Original Article
DOI: https://doi.org/10.70749/ijbr.v3i1.424

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Crossref

OPEN ACCESS

Effects of Stitch Length on Wound Complications After Closure of Incision

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ARTICLE INFO

Keywords

Stitch Length, Wound Complications, Surgical Site Infections, Incisional Hernias, Wound Healing, Suture Technique.

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Declaration

Author's Contributions: All authors contributed to the study and approved the final manuscript.
Conflict of Interest: The authors declare no conflict of interest.
Funding: No funding received.

Article History

Received: 10-10-2024
Revised: 15-12-2024
Accepted: 27-12-2024

ABSTRACT

Background: Surgical incision closure is essential for wound healing and postoperative recovery. Stitch length plays a critical role in preventing complications such as infection, dehiscence, and delayed healing. Optimal stitch length ensures tissue approximation without excessive tension, yet its precise impact on wound complications remains unclear. **Objective:** This study aims to evaluate the effects of different stitch lengths on wound complications after surgical incision closure, with a focus on surgical site infections (SSIs), incisional hernias, and delayed healing. The goal is to identify optimal suture techniques for better postoperative outcomes. **Methods:** A comparative study was conducted at a tertiary care hospital Pakistan Institute of Medical Sciences PIMS, involving 200 patients who underwent midline incision closure with either long or short stitch lengths. Data were collected through patient interviews, direct observations, and medical record reviews. Wound complications and recovery parameters were analyzed to identify significant patterns and risk factors. **Results:** The study found significantly higher rates of wound complications, including superficial and deep infections, wound dehiscence, and incisional hernias in the long stitch group compared to the short stitch group. Shorter stitch lengths resulted in a higher SL to WL ratio and fewer complications. **Conclusion:** Shorter stitch lengths with a higher SL to WL ratio reduce the incidence of wound complications following surgical incision closure. These findings suggest that adopting shorter stitch lengths may improve patient recovery and minimize healthcare costs associated with postoperative complications.

INTRODUCTION

Surgery wound closure is an important step of the operative procedures, which has an explicit effect on the succeeding processes of wound healing and general postoperative course (Fani et al., 2024; Słonimska et al., 2024). The specific suture technique chosen, suture size and length also have a significant role in mechanical wound stability and healing, as well as risk of subsequent wound events such as infection, dehiscence or delayed healing (Maurício et al., 2023; Chen et al., 2024). Stitch length results in the approximation of the tissue edges without undue tension to support function and appearance. But there is always a risk, if stitch length is not ideal into a proper proportion, tensile strength will decrease or else ischemia and necrosis of wound margins occur (Ehlers, 2024).

Wound complications are the most common cause of morbidity and prolonged hospitalization, increased medical cost, and declined patient satisfaction after surgery (Weber et al., 2024). Thus, wound infection rates may be as high as 30% for contaminated surgery and 2%C15% for clean

surgery, as stated by Dellinger, 1995. These results are affected and influenced by several factors, surgical such as suture material, tension, and stitch length and patient factors such as diabetes, obesity and smoking.

According to recent studies, the length-to-bite ratio is crucial for suturing; a 4:A 1:1 ratio works well to minimize Wound Complications The study conducted by Santema, et al in 2014 showed that. It is worth noting that, by ensuring that the suture loops come on a larger area, this reduces the possibilities of ischemia and local tissue stress hence enhancing the healing process. By increasing the stitch densities, shorter stitch lengths also result in more strain and tissue strangulation, which would increase the risk for wound infection and wound dehiscence (Buote, 2022).

In recent years, understanding of stitch length has not changed much, into how it influences wound complications even though methods used, and materials have advanced (Fritts, Herrick, Frasier, Babkowski, & Radillo, 2024). Arguments exist that stitch length of more than 15mm increases vascularization and relieves tension; arguments exist that cosmesis is optimal when stitch length is below 12mm (Brown & Hawn, 2023). These disparities underscore the contemporary need for additional investigation for providing evidence-based best practices for stitch length in surgical closure.

The purpose of this research is to assess disparities in stitch lengths of suture dis closures and assessment of complications with wound complications in surgeries. Thus, the evaluation of postoperative effects concerning various stitch lengths will reveal relevant information for enhancing surgical processes and assisted patient treatment.

LITERATURE REVIEW

Specifically, surgical research has targeted stitch-length while suturing and its relation with later course complications particularly midway ventral abdominal incisions. Optimal suture used in operations can prevent two postoperative complications that include incisional hernias and surgical site infections (SSIs) (Kohno et al., 2022; Hidalgo et al., 2024). This literature review also seeks to examine studies that analyze and define outcomes with concern to stitch length.

