The Efficacy of Complete Mesocolic Excision with Central Vessel Ligation Technique on Lymph Nodes and Safety Margins Compared with Conventional Surgery for Colon Cancer Treatment: Prospective Observational Study

Mahmoud Thabet Ayoub [1], Mohamed Bakr [2], Mostafa Abdelghafoor[2], Amr Essam Hassan Farghaly[*]

[1] General Surgery Department, [2] Surgery Department, Faculty of Medicine, Assuit University, Egypt

***Corresponding author:** Amr Essam Hassan Farghaly, E mail: amrelfayed@gmail.com, Mobile phone: 01004664295

ABSTRACT

Background: The prevalence of colon carcinoma is fairly limited in Egypt, but it has a high fatality incidence. Colon carcinoma is a significant public health issue globally.

Objectives: This study aimed to determine if complete mesocolic excision (CME) with main vessel ligation approach yields an oncologically better outcome in terms of lymph nodes and safety margins compared to traditional operation for colon carcinoma.

Patients and methods: A prospective observational research that was conducted in the General Surgery Department of the Assiut University Hospitals between 2019 and 2021.

Results: Twenty-nine patients performed conventional surgery (non-CME group) and other twenty-nine patients performed CME with sharp separation of the supplying vasculature's (central vessel ligation, CVL) and the embryological planes (CME group). Substantially improved outcomes were noted regarding safety margin clearance and lymph node output (CME group: 22.5 vs. non-CME group:12, P<0.0001) and lymph node ratios (CME group: 0.03 vs. non-CME group: 0.22; P<0.0001).

Conclusion: When carried out in accordance with the right embryological plans and by trained practitioners, CME seems to be a safe therapy. The lymph node ratios are also affected since it offers superior specimens with a larger lymph node output. Therefore, it should be researched and implemented more often to use CM with CVL.

Keywords: Cancer colon, Complete mesocolic excision, Conventional surgery, Malignancy.

INTRODUCTION

Being the 2nd leading source of carcinoma mortality in the USA and the 4th greatest prevalent epithelial tumor, colon cancer poses a serious threat to global public health **(1)**.

It is the 2nd highest prevalent tumors and the main reason of mortality in Italy **(2)**.

Although colon cancer is uncommon in Egypt, its fatality rate is significant **(3)**.

Over the last thirty years, changes have been made in how people with colorectal carcinoma are treated. The best instances of this are the anatomical descriptions of the mesorectum and the invention of the total mesorectal excision (TME) by **Heald *et al.*** **(4)** in the early 1980s. Comparable to the TME as a surgical procedure for rectal cancers, the CME was created by **Hohenberger *et al.*** **(5)** in 2009 as a curable therapy for colon malignancies patients.

Comparable to the TME, the CME strives to completely remove the lymphatic drainage of the tumor while keeping the embryologic fascia intact. Two elements are necessary for the idea of a CME: Dissection of the parietal plane from the visceral plane and the anatomical layers with precision.

The lesion and its lymph drainage are visible in the resultant specimen, and there are no rips in the fascial layers on either side of the mesocolon. Additionally, for lesions of the right colon, a central split of the feed arteries is done at the height of the superior mesenteric artery (SMA), and for lesions of the left colon, at the height of the inferior mesenteric artery (IMA) or the aorta. This makes it feasible to remove as many lymph nodes as possible **(6)**.

PATIENTS AND METHODS

This prospective observational research was conducted at Assiut University Hospitals' Department of General Surgery through the period from 2019 to 2021.

Inclusion criteria: Male and female adults age of 18 years or older, localization of the tumor on radiographic imaging (computed tomography (CT) or barium enema) and preoperative endoscopy where a cancerous colonic tumor was discovered during histopathological analysis. No prior history of Crohn 's syndrome, ulcerative colitis, or familial adenomatous polyposis.

Exclusion criteria: complex surgical exclusions and American Society of Anesthesiologists (ASA) Physiological Status gets 4 contagious illness that has to be treated, expecting mothers, systemic steroid use, intensive pulmonary fibrosis or emphysema.

Sample size and randomization:

All cases that fulfilled the selection criteria during the study period were recruited. The expected number of patients during study period was 58 patients. The patients were divided into treatment groups in a 1:1 ratio using a computer-generated database of random numbers. Patients were allocated to the appropriate therapy group in numerical order after providing their informed permission at the time of enrollment. Permuted blocked randomization was done online to generate the randomization list (https://www.sealedenvelope.com

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https://www.sealedenvelope.com/simple-randomiser/v1/lists). So, we had two groups in the study. Group I included patients who performed conventional surgery (n= 29 patient). Group II included patients who performed complete mesocolic excision with central vessel ligation (n=29 patients).

