ORIGINAL ARTICLE

Is Prophylactic Abdominal Drainage Necessary after Laparoscopic Colectomy for Colon Cancer? A Propensity Score-matched Analysis

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Abstract

Aim: In 2018, the Enhanced Recovery after Surgery (ERAS) Society recommended against routine drainage after colorectal surgery. However, the evidence is relatively old and few studies were performed in low-to-middle income country (LMIC) setting. This study aimed to compare outcomes of laparoscopic colectomy with and without prophylactic drainage for colon cancer.

Methods: A retrospective study was performed from 2018 to 2021 with patients who underwent laparoscopic colectomy with D3 lymphadenectomy for colon cancer. The use of prophylactic drainage was depended on routine practice of surgeons. Outcomes were postoperative complications and postoperative hospital length of stay. The drain and no-drain groups were compared using propensity score-matched (PSM) analysis.

Results: The study included 143 patients (59 in the drain group and 84 in the no-drain group). The PSM resulted in 94 patients (47 in each group). Median age was 62 years. The most frequent was right hemicolectomy (33.6%), followed by left hemicolectomy (32.2%), sigmoid colectomy (21%), extended right hemicolectomy (9.8%), transverse hemicolectomy (2.1%), and total colectomy (1.4%). Postoperative hospital stay was significantly shorter in the no-drain group (median of 5 vs 6 days). The no-drain group also had lower rate of complications (23.8 vs 30.5% and 23.4 vs 34% before and after matching, respectively) and less severe complications based on Clavien-Dindo classification, but the difference was not significant.

Conclusion: Laparoscopic colectomy without prophylactic drainage is safe in the treatment of colon cancer. This approach can shorten postoperative hospital stay and should be applied even in the LMIC setting.

Keywords: Colectomy, Laparoscopic surgery, Routine drainage.

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Introduction

In 2018, the Enhanced Recovery after Surgery (ERAS) Society's guidelines recommended that pelvic and peritoneal drains should not be used routinely in perioperative care in colorectal surgery.[1] However, with routine practices of many surgeons in a long period, prophylactic drainage after colectomy is not easily abandoned, particularly in low-to-middle income country (LMIC) setting. Prophylactic abdominal drains after colectomy have been used to early detect potential complications including bleeding and anastomotic leakage, and prevent fluid accumulation. On the contrary, routine drainage can cause some disadvantages such as increased serous secretion, increased risk of intra-abdominal infection, bowel obstruction, and prolonged hospital length of stay.[2–5] There were a number of studies on the safety and effectiveness of prophylactic drainage after elective colorectal surgery and most of them showed similar complication rate between groups with and without routine drainage.[2,3,5–7] Most authors agreed that prophylactic drains had no effect on clinical outcomes in elective colorectal surgery. Nevertheless, the majority of these studies were performed in upper-middle- or high-income countries, which healthcare facilities are better than in LMICs. Whether no prophylactic drainage after colectomy is safe in LMIC setting is still questioned. Also, the ERAS Society's recommendation was based on relatively old evidences, which most of the studies were performed around 20 years ago.[2,7] Meanwhile, there have been changes in colectomy, for example, the wide application of minimally invasive surgery, more radical surgery such as complete mesocolic excision and extended lymph node dissection (D3 lymphadenectomy), stapled anastomosis, and the use of new instruments in the surgery. Updated studies on whether the use of routine drainage is necessary after colorectal anastomosis are needed.

In our hospital, we started to apply the ERAS guidelines without routine drainage for colectomy since 2018 and the results are promising. Hence, this study aimed to compare outcomes of

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patients who underwent laparoscopic colectomy with and without prophylactic abdominal drainage in the treatment of colon cancer.

Methods

Study Design and Patients

This is a retrospective study performed at Gia Dinh People's Hospital, a referral teaching hospital in Ho Chi Minh City, Vietnam. The study was approved by the ethics committees of the hospital (No. 35/NDGD-HDDD on 22 April 2021) and University of Medicine and Pharmacy at Ho Chi Minh City (No. 114/HDDD-DHYD on 17 February 2021). All patients who underwent laparoscopic colectomy for the treatment of colon cancer from January 2018 to June 2021 were selected and divided into two groups: one with prophylactic drainage after surgery (drain group) and the other without prophylactic drainage (no-drain group). We excluded patients with the conversion to open surgery. Informed consent was waived since all data were retrospective collected.

