Primary Closure or Delayed Primary Closure? Assessment of Optimum Management of Surgical Wounds for Perforated Appendicitis

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Abstract

BACKGROUND: Open appendectomy is the treatment of choice for perforated appendicitis. Perforated appendicitis is associated with a 15–20% risk of developing post-operative wound infection, which is later associated with increased morbidity as increasing post-operative pain, longer hospital stay, suppurative wounds, patient dissatisfaction and increase cost of treatment. Some literatures revealed inconsistent results related to the incidence of surgical site infection (SSI) between delayed primary closures (DPC) and primary closure (PC) in open appendectomy for perforated appendicitis.

AIM: The objective of the study is to define the best practice of wound management in patients operated on for perforated appendicitis.

PATIENTS AND METHODS: One hundred and twenty patients having perforated appendicitis underwent open appendectomy enrolled in the study. The patients were randomly grouped according to the method of managing the surgical incisions into two groups; patients with their incisions closed primarily (PC) and those with their incisions left open to be frequently dressed for 5 days with Betadine-soaked gauze packing till it become clean then closed (DPC).

RESULTS: Out of the total 120 patients, 19.17 % developed SSI following closure of the incision. Patients managed by PC revealed higher rate of SSI than DPC group (32.8% vs. 5.1%, \( p < 0.001 \)) and longer hospitalization (8.3 vs. 6.4 days, with a \( p < 5\% \)).

CONCLUSION: DPC is preferred policy over PC when managing an open appendectomy wounds for perforated appendicitis, as the former is associated with low incidence of wound infection and shorter hospitalization.

Introduction

Acute appendicitis is still the most common surgical problem facing the surgeon in the emergency room [1]. Approximately, 250,000 cases of appendicitis are registered annually in the united states [2]. The collective incidence is between 105 in the Eastern Europe and 151 in the Western Europe per 100,000 population a year with a peak incidence being between the ages of 10 and 30 years [3]. Perforation incidence varies between studies from 16% to 40%, with a higher incidence seen in young age groups (40–57%) and in those older than 50 years (55–70%) [4].

Despite the routine use of broad-spectrum empirical antibiotics against the very predictable microorganisms in both complicated and uncomplicated appendicitis, still surgical site infection (SSI) is the most frequently observed postoperative morbidity in patients with perforated appendicitis reaching up to 25–50% in most of the reported series [5], [6], [7]. Postoperative wound infection is associated with prolonged postoperative pain, prolonged hospitalization and an added cost of extra health resources [8]. To primarily closure (PC) the wound or leaving it for delayed primary closure (DPC), is an important factor that affect the development of postoperative SSI infection. Leaving the wound open to be closed within 3–5 days (DPC) following appendectomy for perforated appendicitis is one policy aimed at decreasing SSI since the First World War [9].

Many studies recommend PC for incisions made for appendectomy of perforated appendicitis based on the availability of advanced well effective antimicrobials that can decrease the rate of SSI in such patients [10]. Chatwiriyacharoen (2002) and McGreal et al. (2002), both revealed that wounds of perforated or gangrenous appendicitis can be closed primarily most of the times [11], [12].

The idea of DPC is that it increases the blood flow and oxygen in the wound [13]. Also, a few days are allowed for the dirty wound to turn clean [10]. Delayed primary skin closure corresponds to a technique in which no special appliance is needed. It can be applied when...
The surgical wounds were carefully watched and possibly opened if signs of wound infection as purulent discharge, increasing redness, induration, or warm incision site evolved.

Collected data were: age, gender, symptoms duration (time lasting from the commencement of symptoms to surgery), WBC count at admission time, LOS and if SSI evolve.

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An associated medical comorbidities that might contribute to SSI were also recorded. Such conditions include diabetes, overweight (BMI > 30 kg/m²), malnutrition which was diagnosed clinically by observing wasted muscles or with a serum albumin level <25 g/l, use of steroid, and diseases related to the heart [16].

