

# Abdominal Drainage in Complicated Appendicectomy - Resources Down the Drain?

Scarlet Nazarian,<sup>1</sup> Charlotte Boardman,<sup>1</sup> Ezzat Chohda,<sup>1</sup> Ankur Shah<sup>1</sup>

<sup>1</sup>Whittington Hospital, UK.

## ABSTRACT

**Background:** There is currently no clear consensus on the use of drains during an appendicectomy to prevent abscess formation. Our aim was to ascertain whether the use of drains in complicated appendicitis reduces post-operative complications and length of stay.

**Methods:** We performed a retrospective review of patients with complicated appendicitis undergoing appendicectomy from March-November 2018. Complicated appendicectomy (perforated or gangrenous appendicitis) patients were divided into two groups; with drain Group 1 (G1) and no drain Group 2 (G2). Groups were compared for post-operative complications and length of stay.

**Results:** Out of a total 76 patients, 26 (34%) had drain (G1) and 50 (66%) had no drain (G2). The pre-operative CRP in G1 vs. G2 (124.8 vs. 48.3,  $p=0.02$ ); post-operative complication 9 (34.6%) vs. 6 (12%),  $p=0.019$ ; intra-abdominal abscess 5 (19.2%) vs. 3 (6%),  $p=0.07$  and LOS 5.5 days vs. 3 days,  $p=0.0001$  were significantly higher in patients with a drain.

**Conclusions:** The use of an intra-operative drain in complicated appendicitis increases the risk of a post-operative complication and increases length of stay.

**Keywords:** Appendicectomy; complicated appendicitis; drain

## INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies, requiring an emergency operation. It commonly affects people aged between 10 years and 30 years. It carries a lifetime risk of 8.6% for males and 6.7% in females.<sup>1,2</sup>

Complicated appendicitis (CA) is defined as histologically proven gangrenous or perforated appendicitis.<sup>3-5</sup> The CA carries a small risk of mortality and a higher risk of morbidity compared to uncomplicated appendicitis.<sup>6</sup> Importantly, it has been associated with an increased risk of intra-abdominal abscesses (IAA).<sup>7</sup> Studies have shown that the risk of IAA in CA has an approximate incidence of 10%.<sup>8</sup> The IAA is associated with poorer outcomes in patients, longer hospital stay and increased costs. Therefore, prevention and timely management of IAA is vital.

The use of an intraoperative surgical drain to prevent postoperative IAA is controversial.<sup>9</sup> The role of a surgical

drain is to remove collected fluids including blood, pus and washout liquid.<sup>10</sup> Drains are functionally used to ensure timely removal of contaminated intra-abdominal fluid in order to prevent abscess formation. However, recent studies have suggested that the use of a drain may act as a foreign body, thereby increasing the risk of IAA causing longer hospital stay, without any benefits.<sup>11,12</sup>

The aim of this study was to assess the impact of using drains at surgery for CA with regards to IAA formation and length of stay (LOS).

## METHODS

A retrospective analysis of all patients undergoing emergency appendicectomies at a district general hospital between March 2018 to November 2018 was performed. All patients over the age of 16 with CA were included. CA was defined as histologically proven gangrenous or perforated appendicitis. Patients with evidence of caecal/ appendicular malignancy were excluded.

**Correspondence:** Scarlet Nazarian, General Surgery Specialist Trainee (ST3), Whittington Hospital, UK. Email: [scarlet.nazarian@nhs.net](mailto:scarlet.nazarian@nhs.net)/[scarlet\\_naz@hotmail.com](mailto:scarlet_naz@hotmail.com) Phone: +447817570243.

Patients were identified from the operation theatre database. All hospital numbers were collected and cross-referenced on the computer system with the discharge letters. All investigations were reviewed independently by 2 different surgeons. All complications and re-admission rates were noted on an excel sheet. The inpatient notes were reviewed for all patients with complications.

