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The tunnel versus medial versus lateral approach in laparoscopic right hemicolectomy in colon cancer: A retrospective study

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ABSTRACT

Background: Laparoscopic right hemicolectomy for the right-side colon cancer is well-established and proven to be better than the open approach in terms of post-operative and overall hospital stay. Laparoscopic right hemicolectomy can be done by lateral to medial approach (LA), medial to lateral approach (MA), or tunnel/IRETA approach (TA). No previous study has been conducted to compare the clinical outcomes of all three approaches and the superiority of one approach over the other is still debatable. **Aims and Objectives:** This retrospective study was conducted to compare all three approaches and to find the ideal one to practice. **Materials and Methods:** This is a retrospective cohort study carried out to analyze 86 patients who were admitted to the department of General Surgery from March 2015 to December 2021 with a diagnosis of the right-side colon cancer and underwent laparoscopic right hemicolectomy with either of these three approaches. A total of 29 patients had operated with lateral to medial approach (LA), 29 patients with medial approach (MA), and 28 with tunnel (TA) approach. The patient's baseline demographics, perioperative parameters, and post-operative outcomes were compared. **Results:** Intraoperative blood loss was significantly lower in the medial to lateral approach and tunnel approach. Duration of surgery was less in the medial to lateral approach as compared to the other two approaches and was statistically significant. R0 resection, lymph node dissection, intraoperative and post-operative complications, morbidity, mortality, and conversion to open were similar in all three groups. **Conclusion:** Laparoscopic medial to lateral to medial to lateral approach is feasible and safe and should be preferred approaches in laparoscopic right hemicolectomy.

Key words: Laparoscopic right hemicolectomy; Medial to lateral approach; Lateral to medial approach; Tunnel approach; IRETA approach

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INTRODUCTION

Colorectal cancer accounts for 10% of malignancies, is the third most common cancer in the world after breast and lung cancer, and is only second to lung cancer in terms of mortality[1]. There are many technical approaches for laparoscopic right hemicolectomy named as medial to lateral approach, lateral to medial approach, and the initial retrocolic endoscopic tunnel approach (IRETA). Many centers have adopted both medial to lateral approaches with their acceptable pros and cons. In addition, several hospitals have also used the other two methods in laparoscopic surgery. The relative merits of each strategy are still up for debate, and it is unclear, in which strategy should be adopted as a rule.

On this note, we aimed to compare these three approaches retrospectively to choose the best approach among these.

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Aims and objectives

The aims of this were to find the ideal approach for laparoscopic right hemicolectomy.

MATERIALS AND METHODS

A total of 86 patients with the right colon cancer were admitted from the Department of General Surgery OPD from January 2015 to January 2021. Each patient had undergone laparoscopic radical right hemicolectomy surgery electively. A total of 29 patients had operated with lateral approach (LA), 29 patients with medial to lateral approach (MA), and 28 with IRETA/tunnel approach (TA), which was decided as per the preference of the operating surgeon. All the operations were performed by experienced laparoscopic colorectal surgeons and patient data were reviewed retrospectively and analyzed on demographics, method of laparoscopic mobilization, intraoperatively duration of surgery and blood loss, histopathological clearance, post-operative recovery, and complication.

Inclusion criteria

The following criteria were included in the study:

1. All patients with histopathological confirmed right colon cancer (growth involving ileocolic junction, cecum, ascending colon, and hepatic flexure)
2. Age 18 years or more
3. Underwent elective laparoscopic right hemicolectomy with complete mesocolic excision
4. Stage I–II.

Exclusion criteria

The following criteria were excluded from the study:

1. Patients aged <18 years
2. Patients who underwent open surgery
3. Those who operated in an emergency or for non-malignancy etiology
4. Patients with distant metastasis confirmed by pre-operative CT scan.

Surgical technique

All the patients underwent laparoscopic right hemicolectomy and the colon was initially mobilized either with a medial or lateral or tunnel approach depending on the surgeon's choice and expertise. Excised specimen was retrieved through a transverse skin incision in the right lumbar region. All patients had stapled extracorporeal also-transverse side-to-side anastomosis after resection. Moreover, all patients received standard post-operative care.

Data analysis

Data were analyzed using SPSS 27.0 (IBM SPSS Inc. Armonk, NY, USA). Comparisons between the groups were made using a Chi-square test or Fischer's exact test for qualitative data and a T-test or Mann–Whitney U-test for quantitative data. Results were extrapolated considering $P<0.05$ as significant.

RESULTS

The demographic characteristics of all the patients were similar in all three groups. The difference in pathological parameters in all three groups was also unremarkable (Table 1).

The blood loss was notably less in the tunnel approach and comparable to a medial group. Moreover, we also found that the duration of surgery was less in the medial approach and it was statistically significant (Table 2).

