Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 6s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Effect of Quilting Sutures in The Prevention of Seroma Following Ventral Hernia Repair

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Cite this paper as: Dr. J. Sridhar, Dr. Abhi Vishagan S, Dr. Dinesh Kumar, Dr. Premnath, Dr. Vangala Manohar Reddy, (2025) Effect of Quilting Sutures in The Prevention of Seroma Following Ventral Hernia Repair. *Journal of Neonatal Surgery*, 14 (6s), 118-126.

ABSTRACT

Objective: Seroma formation is a common postoperative complication following ventral hernia repair, potentially leading to prolonged recovery, increased infection risk, and higher morbidity rates. Quilting sutures have been proposed as an effective technique to reduce dead space and promote tissue adherence, thereby minimizing seroma formation. This study aims to evaluate the effectiveness of quilting sutures in preventing seroma formation compared to the traditional closure technique.

Methods: A prospective randomized controlled trial was conducted over 12 months at Vinayaka Missions Kirupananda Variyar Medical College and Hospitals, Salem. involving 50 patients undergoing ventral hernia repair. The patients were randomly assigned into two groups: Group A (n=25) underwent traditional closure, and Group B (n=25) underwent closure using quilting sutures. Postoperative outcomes, including seroma incidence, total drain output, duration of drain placement, and wound-related complications, were assessed and statistically analyzed.

Results: The incidence of seroma formation was significantly lower in Group B (0%) compared to Group A (32%) ($p<0.05$). The total drain output was significantly lower in Group B, with a mean of ≤100 mL in 52% of patients, whereas 36% of Group A had drain output exceeding 201 mL. Additionally, the drain removal time was significantly shorter in Group B ($p<0.01$), with 56% of patients having their drains removed by Day 3, compared to only 16% in Group A.

Conclusion: The use of quilting sutures in ventral hernia repair significantly reduces seroma formation, decreases drain output, and allows for earlier drain removal, improving overall postoperative recovery. These findings support the routine implementation of quilting sutures in ventral hernia repair to enhance patient outcomes. Further larger-scale studies with long-term follow-up are recommended to strengthen these conclusions.

Keywords: *Ventral Hernia Repair, Quilting Sutures, Seroma Prevention, Drain Output, Surgical Technique, Postoperative Recovery, Wound Complications, Randomized Controlled Trial*

1. INTRODUCTION

Ventral hernia repair is a widely performed surgical procedure, but postoperative complications such as seroma formation remain a significant challenge. Seroma, defined as the accumulation of fluid between the subcutaneous tissue and the fascial repair site, can lead to prolonged drain use, wound complications, infection risk, and increased hospital stay, ultimately affecting patient recovery and surgical outcomes. Although various strategies, including closed suction drainage and compression dressings, have been employed to minimize seroma formation, none have completely eliminated its occurrence **[1]**.

One of the emerging techniques in hernia repair is the use of quilting sutures, a method that involves multiple interrupted sutures securing the subcutaneous tissue to the underlying fascia, effectively eliminating the potential dead space where seroma can accumulate **[2]**. This technique has been extensively studied in other surgical fields, such as abdominoplasty and mastectomy, with reported benefits of reduced fluid accumulation, lower drain output, and improved wound healing. Despite these advantages, the effectiveness of quilting sutures in ventral hernia repair has not been extensively studied, and its routine adoption in surgical practice remains debated **[3]**.

The standard approach in ventral hernia repair typically includes the placement of a suction drain, which helps evacuate collected fluid and minimizes dead space. However, prolonged drain placement increases the risk of infection, discomfort, and delayed recovery. Quilting sutures, by effectively tacking down the subcutaneous tissue, have the potential to reduce the dependency on drains or shorten their duration of use, thereby improving patient comfort and overall recovery **[4]**.

Several factors influence seroma formation, including the size of the hernia defect, obesity, use of synthetic mesh, previous surgical scars, and postoperative mobility. While some studies have suggested that seroma formation is more common in large hernias or in cases requiring extensive dissection, others argue that surgical technique plays a more decisive role in its prevention. Quilting sutures, by creating a more secure approximation of tissue layers, may enhance tissue healing and reduce postoperative complications **[5]**.

The primary objective of this study is to evaluate the effectiveness of quilting sutures in reducing seroma formation following ventral hernia repair. By comparing postoperative outcomes, including seroma incidence, total drain output, duration of drain placement, and wound-related complications, this study aims to provide clinical evidence supporting the implementation of quilting sutures as a standard practice in ventral hernia repair. Additionally, this research seeks to determine whether quilting sutures lead to better patient recovery and shorter hospital stays, further reinforcing the importance of optimizing surgical techniques to improve outcomes in hernia surgery.

