The Frequency of Wound Infection with Single Layer versus Multiple Layer Closure of Wound in Patients undergoing Major Surgeries

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ABSTRACT

Objective: To compare the frequency of post-operative wound infection with single layer versus multiple layer closure of wound in patients undergoing major surgeries.

Study Design: Quasi-experimental Study.

Place and Duration of Study: Department of Surgery, Combined Military Hospital, Rawalpindi Pakistan, from Aug 2018 to Aug 2019.

Methodology: After getting written consent and considering the inclusion criteria 150 patients were chosen for this study. They were indiscriminately separated in two groups by using chit method. In Group A, patients underwent surgery with single layer closure. In Group B, patients underwent surgery with multiple layer closure. Most of surgeries were done under general anesthesia. Then post-operative wound infection was noted in the patients of both groups by using proforma. SPSS version 20 was used for all the collected data analysis.

Results: In this study mean age of the patients in Single Layer Group was 48.17±9.07years and in Double Layer Group was 51.55±18.72 years. Male to female ratio was 1:1.03. The most common cause of surgery was colostomy closure found in 34(22.67%) patients. Wound infection noted in 19(12.67%) patients. In Single Layer Group patients the wound infection was found in 4(5.3%) patients whereas in Double Layer Group the wound infection was noted in 15(20%) patients (p-value=0.007). Conclusion: Single layer closure is safe technique which showed significantly less post-op wound infection than to double layer closure of skin in patients undergoing major surgeries.

Keywords: Double layer, Major surgeries, Single layer, Wound infection.


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INTRODUCTION

The techniques used for wound closure either traumatic or surgical induced has been evolved time by time from the earliest development of suturing materials which consists of synthetic sutures, absorbable sutures, staples, tapes, and adhesive compounds. The knowledge of mechanism of wound healing, skin anatomy and selection of suture material as well as the method used for closure is necessary for the best output of wound closure, either surgically induced or trauma related wound. The selection of particular suture material and wound closure procedure are required for ensuring optimal wound healing.1

After saphenectomy in coronary artery bypass graft surgery CABG, single-layer leg wound is better than double-layer closure and has lower ASEPSIS wound score.2 Single-layer closure minimizes the time used for closure of the wound, incidence of wound rupture and the incidence of wound site hernia.3,4 One randomized trial showed that wound infection was present in 18% (9/50) patients with single layer while 30% (15/50) patients with conventional layered closure underwent laparotomy. The difference was significant (p=0.001).5 Another randomized trial manifested that wound infection was absent in all patients with single layer (0/52) while 16% (4/25) in patients underwent coronary artery bypass graft. The difference was significant (p=0.003).6

But one study showed that wound infection was present in 2.5% (1/40) patients with single layer and 10% (4/40) in patients underwent closure of midline abdominal incisions. The difference was significant (p=0.166).7 One more randomized trial supported the evidence and showed that wound infection was present in 4% (4/100) patients with single layer as well as in 4% (4/100) patients underwent ear surgery for Chronic suppurative otitis media. The difference was significant (p>0.999).8

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Rationale of this study was to compare the frequency of post-operative wound infection with single layer versus multiple layer closure of skin in patients undergoing major surgeries. Through literature, it has been noticed that post-operative wound infection occurred in more patients underwent multiple layer closure as compared to single layer closure. But contradictory results are present in literature and there is no local evidence available in this regard. That is why we want to perform the study to confirm the evidence that either single layer is more effective or multiple layer for prevention of wound infection. So that we can implement the results of this study. This will aid us to achieve local magnitude and enhance our better performance in wound closure.

**METHODOLOGY**

The quasi-experimental study of Surgical Department of Combined Military Hospital, Rawalpindi Pakistan was done from August 2018 to August 2019. 

**Inclusion Criteria**: The patients of both genders of age from 20-80 undergoing major surgeries were selected for this study.

**Exclusion Criteria**: The patients having liver disease, renal disease, hypertension, diabetes mellitus, malnutrition, immunocompromised or undergoing redo surgery.