The post-operative recovery was similar in all three groups (Table 3).

Table 1: Clinicopathological characters

Characteristics	1=MA group (n=29)	2=LA group (n=29)	3=TA group (n=28)
Age (Years), (Mean, SD)	62.86 (7.5)	60.9 (7.3)	61.14 (7.6)
Sex			
Male (%)	15 (34)	15 (34)	14 (32)
Female (%)	14 (33.3)	14 (33.3)	14 (33.3)
BMI (kg/m^2), (Median, IQR)	19.8 (1.7)	20.1 (1.6)	20 (1.3)
ASA grade			
I (%)	17 (33.3)	17 (33.3)	17 (33.3)
II (%)	12 (34.2)	12 (34.2)	11 (31.4)
Site of tumor			
IC Junction	2	1	0
Cecum	6	2	3
Ascending colon	12	14	10
Hepatic flexure	16	10	10
Taken pre-operative chemotherapy	9	4	7
History of abdominal surgery	2	2	1
Pre-operative CEA (ng/mL)			
<5 (%)	20 (34)	18 (30)	21 (36)
>5 (%)	9 (34)	11 (40)	7 (26)

After 6 months of follow-up, serum CEA level was raised in six patients and had 1 mortality in the MA group within 6 months (Table 4).

DISCUSSION

The lateral to medial approach which is ancient of them is mostly preferred in open surgeries[2], starting with the division of the lateral peritoneal attachments, followed by an exploration of medial mesenteric attachments and division of the blood vessels[3,4]. Although the lateral to medial approach is mostly preferred in open right hemicolectomy, one of the previous meta-analyses has concluded that the lateral to medial approach has a shorter post-operative flatus recovery time against medial to lateral[5]. Technically, it is easier to identify Toldt's fascia from a lateral approach to enter between parietal and visceral fascia, especially in obese patients with thick mesocolon[6]. However, the real limitation of the laparoscopic lateral approach is to get adequate operative space for dissection and maneuvering.

Later, the medial-to-lateral approach was developed by Milsom et al., which explains the vessel-first approach from the medial side followed by the division of the lateral peritoneal attachments[2,7]. This was widely accepted due to its pedicle/vessel first approach with a "no-touch" principle followed by mesocolon mobilization. Turnbull et al., had first proposed the "no-touch" principle in concern of increased tumor dissemination if handled before the ligation of vessels[8].

Many previous studies have collated the safety and efficacy of the medial approach against the lateral approach and concluded less blood loss and short duration of surgery with the former approach[9-13]. And also, this approach better complies with the principle of CME. Sometimes this approach might be troublesome if there is local infiltration of the tumor and sometimes it is difficult to get into the

Table 2: Perioperative and short-term outcomes

Peri-operative outcomes	1=MA group (n=29)	2=LA group (n=29)	3=TA group (n=28)	P-value
Tumor size (cm) (Median, IQR)	8 (1)	7 (3)	6 (2)	0.92*
R0 (no.)	28	29	28	0.43⁺
R1 (no.)	1	0	0	0.076⁺
R2 (no.)	0	0	0	0.56⁺
Blood loss (mL) (Median, IQR)	145 mL (43)	190 (78)	128 (18)	0.01*
Duration of surgery (min) (Median, IQR)	165 (18)	178 (20)	175 (15)	0.014*
Conversion to open (no.)	0	0	0	0.34⁺⁺
Lymph node yield (no.) (Mean, SD)	28 (5)	24 (6)	28 (3)	0.58*

*Mann–Whitney U-Test, ⁺Fischer's exact test, ⁺⁺Pearson's Chi-square test

Table 3: Post-operative outcomes complications

Characteristics	1=MA group (n=29)	2=LA group (n=29)	3=IRETA group (n=28)	P-value
First flatus on POD, (median, IQR)	3 (1)	2 (2)	2 (1)	0.4*
Time to oral liquids on POD (median, IQR)	3 (1)	2 (2)	2 (1)	0.4*
Post-operative hospital stays (Days) (median, IQR)	5 (2)	5 (1)	5 (2)	0.56*
Complications				
Wound infection, no.	1	2	2	0.9⁺
Anastomotic leak	0	1	1	0.6⁺
Anastomotic stricture	0	0	0	
Bowel obstruction requiring re-exploration	0	0	0	
Intraperitoneal infection	0	0	0	0.65⁺
Wound/Sheath dehiscence	0	0	0	0.8⁺⁺
Paralytic ileus (IV fluids>7 days)	2	1	1	0.9⁺⁺
Duodenal injury	0	0	0	0.59⁺
Gonadal vessel injury	0	0	0	
Ureteric injury	0	0	0	

*Mann–Whitney U-Test, ⁺Fischer's exact test, ⁺⁺Pearson's Chi-square test

Table 4: Follow-up after 6 months

Follow up parameters	1=MA group (n=29)	2=LA group (n=29)	3=IRETA group (n=28)	P-value
Sr CEA >5 ng/mL, (no.) (%)	3 (10.3)	3 (10.3)	1 (3.5)	0.07*
Received adjuvant chemotherapy	22	25	25	0.3⁺
Death	1	0	0	0.82⁺

⁺Fischer's exact test, *Pearson's Chi-square test

fascial plane through mesenteric windows, especially in obese patients. It also has a steep learning curve and some studies also showed conversion to open as a drawback[14,15].