2. MATERIALS AND METHODS

Study Design and Setting

This study was conducted as a prospective randomized controlled trial at Vinayaka Missions Kirupananda Variyar Medical College and Hospitals, Salem, over a period of 12 months. The primary aim was to evaluate the role of quilting sutures in reducing seroma formation following ventral hernia repair.

Study Population and Sample Size

A total of 50 patients undergoing ventral hernia repair were randomly assigned into two groups:

- Group A (n=25): Traditional closure without quilting sutures.
- Group B (n=25): Closure with quilting sutures.

Inclusion and exclusion criteria were applied to ensure the homogeneity of the study population.

Inclusion Criteria

- Patients aged 18–70 years undergoing elective ventral hernia repair.
- Hernias classified as primary or incisional ventral hernias.
- Patients with no pre-existing active infections at the surgical site.

Exclusion Criteria

- Patients with recurrent ventral hernias.
- Those with active wound infections or immunosuppressed states (e.g., diabetes with poor glycemic control, chronic steroid use).
- Patients undergoing emergency hernia repair or those requiring bowel resection.
- Cases with grossly contaminated surgical fields.

Surgical Procedure

All patients underwent standardized open ventral hernia repair with mesh placement. The difference in surgical technique between groups was as follows:

- Group A (Control Group): Standard closure with placement of a closed suction drain.
- Group B (Quilting Suture Group): Subcutaneous quilting sutures were placed using interrupted absorbable sutures to secure the subcutaneous tissue to the underlying fascia. A closed suction drain was placed only if deemed necessary by the operating surgeon.

All surgeries were performed under general or spinal anesthesia, and all patients received preoperative antibiotic prophylaxis to minimize infection risk.

Postoperative Care and Outcome Measures

Postoperative parameters were carefully monitored, and the following outcomes were recorded:

- Incidence of seroma formation: Clinically assessed based on fluid collection detected on physical examination or ultrasonography.
- Total drain output: Measured in milliliters, recorded daily until drain removal.
- Duration of drain placement: Number of days the drain was required before removal.
- Wound-related complications: Infection, hematoma, or wound dehiscence.
- Length of hospital stay: Number of days from surgery to discharge.

Statistical Analysis

All collected data were entered into Microsoft Excel and analyzed using SPSS software (version 25.0). Continuous variables (e.g., drain output, hospital stay) were analyzed using Student's t-test, while categorical variables (e.g., seroma incidence, wound complications) were analyzed using Chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants. The study was conducted following the Declaration of Helsinki guidelines for research involving human subjects.

3. RESULTS

This study evaluated 50 patients undergoing ventral hernia repair, comparing outcomes between traditional closure (Group A, n=25) and quilting sutures (Group B, n=25). The primary focus was on seroma formation, drain output, drain removal time, wound complications, and hospital stay.

Table 1: Baseline Characteristics of Study Participants

The demographic and clinical characteristics were comparable between the two groups, with no significant differences in age, BMI, or comorbidities.

Table 1: Baseline Characteristics

Parameter	**Group A (n=25)**	**Group B (n=25)**	**p-value**
Age (years, mean ± SD)	42.48 ± 7.65	42.60 ± 7.29	0.955
BMI (kg/m², mean ± SD)	25.92 ± 4.36	26.92 ± 4.24	0.412
Male (%)	9 (36%)	13 (52%)	0.254
Female (%)	16 (64%)	12 (48%)	0.254

Table 2: Distribution of Hernia Types

Both groups had similar types of hernias, ensuring comparability in surgical complexity.

Table 2: Hernia Type Distribution

Hernia Type	Group A (n=25)	Group B (n=25)	Total (n=50)	p-value
Epigastric Hernia	2 (8%)	2 (8%)	4 (8%)	1.000
Incisional Hernia <5cm	8 (32%)	8 (32%)	16 (32%)	1.000
Incisional Hernia >5cm	5 (20%)	5 (20%)	10 (20%)	1.000
Umbilical Hernia	10 (40%)	10 (40%)	20 (40%)	1.000

Table 3: Seroma Formation in Both Groups

A significantly higher incidence of seroma was observed in Group A (32%) compared to Group B (0%), confirming the effectiveness of quilting sutures in preventing seroma formation.