Patients who were immunocompromised as having malignancy, uremic or having chronic liver disease or liver cirrhosis were excluded from the study.

Statistical analysis

Chi-square and Fisher exact tests were applied to assess if there is any relation existed between the development of SSI and the method used to close the wound. Student t-test applied for mean comparisons (for continuous variables). A p < 0.05 was regarded significant. The data were expressed as a mean±standard deviation, percentage forms, or as a frequencies.

Results

One hundred and twenty patients enrolled in our study. Sex distribution was 77 males and 43 females. Their mean age was 35.1 years (ranging 5–81 years). No patient was lost from the current study. No perioperative death or major morbidity as organ impairment, leak from the stump of the appendix or intraperitoneal collection was recorded.
All of the 120 patients received the assigned method of wound managements, 61 in the PC group and 59 in the DPC group. The two groups were nearly comparable with no statistical differences with regard to the age and gender (p 0.644 and 0.663 respectively) (Table 1). The distribution of patients in the two groups with one or more risk factors (associated comorbidities) was also nearly equal (12 patients in DPC group vs. 10 in the PC group, p 0.641). Furthermore, the study revealed no significant differences with regard to symptoms duration and WBC count between DPC and PC group (p 0.107 and 0.157, respectively) (Table 1).

Table 1: Patient's demographic and clinical criteria

<table>
<thead>
<tr>
<th></th>
<th>DPC (No=59)</th>
<th>PC (No=61)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male: Female</td>
<td>39:20</td>
<td>38:23</td>
<td>0.663</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>34.2 ± 19.6</td>
<td>35.9 ± 21.6</td>
<td>0.644</td>
</tr>
<tr>
<td>SSI</td>
<td>3 (5.1%)</td>
<td>20 (32.8%)</td>
<td>0.00029</td>
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<tr>
<td>Associated comorbidities factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients with one or more comorbidity</td>
<td>12 (20.33%)</td>
<td>10 (16.39%)</td>
<td>0.641</td>
</tr>
<tr>
<td>Diabetes</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Malnourishment</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Use of corticosteroids</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Cardiovascular problems</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Over weight (BMI &gt; 30 kg/m²)</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Time from onset of symptoms to surgery (days): 2.7 ± 0.4</td>
<td>2.3 ± 0.3</td>
<td>0.107</td>
<td></td>
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<td>White blood cell count (&gt;10000/uL): 16.7 ± 1.1</td>
<td>14.6 ± 0.5</td>
<td>0.157</td>
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<tr>
<td>Length of hospital stay: 6.4 ± 0.7</td>
<td>8.3 ± 0.9</td>
<td>0.038</td>
<td></td>
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</tbody>
</table>

In our study, a total of 23 out of 120 patients (19.17%) developed SSI. The results of the infected wound cultures were Escherichia coli (58%), then Bacteroides fragilis (29%), and different Streptococci species (18%). These bacteria were fitting those isolated in cultures from ascetic fluid during surgery (Table 2). Three wounds in the DPC group discharged pus 3 days after being closed. These wounds were opened and the discharge culture revealed E. coli, which was similar to the bacteria obtained from ascetic fluid during surgery. The remaining wounds were closely followed up for 14 days, no wound require reopening. Therefore, the rate of SSI in the DPC group was 3/59 (5.1%) (Table 1).

Table 2: Types of organisms obtained by culturing intraperitoneal and the wound pus

<table>
<thead>
<tr>
<th></th>
<th>Ascetic fluid (No=125)</th>
<th>Wound discharge (No=23)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>DPC (No=59)</td>
<td>PC (No=61)</td>
</tr>
<tr>
<td>No growth</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>38</td>
<td>44</td>
</tr>
<tr>
<td>Bacteroides fragilis</td>
<td>34</td>
<td>31</td>
</tr>
<tr>
<td>Streptococci species</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Pseudomas aeruginosa</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Clostridial species</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>