Methodology

An open midline laparotomy was used for all colectomies. According to the position of the tumor, the terminal ileum and colon were first removed from the non-CME group, and the mesocolon was split into two halves in a V shape at an appropriate anatomical site. The ileo-colic vessels, right colic vessels (if found) in the situation of right-sided carcinomas, the trunk of the middle colic vessels in the situation of a transverse, stretched right or left colectomy, or left colic or inferior mesenteric vessels in the situation of left-sided and sigmoid carcinomas were all severed in the mesocolon in terms of avoiding identifying their origins. The surgical method used by the CME group was definitely different [5, 7]. It had 2 components: The visceral plane was separated from the parietal one along the Toldt fascia in the first procedure, which also included meticulously mobilizing the whole mesocolon all the way to the mesentery root. The lesion and its lymph drainage were visible in the resultant specimen, and there were no rips in the fascial layers on either side of the mesocolon. The 2nd component performed a central split of the supplying arteries at their starting points. For lesions on the right side, the split is carried out at the position of the SMA, and for lesions on the left, at the position of the IMA or aorta. This makes it feasible to remove as many lymph nodes as possible [6, 8].

Despite its possible benefit, the Kocher maneuver as described by **Sndenaa *et al*.** [8] was not used. Finally, intra-abdominal drains were placed and hand-sewn ileocolic or colocolic anastomoses were performed in both groups. After receiving any necessary adjuvant chemotherapies in the form of 5-fluorouracil and oxaliplatin, all patients were released from the hospital (pT4, metastatic, or node positive tumors) [9].

In addition, studies on the lymph node output, the quantity of positive lymph nodes, and the LNR (the ratio of lymph nodes that tested positive to lymph nodes that were removed) were performed [10]. Also, the tumor's location, the kind of surgery used, morbidity, mortality, clinical results, and postoperative results were noted.

Ethical considerations:

The Research Ethics Committee, Assuit University approved the study and (gov Identifier: NCT04079946). All patients gave their informed written consents after being educated about the procedure, the benefit of autotransplantation, and any potential problems. The World Medical Association's code of ethics (The Declaration of Helsinki) was followed while conducting this research on people.

Statistical analysis

Version 20.0 of the statistical software for social sciences was utilized to evaluate the recorded data (SPSS Inc., Chicago, Illinois, USA). The mean and standard deviation (SD) of quantitative data were reported and compared utilizing the Student t test. Chi^2 tests were employed to compare qualitative data that were reported as frequency and percentage. Since the level of confidence was maintained at 95%, a P value ≤ 0.05 was significant.

RESULTS

Regarding CME group, 29 patients (14 female and 15 male) were hospitalized to Assuit University Hospital's General Surgery Unit between June 2019 and October 2021. In terms of the tumors' sites, 9 individuals were identified as having cecal cancer, 4 had tumors in the ascending colon, 1 was in the transverse colon, 8 were in the descending colon, and 7 were in the sigmoid colon. A R0 resection was performed on each patient. A moderately differentiated adenocarcinoma was discovered during histopathological investigation in 24 individuals, whereas a poorly differentiated adenocarcinoma was discovered in 5 patients.

Every patient had elective surgery: 8 left hemicolectomies, 5 extended right hemicolectomies, 7 sigmoidectomies, and 9 right hemicolectomies were performed. There were no negative intraoperative occurrences. The typical operation lasted 135 minutes, and 105 mL of blood were lost throughout the procedure on average. In 7 cases, postoperative problems developed. Six suffered wound infections, and one of them got a ruptured abdomen. One of them had conservative treatment for an anastomotic leak. There was no hospital-related mortality (Table 1).

Concerning non-CME group, 29 patients (9 female and 20 male) were hospitalized to Assuit University Hospital's General Surgery Unit. Seven patients were identified as having cecal cancer, 4 patients in the ascending colon, 2 patients in the transverse colon, 5 patients in the descending colon, and 11 patients in the sigmoid colon. Every patient had elective surgery: There were 11 sigmoidectomies, 5 left hemicolectomies, 4 extended right hemicolectomies, and 7 right hemicolectomies. Three individuals had well-differentiated adenocarcinomas, 18 had moderately-differentiated adenocarcinomas, and eight had poorly-differentiated adenocarcinomas, according to histological analysis.