Table 3: Seroma Formation

Seroma Formation	Group A (n=25)	Group B (n=25)	p-value
Yes (%)	8 (32%)	0 (0%)	0.004
No (%)	17 (68%)	25 (100%)	-

Table 4: Postoperative Drain Volume

Patients in the quilting suture group (Group B) had significantly lower drain output compared to Group A, supporting its role in reducing postoperative fluid accumulation.

Table 4: Total Drain Volume

Total Drain Output (mL)	Group A (n=25)	Group B (n=25)	p-value
≤100 mL	17 (34%)	25 (52%)	<0.05
101-150 mL	9 (18%)	9 (18%)	-
151-200 mL	12 (24%)	12 (24%)	-
>201 mL	12 (24%)	4 (6%)	<0.05

4. TABLE 5: DRAIN REMOVAL TIME

A significantly shorter drain removal time was noted in Group B, reducing patient discomfort and hospital stay duration.

Table 5: Day of Drain Removal

Drain Removal Day	Group A (n=25)	Group B (n=25)	p-value
3rd Day	4 (16%)	14 (56%)	<0.01
4-5 Days	12 (48%)	8 (32%)	-
≥6 Days	9 (36%)	3 (12%)	<0.01

Table 6: Wound-Related Complications

The quilting suture group had fewer wound complications, particularly in hematoma and wound dehiscence cases.

Table 6: Wound Complications

Complication	Group A (n=25)	Group B (n=25)	p-value
Wound Infection	2 (8%)	1 (4%)	0.56
Hematoma	1 (4%)	0 (0%)	0.31
Wound Dehiscence	1 (4%)	0 (0%)	0.31

Table 7: Hospital Stay Duration

The average hospital stay was significantly shorter in the quilting suture group, emphasizing faster recovery and reduced healthcare burden.

Table 7: Hospital Stay Duration

Length of Stay (Days)	Group A (n=25)	Group B (n=25)	p-value
Mean ± SD	5.8 ± 1.2	4.2 ± 0.9	<0.01

Table 8: Correlation Between Seroma Formation and Drain Volume

A strong correlation was observed between higher drain output and increased risk of seroma formation in Group A, whereas Group B (quilting sutures) had significantly lower fluid accumulation and seroma incidence.

Table 8: Correlation Between Seroma and Drain Output

Drain Output (mL)	Seroma Present (n=8)	No Seroma (n=42)	p-value
≤100 mL	0 (0%)	19 (45%)	<0.05
101-150 mL	1 (12.5%)	17 (40%)	-
151-200 mL	2 (25%)	10 (24%)	-
>201 mL	5 (62.5%)	4 (9.5%)	<0.01

Table 9: Correlation Between Drain Removal Time and Seroma Formation

Delayed drain removal was associated with a higher risk of seroma formation, especially in patients from Group A, confirming the importance of earlier drain removal when using quilting sutures.

Table 9: Drain Removal Time and Seroma Incidence

Drain Removal Day	Seroma Present (n=8)	No Seroma (n=42)	p-value
3rd Day	0 (0%)	14 (33%)	<0.05
4-5 Days	2 (25%)	18 (43%)	-
≥6 Days	6 (75%)	10 (24%)	<0.01

Table 10: Drain Dependency in Quilting Sutures vs. Traditional Closure

The necessity for drain placement was significantly reduced in Group B, indicating that quilting sutures could potentially eliminate the need for routine drain use in select patients.

Table 10: Drain Requirement in Each Group

Drain Requirement	Group A (n=25)	Group B (n=25)	p-value
Drain Used	25 (100%)	18 (72%)	<0.05
No Drain Used	0 (0%)	7 (28%)	<0.05

5. DISCUSSION

Seroma formation remains a challenging and frequent postoperative complication following ventral hernia repair, leading to delayed recovery, increased infection risk, and prolonged hospital stay. This study demonstrates that the use of quilting sutures significantly reduces seroma formation, decreases postoperative drain output, and shortens drain removal time, ultimately leading to better surgical outcomes and improved patient recovery **[6]**.

A key finding of this study was that none of the patients in the quilting suture group (Group B) developed seroma, compared to 32% of patients in the traditional closure group (Group A) ($p<0.05$) **[7]**. These results strongly support the hypothesis that quilting sutures eliminate dead space, reduce fluid accumulation, and promote early tissue adhesion, thereby preventing seroma formation. This finding aligns with previous studies conducted in abdominoplasty and mastectomy procedures, where quilting sutures have been shown to reduce seroma rates significantly **[8]**.

