

Original Research Article

A prospective study on vertical mattress suture and subcuticular suture skin closure techniques in inguinal hernia repair cases

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Received: 06 November 2022

Revised: 05 December 2022

Accepted: 17 December 2022

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ABSTRACT

Background: Sutures are used to keep tissues in place until enough healing has taken place to produce endogenous wound strength. The method of closure should be quick, simple, affordable, and successful while maximizing the cosmetic of the wound and patient outcomes. So, this study was an attempt to compare subcuticular and vertical mattress suture techniques in inguinal hernia repair.

Methods: A prospective study was carried out among patients posted for inguinal hernia repair. The wound closure of the first 25 patients was done using a subcuticular suture and another by classical vertical mattress suture. Duration required for wound closure, complications, postoperative pain and cosmesis were assessed and analyzed using descriptive and inferential statistics.

Results: The duration required for wound closure was higher in the subcuticular suture compared with the classical vertical mattress suture. There was no significant difference in post-operative pain, wound complications and wound cosmesis in both groups.

Conclusions: Among cases with inguinal hernia repair there was no superiority in subcuticular and classical vertical mattress sutures from the patient side.

Keywords: Vertical mattress, Subcuticular, Suture, Inguinal hernia, Prospective study

INTRODUCTION

Sutures have a long history that dates back more than 2,000 years. With the invention of sterilization techniques in the late 1800s, surgical and suture techniques advanced. The scar is sometimes referred to as the "autograph of a surgeon." Optimal healing and cosmetically acceptable scars are the goals of every surgeon. A crucial requirement of skin closure is an accurate estimation.¹ Soon after the tissue is cut or injured, the healing process begins and goes through the stages of inflammation, proliferation, and maturation/remodelling. After surgery, wound strength is

minimal and quickly increases as collagen types III and II are deposited. Throughout these healing processes, sutures are required to keep the wound closed. Inguinal hernias have clearly defined structural features that are more durable than sutures and that allow evaluation of the tension that potential repair imposes.² To increase wound eversion, vertical mattress sutures are primarily used. Additionally, vertical mattresses eliminate dead space and provide strength all around the wound. Age-related skin inversion and the requirement to evert the skin for correct apposition are advantages of vertical mattress sutures in the elderly population. This method aids in maintaining suitably everted skin without

excessive tension along suture lines.¹ According to the borders of the coapted incision, the traditional vertical mattress suture technique arranges the needle puncture points in a far-far-near-near configuration. Due to the considerable amount of tissue that may be included in the suture loops, the wound margins are everted, the closure is stronger, and the tension on the wound is distributed more evenly. A significant quantity of hemostasis and a good dead space closure is also provided by the stitch.³ To avoid hypereversion of the wound's margins, undue strain, and scarring, interrupted vertical mattress sutures should be knotted securely yet gently. If the knots are knotted excessively firmly, the skin may rip between the near-near puncture sites or turn necrotic beneath the externalized loops of the stitch. The interrupted vertical mattress suture also has other drawbacks, such as a longer stitching time, the potential for cross-hatching suture markings if removal is postponed, and challenges with symmetric edge approximation and equidistant loop placement.³ At the end of the 19th century, the subcuticular suture was developed to lessen wound infection and speed up recovery. For the treatment of inguinal hernias, William S. Halsted was the one who initially recommended the use of hidden sutures.⁴ A single, brief locking stitch is all that is needed to secure the repair distally after using the standard subcuticular approach to close the incision. The ends of the suture are clipped flush with the skin after being passed through the wound and emerging from the skin distal to the apex. This method is quick and easy. It benefits from being completely subcuticular and from not having bulky knots or loose suture ends that could poke through the skin or result in stitch abscesses. Additionally, it prevents penetrating the suture material, maintaining the strength of the suture.⁵ One of the fundamental steps in all surgical procedures is skin suturing. Early wound healing, a crucial step in scar formation, is encouraged. Patient's mental health, interpersonal relationships, and quality of life will all be profoundly impacted by the permanent scar that develops following wound healing.⁶ The method of closure should be quick, simple, affordable, and successful while maximizing the cosmetic of the wound and patient outcomes. Any skin closure approach must ultimately result in skin approximation and sufficient healing with a low amount of wound consequences such as pain, infection, scarring, and keloid formation.⁷ So this study was planned to compare duration for suturing, post-operative pain, wound cosmesis, and complications of classical vertical mattress suture and subcuticular suture among patients posted for inguinal hernia repair.