All patients underwent a resection of the tumor. The LNR had an average = 0.22, substantially greater than in the CME group (0.03; $P< 0.0001$), reflecting the average lymph node output of 12 (ranging, 9-16), a considerable drop as compared to the CME group (average, 22.5; variety, 15-30; $P < 0.0001$) as shown in tables (1 & 2) and figures (1, 2, 3, 4 and 5).

Table (1): Clinico-pathological characteristics

Characteristics	**CME group (n=29)**	**Non-CME group (n=29)**	**P value**
Age (years± SD)	**66.00 ± 8.36**	**57.67 ± 12.56**	**<0.0001**
Sex (male: female)	**15:14**	**20:9**	**0.832**
Tumor site			**<0.0001**
Cecum	9 (31.04)	7 (24.13)	
Ascending colon	4 (13.79)	4 (13.79)	
Transverse colon	1 (3.44)	2 (6.89)	
Descending colon	8 (27.58)	5 (17.24)	
Sigmoid	7 (24.13)	11 (37.93)	
Surgical procedure			**0.009**
Right hemicolectomy	14 (48.27)	13 (44.82)	
Left hemicolectomy	8 (27.58)	5 (17.24)	
Sigmoidectomy	7 (24.13)	11 (37.93)	
Histopathology			**0.087**
Well differentiated adenocarcinoma	0 (0)	3 (10.34)	
Moderate differentiated adenocarcinoma	24 (82.75)	18 (62.06)	
Poorly differentiated adenocarcinoma	5 (17.24)	8 (27.58)	
Safety margins invasion	0 (0)	3 (10.34)	**<0.0001**

Table (2): Analysis of end-points

Variable	CME group	Non-CME group	P value
harvested lymph nodes No., average (IQR)	22.5 (15–30)	12 (9–16)	<0.0001
positive lymph nodes No.			0.0003
average (IQR)	0 (0)	1 (0–4)	
Mean ± SD	0.9 ± 2.64	2.26 ± 3.14	
ratio of Lymph node			<0.0001
average (IQR)	0 (0)	0.076 (0–0.3)	
Mean ± SD	0.03 ± 0.08	0.22 ± 0.36	