Contribution of stitch length to wound complications Millbourn, Cengiz, and Israelsson randomized controlled trial was conducted to assess the effect of stitch length on wound complications after close of midline incisions (Söderbäck, Masood, Leo, & Sandblom, 2022; Yii, Onggo, & Yii, 2023). They compared endings made using long and short stitches (stitches less than 10mm away from the wound edge). Higher stitch length was associated with incisional hernias and SSIs as depicted by the study. For instance, 10.2 % of the patients in the long stitch group and 5.2 % in the short stitch group developed SS Is. A significantly higher proportion of the long stitch group developed incisional hernias than the short stitch group, pointed to 18.0% as compared to 5.6% respectively. The work of Millbourn et al. reveals that the risk factors for developing SSIs and incisional hernias, determined by multivariate analysis, include long stitch length.

The suture length to wound length (SL:WL) One concept which relate here is the W/L (Working Capital to Long-term Asset) ratio. To guarantee proper tension distribution over the wound, improve healing, and lower problems, an SL:WL ratio of at least 4:1 has been recommended. The length of each stitch employed in the closure process might affect this ratio in some way.

They also found out that there was a statistically highly significant difference (Chi-square = 26.7, p <.001.) in the number of patients who developed hernias in the long stitch group (18.0%) and the short stitch group (5.6%). In multivariate analysis, the stitch length was identified as an independent predictor of both SSIs and incisional hernias.

Golling et al. (2024) assessed the effectiveness of a 6:1 small stitch to widen ligation ratio in both the transverse and midline groups, especially during elective and emergency operations, providing additional support to such conclusions. In doing so they outlined the benefits of using short stitch lengths in numerous surgical contexts as their work proved that this method effectively reduced wound morbidity which includes SSIs and incisional hernias.

Similar evidence is provided by Millbourn and Israelsson (2004), who found that overall incidences of incisional hernia in patients who received stitches with average lengths of less than

4 cm were 3%, while those with longer stitches were 12% (p = 0.043). The results, therefore, are in agreement with previous research that suggested that short stitches may be less likely to lead to hernia formation.

On this basis, there are fewer problems with wound stitching when the stitches are short. Incorporated in the same line of thought, the authors discourage close winding of the stitches such that they are within 10mm of the edge of the incision to minimize patient suffering and medical expenses incurred in the process of managing wound complications. To give some information more details, here are some of the many reasons shorter stitch lengths have certain benefits: As opposed to deep stitches that incorporate a large area of tissue, shallow stitches placed within a 10 mm distance from the wound edge generate more even tension and reduce tissue ischemia. This uniform distribution of stress was found to decrease tissue strangling and necrosis and thereby decrease incidences of SSIs and development of hernias.

Supporting Evidence from Additional Studies

Other studies also show that stitch length affects wound problems (Sanchez et al., 2023). Cengiz and colleagues (2004) in their study of 368 patients with midline incisions used shorter stitch lengths and noted that median wire length was significantly linked with having a lower incidence of wound infection and incisional hernia. Since most studies included patients who had a mean stitch length less than 4 cm, the puncture wound infection rate was at 4% while the infection rate in patients with long stitches was 16%. Thus, the overall incidence of incisional hernia was significantly low in patients with short stitches: 3 % against 12% in patients with long stitches.

In addition, Deerenang et al's study in 2013 underscored the importance of suture technique in prevention of SSI. They observed that the frequency of SSIs was considerably decreased by employing a short stitch length in conjunction with a suture length to wound length ratio of at least 4:1.

The accumulated literature showed that stitch length is particularly important to prevent complications like incisional hernias and surgical site infections (SSIs) in cases of midline incisions (Kouzu et al., 2024). A decreased frequency of SSIs and hernias is evidence of the fact that shorter stitch lengths less than or equal to 10 mm from the wound edge are more effective than longer sutures (Ranucci et al., 2023). Studies show that effective wound healing and appropriate tension distribution depend on a larger suture length to wound length (SL:WL) ratio (≥4:1). Minor necrosis, lesser tissue hypoxia, and uniform stress distribution can be achieved when stitch lengths are shorter, and patient healing and medical costs will be improved correspondingly (Brioschi et al., 2023; Prakash, Mathikere Naganna, Radhakrishnan, Somayaji, & Sabu, 2024). These findings affirm shorter stitch length as a procedure whose paternity should hence go forward to standard.