After getting approval from ethical committee 150 patients fulfilling the required criteria for our study were enlisted from the Surgical Department, Combined Military Hospital, Rawalpindi. Written informed consent was taken and demographic profile (name, age, gender, cause of surgery and contact) was noted. They were indiscriminately separated in two groups by using chit method. In group A, patients undergo major surgery with single layer closure. In group B, patients undergo major surgery with multiple layer closure. Most of the surgeries were done under general anesthesia. The patients were managed in surgical ward after surgery. After discharge from ward, the patients were followed-up in OPD for 10 days for assessment of wound infection and all this information was noted on proforma.

Data was entered and analyzed through SPSS version 20. Mean and standard deviation was calculated for the quantitative variables like age. Frequency and percentage was calculated for the qualitative variables like gender, cause of surgery and wound infection. Chi-square test was used to compare both groups for wound infection with significant p-value <0.05. Data was stratified for age, gender and BMI. Stratified groups was compared with the help of Chi-square.

**RESULTS**

The mean age of the patients in single layer group was 48.17±19.07 years whereas the in double layer group was 51.55±18.72 years Table-I.

<table>
<thead>
<tr>
<th>Study Groups</th>
<th>Age (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Standard Deviation</td>
</tr>
</tbody>
</table>

The study results manifested that in single layer group the wound infection was found in 4(5.3%) patients whereas in double layer group the wound infection was noted in 15(20%) patients with p-value=0.007, Table-II.

<table>
<thead>
<tr>
<th>Study Groups</th>
<th>Wound Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p-value</td>
</tr>
<tr>
<td></td>
<td>Single Layer</td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
</tr>
<tr>
<td>No</td>
<td>71</td>
</tr>
</tbody>
</table>

According to age groups, the patients with age ≤50 years, the wound infection was found in 2(4.9%) patients in single layer group whereas in 10(28.6%) in double layer group with p-value<0.05. Similarly among patients with age >50years, the wound infection was found in 2(5.9%) patients in single layer group whereas in 5(12.5%) in double layer group with p-value >0.05, Table-III.

<table>
<thead>
<tr>
<th>Study Groups</th>
<th>Wound Infection</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Layer</td>
<td>Double Layer</td>
</tr>
<tr>
<td>≤ 50 Yes</td>
<td>24(4.9%)</td>
<td>10(28.6%)</td>
</tr>
<tr>
<td>≤ 50 No</td>
<td>39(95.1%)</td>
<td>25(71.4%)</td>
</tr>
<tr>
<td>&gt; 50 Yes</td>
<td>25(5.9%)</td>
<td>5(12.5%)</td>
</tr>
<tr>
<td>&gt; 50 No</td>
<td>32(94.1%)</td>
<td>35(87.5%)</td>
</tr>
</tbody>
</table>

In male patients, the wound infection was found in 0(0.0%) in single layer group whereas in 11(31.4%) in double layer group with p-value <0.05. In female patients, the wound infection was found in 4(11.1%) in single layer group whereas in 4(10.0%) in double layer group with p-value >0.05, Table-IV.
Table-IV: Comparison of wound infection in both groups stratified by gender (n=150)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Wound Infection</th>
<th>Study Groups</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single Layer</td>
<td>Double Layer</td>
</tr>
<tr>
<td>Male</td>
<td>Yes</td>
<td>0(0.0%)</td>
<td>11(31.4%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>39(100%)</td>
<td>24(68.6%)</td>
</tr>
<tr>
<td>Female</td>
<td>Yes</td>
<td>4(11.1%)</td>
<td>4(10.0%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>32(88.9%)</td>
<td>36(90.0%)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

This study was performed at department of surgery, CMH, Rawalpindi to estimate the frequency of post-operative wound infection with single layer versus multiple layer closure of skin in patients undergoing major surgeries.

The proper method of closure and good blood supply to skin is necessary for having good wound healing. The importance of the role played by sutures in this cannot be exaggerated; however, the suture technique has been found out to be equally important in surgery. The wound healing is multifactorial problem even though monolayer wound closure is proved to be superior in terms of wound healing, strength and security.