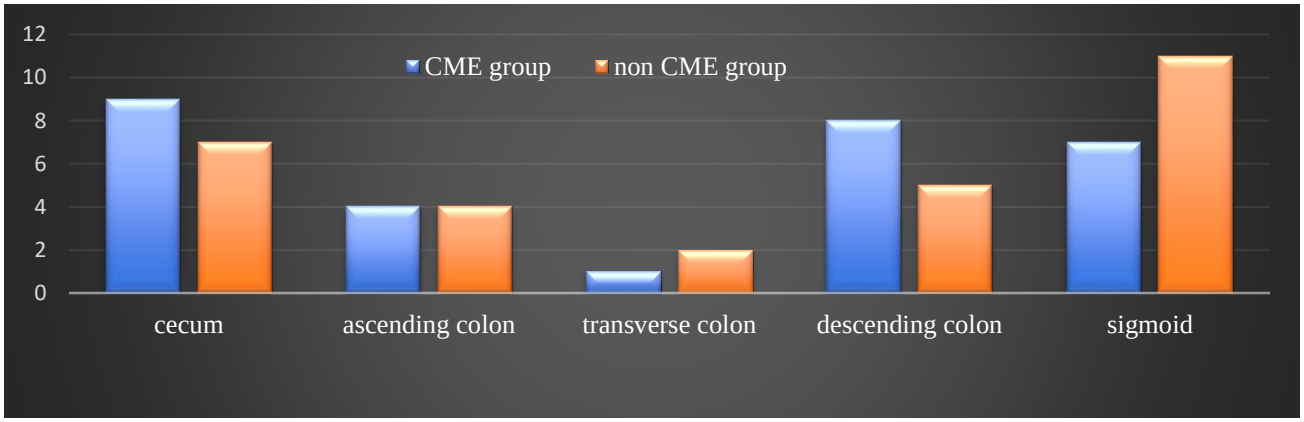

Figure (1): Tumor site in CME and non-CME groups

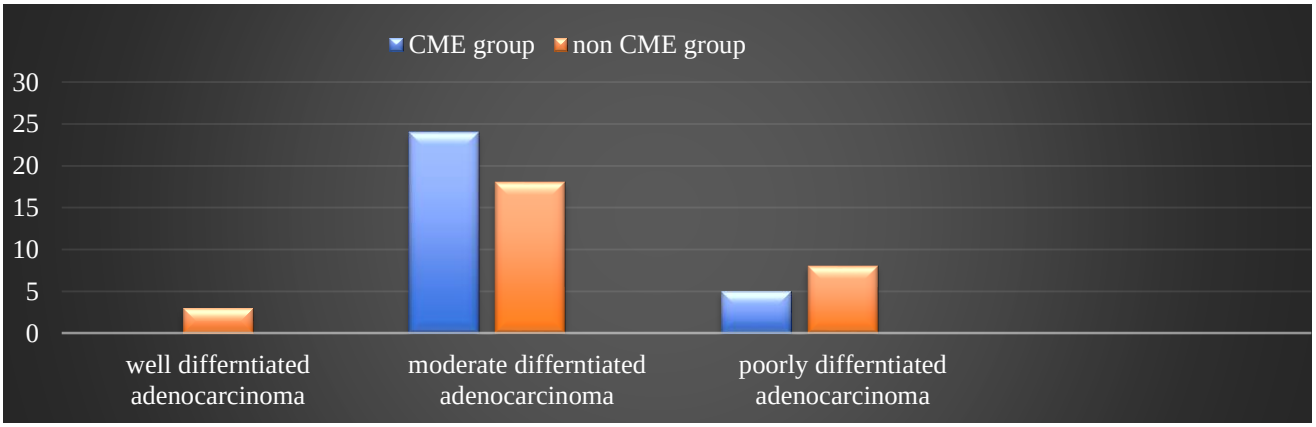

Figure (2): Surgical procedures in CME and non-CME groups

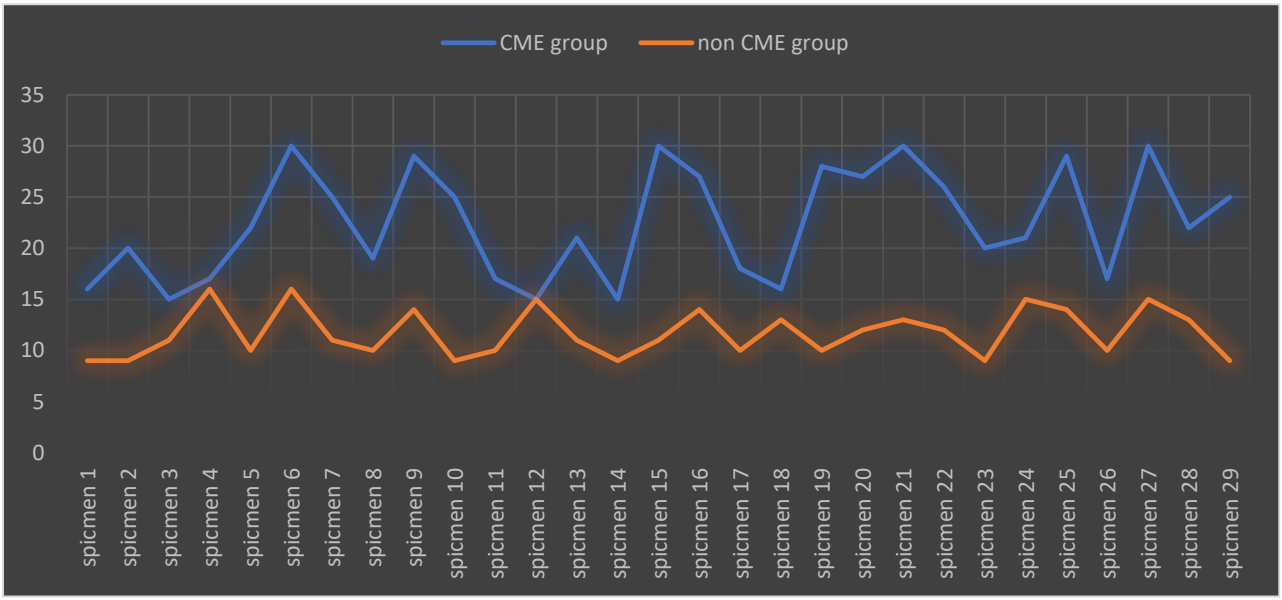

Figure (3): Histopathology of CME and non-CME groups

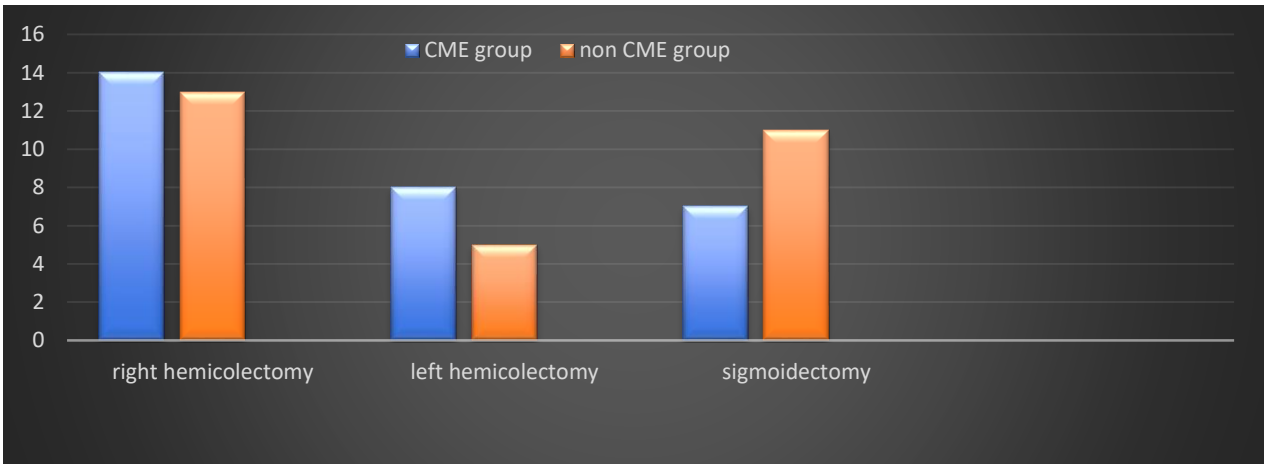