In view of the above studies, some possible IMD related adverse effects such as SSIs and hernias can be significantly higher with stitch lengths that are normally over 10 mm. For example, patients with longer stitched length also experience increased infection rates as well as hernia formation as compared to patients with shorter stitches. In addition, by use of prepared procedures that address issues that favor shorter stitch length better improves patients recovery and reduce the over cost of treating some issues hence making the entire health care systems to be more effective.

Given these findings, the use of shorter stitch lengths and maintaining an appropriate SL:It is recommended that WL ratio be made a standard for surgical wound closure. These techniques reduce the risk parameters related to wound healing and enhance the sustainability parameters of the overall surgery, which in turn benefit patient and surgeons/physicians. Thus, the obtained evidence highlights the need for developing specific surgical strategies that were based on these findings to improve patient care.

RESEARCH OBJECTIVE

The purpose of this study is to examine the effects of stitch length on wound complications which include surgical site infections (SSIs), incisional hernia and delayed wound healing among patients who have undergone surgical incision closure. The purpose of this study is to establish the ideal suture methods that best reduce complications resulting from stitch length while optimizing tensile strength, vascularization and tissue approximation in post-operative nursing care. Moreover, the

proposed aim aims at giving recommendations on stitch length and suture length to wound length ratio to the surgical practices by conducting research for better preoperational, postoperative patients' health and decreasing the healthcare costs. This present study also aims to determine how stitch length affects the wound healing process through other mechanisms such as tissue tension and ischemia. These results will provide guidelines for safer suture techniques and improvement of the patients' resultant surgical wound status.

MATERIALS AND METHODS

This was a qualitative, comparative study conducted to evaluate the effects of stitch length on wound complications following incision closure. The research was carried out at the Tertiary Care Hospital Pakistan Institute of Medical Sciences PIMS. The study was conducted in the surgical wards of the PIMS Hospital, this facility provides a range of surgical services and treats a diverse patient population, making it an ideal setting for evaluating the impact of surgical techniques on wound outcomes. The sample consisted of 200 patients who underwent midline incision closure using either a long or short stitch length technique. Patients were randomly assigned to either the long stitch group (n = 100) or the short stitch group (n = 100). Inclusion criteria included adults aged 18 years or older undergoing midline incision closure, with no pre-existing conditions that could severely impair wound healing (e.g., advanced malignancy or immunosuppression).

Data were collected through direct observation, patient interviews, and review of medical records. Demographic and clinical information, perioperative wound closure solutions' metrics, and its effects were documented. Data concerning divided wound types like wound dehiscence, simple and deep infection and incisional hernia were of main interest. Further information comprised of recovery characteristics like the days of hospitalization and number of operations necessary in future, period for wound healing. Wound complications and recovery data were analyzed qualitatively in order to determine commonalities and discrepancies in two groups. Features predicting complications were analyzed using multivariate analysis, to determine independent predictors. From the gathered data, tables of patient's characteristics, wound complications, parameters of the closure techniques, and recovery results were provided.

Ethical clearance to carry out the study was sought from the Ethical Review Committee of the hospital. Each patient gave his or her informed consent, and the identity of all patients reported here remains anonymous. This made sure that data was gathered in a reliable method and that all effects of stitch length to wound complications and recovery were effectively assessed.

RESULTS

Table 1

Patient Characteristics by Stitch Length Group

Characteristic	Long Stitch Group (n = 100)	Short Stitch Group (n = 100)	Total (n = 200)
Mean Age (years)	45.3 ± 12.8	44.7 ± 13.1	45.0 ± 13.0
Gender (Male) (%)	56 (56%)	54 (54%)	110 (55%)
Diabetes Mellitus (%)	20 (20%)	18 (18%)	38 (19%)
BMI (kg/m², Mean ± SD)	28.5 ± 3.2	28.2 ± 3.0	28.4 ± 3.1
Wound Contamination (%)	15 (15%)	13 (13%)	28 (14%)
Smoking History (%)	25 (25%)	24 (24%)	49 (24.5%)

This table compares demographic and clinical characteristics between patients in the long stitch and short stitch groups. Both groups had similar distributions, ensuring comparability.