Over the past decade, the advancement of the IRETA approach, which is a stepwise approach that provides an excellent view and easy identification of retroperitoneal structures and clearance of fibro-fatty and lymphatic tissue along the vessels and also easy approach to high ligation of the vessels. This involves initial retroperitoneal mobilization between the parietal and visceral fascia of the mesocolon, followed by dissection vertically along superior mesenteric vessels, ileocolic, right colic, and right branch of middle colic vessels, and then vessel ligation, which has become the preferred approach worldwide in many high-volume centers. Even though the minimum 12 lymph nodes are considered to be adequate lymphatic dissection, the previous studies demonstrated that 19–32 lymph nodes could be retrieved with tunnel approach[16,17]. With the tunneling approach, the retroperitoneally placed ureter can be safely dissected from the tumor irrespective of the size. Apart from this, the initial tunnel approach also minimizes tumor handling eventually bowel injury and tumor seeding[16,18]. It is more applicable in late presentation and bulky tumors, where adequate lymph node dissection and R0 resection are challenging and CME is essential to maximize the oncological outcomes.

The ease of surgery has a significant effect on intraoperative outcomes in terms of remarkably minimizing the amount of blood loss and operative duration, which was obvious in our study. The intraoperative bleeding was well controlled in the TA group which was evident in significantly less blood loss of 125+/-18 mL as compared to 145±43 mL in the MA group (P=0.01) and 190±78 mL in the LA group (P=0.01). MA group also had statistically significantly less intraoperative bleeding as compared to the LA group (P=0.04). Yan et al., in their study, had inferred significantly less blood loss in the medial approach (52–65 mL) than lateral (80–110 mL) approach[9].

Notwithstanding any significant difference in the size of the tumors among the groups, we had an excellent R0 resection of the tumor in all three approaches with P-value of 0.43. One patient had R1 resection in the MA group, and the patient had received adjuvant chemotherapy. However, there are no appropriate data on comparing the completion of resection with R0 resection from any previous studies.

The operative duration was considerably lower in both the medial (165±18 min) and tunnel (175±15 min) approach against the lateral (178±20 min) approach with P-value of 0.014 (MA vs. LA) and 0.0 (TA vs. LA). This illustrates that both MA and TA approaches have better intraoperative surgeon comfort.

This study also concluded that all three approaches have good oncological outcomes in terms of lymph node retrieval (P-value of 0.58). We could have harvested 28±5 lymph nodes in the MA group, 24±6 in the LA group, and 28±3 in the TA group. The average lymph nodes yielded in a previous study which was reported to be 30 in the medial approach and fewer than 20 in the lateral approach[19]. Zhu et al., showed medial approach can significantly retrieve more lymph nodes contrary to the lateral approach[20]. Similar results were also seen in other studies by Elsisi et al., Le Voyer et al., and Chang et al.[21-23]

Table 3 shows that four patients had paralytic ileus postoperatively which was managed conservatively (P=0.9). Similarly, the other post-operative parameters were also comparable. Patients with SSI were managed conservatively. The anastomotic leak occurred in a total of two patients, they were managed with re-exploration and stoma creation. We could also draw the inference as no difference in post-operative outcomes as regards time to passage of first flatus, time to first oral liquid consumption, length of hospital stays, and other post-operative complications.

After 6 months of follow-up, a total of seven patients had raised serum CEA levels by more than 5 ng/mL. Out of which, three each in the MA and LA group and only 1 in the TA group, which shows a smaller number of patients had a residual, recurrent or metastatic tumor in the TA group against MA and LA group (P=0.07).

Only one patient expired in the MA group within 6 months of surgery.

Limitations of the study

Our study has the limitation of short follow-up up to 6months.

CONCLUSION

Laparoscopic right hemicolectomy with a medial approach is simple, safe, and feasible to implement which significantly reduces the duration of surgery and intraoperative blood loss. Hence, the medial-to-lateral approach should be the preferred approach for laparoscopic right hemicolectomy.

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LM- Concept and design of the study, prepared the first draft of manuscript; **MKS**- Interpreted the results, reviewed the literatures, prepared the manuscript; **MRS**- Concept and coordination; **PKG**- Data collection and result interpretation; **KKDP**- Reviewed the literatures, revision of the manuscript.

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