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Original Research Article

Interrupted mattress versus continuous subcuticular versus stapler: a comparative study on wound closure outcomes in primary caesarean section with Pfannenstiel incision

Amrita Chaurasia, Kajal Jain*, Vandana Ojha, Nidhi Sachan, Vidhi Singh

Department of Obstetrics and Gynaecology, MLNMedical College, Prayagraj, Uttar Pradesh, India

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***Correspondence:**
Dr. Kajal Jain,
E-mail: kajaljn1995@gmail.com

ABSTRACT

Background: Aim of the study was to compare the suture techniques using interrupted mattress and continuous subcuticular and stapler in terms of wound closure time; pain in stitch line on post-operative day 3, 5 and 7 and patient satisfaction.
Methods: All patients fulfilling the inclusion criteria, were divided into 3 categories (interrupted mattress, subcuticular and staples) by random selection. Assessment parameters being skin closure time; induration and discharge on day 4 and 8; pain score using visual analogue scale on day 3, day 5 and 7; wound gaping and Patient satisfaction in terms of cosmesis using Likert's scale after 4-6 weeks.
Results: The skin closure time in mattress, subcuticular sutures and staples are found to be 8.891±1.343; 11.390±1.438 and 1.518±0.502 respectively. Pain on day 3, 5 and 7 were: severe pain was maximum seen in staples group (n=21) as compared to 7 patients in subcuticular group and 6 in mattress group. Wound complications were seen least in mattress group. One patient (1.20%) had wound gaping in mattress group, 3 (3.65%) of the patients in subcuticular group and 5 (6.17%) in staples group had wound gaping. Patient dissatisfaction rate was higher in staples group (8.64%) as compared to 6.09% patient in subcuticular group and 4.8% in mattress group.
Conclusions: The mattress suturing technique has least wound related complications and most patients satisfaction. Staples are quick in application and subcuticular technique gives a good scar, but is associated with similar complications as staples.

Keywords: Mattress, Subcuticular, Staples, Wound complications, Patient satisfaction

INTRODUCTION

Given there is no single material that is ideal for all situations, the physician must decide which material is best suited for that particular closure.[1] The interrupted vertical mattress technique is the most common skin closure method. These mattress sutures promote wound edge eversion and less prominent scarring. Skin edges are closed under tension in vertical mattress technique when wound edges are brought together over a distance. Although mattress sutures can produce surface scarring or-railroad marks, early removal of these sutures can limit this damage. [2] Advantage of this technique is that it provides closure for both deep and superficial layers, and also perfect eversion and vertical opposition of the superficial skin edges is achieved. Disadvantage of this interrupted mattress technique is that suture has be dug into skin and cause prominent scars. Patients reported significantly less pain following subcuticular closure at both the time of discharge and the postoperative visit. Incisions closed with subcuticular suture were more cosmetically attractive by both patients and physicians at the postoperative visit. Pfannenstiel skin incisions closed with subcuticular closure following caesarean section result in less postoperative discomfort and are more cosmetically appealing at the six-week postoperative visit as compared to incisions closed with staples.[3] The advantage of staples

involves a quick and simple application but, removal may be more painful with staples than with stitches, and much depends on the technique of staple application.[4] Staple closure is faster to perform but associated with a higher risk of wound complications.[5] So many studies have been done to know the best suturing technique, but most of them have been inconclusive in claiming one suture technique better over the other. Therefore, this study was done in the uncomplicated post primary caesarean patients to assess and compare the wound closure techniques using interrupted mattress sutures using ethilon 2.0; continuous subcuticular sutures with ethilon 2.0; and stapler using stainless steel staples. Most placed suture is mattress in our setup followed by subcuticular and least used is stapler.

