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Research Article

Efficacy of Abdominal Drains in Reducing Post-Operative Complications in Patients Undergoing Elective Colorectal Surgery

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Abstract

Aim: Abdominal drainage is believed to be prophylactic against accumulation of fluid and an early indicator of anastomotic leakage. However, evidence for this role remains equivocal. Our study aims to study the efficacy of abdominal drains in reducing post-operative complications in patients undergoing elective colorectal surgery. **Method:** The study is a retrospective non-interventional cohort study which involved adults undergoing elective colorectal surgery from 19 January 2021 to 22 February 2022. The main outcomes measured were fever, ileus, surgical site infections (SSI), pulmonary complications, venous thromboembolism (VTE), 30-day mortality, anastomotic leakage (AL), need for re-intervention, Post-Operative Days (POD) to pass flatus and feces and length of hospital stay (LOS). Categorical variables were analysed using Fisher's exact test and continuous variables were analysed using Mann Whitney U test. **Results:** 44 patients were included (38.6% female, 84.1% Chinese, mean age 74.18 years). The majority patients, 41 (93.2%), underwent surgery for cancer. 29 (65.9%) patients received abdominal drainage. There was no significant difference between the no drain and drain groups for fever (p=0.135), ileus (p=0.452), SSI (p=1.000), pulmonary complications (p=1.000), VTE (p=1.000), 30-day mortality (p=1.000), clinical AL (p=1.000), radiological AL (p=1.000), non-surgical re-intervention (p=0.488), surgical re-intervention (p=1.000), POD to pass flatus (p=0.258), POD to pass feces (p=0.984) and LOS (p=0.096). **Conclusion:** Abdominal drainage after elective colorectal surgery does not reduce the development of post-operative complications. The routine use of abdominal drainage can be avoided to minimise risk to patients. Further well-controlled Randomised Controlled Trials (RCTs) should be conducted to consolidate the evidence.

Keywords: Abdominal Drainage; Elective Colorectal Surgery; Post-Operative Complications

Introduction

The routine use of abdominal drains after elective colorectal surgery has been debated. Drainage is believed to be prophylactic against accumulation of blood and fluid, an early indicator of Anastomotic Leakage (AL), therapeutic in the conservative management of AL and decreases the severity of systemic sepsis [1]. In a meta-analysis by [2], it demonstrated that pelvic drainage reduced AL rate and the rate of re-intervention in patients. On the other hand, several cohort studies like [3] showed that placement of an intraperitoneal drain after elective colorectal surgery was not associated with earlier detection of postoperative collections, but instead prolonged hospital stay and increased the risk of Surgical Site Infection (SSI). As the evidence remains to be equivocal, our study aims to find the efficacy of abdominal drains in reducing post-operative complications in patients undergoing elective

colorectal surgery.

A retrospective cohort study was performed in patients that underwent elective colorectal surgery and post-operative complications such as fever, ileus, SSI, pulmonary problems, venous thromboembolism (VTE), 30-day mortality, AL, need for re-intervention, number of Post-Operative Days (POD) to pass flatus and feces and length of hospital stay (LOS) were compared among patients who had abdominal drainage with patients who did not have abdominal drainage after elective colorectal surgery. It was hypothesised that the use of abdominal drains will not reduce post-operative complications. Thus, this study was conducted to guide clinicians on whether the use of drainage could be avoided in patients undergoing elective colorectal surgery, so that it minimises their risk from drain related complications like fistulas and skin ulceration [4].

Methods

Study Design

The study was a non-interventional retrospective study on the efficacy of abdominal drains in reducing post-operative complications in patients who underwent elective colorectal surgery The patients were from a hospital that had 795 beds and provided acute and general care.

Data Collection

Data was retrieved from the hospital database, which contained electronic patient records and operating theatre notes. Search was conducted by filtering patients to the Department of Colorectal Surgery and screening records of those who underwent procedures that involved the caecum, ascending colon, transverse colon, splenic flexure, descending colon, rectosigmoid region, sigmoid colon and rectal region. The information extracted was patient demographics, BMI, ASA score, diagnosis, location and type of surgery, the presence or absence of an abdominal drain, post-operative outcomes such as fever, ileus, SSI, pulmonary complications, VTE, 30-day mortality, clinical or radiological AL, need for non-surgical or surgical re-intervention, POD to pass flatus and faeces and LOS.

Inclusion and Exclusion Criteria

Patients that underwent elective colorectal surgery from the period of 19 January 2021 to 22 February 2022 were included in the study. The age of patients ranged from 60 to 97. Patients with emergency colorectal surgeries or below the age of 21 were excluded.