The use of prophylactic drainage after surgery was decided by the operating surgeon and this was mainly depended on the routine practice of the surgeons rather than any clinical criterion. Patients in both groups were treated with the same protocol for preoperative preparation, intraoperative approach (except for prophylactic drainage after surgery), and postoperative evaluation. Preoperative bowel preparation was done or not depending on the operating surgeons. All patients underwent laparoscopic or laparoscopy-assisted colectomy with hand-sewn or stapled anastomosis. The colectomy along with D3 lymphadenectomy was performed in accordance with the Japanese Society's guidelines for Cancer of the Colon and Rectum.[8] In the drain group, 28F natural latex rubber tubes without vacuum devices (passive drains) were used to place near the anastomosis. The drains were removed when the output was less than 20 mL per day and the color of the output fluid was normal (light pink or light yellow). Antimicrobial prophylaxis was administered for all patients in both groups.

Patient's Assessment

Patient's characteristics were collected using the hospital medical records, including preoperative variables [age, sex, body mass index (BMI), comorbidities, history of abdominal surgery, American Society of Anesthesiologists (ASA) score, hemoglobin, and serum albumin], intraoperative variables (surgical method, operating time, combined surgery, the amount of blood loss, anastomosis technique, and the number of drains), and pathological findings [tumor's location and stage according to the American Joint Committee Cancer (AJCC) tumor/node/metastasis (TNM) classification and staging system]. Outcomes of interest were postoperative complications (abdominal fluid collection, abscess, bleeding, anastomotic leakage, bowel obstruction, surgical site infection, and other organ complications), length of postoperative hospital stay, and time to flatus and oral feeding. All complications were recorded within 30 days after surgery and were evaluated using the Clavien-Dindo classification.[9]

Statistical Analysis

Data were summarized by each group using median and interquartile range (IQR) for continuous variables and count and percentage for categorical variables. The comparison between the two groups was performed using Mann–Whitney-*U* test and Fisher's exact test for continuous and categorical variables, respectively. We used propensity score-matched (PSM) analysis to adjust for differences in baseline and operating characteristics between the two groups. The propensity score was developed from a logistic regression model with covariates age, sex, BMI, ASA score, TNM stage, the type of surgery (elective or emergency), type of colon resection, and preoperative bowel preparation. Matched cases were selected at a ratio of 1:1 using the nearest neighbor method with a caliper of 0.1. We used the statistical software R version 4.1.0 to analyze the data and the "MatchIt" package for the PSM analysis.[10]

Results

A total of 143 patients with colon cancer underwent laparoscopic colectomy from January 2018 to June 2021 were included in the study: 59 patients with prophylactic drainage and 84 patients without prophylactic drainage after the surgery. The PSM strategy resulted in 94 patients (47 patients in each group). The characteristics of the patients and tumors were more balanced between the two groups after matching (Tables 1 and 2).

Median age was 62 years in both groups before matching and 62 and 64 years in the drain and no-drain groups after matching, respectively. Female was predominant in both groups after matching. Before matching, the most frequent comorbidities were hypertension (54.2 and 46.4% in the drain and no-drain groups before matching), followed by diabetes (20.3 and 20.2%) and coronary artery disease (22 and 16.7%); there were 13 patients (22%) in the drain group and 17 patients (20.2%) in the no-drain group with previous laparotomy or laparoscopic surgery. Comorbidities were balanced between groups after matching (Table 1).

In our study, the tumors located in all sections of the colon. Before matching, the most frequent were the sigmoid colon (25.4 and 20.2% in the drain and no-drain groups, respectively), followed by the descending colon (22 and 17.9%) and left colic flexure (15.3 and 7.1%). According to the TNM staging system, most of the patients were graded as stage III postoperatively (57.6 and 71.4% in the drain and no-drain groups before matching). After matching, tumor's location and stage were balanced between groups (Table 2).