METHODS

Duration of the study is 1 year (September 2021-septemver 2022) at department of obstetrics and gynaecology, Swaroop Rani Nehru hospital, Moti Lal Nehru medical college and Kamla Nehru memorial hospital, Prayagraj after approval from the institute ethics committee. A detailed clinical history regarding age, occupation, socioeconomic status, presence of obstetrical complications like severe preeclampsia, eclampsia, prolonged PROM, presence of chorioamnionitis, obstructed labour, massive antepartum haemorrhage, was taken. Menstrual, obstetric, personal, medical, family and dietary history were taken and general, systemic and obstetrical examination was done along with antenatal and routine pre-operative investigation being done. All patients fulfilling the inclusion criteria were divided into 3 categories by random selection with group A comprised of 83 women having wound closure by interrupted mattress suture using ethilon 2.0 suture material, group B comprised of 82 women having wound closure by continuous subcuticular suture using ethilon 2.0 suture material and group C comprised of 81 women having wound closure by staplers using stainless steel staple clips. To maintain homogeneity, All the patients received same injectable broad-spectrum antibiotics for 3 days, injectable analgesics for 2 days followed by oral tablet with multivitamins, serratiopeptidase, vitamin C, and vitamin A. Follow up protocol was as follows: The patients were followed on day 3, 4, 5, 7 and 8 and at 6 weeks postpartum. On day 3, day 5 and day 7: Stich line pain was assessed by visual analogue scale score. On day 4 and day 8: Wound status was assessed in the form of seroma, hematoma, discharge, induration was noted on day 4 and day 8, as stitch line dressing was done on day 4 and stiches were removed on day 8. Pain score using visual analogue score was calculated on day 8 during suture removal. At 6 weeks or postpartum follow up (whenever patients came between 4-8 weeks): patient satisfaction was calculated using Likert's scale. Assessment parameters taken were: Skin closure time, post operative induration and discharge on day 4 and 8, Pain score using visual analogue scale on day 3, day 5 and 7, Pain score using visual analogue scale while removing the sutures and staples, Post operative wound gaping during suture removal on day 8 and patient satisfaction in terms of cosmesis using Likert's scale after 4-6 weeks.

Inclusion criteria

All the pregnant women undergoing primary caesarean section with Pfannenstiel incision were enrolled in the study.

Exclusion criteria

Hemoglobin less than 8 gm/dl, repeat surgery through the previous scar: hysterotomy, laprotomy for ectopic pregnancy, laprotomy for any abdominal surgery, caesarean section and women with paramedian incision, total leucocyte count >14000 cells/cm^3, BMI >25 kg/m^2, BMI<18 kg/m^2, obstetrical complications like severe preeclampsia, eclampsia, prolonged PROM, presence of chorioamnionitis, obstructed labor, massive antepartum hemorrhage, massive postpartum hemorrhage (more than or equal to 20% blood loss), caesarean hysterectomy. Medical conditions: GDM/ overt diabetes, renal diseases, uncontrolled thyroid disorders, active liver disorders, genito-urinary infections, pre-existing skin infections. Immunocompromised state: HIV infection, on steroid therapy, immunomodulators. History of addictions like habitual smoking, alcoholic, tobacco consumption, recreational drug use. Patients unwilling to give consent to be enrolled in the study.

RESULT

Mean skin closure time

The skin closure time in mattress, subcuticular sutures and staples are found to be 8.891±1.343; 11.390±1.438 and 1.518±0.502 respectively. The difference in mean time taken to close the wound in each technique is found to be statistically significant at $p<0.05$ with least time taken in stapler group.

Pain on day 3, 5 and 7

Occurrence of pain at day 3, 5 and 7 was measured. Occurrence of severe pain was maximum seen in staples group (n=21) as compared to 7 patients in subcuticular group and 6 in mattress group. The results were found to be not significant.

Wound inspection findings on day 4

Wound complications were seen least in mattress group (74.69% healthy patients, 15.866% and 9.63% had induration and discharge respectively). The 60.97% patients had healthy wounds in subcuticular group with 21.9% patients had induration and 17.07% had discharge. 61.72% of the patients had healthy wounds in stapler group whereas, 24.69% had induration and 13.5% of the patients had discharge. The difference in wound complications were found to be statistically insignificant.

Wound inspection findings on day 8

Wound complications seen least in mattress group (83.13% healthy patients, 10.84% and 6.02% had induration and discharge resp.), 71.95% patients had healthy wounds in subcuticular group with 18.29% patients had induration and 9.75% had discharge, 76.54% of patients had healthy wounds in stapler group whereas, 16.04% had induration and 7.4% had discharge. Diff. in wound complications found statistically insignificant.

Mean suture removal time

Skin closure time in mattress, subcuticular sutures and staples are found to be 2.192±0.426; 1.097±0.298 and 1.074±0.380 respectively. Results found to be significant at $p<0.05$ with max time taken in mattress group.

Wound gaping

One (1.20%) patients had wound gaping in mattress group, 3 (3.65%) of patients in subcuticular group, 5 (6.17%) in staples group had wound gaping. Diff. in wound gaping in different groups was found to be statistically insignificant.

Patient satisfaction

Patient dissatisfaction rate was higher in staples group (8.64%) as compared to 6.09% patient in subcuticular group and 4.8% in mattress group. The results were found to be not statistically significant.