METHODS

Study design, location, duration and population

Current study is a prospective study conducted at department of surgery, Trichy SRM Medical college hospital and research centre, Irungalur, Thiruchirapalli, Tamil Nadu for a duration of Six months (March 2021-

August 2022). Patients with inguinal hernia repair were taken as study population.

Inclusion and exclusion criteria

Inclusion criteria for current study were patients with reducible inguinal hernia and patients willing to give informed written consent. Exclusion criteria for current study were; patients with another type of hernia and inguinoscrotal swellings and patients with an inguinal hernia with urinary complications.

Sampling technique and sample size

Simple random sampling technique was used; sample size was calculated by using formula $4pq/d$ and estimated to be 50 (68% proportion of better cosmetic appearance of subcuticular suture in Karia et al study with 14% absolute precision, 20% non-response rate and 80% power).¹

Study tools

A semi-structured questionnaire. Suture materials; nylon 3-0 material and monocryl 3-0 material.

Operational definition

Vertical mattress suture method; 3-0 Nylon suture material was used for the vertical mattress closure. The needle is first entered away from the edge of the cut, travels into the dermal tissue, and then emerges through the skin on the other side, also away from the edge of the wound. The far-far, near-near system is employed in the vertical mattress suture. The direction of the Suture loop is reversed, and the needle was turned 180 degrees in the needle holder (backhanded). The epidermal/dermal edges, which became approximated when the knot was knotted, are nibbled on upon recovery. The suture's loop closes and everts the wound's edges in this near-near section.⁸ Subcuticular suture method; 3-0 monocryl suture material was used to perform subcuticular closure. By inserting a needle through the margin of one wound, it is started. The needle is inserted horizontally into the top dermis with the opposing edge everted. On alternate sides of the wound, this is repeated. It is finished by either looping through the final loop of the other side or tying it with leftover material over the wound.⁹

Data collection

Data was collected in the inpatient department of surgery among patients admitted for inguinal hernia repair. A semi-structured questionnaire was administered among them and a clinical examination was carried out with their informed written consent. After inguinal hernia repair, the outer wound was sutured with two types of materials in two different groups. The first 25 participants received subcuticular suture technique and another 25

participants received the traditional vertical mattress suture technique.

The time taken for closure was recorded during the surgery using a stopwatch. Postoperative pain was evaluated by using the Visual Analog scale which was calibrated from 0-10. For no pain was recorded as 0 and the state of worst pain was recorded as 10. The pain score was observed during the day of surgery, the first post-operative day, third post-operative day and seventh postoperative day on suture removal. Complications were observed until suture removal. The most prevalent were discharge and wound separation.

Wound cosmesis score

On seventh day of surgery, wound cosmesis score was assessed by using the modified Hollander Cosmesis scale consists of 6 clinical variables as step-off borders, edge inversion, contour irregularities, excess inflammation, wound margin separation, and good overall appearance. The scores of the variables were added to produce a final cosmetic score. Each variable receives a value of 1 if it is present in the wound, making a score of 0 ideal and a score of 1 or higher sub-optimal. Wound cosmesis is evaluated on the fourth- and eighth-week wound grading is carried out using a visual analog scale from 0 to 100.

Data analysis

Data was entered in Microsoft excel 2019 and analyzed using descriptive and inferential statistics using SPSS software. The Independent t test was used to test the association for continuous variables.