Preoperative bowel preparation was performed in 18.6 and 10.7% of the patients in the drain and no-drain groups before matching. The operating time was similar in the two groups (median was 210 and 198 minutes before matching and 205 and 198 minutes after matching in the drain and no-drain groups, respectively). Before matching, the most frequent types of colectomy were right hemicolectomy (48 patients, 33.6%), followed by left hemicolectomy (46 patients, 32.2%). Median intraoperative blood loss was 50 mL in both groups and 11 patients (five in the drain group and six in the no-drain group) required blood transfusion. Most operative characteristics were balanced between groups after matching (Table 3). The median (IQR) time of drainage in the drain group was 5 (4.2; 6) days.

There were no significant differences in time to oral feeding, time of analgesics use, and time to flatus between the two groups in both the analyses before and after matching. Postoperative hospital length of stay, however, was significantly shorter in the no-drain group compared to the drain group in both the unmatched and matched cohorts (median of 5 vs 6 days). The drain group had higher rate of postoperative complications and more severe complications based on Clavien-Dindo classification in both the analyses before and after matching; however, the difference did not reach statistical significance. The most frequent complication was fluid accumulation but all required medical treatment only. Other complications were uncommon (Table 4).

Table 1: Patient's characteristics

	Unmatched cohort			*Matched cohort*		
	Drain (N = 59)	*No-drain (N = 84)*	*p-value*	*Drain (N = 47)*	*No-drain (N = 47)*	*p-value*
Age (year), median (IQR)	62.0 (49.5–70.5)	62.0 (51.0–70.2)	0.886	62.0 (51.0–71.0)	64.0 (57.0–72.5)	0.449
Sex female, *n* (%)	36 (61.0)	43 (51.2)	0.306	30 (63.8)	28 (59.6)	0.832
BMI (kg/m^2), median (IQR)	23.2 (21.2–25.0)	22.4 (19.6–24.7)	0.070	22.9 (20.5–24.6)	22.7 (19.6–25.0)	0.689
ASA, *n* (%)			0.271			0.828
I	5 (8.5)	10 (11.9)		5 (10.6)	4 (8.5)	
II	33 (55.9)	34 (40.5)		24 (51.1)	22 (46.8)	
III	21 (35.6)	39 (46.4)		18 (38.3)	21 (44.7)	
IV	0 (0)	1 (1.2)		0 (0)	0 (0)	
Hypertension, *n* (%)	32 (54.2)	39 (46.4)	0.398	26 (55.3)	25 (53.2)	1
Diabetes, *n* (%)	12 (20.3)	17 (20.2)	1	10 (21.3)	10 (21.3)	1
Coronary artery disease, *n* (%)	13 (22.0)	14 (16.7)	0.516	11 (23.4)	8 (17.0)	0.608
Previous stroke, *n* (%)	2 (3.4)	6 (7.1)	0.470	2 (4.3)	3 (6.4)	1
Chronic lung disease, *n* (%)	3 (5.1)	4 (4.8)	1	3 (6.4)	2 (4.3)	1
Heart failure, *n* (%)	0 (0)	3 (3.6)	0.268	0 (0)	3 (6.4)	0.242
History of pulmonary tuberculosis, *n* (%)	2 (3.4)	1 (1.2)	0.569	2 (4.3)	0 (0)	0.495
Chronic liver disease, *n* (%)	0 (0)	2 (2.4)	0.512	0 (0)	0 (0)	–
Chronic kidney disease, *n* (%)	0 (0)	1 (1.2)	1	0 (0)	0 (0)	–
Previous laparotomy/laparoscopic surgery, *n* (%)	13 (22.0)	17 (20.2)	0.837	11 (23.4)	11 (23.4)	1
Hemoglobin (gm/L), median (IQR)	122 (107–134)	118 (102–133)	0.574	123 (108–134)	118 (105–128)	0.296
Albumin (gm/L), median (IQR)	40.0 (38.0–42.8)	39.0 (36.0–42.0)	0.192	40.0 (38.0–42.0)	39.5 (37.0–41.8)	0.538

ASA, American Society of Anesthesiologists; BMI, body mass index; IQR, interquartile range

