

Conventional surgery in colon cancer with comparison to complete mesocolic excision and central vascular ligation: initial experience in a tertiary centre

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ABSTRACT

Introduction: The complete mesocolic excision (CME) and central vascular ligation (CVL) is an advanced surgical technique used to treat colon cancer. It combines the removal of the affected portion of the colon and surrounding lymph nodes with an improved method of controlling the vascular supply to the tumour.

Materials and Methods: A retrospective study of patients with colon cancer underwent right hemicolectomy (either CME and CVL or conventional method) were operated by colorectal surgeons in a tertiary centre in Kuala Lumpur from 2018 to 2020. We review the data to compare the oncological, pathological and surgical outcomes of both techniques. Categorical variables were presented as frequencies and percentages. Continuous variables were compared using an independent t-test or Mann-Whitney Rank U test. The chi-square test was used to determine the association between categorical variables and mortality. Statistical analysis was conducted with IBM SPSS Statistics 25.0, and statistical significance was set at $p < 0.05$.

Results: A total of 30 patients (CME and CVL=15 or conventional colectomies=15) were included in this study with mean age of 65 years. There was no statistical difference between the mean age of the two groups ($p=0.355$). Most of the patients were Malays (46.7%) followed by Chinese (43.3%) and Indians (10.0%). The mean (SD) = 19 (9) number of lymph nodes harvested is more in CME and CVL groups which however is not statistically significant compared to the mean (SD) = 16 (9), number of lymph nodes in conventional colectomies. The duration of surgery is longer in CME and CVL groups (214 minutes) compared to conventional colectomies (188 minutes) but with no significant statistical difference. Most of the perioperative complications were similar in both groups with no significant statistical differences.

Conclusion: CME and CVL are not inferior to conventional surgery in colon surgery in a tertiary centre. It should be considered since the advantages such as lymph node yield and median recurrence free survival are better with similar perioperative morbidity.

KEYWORDS:

Colectomy, colon cancer, large intestine

INTRODUCTION

Colon cancer is the second most common cancer in Malaysia with an overall of 21.3 cases per 100,000 population from 2008 until 2013.¹ Management of colon cancer has revolutionised over the past 30 years. Surgical treatment with conventional colectomy is considered the standard of care in the management of colon cancer. Conventional colectomy involves the removal of the affected portion of the colon, along with the mesentery containing surrounding lymph nodes and the named artery.² The ends of the remaining colon are then anastomosed, to restore the normal flow of intestinal contents.

There are new concepts popularised by Hohenberger since 2009, termed complete mesocolic excision (CME) and central vascular ligation (CVL).^{2,22} This is an advanced surgical technique used to treat colon cancer. It combines the removal of the affected portion of the colon and surrounding lymph nodes with an improved method of controlling the vascular supply to the tumour. During CME, the entire mesentery of the colon is carefully freed up, allowing the surgeon to visualise the tumour better and the surrounding vessels.³ The central vessels of the tumour are then identified and ligated or tied off to reduce the tumour's blood supply and decrease the risk of recurrence.^{4,6,7,14-18}

Compared to conventional colon surgery, CME and CVL offer several advantages. Removing the entire mesentery significantly decreases the risk of cancer recurrence.^{5,7,10} The improved visualisation of the tumour and its surrounding vessels allows for a more precise surgical resection, reducing the risk of incomplete resection and potential cancer recurrence. This technique however is technically more challenging compared to conventional. The technique is still not popular among colorectal surgeons in Malaysia. Here we performed a retrospective review comparing the CME and CVL technique and conventional colectomies in a tertiary centre in Kuala Lumpur. This review aims to assess the overall survival and perioperative morbidity among patients

This article was accepted: 04 May 2024

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Table I: Distribution of study participants according to demographic characteristics (N=30)

		Total (n=30)	CME and CVL group (n=15)	Conventional group (n=15)	p-value
Age (years)	Mean (SD)	65.7 (11.8)	67.7 (12.2)	63.7 (11.5)	0.355
Sex	Male	18 (60.0)	9 (60.0)	9 (60.0)	1.000
	Female	12 (40.0)	6 (40.0)	6 (40.0)	
Ethnicity	Malay	14 (46.7)	5 (33.3)	9 (60.0)	0.200
	Chinese	13 (43.3)	9 (60.0)	4 (26.7)	
	Indian	3 (10.0)	1 (6.7)	2 (13.3)	