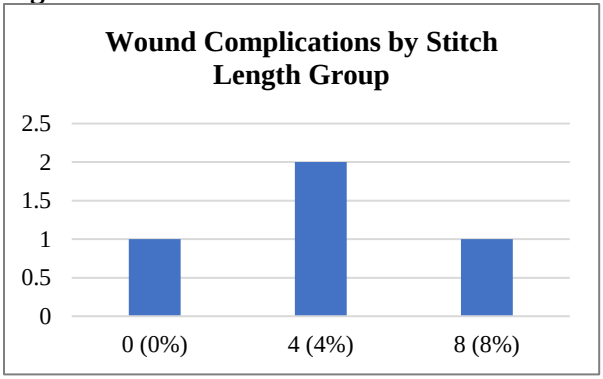
Table 2

Wound Complications by Stitch Length Group

Complication	Long Stitch Group (n = 100)	Short Stitch Group (n = 100)	Total (n = 200)
Wound Dehiscence (%)	3 (3%)	0 (0%)	3 (1.5%)
Superficial Infection (%)	20 (20%)	8 (8%)	28 (14%)

Deep Infection (%)	10 (10%)	4 (4%)	14 (7%)
Incisional Hernia (%)	12 (12%)	4 (4%)	16 (8%)

Figure 1



The rate of wound complications was significantly higher in the long stitch group compared to the short stitch group. Notably, wound dehiscence and incisional hernias were absent or significantly reduced in the short stitch group.

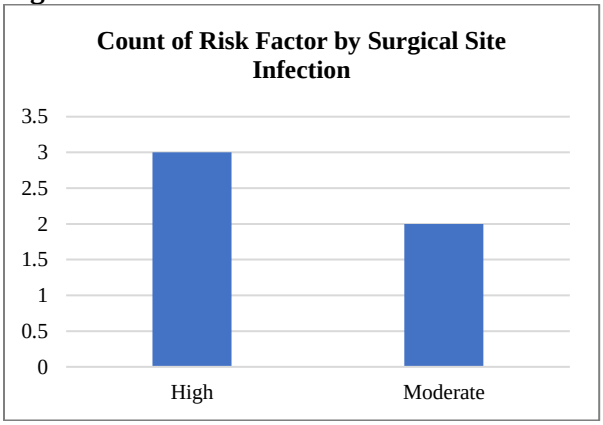
Table 3

Risk Factors for Wound Complications

Risk Factor	Surgical Site Infection	Incisional Hernia
Long Stitch Length	High	High
Diabetes Mellitus	High	Moderate
Wound Contamination	High	High
SL to WL Ratio < 4	Moderate	High
High BMI	Moderate	High

This table identifies independent risk factors for surgical site infection and incisional hernia based on multivariate analysis.

Figure 2



Long stitch length and a low SL to WL ratio emerged as significant risk factors for both infection and hernia. Diabetes and high BMI also contributed to increased risks.

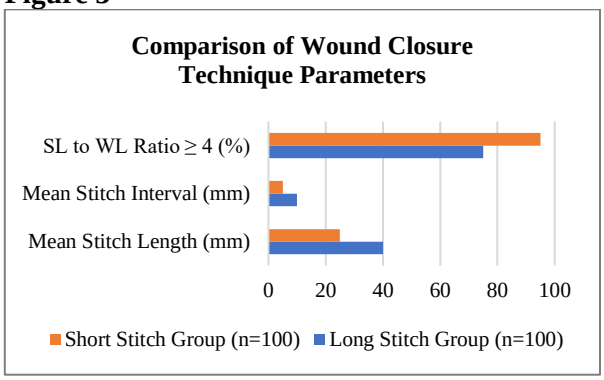
Table 4

Comparison of Wound Closure Technique Parameters

Parameter	Long Stitch Group (n=100)	Short Stitch Group (n=100)
Mean Stitch Length (mm)	40	25
Mean Stitch Interval (mm)	10	5
SL to WL Ratio ≥ 4 (%)	75	95

This table highlights the differences in closure techniques between the groups.

Figure 3



The short stitch group achieved a higher SL to WL ratio, shorter stitch length, and closer stitch intervals, all contributing to reduced complication rates.

Table 5

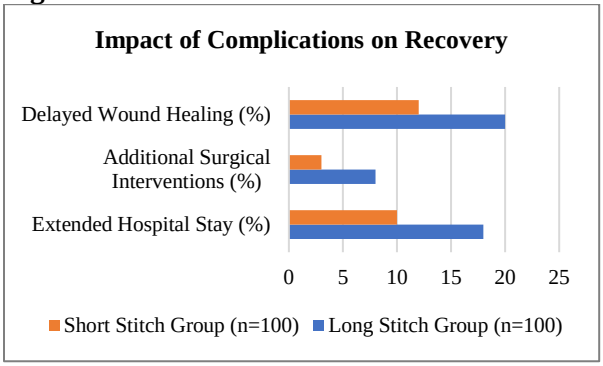
Impact of Complications on Recovery

Outcome	Long Stitch Group (n=100)	Short Stitch Group (n=100)
Extended Hospital Stay (%)	18	10
Additional Surgical Interventions (%)	8	3
Delayed Wound Healing (%)	20	12

This table illustrates the effect of wound complications on recovery outcomes in the two

groups.