Table 2: Tumor's characteristics

	Unmatched cohort			*Matched cohort*		
	Drain (N = 59)	*No-drain (N = 84)*	*p-value*	*Drain (N = 47)*	*No-drain (N = 47)*	*p-value*
Tumor location, *n* (%)			0.199			0.637
Cecum	5 (8.5)	4 (4.8)		5 (10.6)	3 (6.4)	
Ascending colon	5 (8.5)	18 (21.4)		4 (8.5)	5 (10.6)	
Right colic flexure	4 (6.8)	15 (17.9)		4 (8.5)	9 (19.1)	
Transverse colon (1/3 right)	4 (6.8)	6 (7.1)		4 (8.5)	4 (8.5)	
Transverse colon (1/3 middle)	1 (1.7)	2 (2.4)		0 (0)	1 (2.1)	
Transverse colon (1/3 left)	1 (1.7)	1 (1.2)		1 (2.1)	0 (0)	
Left colic flexure	9 (15.3)	6 (7.1)		6 (12.8)	3 (6.4)	
Descending colon	13 (22.0)	15 (17.9)		9 (19.1)	11 (23.4)	
Sigmoid colon	15 (25.4)	17 (20.2)		14 (29.8)	11 (23.4)	
Cecum + Sigmoid colon	1 (1.7)	0 (0)		0 (0)	0 (0)	
Cecum + Left colic flexure	1 (1.7)	0 (0)		0 (0)	0 (0)	
T stage, *n* (%)			0.014			0.906
Tis	3 (5.1)	3 (3.6)		1 (2.1)	1 (2.1)	
T1	2 (3.4)	1 (1.2)		1 (2.1)	1 (2.1)	
T2	14 (23.7)	5 (6.0)		7 (14.9)	4 (8.5)	
T3	14 (23.7)	23 (27.4)		14 (29.8)	14 (29.8)	
T4a	26 (44.1)	52 (61.9)		24 (51.1)	27 (57.4)	
N stage, *n* (%)			0.659			0.760
0	39 (66.1)	55 (65.5)		28 (59.6)	29 (61.7)	
1a	7 (11.9)	11 (13.1)		6 (12.8)	5 (10.6)	
1b	7 (11.9)	11 (13.1)		7 (14.9)	8 (17.0)	

(Contd...)

Table 2: *(Contd...)*

	Unmatched cohort			*Matched cohort*		
	Drain (N = 59)	*No-drain (N = 84)*	*p-value*	*Drain (N = 47)*	*No-drain (N = 47)*	*p-value*
1c	3 (5.1)	2 (2.4)		3 (6.4)	1 (2.1)	
2a	0 (0)	3 (3.6)		0 (0)	2 (4.3)	
2b	3 (5.1)	2 (2.4)		3 (6.4)	2 (4.3)	
TNM stage, *n* (%)			0.063			1
Stage 0	3 (5.1)	3 (3.6)		1 (2.1)	1 (2.1)	
Stage I	13 (22.0)	6 (7.1)		5 (10.6)	5 (10.6)	
Stage II	9 (15.3)	15 (17.9)		9 (19.1)	10 (21.3)	
Stage III	34 (57.6)	60 (71.4)		32 (68.1)	31 (66.0)	