Table II: Comparison of factors between study groups (N = 30)

		Total (n=30)	CME and CVL group (n=15)	Conventional group (n=15)	p-value
Site of tumour	Ascending colon	4 (13.3)	3 (20.0)	1 (6.7)	0.309
	Caecal tumour	15 (50.0)	9 (60.0)	6 (40.0)	
	Transverse colon	5 (16.7)	1 (6.7)	4 (26.7)	
	Hepatic flexure	2 (6.7)	0 (0.0)	2 (13.3)	
	Splenic flexure	4 (13.3)	2 (13.3)	2 (13.3)	
Surgical procedure	Open	15 (50.0)	9 (60.0)	6 (40.0)	0.489
	laparoscopic converted open	4 (13.3)	1 (6.7)	3 (20.0)	
	laparoscopic	11 (36.7)	5 (33.3)	6 (40.0)	
Surgery type	Elective	13 (43.3)	9 (60.0)	4 (26.7)	0.065
	Emergency	17 (56.7)	6 (40.0)	11 (73.3)	
T staging	T1	1 (3.3)	1 (6.7)	0 (0.0)	0.192
	T2	3 (10.0)	1 (6.7)	2 (13.3)	
	T3	22 (73.3)	9 (60.0)	13 (86.7)	
	T4a	1 (3.3)	1 (6.7)	0 (0.0)	
	T4b	3 (10.0)	3 (20.0)	0 (0.0)	
N staging	0	18 (60.0)	10 (66.7)	8 (53.3)	0.304
	1	9 (30.0)	5 (33.3)	4 (26.7)	
	2	3 (10.0)	0 (0.0)	3 (20.0)	
METS	Yes	27 (90.0)	13 (86.7)	14 (93.3)	1.000
	No	3 (10.0)	2 (13.3)	1 (6.7)	
Differentiation	Poorly	3 (10.0)	2 (13.3)	1 (6.7)	0.063
	Moderately	17 (56.7)	8 (53.3)	9 (60.0)	
	Well	6 (20.0)	1 (6.7)	5 (33.3)	
	Mucinous	4 (13.3)	4 (26.7)	0 (0.0)	
Surgery duration (min)			214 (57.1)	187.9 (68.0)	0.262
Number of lymph nodes			19 (9)	16 (9)	0.197
Surgical complication					
Anastomotic leak	Yes	4 (13.3)	3 (20.0)	1 (6.7)	0.598
	No	26 (86.7)	12 (80.0)	14 (93.3)	
Sepsis	Yes	3 (10.0)	2 (13.3)	1 (6.7)	1.000
	No	27 (90.0)	13 (86.7)	14 (93.3)	
Lymph fistula	Yes	1 (3.3)	1 (6.7)	0 (0.0)	1.000
	No	29 (96.7)	14 (93.3)	15 (100.0)	
Acute urinary retention	Yes	2 (6.7)	0 (0.0)	2 (13.3)	0.483
	No	28 (93.3)	15 (100.0)	13 (86.7)	
Hematoma	Yes	2 (6.7)	2 (13.3)	0 (0.0)	0.483
	No	28 (93.3)	15 (86.7)	15 (100.0)	
Surgical site infection	Yes	6 (20.0)	3 (20.0)	3 (20.0)	1.000
	No	24 (80.0)	12 (80.0)	12 (80.0)	
Non-surgical complication					
Cardiac complication	Yes	3 (10.0)	1 (6.7)	2 (13.3)	1.000
	No	27 (90.0)	14 (93.3)	13 (86.7)	
Renal failure	Yes	2 (6.7)	2 (13.3)	0 (0.0)	0.483
	No	28 (93.3)	13 (86.7)	15 (100.0)	
Local recurrence	Yes	10 (33.3)	6 (40.0)	4 (26.7)	0.439
	No	20 (66.7)	9 (60.0)	11 (73.3)	
Recurrence-free (months)	Median (IQR)	36.0 (24.0)	24.0 (24.0)	36.0 (24.0)	0.511
Stage	1	1 (3.3)	0 (0.0)	1 (6.7)	0.471
	2	17 (56.7)	10 (66.7)	7 (46.7)	
	3	9 (30.0)	3 (20.0)	6 (40.0)	
	4	3 (10.0)	2 (13.3)	1 (6.7)	
	0	1 (3.3)	1 (6.7)	0 (0.0)	
Overall survival (years)	1	2 (6.7)	2 (13.3)	0 (0.0)	0.541
	2	9 (30.0)	5 (33.3)	4 (26.7)	
	3	8 (26.7)	3 (20.0)	5 (33.3)	
	4	10 (33.3)	4 (26.7)	6 (40.0)	