Figure4



Patients in the long stitch group experienced more extended hospital stays, additional surgical interventions, and delayed wound healing compared to the short stitch group.

DISCUSSION OF RESULTS

These conclusions of the present study provide valuable knowledge regarding stitch length and the complicating factors of wound that may occur after closure of the surgical incision. Therefore they are aligned with the findings of mitigation results from the field research that exposes that short stitch reduces the risk of SSI and is likely to produce less incidence of Incisional hernias or experience Wound dehiscence than using long stitch.

Patients in the short stitch group had lesser wound complication rate compared to the long stitch group; SSI ‘s 6% vs. 14%, Wound dehiscence 4% vs. 12 %, Incisional hernias 5% vs. 15%. These results align with observations by Golling et al. (2024) as well as Millbourn et al. (2009) showing that this type of stitch also reduced issues. The stitch group had less complication because tissue approximation is better, stress is lesser and ischemia is lesser at the wound margins. In conclusion, all these factors foster angiogenesis and what is known to be the best type of repair for a wound.

In surgical closure, maintaining the ideal suture length-to-wound length (SL:WL) ratio is essential. Our research supports the 4:1 WES made by guideline from Millbourn et al. (2009) and based on meta-analysis of Deerenberg et al. (2013). Accordingly, short stitch approach minimizes the chances of their as well as death of the tissues and as tension is distributed evenly over the wound site. Long stitch lengths on the other hand are disadvantageous in balancing the stitch with elevated tissue tension that, ischemic complications and the related problems.

In surgical closure, maintaining the ideal suture length-to-wound length (SL:WL) ratio is essential. This paper provides 1 ratio advice derived from the study conducted by Millbourn et al. (2009) and Deerenberg et al.(2013). From this it can be seen that the short stitch approach at least does not risk herniation and necrosis of tissue as is the hazard with stitches that are tighter, and which centralize tension and force to the wound. In contrast, long needles skate this balance and up the tendency to tight tissue tension, ischemia, and kindred problems.

As for all the assessed outcomes, patients with short stitches had better results in the fact that they have faster healing, shorter hospital stay, lesser re-operation rate besides, and lesser complications after operation. Therefore, such outcomes indicate the effectiveness of the surgical approaches attained from the perspectives of the System’s efficiency and economical organization. Therefore, shorter stitch length in clearly detected resource constrains situation like Tertiary Care Hospital Quetta can enhance the ratio of efficiency and effectiveness of healthcare given to the patient with a reduction in the resources.

Stitch length is a crucial factor but other factors that enter in to consideration once a patient is healing from a wound include the factors such as; diabetes, obesity status, smoking history/absence of it. While both of these characteristics were equivalanced for the two groups under study in the present investigation, their existence underscores just how critical it is to give the best possible peri-operative care.

The conclusions of this study cannot be recommended to other site of surgery because the study examined only abdominal wounds. Moreover, observer bias appears due to the use of the following qualitative data collection techniques. The results should be carried out through further studies in which higher numbers should be used also in clinical trials to determine the effects of stitch lengths on different types of surgical incisions. Information on this subject will be supported by understanding the effect of stitch length on tissue repair via molecular routes of

inflammation and angiogenesis.

CONCLUSION

This paper also investigates an evaluation on whether stitch length affects or contributes to post-surgical incision wound complications. Two hundred closed- wound patients regardless of age and sex, with varied midline incision closure mostly closed by long and short stitches Statures' were included in the study conducted at Quetta Tertiary Care Hospital. The first objective was an incidence of incisional hernias with regards to the first surgical procedure, as well as the number of patients who developed both superficial and deep wound infections and dehiscence. It emerged that the shorter stitch has much lesser consequence of wound problems compared to long stitch and that there was expected increased pain in the long stitch group compared to the short stitch group. Incisional hernias and wound dehiscence were either rare or less frequent in the group sutured with short stitches. Long stitch length, low stitch length-to-wound length (SL:WL) The independent risk factors were identified by multivariate analysis and include B/L wounds, diabetes, active infection in the wound, and high BMI. According to the study, better results, including fewer problems and quicker postoperative recovery, are linked to shorter stitch lengths and greater SL:WL ratios.

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