In our study, the rate of wound infection was 5.1% versus 32.8% for DPC and PC, respectively. Our results are nearly compatible to those by Ali et al., who revealed much higher rate of wound infection in the PC group than in the DPC one (36.67% vs. 6.67%) respectively with p < 0.005. In Ali et al. study, a total of sixty patients with perforated appendicitis were included, 30 patients were managed by PC and the other 30 were managed by DPC. Eleven patients out of thirty in the PC group and only two patients out of thirty in the DPC group developed wound infection [24]. In Ruy-En et al. study, a total of 70 patients with perforated appendicitis were randomly studied for the development of wound infection following primary and DPC. SSI occurred in 21.4% (15 patients). The incidence of SSI was higher for those managed by PC (38.9% vs. 2.9%, p < 0.001) [25]. Another study by Panhwar et al. in which sixty patients...
with perforated appendicitis were included. Twenty out of sixty patients (33.3%) developed wound infection. No significant statistical difference was seen between PC group and DPC group (43.3% and 23.3% - p = 0.10), but a half decrease in the incidence of wound infection in the delayed primary group observed. May be a more number of patients need to be enrolled [26]. In Ahmad et al., A total of 158 patients with perforated appendicitis assigned into two groups (PC group and DPC group) each 79 patients. Thirty-six (22.8%) patients developed wound infection. A significant association between the occurrence of wound infection and type of skin closure found (6.3% in DPC vs. 39.2% in PC, p < 0.000) [27]. Managing the wounds using DPC decrease the number of colonic bacteria in the surgical wound, more precisely reducing anaerobic contamination of the wound [28]. However, DPC has the detriment of permitting Staphylococci bacteria to infect wounds of other patients before time to close the wound reached [19].

In our study, there was nearly equal sex distribution between DPC and PC group with p = 0.663, which fit a study achieved by Siribumrungwong et al. who also found no difference with regard to the sex distribution with p = 0.42 [14]. Also, in the current study, the mean age in those managed by DPC was 34.2 years while that for those dealt with PC was 35.9 p = 0.644. Such results are nearly comparable with study described by Chiang et al. [25], which found comparable mean age between the two groups (38.2 years for DPC group vs. 37.5 years for PC group). With regard to the duration of symptoms in the current study, it ranges from 1 to 3 days in both DPC and PC groups. In the study performed by Meka and Anasuri the mean duration of symptoms ranges from 1 to 4 days [29].

The current study revealed significant difference with regard to the total post-operative hospitalization length (6.4 ± 0.7 days in DPC group vs. 8.3 ± 0.9 days in PC group p = 0.038). Such result does not agree those by Siribumrungwong et al. [14], who revealed no significant difference with regard to LOS between the two groups. But, it agrees with systematic review and meta-analysis by Tang et al. that revealed significant difference in the LOS between patients managed by DPC and those managed by PC; the mean difference was 0.39 and p value of 0.0004) [30].

Our study revealed that the most common bacteria isolated from the wounds were E. coli (58%), then B. fragilis (29%), and different Streptococci species (18%). Such results agrees results by Mostafa et al. [31] who also revealed that the commonest organisms obtained by culturing the infected surgical incisions were E. coli (46.1%), then B. fragilis (23%), and various Streptococci species (15%).

The main limitations of the study was when applying the DPC because many patients frequently complain of the pain associated with the frequent change of dressing and the psychological upset of seeing the wound still open and the fears of the expected pain when the wound going to be closed under local anesthesia.

Conclusion

DPC is preferred policy over PC when managing an open appendicectomy wounds for perforated appendicitis, as the former is associated with low incidence of wound infection and shorter hospitalization.

Recommendations

It is recommended that wounds made for open appendicectomy for perforated appendicitis left open for frequent daily dressing using betadine or normal saline till the wound become clean and be ready for closure, usually within 3–5 days.

References

PMid:27830041


PMid:28288060

PMid:17522514

PMid:29946346

PMid:24238751

PMid:4334929

PMid:34367794


PMid:25992746


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