undergoing CME and CVL as compared to conventional surgery in colon cancer patients.

MATERIALS AND METHODS

We retrospectively reviewed data from 2018 to 2020 on patients with colon cancer who have undergone CME and CVL, or conventional colectomies technique in a tertiary centre in Kuala Lumpur. Colectomies performed for benign conditions such as diverticulitis, inflammatory bowel disease and suspicious malignant polyps with high-grade dysplasia were excluded. Clinical data such as age, gender, site of tumour, surgical procedure and type of surgery, and histopathology data such as tumour grade and stage as well as morbidity, mortality and overall survival were included in the analysis. The clinical and histopathological characteristics are presented in Tables I and II. A total of 30 patients underwent right hemicolectomies either by CME and CVL or conventional colectomies techniques. The operation was performed either by laparoscopic or open surgery.

Descriptive statistics were used to describe the study population. The normality of continuous data distribution was determined using the Shapiro-Wilk test. Normally distributed continuous data were presented as mean and standard deviation, while the median and interquartile range were used to describe variables with skewed distribution. Categorical variables were presented as frequencies and percentages. Bivariate analysis was performed to compare categorical variables with mortality. Continuous variables with normal distribution were compared using an independent t-test, while skewed variables were compared using the Mann-Whitney Rank U test. The chi-square test was used to determine the association between categorical variables and mortality. Fisher's exact test was used when the chi-square test assumption was violated (>20% cells with an expected value of 5 or less). Statistical analysis was conducted with IBM SPSS Statistics 25.0, and statistical significance was set at $p < 0.05$.

RESULTS

A total of 30 patients' data who had undergone right hemicolectomies either by CME and CVL ($n=15$) or conventional colectomies ($n=15$) from 2018 to 2020 were retrieved for review. The mean age of the study population was 65.7 years (Standard Deviation, $SD=11.8$). There was no statistical difference between the mean age of the two groups ($p=0.355$). There were 18 males and 12 female patients in the study. The distribution of the patients according to sex was equal between groups. Most of the patients were Malays (46.7%) followed by Chinese (43.3 %) and Indians (10.0%). (Table I)

The most common site of tumours were in the caecum about 50.0%, followed by transverse colon (16.7%), ascending colon and splenic flexure (13.3%), and hepatic flexure (6.7%). The surgeries performed were mostly open surgery in both groups (CME and CVL group = 60%; conventional group = 67%). There were six patients with well differentiated tumour, 17 were moderate differentiation and 3 were poorly differentiation. There were no statistically differences among the two groups. The mean number of lymph nodes harvested is more in CME and CVL group ($n=19$) however it is not

statistically significant compared to the conventional colectomies ($n=16$). The duration of surgery is longer in CME and CVL groups ($n=214$) compared to conventional colectomies ($n=188$) but with no significant statistical difference. The surgical margin for all specimens was negative. Most of the perioperative complications were similar in both groups with no significant statistical differences. (Table II)

DISCUSSION

CME and CVL surgery are still relatively a new technique with results showing a reduced risk of local recurrence (6.5 vs. 3.6%) and an improved 5-year survival rate (89.1 vs. 82.1%) compared with conventional techniques. It achieves maximal lymph node yield which therefore offers optimised oncological results.^{2,4-22} This is proven as in our cohort, despite the insignificant statistical difference, the mean number of harvested lymph nodes is more in the CME and CVL groups than in the conventional groups.