Data analysis

The data was analysed using SPSS. Descriptive data, mean with standard deviation or the median with interquartile range that summarised results of the subgroups were included. All statistical tests were performed with a significance threshold at p £ 0.05. Categorical variables were compared using the Chi-Squared test if ≤ 20% of expected cell counts were less than 5 or using the Fisher's exact test if > 20% of expected cell counts were less than [5]. The type of statistical test used for continuous data was dependent on the Shapiro-Wilk Test. Continuous and normally distributed data was analysed using the unpaired two-tailed t-test while continuous and non-normally distributed data was analysed using the Mann Whitney U test [6].

Results

Results from 44 patients met the research criteria and were included (Table 1). The mean age of patients was 74.18 (SD of 10.23) years and the mean BMI was 24.61 (SD of 9.79) kg/m^2. For gender, 17 (38.6%) patients were female and 27 (61.4%) patients were male. 37 (84.1%) patients were Chinese while 7 (15.9%) patients were Malay. 12 (27.3%) patients had an ASA status of 2, 29 (65.9%) patients had an ASA Status of 3 and 3 (6.8%) patients had no available data. 41 (93.2%) patients underwent surgery for colorectal cancer, 1 patient (2.3%) for parastomal hernia repair, 1 patient (2.3%) for reversal of Hartmann's and 1 patient (2.3%) for ulceration. The most common location of surgery were the ascending colon and sigmoid colon. For abdominal drainage, 15 (34.1%) patients had no drainage while 29 (65.9%) patients received drainage.

Epidemiology	
Age (years)	
• Mean (SD)	• 74.18 (10.23)
• Median (IQR)	• 75.50 (11.00)
BMI (kg/m²)	
• Mean (SD)	• 24.61 (9.79)
• Median (IQR)	• 22.90 (7.25)
Gender – n (%)	
• Female	• 17 (38.6%)
• Male	• 27 (61.4%)
Race – n (%)	
• Chinese	• 37 (84.1%)
• Malay	• 7 (15.9%)
ASA Status – n (%)	
• ASA Status 1	• 0 (0.0%)
• ASA Status 2	• 12 (27.3%)
• ASA Status 3	• 29 (65.9%)
• ASA Status 4	• 0 (0.0%)
• No data available	• 3 (6.8%)
Diagnosis – n (%)	
• CA	• 41 (93.2%)
• Parastomal hernia	• 1 (2.3%)
• Reversal of Hartmann's	• 1 (2.3%)
• Ulceration	• 1 (2.3%)
Location of surgery – n (%)	
• Caecum	• 2 (4.5%)
• Caecum and Ascending	• 1 (2.3%)
• Ascending	• 10 (22.7%)
• Proximal transverse	• 1 (2.3%)
• Transverse	• 2 (4.5%)
• Descending	• 3 (6.8%)
• Sigmoid	• 10 (22.7%)
• Rectosigmoid	• 6 (13.6%)
• Rectum	• 6 (13.6%)
• Rectum and Caecum	• 1 (2.3%)
• No data available	• 2 (4.5%)
Anastomosis – n (%)	
• No anastomosis	• 5 (11.4%)
• Anastomosis	• 39 (88.6%)
Stoma – n (%)	
• No stoma	• 35 (79.5%)
• Stoma	• 9 (20.5%)
Abdominal Drain – n (%)	
• No drainage	• 15 (34.1%)
• Drainage	• 29 (65.9%)

Table 1: showing epidemiology of patients (n=44) included in the study. Demographics include Age, BMI, Gender, Race, ASA status, diagnosis, location of surgery, anastomosis, stoma and abdominal drain.

Post-operative complications between patients that did not and did receive abdominal drainage were compared. For all the categorical variables > 20% of cell counts were less than 5 and hence, Fisher's exact test was used [5] (Table 2). 1 (6.7%) patient developed post-operative fever in the no drain group while 8 (27.6%) had fever in the drain group. The p-value was 0.135, so no significant difference between the two groups. 2 (13.3%) patients experienced post-operative ileus in the no drain group while 8 (27.6%) patients had post-operative ileus in the drain group. The p-value was 0.452, so no significant difference between the two groups. In the no abdominal drain group, 2 (13.3%) patients developed SSI while in the drain group 4 (13.8%) patients had SSI. It was not significantly different (p=1.000). In terms of pulmonary complications, 1 (6.7%) patient in the no abdominal drain group experienced it while 3 (10.3%) patients had it in the drain group. This was not significantly different (p=1.000). 1 (6.7%) patient had a VTE event in the no drain group while 2 (6.9%) patients had a VTE event in the drain group. This was not significantly different (p=1.000). No patient experienced a 30-day mortality, Clinical AL or Radiological AL in the no drain group. While the drain group had 1 (3.4%) patient for each of these complications. These were all not significantly different as the p-value was 1.000. 3 (20.0%) patients had a non-surgical re-intervention done in the no drain group while 10 (34.5%) patients had it in the drain group. This was not significantly different (p=0.488). In the no drain group, 1 (6.7%) patient had a surgical reintervention while 3 (10.3%) patients had it in the drain group. There was no significant difference between both groups (p=1.000).