The notes were analysed and information was gathered in regards to the level of the operating surgeon, whether a drain was used or not, the presence or absence of 4-quadrant pus or peritonitis (4QP), preoperative white cell count (WCC) and CRP, and whether or not patients had imaging in the form of an ultrasound scan (USS) or computed tomography (CT) scan. The use of antibiotics, peri-operatively, was extracted from the operation notes.

All patients with CA were divided into two groups. Group 1 (G1) included patients who had a drain inserted; Group 2 (G2) were patients without a drain.

Post-operatively, all complications were noted, including any readmissions. These were categorized into intra-abdominal abscess (IAA), wound infection, respiratory pathology, ileus or post-operative abdominal pain. It was noted whether the IAA was diagnosed using USS and/or CT. LOS was calculated for all patients from date of admission.

This study was performed retrospectively from existing data. No risk was therefore posed to any of the patients as a result of this study. All patient information gathered was de-identified to ensure patient confidentiality.

Statistical analysis was performed using paired t-test, one-way ANOVA and Mann-Whitney U test for independent samples, such as age, preoperative WCC and CRP. Chi-Squared test was used for categorical variables, such as presence of 4QP and post-op complications. P values of  $\leq 0.05$  were considered significant. SPSS ®(26) was used. The study was reported in line with the STROCCS criteria.<sup>13</sup>

## RESULTS

A total of 76 patients were included in this study, of which 26 (34%) belonged to G1 and 50 (66%) to G2 (Figure 1).

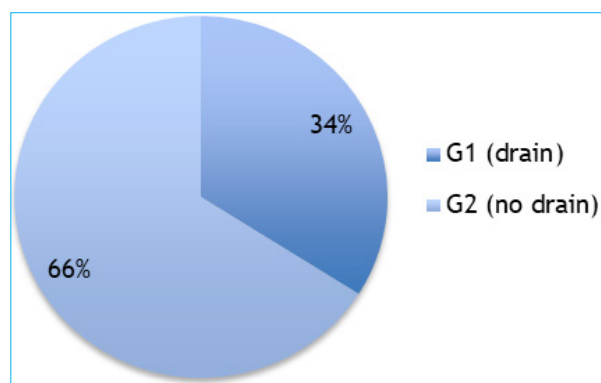


Figure 1. Percentage of patients included in the two groups.

There were no significant differences in patient age ( $p=0.11$ ) or pre-operative WCC count ( $p=0.97$ ) between G1 and G2. However, the pre-operative CRP was significantly higher in G1 than G2 (124.8 vs. 48.3,  $p=0.02$ ). Table 1 shows patient demographics and pre-operative factors in each study group.

Table 1. Patient demographics and pre-operative factors in G1 (drain) and G2 (no drain).

Factors	G1(n= 26)	G2(n=50)	p-value
Age (min-max)	39.62(17-82)	37.42(19-79)	0.11
Pre-op WCC / $\times 10^9/L$	15.1	14.6	0.97
Pre-op CRP	124.8	48.3	0.02
USS (%)	2(7.7)	5(10)	
CT scan (%)	16(61.5)	22(44)	

The presence of 4QP during surgery was mentioned in the notes of 5 (19.2%) patients in G1 and 2 (4%) patients in G2. This presented as a significant difference ( $p=0.029$ ) between the groups. All patients in G1 and G2 received antibiotics peri-operatively.

In G1; 9/26 (34.6%) patients had a post-operative complication, whilst in G2; 6/50 (12%) patients developed a complication. Overall morbidity was significantly higher in G1 compared to G2 ( $p=0.019$ ).

Post-operatively, 5 (19.2%) patients in G1 developed an IAA in spite of a drain, whilst 3 (6%) patients in G2 developed an IAA. There was no statistical significance in the rate of IAA between G1 and G2 ( $p=0.07$ ). A summary of post-operative complications occurring in each study group is shown in Table 2.

