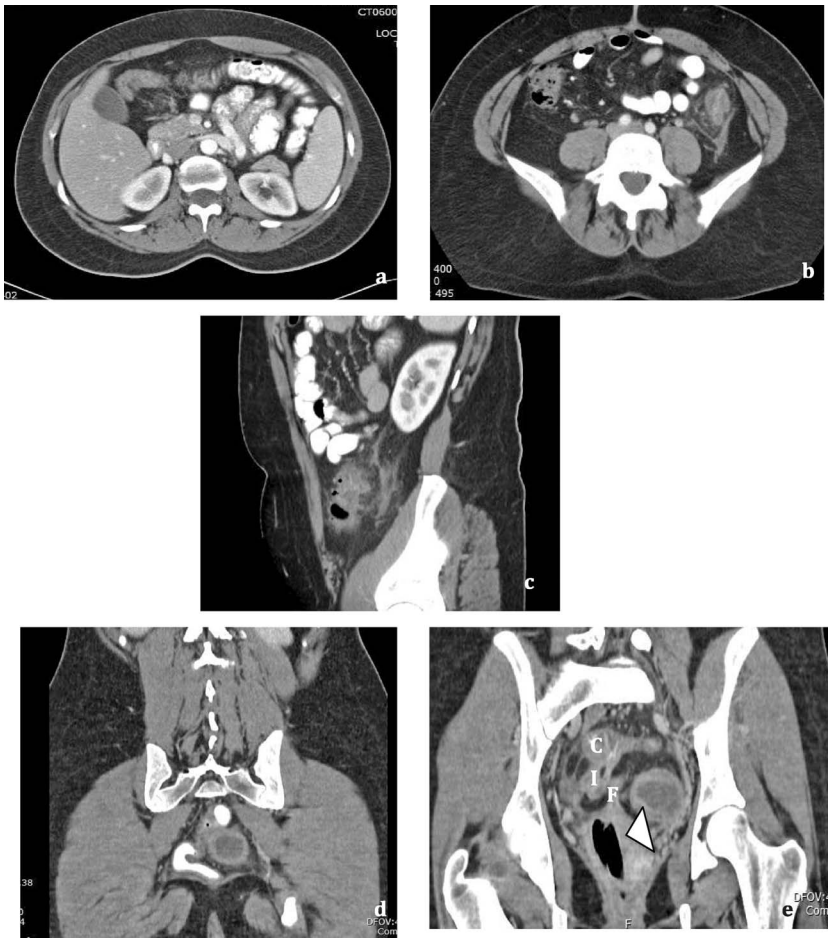

Fig. 2 Computed tomography (CT) imaging showing synchronous pathology. (a, b, c) Patient with right sided diverticulitis and sigmoid diverticulitis. (a) Axial view showing right sided diverticulitis. (b) Axial view showing sigmoid diverticulitis. (c) Sagittal view showing sigmoid diverticulitis. (d, e) Patient with Crohn's Ileosigmoid and ileovaginal fistula. (d) Coronal view showing the Ileosigmoid fistula. Contrast is seen in the sigmoid colon. (e) Coronal view showing the Ileosigmoid and ileovaginal fistula. C, sigmoid colon; I, ileum; F, ileovaginal fistula. The arrowhead points to air in the vagina.

uncommon. Synchronous colonic adenomas are found in 14 to 48% of patients with colorectal cancer.[7–11] Likewise, the association between inflammatory bowel disease and colorectal cancer is well known.[12–13] The risk of colorectal cancer associated with diverticular disease is controversial,[14] but reports cite an association between the 2 conditions.[15–17]

When faced with dual colonic pathology needing surgical resection, the surgeon has to decide on the best surgical option for the patient. The surgical options include: (1) an extensive colonic resection, i.e., subtotal colectomy with a single anastomosis, (2) multiple synchronous resections with anastomoses with or without diversion, or (3) staged resections. Identification of presence of synchronous pathology in the preoperative period does help by involving the patient in decision-making. Nevertheless, sometimes the surgeon is faced with the diagnosis of a second pathology in the operating room.