Post-operative complications			
Clinical Parameters	**No Abdominal drain group (n= 15)**	**Abdominal Drain group (n=29)**	**p-value**
Post-operative fever (37.5°C) – n (%) • No fever • Fever	 • 14 (93.3%) • 1 (6.7%)	 • 21 (72.4%) • 8 (27.6%)	0.135
Post-operative ileus – n (%) • No ileus • Ileus	 • 13 (86.7%) • 2 (13.3%)	 • 21 (72.4%) • 8 (27.6%)	0.452
Surgical Site Infection – n (%) • No SSI • SSI	 • 13 (86.7%) • 2 (13.3%)	 • 25 (86.2%) • 4 (13.8%)	1.000
Pulmonary Complications – n (%) • No Pulmonary Complications • Pulmonary Complications	 • 14 (93.3%) • 1 (6.7%)	 • 26 (89.7%) • 3 (10.3%)	1.000
VTE – n (%) • No VTE • VTE	 • 14 (93.3%) • 1 (6.7%)	 • 27 (93.1%) • 2 (6.9%)	1.000
Mortality 30 day – n (%) • No mortality • Mortality	 • 15 (100.0%) • 0 (0.0%)	 • 28 (96.6%) • 1 (3.4%)	1.000

Clinical AL – n (%) • No Clinical AL • Clinical AL	• 15 (100.0%) • 0 (0.0%)	• 28 (96.6%) • 1 (3.4%)	1.000
Radiological AL – n (%) • No Radiological AL • Radiological AL	• 15 (100.0%) • 0 (0.0%)	• 28 (96.6%) • 1 (3.4%)	1.000
Non-surgical reintervention – n (%) • No • Yes	• 12 (80.0%) • 3 (20.0%)	• 19 (65.5%) • 10 (34.5%)	0.488
Surgical re-intervention – n (%) • No • Yes	• 14 (93.3%) • 1 (6.7%)	• 26 (89.7%) • 3 (10.3%)	1.000

Table 2 : showing the summarized statistical analysis for the categorical variables between the no abdominal drain and drain groups. These post-operative complications include Post-operative fever, Post-operative ileus, SSI, Pulmonary Complications, VTE, Mortality 30 day, Clinical AL, Radiological AL, Non-surgical reintervention, Surgical re-intervention. The results revealed that there was no significant difference between the two groups for the development of all the above-mentioned complications.

For POD to pass flatus, data from 33 patients met the criteria and the Mann Whitney U Test was used [6] (Table 3). The median POD to pass flatus was 1.5 (IQR of 1.0) days in the no drain group while it was 2.0 (IQR of 2.0) days in the drain group and no significant difference between both groups (p=0.258).

Post-operative complication			
Clinical parameter	**No abdominal drain group (n = 12)**	**Abdominal drain group (n=21)**	**p-value**
POD to pass flatus (days) • Median (IQR)	• 1.5 (1.0)	• 2.0 (2.0)	0.258

Table 3: showing the POD to pass flatus between both groups. As the data from both groups were non-continuous, they were expressed in median with the interquartile range. Mann Whitney U test revealed that there was no significant difference between both groups (p=0.258).

For POD to pass feces, data from 32 patients met the criteria and the Mann Whitney U Test was used [6] (Table 4). The mean POD to pass feces in the no drain group was 3.8 (SD of 2.5) days and the median POD to pass feces in the drain group was 3.0 (IQR of 2.8) days and no significant difference between both groups (p=0.984).

Post-operative complication			
Clinical parameter	**No abdominal drain group (n = 10)**	**Abdominal drain group (n=22)**	**p-value**
POD to pass feces (days) • Mean (SD) • Median (IQR)	• 3.8 (2.5)	• 3.0 (2.8)	0.984

Table 4: showing the POD to pass feces between both groups. The data from the no drain group was continuous while the data from the drain group was non-continuous. Hence, they were expressed in mean with standard deviation and median with interquartile range respectively. Mann Whitney U test revealed that there was no significant difference between both groups (p=0.984).