RESULTS

This study recruited fifty patients for inguinal hernia repair who were admitted to the department of surgery. The majority of participants were in the age group of 51-60 years in both groups. Yje common co morbid condition in both groups was Type II DM. There was no meaningful difference in age group among both groups. The duration taken for closure of the wound by subcuticular suture (402.8 ± 35.939 seconds) was higher compared with vertical mattress (144.08 ± 33.199 seconds) and this result was significant. The post-operative pain score was almost the same in both groups and it shows non-significant values. The mean scores were 7.8 ± 0.93 and 7.8 ± 0.93 among vertical and subcuticular stitches respectively during day 0. The mean scores were 6.92 ± 1.152 and 6.6 ± 1.225 among vertical and subcuticular stitches respectively during day 1. The mean scores were 4.24 ± 1.4 and 4.12 ± 1.394 among vertical and subcuticular stitches respectively during day 3. The mean scores were 2.36 ± 1.44 and 2.6 ± 1.472 among vertical and subcuticular stitches respectively during day 7. There was no difference in cosmesis score in vertical mattress (1.68 ± 0.476) and subcuticular suture (1.8 ± 0.764) on seventh post-operative day by using Modified Hollander score. On the fourth week of post-operative day, the cosmesis score was significantly better in subcuticular stitches (71.04 ± 2.937) compared with vertical mattress stitches (68.48 ± 2.452). There was no difference in cosmesis score in vertical mattress (80.12 ± 1.563) and subcuticular suture (81.04 ± 2.263) in the eighth week post-operative day. There was no significant difference in complications. Wound separation was observed in 4% of cases in both stitches. 4% of cases with mattress stitches and 8% of subcuticular stitches reported with purulent discharge. Rest of them remains uncomplicated.

Table 1: Baseline characteristics of the patients (n=50).

Variables		Subcuticular suture N (%)	Vertical mattress suture N (%)
Age (years)	41-50	6 (24)	8 (32)
	51-60	12 (48)	9 (36)
	61-70	7 (28)	7 (28)
	71-80	0	1 (4)
Comorbid	Nil	18 (72)	19 (76)
	Hypertension	1 (4)	1 (4)
	Type II DM	5 (20)	4 (16)
	HT & Type II DM	1 (4)	1 (4)

Table 2: Comparison of duration taken for skin closure and age in vertical mattress and subcuticular sutures (n=50).

Variables	Sub cuticular (N=25)	Vertical mattress (N=25)	P value
Age	55.88 ± 7.865	55.64 ± 8.967	0.920
Duration for skin closure	402.8 ± 35.939	144.08 ± 33.199	0.001

DISCUSSION

Time required for skin closure

This study found that there was no meaningful difference in age group among both groups. The duration taken for closure of the wound by subcuticular suture (402.8 ± 35.939 seconds) was higher compared with vertical mattress (144.08 ± 33.199 seconds) and this result was significant. Haribabu et al study in Tirupati compared vertical mattress and subcuticular suture procedures among patients scheduled for inguinoscrotal operations and discovered that the average time required for subcuticular skin closure is 476.67 ± 101.73 seconds and the average amount of time needed to close a vertical mattress skin is 149.35 ± 61.079 seconds.⁹ The closure time was higher in subcuticular than in mattress which shows a significant p value (0.001) which was similar to our study results.

Table 3: Post operative pain score (n=50).

Variables	Sub cuticular (N=25)	Vertical mattress (N=25)	P value
Day 0	7.8 ± 0.93	7.8 ± 0.93	0.128
Day 1	6.6 ± 1.225	6.92 ± 1.152	0.346
Day 3	4.12 ± 1.394	4.24 ± 1.4	0.762
Day 7	2.6 ± 1.472	2.36 ± 1.44	0.563

Table 4: Cosmesis score (n=50).