Table 3: Operative characteristics

	Unmatched cohort			*Matched cohort*		
	Drain (N = 59)	*No-drain (N = 84)*	*p-value*	*Drain (N = 47)*	*No-drain (N = 47)*	*p-value*
Preoperative bowel preparation, *n* (%)	11 (18.6)	9 (10.7)	0.223	8 (17.0)	7 (14.9)	1
Type of surgery, *n* (%)			0.629			1
Elective	52 (88.1)	71 (84.5)		41 (87.2)	42 (89.4)	
Emergency	7 (11.9)	13 (15.5)		6 (12.8)	5 (10.6)	
Operating time (min), median (IQR)	210 (180–230)	198 (170–230)	0.157	200 (180–220)	200 (170–225)	0.560
Type of colon resection, *n* (%)			0.068			0.916
Right hemicolectomy	13 (22.0)	35 (41.7)		13 (27.7)	16 (34.0)	
Extended right hemicolectomy	5 (8.5)	9 (10.7)		4 (8.5)	5 (10.6)	
Transverse hemicolectomy	2 (3.4)	1 (1.2)		1 (2.1)	1 (2.1)	
Left hemicolectomy	23 (39.0)	23 (27.4)		16 (34.0)	15 (31.9)	
Sigmoid colectomy	14 (23.7)	16 (19.0)		13 (27.7)	10 (21.3)	
Total colectomy	2 (3.4)	0 (0)		0 (0)	0 (0)	
Dissection instrument, *n* (%)			0.073			0.158
LigaSure scalpel	8 (13.6)	4 (4.8)		7 (14.9)	2 (4.3)	
Harmonic scalpel	51 (86.4)	80 (95.2)		40 (85.1)	45 (95.7)	
Blood loss (mL), median (IQR)	50 (50–100)	50 (20–100)	0.009	50 (50–100)	50 (20–100)	0.091
Anastomosis performing, *n* (%)			1			0.677
Stapled	54 (91.5)	77 (91.7)		43 (91.5)	45 (95.7)	
Handsewn	5 (8.5)	7 (8.3)		4 (8.5)	2 (4.3)	
Intra- or extracorporeal anastomosis, *n* (%)			<0.001			<0.001
Intracorporeal	20 (33.9)	73 (86.9)		16 (34.0)	43 (91.5)	
Extracorporeal	39 (66.1)	11 (13.1)		31 (66.0)	4 (8.5)	
Anastomosis technique, *n* (%)			1			0.617
Side-to-side	56 (94.9)	80 (95.2)		44 (93.6)	46 (97.9)	
Side-to-end	0 (0)	0 (0)		0 (0)	0 (0)	
End-to-end	3 (5.1)	4 (4.8)		3 (6.4)	1 (2.1)	
Blood transfusion, *n* (%)	5 (8.5)	6 (7.1)	0.761	3 (6.4)	2 (4.3)	1

IQR, interquartile range

Discussion

Our study revealed the safety and effectiveness of laparoscopic colectomy without prophylactic drainage after surgery for colon cancer in a LMIC setting. Compared to laparoscopic colectomy with prophylactic drainage, the approach without prophylactic drainage yielded similar safety results when considering the prevention of postoperative complications. The rate of anastomotic leak, bleeding, abdominal abscess, and reoperation due to complications was low and balanced between the two groups. With respect to the effectiveness, the two groups were not significantly different in the time to flatus, time to oral feeding and time of analgesics use, but the approach without prophylactic drainage significantly shortened the length of postoperative hospital stay.

Prophylactic drainage is expected to provide some benefits. The first is to remove collected fluid after surgery, which is thought to reduce the risk of intra-abdominal infection.[11,12] The second is to

Table 4: Study outcomes

	Unmatched cohort			*Matched cohort*		
	Drain (N = 59)	*No-drain (N = 84)*	*p-value*	*Drain (N = 47)*	*No-drain (N = 47)*	*p-value*
Time to oral feeding (days), median (IQR)	3.0 (3.0–4.0)	3.0 (2.0–4.0)	0.108	3.0 (3.04.0)	3.0 (2.0–4.0)	0.087
Time of analgesics use (days), median (IQR)	4.0 (3.0–5.0)	4.0 (3.0–5.0)	0.210	4.0 (3.5–5.0)	4.0 (3.0–5.0)	0.302
Time to flatus (days), median (IQR)	3.0 (2.0–3.0)	3.0 (2.0–3.0)	0.658	3.0 (2.0–3.0)	3.0 (2.0–3.0)	0.229
Postoperative hospital stay (days), median (IQR)	6.0 (6.0–7.0)	5.0 (4.8–6.0)	<0.001	6.0 (6.0–7.5)	5.0 (5.0–6.0)	<0.001
Any complication, *n* (%)	18 (30.5)	20 (23.8)	0.443	16 (34.0)	11 (23.4)	0.362
Clavien-Dindo classification, *n* (%)			0.336			0.071
Grade I	8 (44.4)	14 (70.0)		7 (43.8)	10 (90.9)	
Grade II	6 (33.3)	4 (20.0)		6 (37.5)	1 (9.1)	
Grade III	3 (16.7)	2 (10.0)		2 (12.5)	0 (0)	
Grade IV	0 (0)	0 (0)		0 (0)	0 (0)	
Grade V	1 (5.6)	0 (0)		1 (6.2)	0 (0)	
Intra-abdominal fluid accumulation, *n* (%)	9 (15.3)	10 (11.9)	0.621	8 (17.0)	8 (17.0)	1
Surgical site infection, *n* (%)	4 (6.8)	7 (8.3)	1	4 (8.5)	4 (8.5)	1
Pulmonary complication, *n* (%)	3 (5.1)	3 (3.6)	0.691	3 (6.4)	1 (2.1)	0.617
Bowel obstruction, *n* (%)	3 (5.1)	0 (0)	0.068	2 (4.3)	0 (0)	0.495
Anastomotic leak, *n* (%)	1 (1.7)	2 (2.4)	1	1 (2.1)	0 (0)	1
Cardiovascular complication, *n* (%)	1 (1.7)	1 (1.2)	1	1 (2.1)	1 (2.1)	1
Bleeding, *n* (%)	0 (0)	1 (1.2)	1	0 (0)	0 (0)	–
Abdominal abscess, *n* (%)	1 (1.7)	0 (0)	0.413	1 (2.1)	0 (0)	1
Death, *n* (%)	1 (1.7)	0 (0)	0.413	1 (2.1)	0 (0)	1