Table 3 Postoperative outcomes

Outcomes	Median (range) in days
Return of bowel function	
Tolerating soft diet	2 (2–5)
Length of hospital stay	3.5 (3–9)
Complications	Number of patients – Grade of complication
Wound infection	2 – Grade I
Anastomotic leak	1 – Grade IIIb

In our opinion, the following factors need to be considered:

1. Extent of resection: Subtotal colectomy versus Synchronous multiple resection with anastomoses.

Subtotal colectomy has the advantage of eradication of the synchronous pathology, a single anastomosis, and prevention of metachronous disease. Traditionally, subtotal colectomy was therefore preferred, especially with synchronous colon cancers. However, the colon plays an important

physiologic role in fluid balance and the resultant altered bowel pattern and frequency can be very disabling in older patients. You *et al*[1] have shown a significant decrease in the quality of life of patients undergoing subtotal colectomy in comparison with segmental resection.

Synchronous segmental colonic resections preserve some colon and hence enable better fluid balance, bowel frequency, and quality of life. However, there is a theoretical increase in risk of anastomotic leak with the additional anastomoses. But, this is not the case, as shown by Holubar *et al*,[3] who had no anastomotic leak in a cohort of 69 patients who underwent multiple segmental colonic resections. Whelan *et al*[2] showed that synchronous anastomoses without diversion are safe. Furthermore, Yamamato *et al* showed that the number of anastomoses did not increase the risk of anastomotic leak in patients with Crohn's disease.[18] We had 1 patient with severe Crohn's disease, who was re-explored for suspected anastomotic leak. During surgery, there was no evidence of any anastomotic disruption or obvious leak at either of the 2 anastomoses.

Synchronous segmental colonic resections are therefore more physiologic and without increased risk of complications.

2. Type of surgery: open versus hand-assisted laparoscopic.

Traditionally, these surgeries have been performed open due to the technical challenges. Multiple segmental resections, entailing bilateral colonic segments, involve dissection and mobilization of colon in different quadrants, multiple vascular transections, extraction of 2 specimens, and construction of 2 anastomoses. The presence of inflammatory bowel disease adds to the complexity. In recent years, there has been advancement in laparoscopic skills, and there are few case reports of synchronous multiple colonic resections in the literature.[19–21]

Hand-assisted laparoscopy (HAL) allows the surgeon to insert a hand into the abdominal cavity through a relatively small incision (5–6 cm). This approach allows tactile feedback that is not possible with straight laparoscopic surgery. Furthermore, the hand can be used for retraction and dissection. HAL is still a minimally-invasive surgery with the advantages of laparoscopic surgery[22] of decreased pain, length of ileus, and length of stay. It eliminates the technical challenges associated with pure laparoscopy in complex cases, such as bilateral segmental resections. HAL has been shown to be more efficient than laparoscopic surgery in operating time and conversion rates especially in more complex colectomies.[23]

The current study is the only cohort of patients who underwent multiple segmental resections with HAL. This study shows that HAL multiple synchronous segmental colonic resections are safe, with satisfactory operating times and minimal blood loss. The tactile feedback provided by HAL plays an important role in these patients with synchronous colonic pathology. We had only 1 conversion (1/8 patients; 12.5%) in a patient with extensive inflammation and adhesions due to Crohn's. Holubar *et al*[3] had 10 cases of laparoscopic-assisted synchronous multiple segmental colectomies with a conversion rate of 44%.

3. Diversion or not

This study and others[2,3] show that multiple segmental resections are safe and diversion is not necessary in a majority of cases. However, in patients who are malnourished, immunocompromised, or with sepsis a diversion should be considered. The surgeon must decide on a case-to-case basis considering the patient's comorbidities and the role these may play in increasing risk of anastomotic leak.

The limitation of this series is in the small number of cases. Moreover, this is a retrospective study and hence has added selection bias. This series represents a cohort of patients in multiple hospitals by multiple colorectal surgeons in a single metropolitan area and is not limited by a referral pattern. Despite the limitations, this study, to our knowledge, represents the largest series of patients undergoing HAL multiple segmental colorectal resections to date.

Conclusions

This study shows that synchronous segmental colonic resections using hand-assisted laparoscopy are safe and feasible. Surgeons should use their discretion for early conversion in technically difficult cases. If ideal conditions for anastomoses do not exist, either a diverting stoma or subtotal colectomy should be considered.

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