For LOS, data from 33 patients met the criteria and the Mann Whitney U Test was used [6] (Table 5). The median LOS was 5.5 (IQR of 4.5) days in the no drain group while it was 7.0 (IQR of 6.0) days in the drain group and no significant difference between both groups (p=0.096).

Post-operative complication			
Clinical parameter	**No abdominal drain group (n = 12)**	**Abdominal drain group (n=21)**	**p-value**
LOS (days) • Median (IQR)	• 5.5 (4.5)	• 7.0 (6.0)	0.096

Table 5: showing the LOS of both groups. As the data from both groups were non-continuous, they were expressed in median with the interquartile range. Mann Whitney U test revealed that there was no significant difference between both groups (p=0.096).

Discussion

The study aimed to investigate the efficacy of abdominal drains in reducing post-operative complications in patients undergoing elective colorectal surgery. It was hypothesised that the use of abdominal drains did not reduce post-operative complications. Statistical analysis revealed there was no significant difference in post-operative complications between patients that did not and did receive drainage. Hence, the hypothesis was accepted.

There was a higher percentage of patients that experienced post-operative fever and there was no significant difference (p=0.135). POD to pass flatus, POD to pass feces and post-operative ileus were used as surrogates for the return of bowel function. The patients in the drain group had a higher median number of days to pass flatus and feces. There was no significant difference if there was a drain or not. In the drain group, there was a higher percentage of patients that experienced post-operative ileus (p=0.452). In a meta-analysis, the results from 4 RCTs supported this and showed no significant difference whether a drain was present or not [7]. It could be considered that surgical drains promote the formation of dense adhesions or could be directly involved in the intestinal obstruction postoperatively [8]. As for SSI as a complication, there was a larger proportion of patients in the drainage group that experienced it and there was no significant difference (p=1.000). Theoretically, drains should allow flow of fluids from the peritoneal cavity, sparing the surgical scar and minimize the risk of local infection, but this was not observed in this study and in other papers like a meta-analysis [9]. Given that intraperitoneal drain insertion is invasive in nature, its potential for harm cannot be disregarded and there has been evidence to suggest that drains may impede wound healing and promote infection [3].

Only very few patients experienced pulmonary complications, VTE, 30-day mortality, clinical and radiological AL and there was no significant difference between the two groups (p=1.000). In a meta-analysis by *Zhang et.al* (2016) [10], it supported the findings. As drains were associated with increased pain and immobility, this could explain it leading to pulmonary complications [3]. Conventionally, surgeons believed abdominal drainage helped to guide exudates in flowing out of the abdominal cavity rather than accumulating when anastomotic dehiscence took place [10]. However, results from a meta-analysis showed that pus or enteric content appeared in the effluent of existing drain only in 1 of 20 clinical leaks [11]. Thus, based on this study and other papers, it could suggest that drains tend to get blocked quickly, cannot guide leakage out of the abdominal cavity efficiently and even stimulate the formation of serous fluid [10]. For non-surgical and surgical re-intervention, there was no difference between the groups and this concurred with results found in other studies [12].

In terms of LOS, the patients that received drainage had a higher median number of days and there was no significant difference between both groups. In the COMPASS cohort study by [3], it even proved that it was significant and drainage was associated with prolonged hospital stay ($p<0.001$).

There were several limitations of this study. Firstly, being a retrospective study there was a lack of randomisation and there could have been selection bias. Secondly, there was no criteria on which patients should receive abdominal drainage and it was done under the discretion of the surgeon, where they could have had different thresholds. Thirdly, the type, location and duration of drains used were not accounted for. Lastly, there was small participant number and for some post-operative complications, there was only 1 patient that experienced it. Low participant number makes it difficult to detect differences between the groups that may be present, which meant that conclusions may be limited due to inadequate power and a possible type II error. In future studies, large-sized well Randomised Control Trials (RCTs) could be conducted to eliminate bias. There could be an objective criteria on which patients received abdominal drainage and the type of drains, location and duration could be controlled. Also, a further area of research could be to look into the efficacy of abdominal drainage in emergency colorectal surgeries.

Conclusion

Abdominal drainage after elective colorectal surgery does not reduce the development of post-operative complications. The routine use of abdominal drainage can be avoided to minimize risk to patients. Further well-controlled Randomised Controlled Trials (RCTs) should be conducted to consolidate the evidence.

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Ethical approval

The study had approval from the appropriate institutional review board and met the guidelines of the responsible government agency and performed in accordance with 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study, formal consent was not required.

Ethical Guidelines

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institution and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study had approval from the appropriate institutional review board. For this type of study, formal consent was not required.

Conflict of interest

There is no conflict of interest on the part of any named author.

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