IQR, interquartile range

early detect postoperative complications such as intra-abdominal bleeding or anastomotic leakage. Another potential benefit is to minimize the severity of leakage when occurring and possibly avoid reoperation.[13,14] Our study showed that there was no difference in fluid accumulation and intra-abdominal infection between the two groups. Thus, similar to other studies,[1,15] our results suggest that prophylactic drainage for the prevention of intraperitoneal fluid accumulation is not necessary.

Abdominal drainage might have a role in the diagnosis and treatment of anastomotic leakage. In our study, one patient in the drain group was diagnosed with anastomotic leakage at day 6 postoperatively without clinical signs of peritonitis except that there was fecal fluid in the drain's output. Conservative treatment was successful for that patient. Whereas two patients in the no-drain group with anastomotic leakage required reoperation, one with a misdiagnosis of postoperative paralytic ileus and the other with a diagnosis of localized peritonitis in the right upper quadrant. Prophylactic drainage in these two patients might help to early diagnose anastomotic leakage or prevent reoperation. Therefore, routine drainage may still play a role in the diagnosis and treatment of anastomotic leakage. Nevertheless, it should be highlighted that with the application of the ERAS protocol and the advancement of surgical techniques and instruments, anastomotic leakage is very rare. Thus, routine drainage for all patients should be considered and further studied in terms of the diagnosis and prevention of anastomotic leakage.

On the other hand, routine drainage may cause some problems. In our study, three patients in the drain group had intestinal obstruction; one patient resolved after drain removal and two patients required reoperation. Whether the drainage tube causes intestinal obstruction is still unclear, but this complication was mentioned before.[4,16] In addition, routine drainage can cause other problems such as pain, discomfort, and limitation of returning to normal activities of the patients.

Routine abdominal drainage is still under debate in colectomy for colon cancer. Some studies showed no significant difference between the groups with and without prophylactic drainage in terms of postoperative complications such as anastomotic leakage, mortality, wound infection, pelvic sepsis, postoperative bowel obstruction, and reintervention for abdominal complication.[5,7,13,17–20] Several other studies favored routine drainage after colorectal surgery because a prophylactic drain could reduce the incidence of colorectal anastomotic leakage and the rate of reintervention due to complications.[21–23] However, since most level-1 evidence studies (well-designed randomized controlled trial and systematic review and meta-analysis) recommended against the use of prophylactic drainage, we agree with the ERAS guidelines that routine drainage should not be used after colorectal anastomosis. Since most of the studies were performed in the upper-middle- or high-income countries, our study supports this recommendation in the LMIC setting.

There are several limitations in this study. First, the sample size of the study is relatively small. Second, there was potential selection bias in the comparison between the two groups, which is a nature of a non-randomized comparative study. We tried to overcome this issue by using the PSM analysis, but potential bias might not be ruled out completely. Third, this study came from a single center with a single surgical team. This might limit the generalizability of the results to other settings.

Conclusion

In conclusion, laparoscopic colectomy without prophylactic drainage is safe in the treatment of colon cancer. This approach

does not increase postoperative complications but shortens the length of postoperative hospital stay when compared to the surgery with routine prophylactic drainage. We suggest against the use of prophylactic drainage after laparoscopic colectomy for colon cancer even in the LMIC setting.

Authors' Contributions

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Le Huy Luu, Tran Van Hoi, and Nguyen Lam Vuong. The first draft of the manuscript was written by Le Huy Luu and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Disclaimer

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