Table 1: Distribution of study participants according to type of skin closure, (n=246).

Skin closure	N (%)
Group A (mattress suture)	83 (33.7)
Group B (subcuticular suture)	82 (33.33)
Group C (staples)	81 (32.92)

Table 2: Distribution of study participants according to age, (n=246).

Age (Years)	Total, n (%)	Group A (Mattress), (n=83) (%)	Group B (Subcuticular), (n=82) (%)	Group C (Staples), (n=81) (%)	P value
15-20	16 (6.5)	4 (25)	9 (56.25)	3 (18.75)	1.005
21-25	139 (56.5)	49 (35.25)	47 (33.8)	43 (30.93)	1.283
26-30	79 (32.11)	26 (32.91)	23 (29.11)	30 (37.97)	0.089
31-35	12 (4.8)	4 (33.33)	3 (25)	5 (41.66)	1.006
>35	00 (0)	0	0	0	0

Table 3: Distribution of patients according to BMI, (n=246).

BMI (kg/m^2)	Total, n (%)	Group A (Mattress), (n=83) (%)	Group B (Subcuticular), (n=82) (%)	Group C (Staples), (n=81) (%)	P value
<20	38 (15.44)	12 (31.57)	13 (34.21)	13 (34.21)	0.965
20.1-21.5	112 (45.52)	37 (33.03)	40 (35.71)	35 (31.25)	0.902
21.5-22.5	27 (10.97)	9 (33.33)	11 (40.74)	7 (25.92)	0.682
>22.5	69 (28.04)	25 (36.23)	18 (26.08)	26 (37.68)	0.509

Table 4: Distribution of patients according to hemoglobin levels, (n=246).

Hb levels (gm/dl)	Total, n (%)	Group A (Mattress), (n=83) (%)	Group B (Subcuticular), (n=82) (%)	Group C (Staples), (n=81) (%)	P value
8-9	36 (14.63)	11 (30.5)	13 (36.11)	12 (33.33)	0.918
9-10	95 (38.61)	40 (42.1)	27 (28.42)	28 (29.47)	0.349
10-11	103 (41.86)	28 (27.18)	39 (37.86)	36 (34.95)	0.472
>11	12 (4.8)	4 (33.33)	3 (25)	5 (41.66)	0.777

Table 5: Mean skin closure time with different skin closure techniques.

Skin closure	Mean skin closure time (min)	SD	Mode	Median	P	Mean suture removal time (min)	SD	Mode	Median	P
Group A (Mattress	8.891	±1.343	9	9	<0.05	2.192	±0.426	2	2	<0.05

Continued.

Skin closure	Mean skin closure time (min)	SD	Mode	Median	P	Mean suture removal time (min)	SD	Mode	Median	P
suture)										
Group B (Subcuticular suture)	11.390	±1.438	12	12	<0.05	1.097	±0.298	1	1	<0.05
Group C (Staples)	1.518	±0.502	2	2		1.074	±0.380	1	1	

Table 6: Comparison of pain with different skin closure techniques.

Pain score (VAS score)		Skin closure techniques			P value
		Group A (Mattress), (n=83) (%)	**Group B (Subcuticular), (n=82) (%)**	**Group C (Staples), (n=81) (%)**	
Day 3	Mild (VAS score 1-2)	0 (0)	0 (0.0)	0 (0)	0.0865
	Moderate (VAS score 3-4)	79 (95.1)	77 (93.9)	70 (86.4)	
	Severe (VAS score 5-6)	4 (4.81)	5 (6.09)	11 (13.5)	
Day 5	Mild (VAS score 1-2)	80 (96.3)	78 (95.1)	73 (90.1)	0.270
	Moderate (VAS score 3-4)	2 (2.40)	3 (3.65)	3 (3.70)	
	Severe (VAS score 5-6)	1 (1.20)	1 (1.21)	5 (6.17)	
Day 7	Mild (VAS score 1-2)	81 (97.5)	81 (98.7)	76 (93.8)	0.148
	Moderate (VAS score 3-4)	1 (1.20)	0 (0)	0 (0)	
	Severe (VAS score 5-6)	1 (1.20)	1 (1.21)	5 (6.17)	

Table 7: Wound infection finding in different study groups.