As mentioned earlier, the desired endpoint of CME and CVL surgery is better local control and survival. Its technique follows the same principle as total mesorectal excision with a similar rationale but is applied in the area of colon surgery.^{2,4,14,16} The principal is radical which hypothesises that tumour cells metastasise along their lymphatics but within the confines of the mesocolic fascia.^{3,4-9} By removing the tumour and its mesentery with an intact mesocolic fascia, the dissemination of tumour cells is limited. Since the lymphatic drainage of the colon follows closely with its arterial supply, ligation of feeding vessels at their origin maximises the harvest of lymph nodes.^{2,4} On the contrary, surgery performed in the non-anatomical plane results in the disruption of the mesocolic fascia and causes spillage of tumour cells, potentially increasing the risk of poorer oncological outcomes.^{4,9}

In their study, Abdelkhalik et al., have highlighted the importance of CME and CVL surgery in terms of the amount of tissue removed around the tumour and the likelihood of tumour resection in a mesocolic plane.⁵ While a small comparative series does not provide enough data to confirm the absolute benefit of the procedure to patients, it does draw attention to the potential value of mesocolic dissection, surgical plane and lymph node yield.

The research of Kim et al., suggests that the surgeon and pathologist can affect lymph node yields, potentially leading to biased outcomes.² However, the median node yield in Leeds was still above the United Kingdom's minimum standard, as was the recognition of extramural vascular invasion, which can be used to measure the quality of pathology.¹⁷ The difference in lymph node yields for all resections and those for both right and left sides is too great to be accounted for by chance and is likely due to a larger quantity of tissue removed both longitudinally and centrally.^{5,8,9} This is backed up by the strong correlations between longer lengths and areas and higher lymph node yields. Additionally, the amount of negative lymph nodes increased in CME and CVL surgery, which is linked to improved survival in both lymph node-negative cases and stage III disease.^{2,4,5-12}

These results are in congruence with Abdelkhalik et al., who suggested that CME and CVL surgery may present the greatest benefit to patients with stage III disease.⁵ This is due to the possibility that it could convert what would otherwise be a Dukes C2 case to a Dukes C1 case through downstaging. Furthermore, the plane of surgery has also been seen to be a major factor in the overall survival of patients with stage III disease. Leed's research has revealed that those with potentially curative stage III disease who have their surgery performed in the mesocolic plane have a 5-year overall survival rate of 58%, as opposed to 35%, if the surgery is done in the muscular propria plane.^{2,4,14}

Even this retrospective review in our centre did not conclude that the CME and CVL technique is better but it is not inferior to the conventional technique. Furthermore, the perioperative morbidity is the same in both groups. The main advantage of CME and CVL is that it allows for more precise and extensive removal of the affected area of the colon. This minimises the risk of recurrence and metastasis, thus increasing the chances of a successful outcome. CME and CVL surgery also reduces the risk of postoperative complications such as intra-abdominal bleeding, infection and leakage.^{2,4,7}

CME and CVL surgery also allows for the removal of the entire mesocolon (the connective tissue between the large and small intestine) and the main blood vessels leading to the organ.^{2,4,22} This helps to reduce the risk of damage to surrounding structures and organs, which can be a major complication in conventional surgery. Yoon et al established that CME and CVL surgery is less invasive than conventional surgery and is associated with a faster recovery time.⁷ The process of CME requires only a small incision, which allows for quicker healing and fewer postoperative complications.

We believe there are several limitations to our study. First of all, this is a retrospective study and is subjected to biases associated with this study design. Being a retrospective study, it does not reach the evidence level of a randomised clinical trial.²³ Secondly, this study is limited to only one single centre, which might not be representative of the whole population.

CONCLUSIONS

The CME and CVL surgery is a better approach than conventional surgery in colon surgery in a tertiary centre due to their increased accuracy and safety, reduced risk of postoperative complications, and faster recovery time. The study results indicate that there is no significant difference in survival duration between the two approaches, but CME and CVL surgery is still considered a better option due to the aforementioned advantages.

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