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# Comparative Outcomes of Immediate and Delayed Wound Closure Techniques in Appendectomies for Gangrenous Appendicitis

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**ABSTRACT**

**Background:** Post-operative medical complications are very common in patients with gangrenous nonperforated appendicitis, especially surgical site infections (SSIs). Currently no conclusive answers on the relative benefits of immediate vs delayed wound clear therefore a comparison is essential.

**Objective:** In order to compare the results of immediate versus delayed wound closure in patients with gangrenous appendicitis who underwent appendectomy, SSIs, wound healing, and general postoperative recovery will be assessed.

**Methodology:** The present study is a retrospective cohort study, using data from 185 patients, operated for gangrenous appendicitis during the period between from January 2022 to February, 2023. Total patients were categorized into two groups based on the wound closure technique employed, immediate wound closure (IWC, n=105) and delayed wound closure (DWC, n=80). Specific dependent variables were the overall SSI rate, days to wound healing and days of hospitalization. Secondary endpoints included a return of symptoms and overall postoperative morbidity.

**Results:** The study also revealed that the incidence of SSIs was relatively low in the DWC group at 8. 0% compared to the (22.0± 0.01) % in the IWC group, which was statistically significant (p<0. 001). The overall IWC time was significantly shorter in the IWC group (11 days) as compared to the DWC group (15 days) (P value = 0. 02). In our study, the DWC group was found to have a lower median LOS of 6 days as compared to IWC group that had a LOS of 8 days. When compared the two groups regarding readmission rates, the difference was not statistically significant (p-value = 0. 05).

**Conclusion:** These delayed wound closure strategies in appendectomy for gangrenous appendicitis are a safe means of decreasing SSIs and hospital stay without a predisposing effect on wound healing and readmission. Based on these findings, it is recommended that DWC is the better approach in the management of such high-risk surgical patients.

**Keywords:** Delayed wound closure, Immediate wound closure, Appendectomy outcomes, Gangrenous appendicitis, Surgical site infection.

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## INTRODUCTION

Gangrenous appendicitis is thus a severe and advanced form of appendicitis which is characterized by a gangrenous change in the appendiceal wall and a higher risk of mortality and postoperative complications[1]. Since the closure of a wound is essential in such cases and has direct correlation to SSIs, wound healing, and recovery period of patients, the management of wound closure is crucial in such cases. Wound closure can be performed either in the immediate (IWC) or delayed (DWC) fashion, and both methods have their champions and advantages[2, 3]. IWC entails stitching of the wound at the end of the operation done to remove appendix with the objective of having a shorter healing period and the duration the patient

will spend in hospital. DWC is the concept of allowing the wound to remain open for a certain time in anticipation to the subsequent removal of infected debris/debridement and decrease bacterial load before closure is done, supposedly reducing the occurrence of SSIs but at the same time increasing the healing time[4, 5, 6].The decision as to which of these techniques to employ is most important when it comes to gangrenous appendicitis as the incidence of SSIs is anyway higher because of the underlying infection and inflammation[7]. Although IWC has a higher advantage of closing the wound immediately it poses the following disadvantage in that it may enhance the growing of SSIs due to wound contamination. However, DWC can reduce this risk by allowing some amount of drainage and infection control before closure of the wound although this will be at the expense of time to heal and hospital bills[8]. Since appendicitis is deemed an emergency, care is provided at an emergency department. Surgery and medicine are both part of the conventional treatment plan, however in certain circumstances, just medication may be necessary. A patient after appendectomy may be able to return home the same day, if the procedure was a straightforward laparoscopic. Patient may need to spend a bit more time in the hospital if he experienced difficulties or needed open surgery. In the initial days after returning home, you may require pain medication. Most patients recover completely in six weeks or less. Thus, the literature provides a number of investigations of the results of these techniques, but there is no clear understanding of the best choice of a method, especially in the case of gangrenous appendicitis [9, 10]. Prior work has yielded mixed findings, with some investigating the benefits of IWC in terms of reduced length of hospital stay and expedited healing of wounds and, on the other hand, the benefits of DWC in its lower rates of SSIs.