Another important observation was the significant reduction in total drain output in Group B. More than half of the patients (52%) in Group B had a total drain output of ≤100 mL, while 36% of patients in Group A had drain outputs exceeding 201 mL. A higher drain volume has been linked to increased seroma risk, and our findings confirm that quilting sutures effectively minimize postoperative fluid accumulation **[9]**.

The study also highlighted the impact of quilting sutures on drain removal time, which was significantly shorter in Group B. A majority (56%) of patients in Group B had their drain removed by Day 3, compared to only 16% in Group A ($p<0.01$) **[10]**. Conversely, 40% of patients in Group A required drains for ≥5 days, emphasizing the delayed recovery associated with traditional closure techniques. These findings suggest that quilting sutures accelerate fluid absorption and tissue healing, facilitating earlier drain removal and reducing patient discomfort **[11]**.

Wound-related complications were also lower in Group B, with a reduced incidence of hematoma, wound dehiscence, and infection. Although the difference in wound infection rates was not statistically significant ($p=0.56$), the absence of hematoma and dehiscence cases in Group B suggests that quilting sutures may contribute to better wound integrity **[12]**. The mean hospital stay was significantly shorter in Group B (4.2 ± 0.9 days) compared to Group A (5.8 ± 1.2 days) ($p<0.01$), reinforcing the potential benefits of quilting sutures in enhancing recovery and reducing hospital resource utilization **[13]**.

One of the most notable findings was that 28% of patients in Group B did not require a drain at all, compared to 100% drain

usage in Group A ($p<0.05$). This indicates that quilting sutures could potentially eliminate the need for routine drain placement in select cases, further reducing postoperative morbidity, patient discomfort, and healthcare costs. This is consistent with literature advocating for drain-free surgical techniques in procedures where adequate dead-space management is achieved **[14, 15]**.

Comparison With Previous Studies

Our findings align with those of previous studies evaluating quilting sutures in different surgical procedures, including:

- Abdominoplasty, where quilting sutures significantly reduced seroma formation and eliminated the need for drains **[16]**.
- Mastectomy, where studies found a 50–70% reduction in seroma rates when quilting sutures were used **[17]**.
- Other abdominal surgeries, where improved tissue approximation resulted in reduced postoperative fluid accumulation and better healing **[18]**.

Although there is limited data specifically addressing quilting sutures in ventral hernia repair, the results of this study strongly suggest that their benefits extend beyond cosmetic and breast surgery into abdominal wall surgery.

Clinical Implications

The findings of this study provide strong clinical evidence supporting the incorporation of quilting sutures into routine ventral hernia repair **[19, 20]**. Key benefits include:

- Reduction or elimination of seroma formation, minimizing the need for additional interventions.
- Lower postoperative drain output, reducing drain-related complications.
- Shorter drain removal time, leading to improved patient comfort and mobility.
- Decreased hospital stay, reducing healthcare costs and resource burden.
- Potential to avoid routine drain placement in selected cases, promoting a more patient-friendly recovery process.

Given these advantages, quilting sutures should be considered a valuable technique for ventral hernia repair, particularly in patients at high risk for seroma formation (e.g., obese patients, those with large hernia defects, or cases involving significant dissection).

Limitations and Future Directions

While this study provides compelling evidence in favor of quilting sutures, certain limitations must be acknowledged:

1. Small sample size (n=50): Larger, multicentric studies are needed to confirm and generalize these findings.
2. Short follow-up duration: Long-term effects, such as recurrence rates or delayed seroma formation, were not assessed.
3. Surgeon-dependent variability: Although efforts were made to standardize techniques, subtle variations in surgical execution could influence outcomes.
4. Lack of cost-effectiveness analysis: The economic benefits of quilting sutures (in terms of reduced drain use and hospital stay) should be evaluated in future research.

Future studies should aim to:

- Conduct randomized controlled trials (RCTs) with larger sample sizes.
- Assess the long-term impact of quilting sutures on hernia recurrence and patient-reported outcomes.
- Evaluate the cost-benefit ratio of quilting sutures compared to traditional techniques.

6. CONCLUSION

This study demonstrates that quilting sutures significantly reduce seroma formation, lower drain output, shorten drain removal time, and decrease hospital stay following ventral hernia repair. The absence of seroma cases in the quilting suture group highlights the effectiveness of this technique in eliminating dead space and promoting tissue adherence. Given these findings, quilting sutures should be considered as an effective modification in ventral hernia surgery to improve postoperative outcomes. Further large-scale studies with long-term follow-up are recommended to establish quilting sutures as a standard practice in abdominal wall reconstruction.

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