In our study the most common cause of surgery was colostomy closure found in 34(22.7%) patients, followed by bypass found in 30(20%), hernia repair cause of surgery found in 30(20%), ileostomy in 29(19.3%) patients, gastric cause in 17(11.3%), splenectomy in 6(4%) and pancreatic cause in 4(2.7%). The wound infection noted in 19(12.7%) patients. In single layer group the wound infection was found in 4(5.3%) patients whereas in double layer group the wound infection was noted in 15(20%) patients with p-value=0.007.

One study showed that wound infection was present in 2.5% (1/40) patients with single layer and 10% (4/40) in patients underwent closure of midline abdominal incisions. The difference was significant (p=0.166).7One more randomized trial supported the evidence and showed that wound infection was present in 4% (4/100) patients with single layer as well as in 4% (4/100) patients underwent ear surgery for Chronic suppurrative otitis media. The difference was significant (p>0.999).8

A study by Mohammad Salman Siddiqi et al.6 documented about the leg wound closure he said that if leg wound closed in single layer along with suction drain resulted better outcome of wound as compared to leg wound closed in double-layer. He also observed that, the better wound healing in the single layer closure might be because of limited handling of the tissues and a decreased leg edema.

Multiple studies have documented that post-operative complications ratio which is definitely low in single layer closure than in traditional layered closure. The incidence of post-op seroma formation in MV Sreeharsha et al.5 study was 10% in routine layered closure and 6% in single layer closure group that means incidence of post-op seroma formation is higher in routine conventional layered closure group.

Chowdhury Sk and Chowdhury JD,11 was 22.5% and 47.5% in single layer closure and conventional layered closure respectively. Gurjit Singh and Rajat Ahluwalia4 conducted a study on midline abdominal incisions in which they compared between mass closure versus layered closure. They described the benefits of single layer closure method as compared to layered closure method in case of less time consumed for closure of wound, reduced chance of wound dehiscence and decreased incidence of incisional hernia. However, they could not able to tell the exact chances of burst abdomen and incisional hernia because of the short duration of study and small number of cases without a long follow up.

AkashBande et al.9 conducted a study on closure methods of laparotomy wounds in which they compared single layer closure versus routine layered closure. They showed that single layer technique consumed 18.2±3.2 minutes for closure of wound and conventional layered closure consumed 26.4±4 minutes for closure of the wound, it manifested that single layer closure required remarkable less closure time in comparison to routine conventional layered closure, time of (p<0.001). Also, single layer closure causes significantly less postoperative complications (17.18%) as compared to the routine layered closure (42.42%).

Zafar et al.2 conducted a study on the two different techniques of wound closure, one is single layered closure another is multilayered closure and showed that single layer wound closure is better than the conventional layer wound closure.

The studies conducted by Kiaii et al, and Allen KB12,13 et al on the two different methods of leg wound closure after taking saphenous vein graft showed that single layer closure over drain caused less post-operative edema as compared to routine layered closure method. This might be because of decreased space owing to extraction of the post-operative collect-ed blood and minimal tissue handling when using the single-layer closure technique.
The study by Santoshkumar N Deshmukh et al. showed that Mass closure method is less time consuming, more cost effective and safe for closure of midline laparotomy incisions. The study by Rajneesh Kumar et al. concluded that Single Layer Closure method is superior than conventional layered closure in terms of time duration of operation and post-operative complications and other studies by Ganesh S Bhavikatti and by Kumar et al. Concluded that mass closure (monolayer closure) is significantly better than layered closure technique so far as wound infection is concerned.

The comparative study conducted in Ibn-e-Siena Hospital Multan by Khan et al. mass closure single layer with proline is better than conventional layered closure to get of early and late wound strength.

CONCLUSION

This study concluded that single layer closure is safe technique which showed less post-op wound infection than to double layer closure of skin in patients undergoing major surgeries.

Conflict of Interest: None.

Author’s Contribution

Following authors have made substantial contributions to the manuscript as under:

ZS & AJ: Study design, drafting the manuscript, concept, critical review, approval of the final version to be published.

N & MZ & MYS: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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