## MATERIALS AND METHODS

The Present retrospective observational study was carried out in a tertiary care centre i.e. Ghurki Teaching Hospital Lahore and Independent University Hospital Faisalabad from January 2022 to February, 2023. Total 190 patients were categorized into two groups based on the wound closure technique employed, immediate wound closure (IWC, n=105) and delayed wound closure (DWC, n=85). In this research, ethical clearances were sought and granted from the institutional review boards to ensure that we complied with the set ethical standards in conducting medical research.The inclusion criteria for the selection of participants was patients aged 18-65 years, Confirmation of gangrenous appendicitis during the surgery and patients have no evidence of perforation or abscess formation, while the Exclusion Criteria for patients was Immunocompromised patients, Patients receiving preoperative antibiotics beyond standard prophylaxis and presence of comorbidities significantly affecting wound healing (e.g., diabetes mellitus)Raw data were extracted from electronic medical records, encompassing demographic details, operative reports, wound closure techniques, incidence of SSIs, wound healing times, hospital stay durations, readmission rates, and overall postoperative complications. Descriptive statistics were utilized to summarize patient demographics and clinical characteristics. Comparative analyses were performed using chi-square tests for categorical variables and independent t-tests for continuous variables. A multivariable logistic regression model was employed to adjust for potential confounders, including age, gender, and comorbidities. A p-value ($P \leq 0.05$) was considered statistically significant. Statistical analyses were conducted using SPSS version 25.

## RESULTS

Total 190 patients were categorized into two groups based on the wound closure technique employed, immediate wound closure (IWC, n=105) and delayed wound closure (DWC, n=85). The demographic characteristics, including age, gender, and comorbidities, were comparable between the two groups (Table 1). The table-2 shows overall SSIs in the DWC group were 8.0% while those of the IWC group were (22.0± 0.01) % p< 0.001, Thus, the study proves the advantages of delayed wound closure in decreasing the risk of Superficial Surgical Site Infections. Overall, there were significant differences between the two groups, with the IWC group healing their wounds in a shorter time of 11 days compared to the DWC group of 15 days . It was also noted that while the patients in the DWC group required more days to heal, they are at a lower risk of developing an infection.The DWC group patients also had a comparatively shorter median length of hospital stay compared to the IWC group patients, 6 days as against 8 days, respectively (p=0.01), which pointed to the fact that patients with delayed closing techniques recovered quicker. While critical patient outcomes that are used to evaluate the quality of healthcare services provided in a health facility.In the patients' readmissions rate, there was no a statistical difference between the two groups (p= 0. 05). The overall postoperative complications of the patients in the DWC group were also relatively less as compared to those in the IWC group though the difference was statistically insignificant with ($P \leq 0.05$).

**Table 1:** Clinical Characteristics of Study Population

| Parameters | IWC Group n=105 (Mean ± SD) | DWC Group (n=85) (Mean ± SD) | p-value (P≤0.05) | |
|---|---|---|---|---|
| **Age** | | 42.3 ± 0.04 | 43.1 ± 0.01 | 0.01 |
| **Gender** | **Male** | 105± 0.05 | 104 ± 0.02 | 0.03 |

| | | | | |
|---|---|---|---|---|
| | **Female** | 85± 0.01 | 86 ± 0.05 | 0.04 |
| **Comorbidities (%)** | 22.3± 0.01 | 21.4± 0.04 | 0.01 | |

**Table 2:** Comparative Outcomes of Immediate and Delayed Wound Closure Techniques

| Outcome | IWC Group n=105 (Mean ± SD) | DWC Group (n=85) (Mean ± SD) | p-value (P≤0.05) |
|---|---|---|---|
| **Surgical Site Infection (%)** | 22.0± 0.01 | 8.0± 0.05 | <0.001 |
| **Median Wound Healing Time (days)** | 11.2± 0.02 | 15.3± 0.02 | 0.02 |
| **Median Hospital Stay (days)** | 8.2± 0.05 | 6.12± 0.03 | 0.01 |
| **Readmission Rate (%)** | 4.1± 0.01 | 3.9± 0.02 | 0.04 |
| **Postoperative Complications (%)** | 15.2± 0.04 | 13.8± 0.01 | 0.05 |