Figure (4): Median lymph node harvest in CME and non-CME groups.

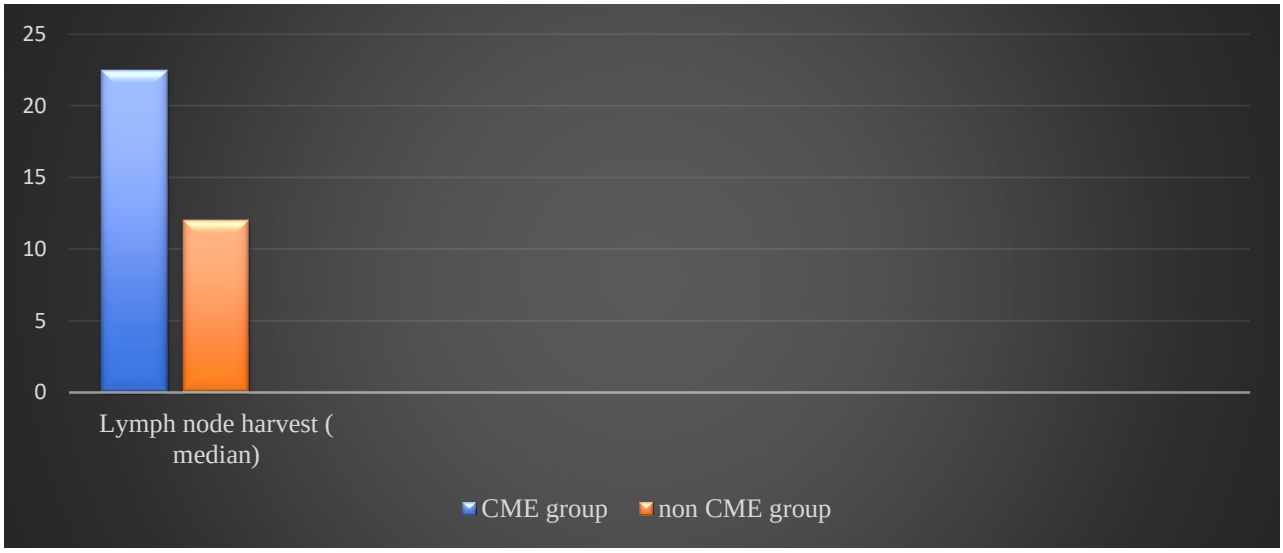

Figure (5): Lymph node harvest in all patients of CME and non-CME groups in this study

DISCUSSION

Various studies were conducted and being conducted to identify certain factors for evaluation the efficacy of CME with CVL technique for management of cancer colon .