Findings	Group A (Mattress), (n=83) (%)	Group B (Subcuticular), (n=82) (%)	Group C (Staples), (n=81) (%)	P value
Healthy (day 4)	62 (74.69)	50 (60.97)	50 (61.72)	0.644
Induration (day 4)	13 (15.66)	18 (21.9)	20 (24.69)	0.489
Discharge (day 4)	8 (9.63)	14 (17.07)	11(13.5)	0.471
a) Serous	7 (87.5)	13 (92.8)	8 (72.7)	0.372
b) Serosanguinous	0 (0)	1 (7.14)	1 (9.09)	0.602
c) Purulent	1 (12.5)	0 (0)	2 (18.18)	0.365
Healthy (day 8)	69 (83.13)	59 (71.95)	62 (76.54)	0.542
Induration (day 8)	9 (10.84)	15 (18.29)	13 (16.04)	0.493
Discharge (day 8)	5 (6.02)	8 (9.75)	6 (7.4)	0.703
a) Serous	4 (80)	8 (100)	5 (83.33)	0.487
b) Serosanguinous	0	0	1 (16.66)	0.364
c) Purulent	1 (20)	0	0 (0)	0.377

Table 8: Comparison of patient satisfaction with different skin closure techniques.

Skin closure	Total patients	Wound gaping		Patient satisfaction	
		Yes, n (%)	**Yes, n (%)**	**No, n (%)**	**No, n (%)**
Group A (Mattress suture)	83	1 (1.20)	79 (95.1)	4 (4.8)	82 (98.80)
Group B (Subcuticular suture)	82	3 (3.65)	77 (93.9)	5 (6)	79 (96.34)
Group C (Staples)	81	5 (6.17)	74 (91.35)	7 (8.6)	76 (93.83)
P value		0.238		1.0185	

DISCUSSION

Table no 5 shows that staplers were the quickest method to close the abdomen. The mean time taken in staples group was 1.51 minutes as compared to 11.3 minutes in subcuticular and 8.8 minutes in mattress group. In mattress suture, the skin is pierced 4 times for each suture, which takes time longer than staples. Subcuticular suture needs expertise and time taking for the suture must be kept in the right plane, immediately below the epidermal layer. 'Comparative study of wound healing, pain and cosmetic results by staples versus subcuticular skin suture after

caesarean delivery' by Arpitha et al at RGUHS, Bangalore, Karnataka, India had a total of 230 patients of which 115 women were in subcuticular sutures group and 115 women were in staples group.[6] The closure time was 2.02 min lesser in staples closure than subcuticular closure which was significant (p=0.0001). Therefore, use of staples will mean a shorter duration of surgery and anaesthesia for the patients and better efficacy of obstetric services in a busy labour ward setting where several patients may require interventions consecutively. In a similar study 'randomized study comparing skin closure in caesarean section: staples vs subcuticular sutures' conducted by Rousseau et al operative time was found to be shorter in staple group (24.6 vs 32.9 minutes; p<0.0001).[7] Another study like 'a randomized study comparing skin staples with subcuticular sutures for wound closure at caesarean section' by Abdus-Salam et al university college hospital, Ibadan, Nigeria in 2014 found that the operation time which was defined by duration from skin incision to the completion of wound closure, was shorter for participants in the staple group, 40.26 minutes (±16.53) compared to the suture group 47.55 minutes (±14.55).[8] On comparing the suture removal time in different techniques, the skin closure time in mattress, subcuticular sutures and staples are found to be 2.192 minutes; 1.097 minutes and 1.074 minutes respectively. There was a significant time difference noted between removing mattress suture and other groups. To remove sutures, one tail was grasped with forceps and pulled gently towards one side to the wound, elevating the knot. The opposite side of the suture should then be cut with stitch-cutters or fine suture scissors immediately under the knot. This process takes time as compared to the staple removal and subcuticular suture.

Table 6 shows stitch line pain scores at day 3, 5 and 7 that was measured by visual analogue scale score. Pain score was maximum in staples group as compared to patients in subcuticular group and in mattress group. The 6.17% patients had severe pain (VAS score 5-6) on day 7 while only 1.2% patients in mattress and subcuticular group each; similar trends were seen on day 3 and 5. The results even though not being significant, pointed towards staplers causing maximum distress in the patient. Similar results were found in the study 'comparison between interrupted vertical mattress suture versus skin stapler versus subcuticular suture for skin closure in clean surgery' by Patel et al at Baroda medical college, S.S.G. hospital where they concluded that 'Local site pain was observed more in stapler group patients as compared to other'.[9]