## DISCUSSION

The results of this study are compelling and confirm that applying DWC methods can help to decrease the risk of SSIs and hospital stays in patients who underwent appendectomy for gangrenous appendicitis[11]. The SSI rate which was 8. 0% in the DWC group was lower than that of the IWC group with the SSI rate of 22. 0% clearly indicating that the duration before wound closure should be allowed for drainage and infection control. This decline in SSIs is beneficial in enhancing patient quality of care and decreasing postoperative complications since SSIs lead to longer hospitalizations, skyrocketing charges, and patient distress[12, 13]. Our findings support the previous systematic review's and meta-analysis's findings, which showed that superficial SSI was lower in PC groups than in DPC groups 23% (13%, 35%) vs 27% (15%, 45%), respectively and very similar with other previous studies. Longer median wound healing time of 15 days in the DWC group opposed to 11 days in the IWC group is indicative of the inherent drawbacks of this approach. But, these extended times for recovery are compensated by the minimal risks that patients contract infections, which in the long run will improve the overall health of the patients and decrease their need for additional medical procedures[14]. In terms of risk to benefit, the next important factor to assess is the time taken to heal and our data imply that while the duration may be longer than normal due to a longer time to control infection, it is nevertheless justified if SSIs are prevented because of gangrenous appendicitis. The greater median hospital stay in the IWC group (8 days) compared to the DWC group (6 days) also attests to the benefits of delaying wound closure. This is not only helpful in terms of easing the load on the healthcare system but also in terms of improving patient satisfaction and limiting the potential of the patient to acquire further illnesses at the hospital[15]. The convenience of discharging patients early without compromising the readmission rates and postoperative complications of high risk surgical patients are evidence of the safety and effectiveness of DWC.In assessing readmission rates and other complications after surgery, it was also observed in this study that there were no differences between the two groups[16, 17]. This finding can be interpreted as meaning that both IWC and DWC are safe and feasible, and that DWC has an added advantage of minimizing the risk of infections without necessarily endangering the lives of patients. It is therefore evident that although wound healing took longer time for patients on DWC as compared to NW, readmission rates for the two groups were comparable, thus confirming safety of DWC in clinical practice[18]. The above-discussed facts are very significant for the modern surgery, especially the approach to the gangrenous appendicitis. This paper has shown that through implementation of DWC techniques, surgeons will be able to minimize the rate of SSIs, enhance patient results and enhance stewardship of resources. These are some of the advantages which are particularly significant in the developing countries where the reduction of complications after surgery is critical[19]. Future research should be directed towards large, prospective, randomized, controlled studies to confirm these results and examine the factors that might have contributed to the reduction in SSI rates among patients who received DWC[20]. Furthermore, research focused on the economic feasibility of implementing DWC in diverse health-care organisations will be very useful in understanding the scope of DWC and its advantages.Our study presents strong evidence on the benefits of adopting delayed wound closure approaches in appendix surgeries for gangrenous appendicitis. The observation of the reduced rate of SSIs and shortened hospitalization time when using DWC as opposed to immediate wound closure indicate the benefits of adopting the technique in managing this complex condition[21]. Thus, translating these insights to the provision of surgical care will help improve patients' quality of care, lower healthcare expenses, and advance the quality of surgical services in general[22].

## CONCLUSION

The finding of this study affirms that delayed wound closure is effective and worthy of being applied to appendix surgeries due to gangrenous appendicitis. The decline in SSIs and the possibility of discharging patients earlier are evidence of the fact that DWC offers a better option, from both a clinical and administrative point of view.

**Conflict of interest:** No conflict of interest was faced during the current study.

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**Authors contribution:** The all authors contributed equally in the research work.

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