The current study was one of these studies to assess the efficacy of CME with CVL technique in cancer colon surgeries . The study enrolled 29 patients underwent CME with CVL technique with mean age of 66.00 ± 8.36 years and 29 patients underwent conventional surgery with mean age of 57.67 ± 12.56. Many previous studies reported that old age (age > 50 years) has been found to be a substantial risk factor for cancer colon as **Siegel *et al*.** [(11)].

Our study showed that cancer colon was common in male patients than female patients. Currently, colon cancer prevalence rates are 24 % greater among black men and 19 % greater among black women compared to white males and females, respectively as described by **Siegel *et al*.** [(11)].

In this study the most common site of cancer colon was in the left side (descending colon and sigmoid colon) represents 31 cases (about 53 %), the second common site was cecum with 16 cases (about 27 %) then ascending colon with 8 cases and transverse colon with 3 cases. The distribution of malignancies in the lower gastrointestinal tract in the United States from 2009 to 2013 was as follows: 41% in the proximal colon (incorporating the splenic flexure and close by), 22% in the distal colon (sigmoid and descending), 28% in the rectum, and 8% in other locations [(12)].

Although, CME is still in its infancy, the findings are encouraging. It has been shown that CME produces specimens of higher quality than traditional colon surgery [(13)]. Additionally, CME optimizes the amount of lymph nodes extracted, which serves as a crucial quality surrogate sign for the best possible oncological outcomes [(14, 15)]. Similarly, adjuvant treatment has a substantial impact on prognosis in individuals with positive lymph nodes [(16)]. Adjuvant chemotherapy, however, cannot make up for poor surgical performance. As a result, combining the CME's benefits with the major advantages of adjuvant chemotherapies constitutes a multidisciplinary strategy for enhancing results in colon cancer sufferers. A substantial improvement in disease-free survival (DFS) was seen in the CME group compared to the non-CME group in noteworthy research by Lancet Oncology in 2014 (85.8 percent versus 75.9 percent), suggesting that CME surgery may enhance results for colon cancers patients [(17)].

The finding of this research showed that although using CME and CVL in addition to the standard procedure had no effect on the number of intraoperative or postoperative consequences. It did result in a substantial rise in the lymph nodes collected number, which in turn decreased the LNR, it is strongly connected to DFS [(17)]. Our findings concur with those of research that shows that right hemicolectomy with CME produces more lymph nodes than conventional surgery in terms of oncologic results (MD 7.05, 95 percent CI 4.06-10.04) [(18)]. As was already mentioned, adhering to the recommendations of a combined CME and CVL will impacts the quantity of lymph nodes gathered, cover a sizable drainage area, like the CVL area, and have central or apical lymph nodes that are skipped in a classic dissection, potentially under-staging the cancer from phase III to phase II, such skipped micro metastases may result in a future local recurrence. The extensive lymphadenectomy that may occur in the CME approach is opposed by the authors of several researches due to potential morbidities. There was no discernible variation between the 2 groups' rates of morbidity in this investigation. This may be ascribed to the surgeons' skill in carefully dissecting the central supplying blood arteries and adhering to the embryological planes. Because it yields better specimens that follow embryological planes, boosts lymph node output with a reduced LNR, and has tolerable rates of sickness. The findings of this research should persuade surgeons to utilize the CME with CVL approach for the management of patients with colon tumors.

This study did not meet the standard for proof that a randomized clinical trial must meet. Given the difficulty in creating and executing such trials, studies may offer an alternative practical method to compare the TME with the CME + CVL methodology.

In conclusion, the CME with CVL approach yields better specimens than the traditional technique in terms of the quantity of collected lymph nodes, the LNR, and entire planes. Given the technical difficulty of the CME plus CVL approach, it is essential to have a solid grasp of the relevant anatomical structure in order to dissect via the appropriate plane. The CME with CVL approach will eventually be used more often to treat patients with colon cancer, but up until then, it has to be more extensively researched. Additional comparison research is required for a more thorough assessment of this method and its results.

CONCLUSION

When carried out in accordance with the right embryological planes and by trained practitioners, CME seems to be a safe therapy. The lymph node ratios are also affected since it offers a superior specimen with more lymph nodes. Therefore, more frequent use of and detailed investigation of CME with CVL should occur.

DECLARATIONS

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