Table 2. Post-operative complications in G1 and G2.

Post-operative complications	G1 (n=26)	G2 (n=50)	p-value
Wound infection (%)	3 (11.5)	2 (4)	0.21
Pain (%)	1 (3.8)	1 (2)	0.63
Ileus (%)	3 (11.5)	0	0.04
Respiratory (%)	1 (3.8)	0	0.34
IAA (%)	5 (19.2)	3 (6)	0.07

LOS for patients was significantly higher in G1 compared to G2 ( $p=0.0001$ ). The median LOS was 5.5 days in G1 and 3 days in G2, with a range of 1-9 days vs. 4-27 days respectively.

In summary, the overall morbidity, post-operative ileus and length of stay was significantly higher in patients with an intra-operative drain insertion.

## DISCUSSION

There has been much debate regarding the use of intra-operative drains for complicated appendicitis. In this study we were not able to show a significant difference between patients with a drain and those going on to develop IAA ( $p=0.07$ ).

Several studies have shown that the use of a drain in CA does not reduce the risk of IAA, contrary to previous belief.<sup>14,15</sup> Sleem et al found that use of a pelvic or right lower quadrant drain intra-operatively during open or laparoscopic appendicectomy did not reduce the incidence of IAA.<sup>16</sup> Similarly, a meta-analysis by Cheng et al assessing the role of an intra-abdominal drain after open appendicectomy for CA concluded that there was no difference in development of IAA between those with a drain and those without.<sup>17</sup>

Pre-operative CRP was significantly higher in patients with CA who consequently went on to have a drain. Numerous studies have suggested that pre-operative CRP level is a useful predictor of surgical site infections (SSI) after appendicectomy.<sup>18,19</sup> Thus, in patients with a drain who go on to have post-operative IAA, it is unclear whether it is disease severity or the insertion of a foreign object that precipitates formation of infection.

Following drain insertion, morbidity was significantly higher, particularly in relation to post-operative ileus. We showed that patients with 4QP were more likely to receive a drain intra-operatively ( $p=0.029$ ). These patients had a higher disease severity and for this reason had a high pre-operative CRP, in keeping with our findings. Some may argue that the presence of intra-

abdominal contamination, including pus and faecal matter, may lead to post-operative ileus despite careful irrigation, however, the direct irritant effect of the drain on the bowel serosa may increase the risk of ileus.<sup>20</sup>

Prevention of post-operative ileus is a major goal of enhanced recovery programmes within surgery. Ileus leads to slower recovery and delays in discharge.<sup>21</sup> In our study the higher rates of ileus may have been a contributing factor to the significantly higher length of hospital stay (5.5 days vs. 3 days,  $p=0.0001$ ) shown amongst patients who had a drain inserted for CA. Similar to our findings, Schlottman et al also showed that use of drains was associated with a longer hospital stay and concluded that this was due to reduced mobility and adoption of the 'sick role' by patients.<sup>11</sup> In a case match study undertaken by Allemann et al, it was shown that patients without a drain had significantly reduced recovery time and significantly shorter hospital stay (4.2 vs. 7.3 days,  $p<0.0001$ ).<sup>12</sup> An increase in hospital stay has a huge effect on costs and resources.

This study has many limitations. Firstly, this was a retrospective study based on a single hospital. Secondly, when considering patient demographics, more information could have been gathered from the patient notes, for example comorbidities and social history. Use of immunosuppressive medication, chronic medical conditions or a history of heavy smoking may have effected the patients' complications and length of stay. Lastly, our sample size was relatively small. Ideally, a sample size calculation should have been made to determine the appropriate number of subjects needed to answer the study question. Future prospective trials with a larger cohort and/or randomised controlled trials are needed to accomplish definitive conclusions.

## CONCLUSIONS

In conclusion, the use of an intra-operative drain in complicated appendicitis increases the risk of morbidity post-operatively and increases the length of stay.

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