In Table 7 we compared wound complications on day 4 and day 8 and we found that: No. of patients with induration in subcuticular group (21.9%) and staples group (24.69%) were more than mattress group (15.66%) on day 4. Similar trends, however in reduced percentages, were seen on day 8 where we found that patients in subcuticular group (18.29%) and staples group (16.06%) had more induration than mattress group (10.84%). And similarly wound discharge on day 4 was maximum (17.07%) in subcuticular followed by staplers (13.5%) and was least; (9.63%) in mattress suturing. On day 8, the incidence of discharge was reduced but the trend was same with maximum incidence (9.75%) in subcuticular group, (7.4%) in staples group and (6.02%) in mattress group; and the differences in occurrence of induration and Subcuticular was found to have more unhealthy wounds and the reason a can be explained by the fact that there is no space for discharge drainage and this leads to pent up discharge and wound infections. Likewise, some other studies also found subcuticular stiches with maximum rates of wound complications. Basha et al compared subcuticular stitching to staples to close the skin with good number of study participants (n=435) and concluded that staple closure was associated with a 4-fold increased risk of wound separation and quoted that 'It seemed to me that I was seeing more patients return with complications after a caesarean birth when staples were used instead of sutures but I couldn't find any studies that supported a recommendation for use of either method'.[10] In Another study by Shwetha et al who did 'Comparison between interrupted vertical mattress suture versus subcuticular suture for skin closure in CS at SMIMS showed that Serous discharge was seen in 40% (2/5) of mattress sutures and 60% (3/5) of subcuticular sutures.[11] These percentages were high because they took the total number of patients with wound complication as denominator, whereas we calculated the percentages from the total population in the particular study groups. If we calculate the same way, 4/5 (80%) had serous discharges in mattress group while 5/6 (83%) in stapler group, which is almost same

Table 8 shows the occurrence of wound gaping was significantly higher in staples group (6.17%) as compared to (3.65%) patient in subcuticular group and (1.20%) in mattress group. Even though statistically insignificant, wound gaping was mostly associated with staples. Similar results were found in a study by Tuuli et al 'Staples compared with subcuticular suture for skin closure after caesarean delivery: a systematic review and meta-analysis.'[12] They also found that staple closure (n=803) was associated with a twofold higher risk of wound infection or separation compared with subcuticular suture closure. Even though wound complications were almost comparable in subcuticular and staples group, both on day 4 and 8, with maximum in subcuticular group. Still, wound gaping was maximum in stapler group, one of the reasons could be due to the superficial placement of the staples. Patient dissatisfaction rate was higher in staples (8.64%) as compared to 6.09% patient in subcuticular group and 4.8% in mattress group. Due to higher incidences of post operative wound complications and wound gaping, and, pain during removal, staples was the least preferred by the patient. In a similar study, 'Comparative study of wound healing, pain and cosmetic results by staples versus subcuticular skin suture after caesarean delivery' by Arpitha et al at RGUHS, Bangalore, Karnataka, India showed patient satisfaction was noted in 51.3% and 53% of the participants while 48.7% and 47% expressed neutral opinion among staples and subcuticular study group respectively.[6] The patient satisfaction between the two

groups was found to be almost equal and it was not significant (p=0.792). the result of this study was comparable to our study. Where as in a study by comparison between interrupted vertical mattress suture versus skin stapler versus subcuticular suture for skin closure in clean surgery' by Patel et al at surgery department of Sir Sayajirao general hospital and medical college, Baroda from February 2013 to October 2013.[9] The mean patient satisfaction score in group A (stapler) is 6.94±1.09, in group B (subcuticular) is 7.42±0.95 while in group C (vertical mattress) it is 6.54±1.15. Satisfaction was maximum in B group (subcuticular), which is contradictory to our study where maximum satisfaction was found in mattress group owing to least complications.

Limitations

Although the present study represents sincere and honest work by the researcher in obtaining data pertaining to compare mattress v/s subcuticular v/s stapler technique in Pfannenstiel incision in primary caesarean section, the present study had its own short comings. Patients enrolled were not segregated into emergency and elective procedures and considering the setup being a tertiary referral hospital, most of the patients underwent emergency caesarean section. Results were concluded from a single tertiary referral centre and therefore, cannot be generalized for all settings.

CONCLUSION

Present study recommends that mattress suturing technique has least wound related complications in terms of pain, discharge, induration and wound gaping and most patients satisfaction. Every suture technique has its own advantages and disadvantages in terms of pain, cost etc. Staples though associated with more complications are quick in application and in a busy labor room with multiple procedures lined up, is recommended to save time. Subcuticular technique on other hand gives good scar, but is associated with almost similar complications as staples.

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