Variables	Sub cuticular (N=25)	Vertical mattress (N=25)	P value
Modified Hollander score	1.8 ± 0.764	1.68 ± 0.476	0.508
4 weeks post-operative	71.04 ± 2.937	68.48 ± 2.452	0.002
8 weeks post-operative	81.04 ± 2.263	80.12 ± 1.563	0.101

A study conducted in Baroda by Patel et al among patients posted for elective surgeries compared three types of sutures and found that the time required for closure was 1.08 ± 0.3 minutes, 7.15 ± 3.15 minutes and 10.29 ± 4.65 minutes in the stapler, subcuticular and vertical mattress suture technique respectively.⁷ The duration of wound closure time was higher in vertical mattress suture compared with subcuticular which shows contrast values might be due to sampling size (N=56 in subcuticular & N=53 in mattress group). A comparative study of subcuticular and three mattress sutures for Pfannenstiel skin closure among women with obstetric and gynecological surgeries in Indore by Joshi et al described that the time required for suturing was 5-10 mins in 66% of mattress stitches and 4% of subcuticular stitches.¹⁰ Total 10-15 minutes are required for 96% of

subcuticular stitches. None of the subcuticular stitches were completed in less than five minutes. 34% of mattress sutures were completed in less than five minutes. Subcuticular stitches required a higher time which shows the same results. Ghag et al in Mumbai among 90 hernia patients found that the least duration of time was needed to close the skin with a stapler 44.63 sec (± 47.23), which was considerable when compared to the subcuticular group's 459.93 sec and the simple interrupted closure's 193.33 sec.¹¹ Subcuticular stitches required higher time which also shows the same results.

Postoperative pain

This study reported that the post-operative pain score was almost the same in both groups and it shows non-significant values.



Figure 1: Classical vertical mattress suture.



Figure 2: Subcuticular suture.

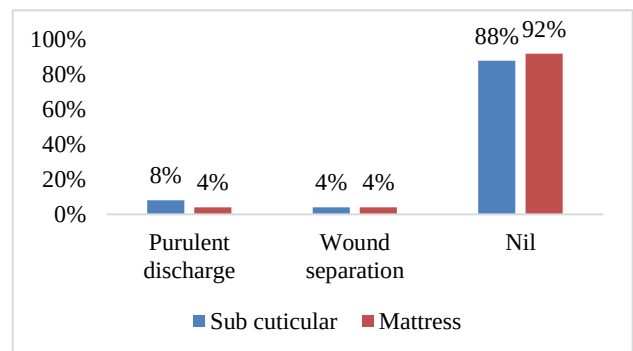


Figure 3: Complications of suture techniques.

Postoperative pain was estimated using a visual analog scale which had no significant mean difference among both groups (vertical mattress and subcuticular suture) based on Haribabu et al research similar to this study.⁹ Patel et al reported the pain score using the visual analog scale was 1.05, 0.53 and 0.23 on day 3, 7 and 14 post-operative days of subcuticular suture wound closure.⁷ The pain score using the visual analog scale was 1.9, 2.03 and 0.9 on day 3, 7 and 14 post-operative days of vertical mattress suture wound closure. There was no difference in the vertical mattress and the subcuticular group shows similar results. Joshi et al found that using a numerical rating scale 56% of subcuticular stitches had severe post-operative pain on the second post operative day which was higher than mattress sutures (20%).¹⁰ This shows contradictory results compared with our results could be due to type of surgery (inguinal hernia repair vs obstetric and gynecological surgeries). A post-operative pain score using the VAS scale was 1.13 ± 1.36 in subcuticular stitches which was lower compared with a stapler (1.80 ± 1.56) and simple interrupted skin closure (1.87 ± 1.22) by Ghag G et al. Subcuticular stitches had lower pain score compared to other stitches.

Complications

In this study, there was no significant difference in complications. Wound separation was observed in 4% of cases in both stitches. 4% of cases with mattress stitches and 8% of subcuticular stitches reported purulent discharge. 2% of patients had purulent discharge and 2% of them had wound separation in vertical mattress sutures and 4% of cases had wound separation and 4% of them had purulent discharge according to Haribabu et al study similar to our study results. A study by Karia et al in Gujarat reported that 6% of vertical mattress stitches were found to have serous discharge and 4% of subcuticular stitches were found to have serous discharge.¹ The purulent discharge was seen among 4% of vertical mattress stitches and none was reported with pus discharge in subcuticular stitches. Discharge was observed in both stitches as same compared with our study results. 3.57% of patients with subcuticular sutures had local wound infections and 24.52% of patients with vertical mattress suture closure had local wound infections to Patel et al research. Vertical mattress stitches had a higher rate of local wound infections compared with subcuticular which shows contradictory results might be due to sampling size. Joshi et al found there was no difference in presence of wound discharge in subcuticular (12%) and mattress stitches (16%) which was same as our results. Subcuticular group had the greatest wound infection rate (60%) followed by simple interrupted group (40%) and stapled group with the lowest wound infection rate by Ghag et al. Subcuticular stitches had higher infection rate compared with other stitches. Ten of the 25 patients with subcuticular sutures had wound discharge, compared to three individuals in the mattress group by Narahari et al in Chennai among obese patients posted for obstetric and gynecological

surgeries.¹² In the subcuticular group of 25 patients, wound gaping was discovered in 6, but in the mattress group, it only occurred in 1 by Narahari et al research. Wound separation was high in subcuticular group compared with mattress group which shows contrast results might be due to type of surgery. In patients scheduled for caesarian sections in Kanyakumari, purulent discharge was observed in 6% of cases, of which 83% (5/6) belonged to the mattress group and 17% (1/6) to the subcuticular group by Shwetha et al.¹³ Shwetha et al study also showed higher wound infection rate in subcuticular stitches could be due to obstetric and gynecological surgeries

Cosmesis

This study reported that there was no difference of cosmesis score in vertical mattress (1.68 ± 0.476) and subcuticular suture (1.8 ± 0.764) in seventh post operative day. On fourth week of post operative day, cosmesis score was significantly better in subcuticular stitches (71.04 ± 2.937) compared with vertical mattress stitches (68.48 ± 2.452). There was no difference of cosmesis score in vertical mattress (80.12 ± 1.563) and subcuticular suture (81.04 ± 2.263) in eighth week post operative day. Haribabu et al described in a study that wound cosmesis score had no significant mean difference on the seventh day of postoperative day. But it showed a higher cosmesis score in subcuticular sutures compared with mattress sutures which were significant in the fourth week of post-operative period. There was no significant mean difference in both sutures in the eighth week of post operative period which was similar to our study results. Joshi et al reported after a month cosmesis was excellent in mattress (44.1%) than subcuticular (35%), good in subcuticular (35%) than mattress (32.5%), and poor in subcuticular (30%) than mattress stitches (23.25%). There was no difference in both stitches in cosmetic appearance. The subcuticular group had the best overall cosmetic scar appearance, with a mean Overall POSAS (patient and observer scar assessment scale) Score of 2.23 ± 0.43 , which was substantially lower ($p=0.003$) than those of the stapled and simple interrupted groups, respectively. Subcuticular stitches had higher rate of cosmetic appearance compared other stitches rather than vertical mattress sutures.

Limitations

Limitations of current study were; the sample size was lower, for a need of generalisability larger sample size has to be considered.

CONCLUSION

Current study concluded that the duration of skin closure was higher in subcuticular compared with vertical mattress stitches. In the view of post operative pain there was no significant difference in both the groups. As complications concerned, wound discharge and

separation were the commonest findings observed in both stiches. Based on cosmetic appearance subcuticular stiches were shown better appearance compared with classical mattress stiches in fourth week of surgery but anyhow on eighth week of surgery both scars were shown same cosmetic appearance. In inguinal hernia repair there was no superiority of subcuticular suturing compared with vertical mattress suturing.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Saranya R, Padma S, Manoj SK. A prospective study on vertical mattress suture and subcuticular suture skin closure techniques in inguinal hernia repair cases. Int Surg J 2023;10:81-6.