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ORIGINAL ARTICLE

# Poliglecaprone 25 versus Polyamide Suture for Skin Closure during Cesarean Delivery: A Prospective Comparative Study

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## ABSTRACT

***Background and Objective:*** Cesarean delivery (CD) is the most common surgery performed in obstetrics. Most of the CDs are performed by Pfannenstiel incision, a low transverse suprapubic incision. The skin wound of the CD is generally closed with nonabsorbable or absorbable monofilament sutures. In this study, we compared the patient satisfaction and wound outcomes of poliglecaprone 25 (Monocryl) absorbable monofilament suture with polyamide (Ethilon) non-absorbable monofilament suture for Pfannenstiel skin closure following CD.

***Methods:*** A prospective comparative study was conducted on women who were undergoing CD in the Department of Obstetrics and Gynaecology, AIIMS Rishikesh. A total of 132 women were included in the study as per eligibility criteria. Of these, 66 women had Pfannenstiel skin closure with Polyamide sutures and another 66 women with Poliglecaprone 25 sutures. The primary outcome measures were patient satisfaction and scar assessment. The secondary outcome measures were skin closure time and wound outcomes.

***Results:*** Both groups had similar baseline demographic characteristics like age, body mass index, and co-morbidities. However, polyamide suture group had the larger proportion of previous CDs.The mean patient satisfaction score was significantly higher in poliglecaprone 25 suture group ($p<0.001$). The Modified

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Hollander cosmetic scale was used for scar assessment, the score was significantly higher in the polyamide suture group ($p<0.001$), which suggests a significantly better cosmetic appearance in poliglecaprone 25 suture group than polyamide suture group. Skin closure time was significantly higher in the poliglecaprone 25 suture group ($p<0.001$). Wound seroma, wound gap and wound infection were comparable in both groups. None of the patients in both groups developed wound hematoma. Approximately 6.3% of patients in the polyamide suture group required wound resuturing.

***Conclusion:*** Subcuticular stitch using poliglecaprone 25 absorbable suture is superior to the interrupted mattress stitch using polyamide suture for Pfannenstiel skin closure following CD with respect to patient satisfaction, cosmetic appearance and better wound outcomes.

**KEYWORDS**

• Cesarean delivery • Visual analogue scale • Modified Hollander Cosmesis Scale

## INTRODUCTION

Cesarean delivery (CD), also known as C-section, is the delivery of the baby through abdominal and uterine incisions; technically, we can say laparotomy and then hysterotomy. CD is the most common surgery performed in obstetrics. Most of the CDs are performed by Pfannenstiel incision, a low transverse suprapubic incision that involves separation of rectus muscle from the overlying rectus sheath after incising skin and rectus sheath. This transverse incision is generally assumed to have superior strength and healing outcomes than vertical midline incisions. It provides adequate exposure to pelvic organs and leaves a cosmetically acceptable scar. These incisions need closure to restore the anatomy.[1] The main aim of surgical suturing is to bring the skin edges together without tension, obliteration of dead space, even distribution of tension along deep suture lines, and maintenance of tensile strength across the wound.[2]

Various methods used to close cesarean skin incisions include interrupted mattress sutures, subcuticular stitches, staples, and adhesive tapes. Each method has its own advantages and disadvantages. The ideal skin closure should be safe, effective, inexpensive, take less time, yield minimal patient discomfort, and have good cosmetic outcomes. It should also require minimal follow-up and yield a low rate of wound complications.[3] The efficient healing of the cesarean wound is a very important determinant of the postoperative satisfaction of the patient.

The skin incision of the CD is generally closed with nonabsorbable or absorbable monofilament sutures. The nonabsorbable suture is associated with poor cosmesis, an additional procedure is required to remove sutures, and the timing of suture removal affects the degree of scarring.[4] Poorer skin approximation and lesser satisfaction are reported with non-absorbable sutures. Rapid suture removal can result in weak wound tensile strength and wide scar, while late removal can result in scar formation due to inflammation. In contrast, an absorbable suture yields good cosmesis, significantly fewer wound complications, less postoperative pain, better wound outcomes, and more patient satisfaction; however, their use has the disadvantage of being time-consuming and expensive.[5,6]

The use of absorbable sutures in non-complicated obstetric cases undergoing CD should be advocated. Only a few studies have compared absorbable and non-absorbable sutures for skin closure after CD and their cosmetic outcomes and wound complications.[7-10]

In the present study, we compared patient satisfaction, scar assessment, and wound outcomes of poliglecaprone 25

(Monocryl) absorbable monofilament suture and polyamide (Ethilon) non-absorbable monofilament suture for Pfannenstiel skin closure following CD.

## METHODOLOGY

It was a prospective comparative study conducted in the Department of Obstetrics and Gynecology, All India Institute of Medical Science, Rishikesh, Uttarakhand, India, over a period of 1 year and 6 months (January 2022 to June 2023) after obtaining institutional ethical committee clearance (AIIMS/IEC/22/600) and registered in the clinical trial registry of India (CTRI/2023/04/051894).

The sample size was calculated based on a similar study done by Nayak G B *et al*.[3] using G power version 3.1 using a proportion of patient satisfaction following usage of Ethilon and Monocryl suture. Accounting for attrition of 10%, the calculated sample size was 132 (66 in each group).

All women who were getting admitted for CD from the AIIMS outpatient department and emergency department were assessed for eligibility. Women with a history of previous CDdone by midline vertical skin incision, clinical signs of infection, uncontrolled diabetes, any allergy to suture materials, immunosuppressive patients and a tendency for keloid formation were excluded from this study. All other women undergoing CD were invited to participate in the study.

A written informed consent was obtained from all participants. Baseline data related to age,parity,any history of previous surgery, co-morbidities and high-risk factors were recorded. All patients underwent the standard pre-operative work-up before surgery, received prophylactic perioperative antibiotics, and had CDas per the routine technique. The rectus sheath was closed with an absorbable polydiaxone surgical suture (Loop PDS 2-0). The skin incision was closed with either vertical mattress sutures using polyamidesuture (Ethilon 2-0) or subcuticular sutures using poliglecaprone 25 suture (Monocryl 3-0). Interrupted vertical mattress stitches were made by piercing the skin at four points (far-far-near-near) at the same level for a single stitch using a non-absorbable polyamide suture. The far loop enters and exits the skin surface at a 90-degree angle and passes deep into the dermis, including the whole of the fat layer. Subcuticular stitches were made by repairing the subcuticular or epidermal tissue in a running suture using an absorbable poliglecaprone 25 suture. The subcutaneous fat layer was sutured if it was more than 2.5 cm thick. Sterile dressing was applied following skin closure in both groups.

Our primary outcome measures were patient satisfaction and scar assessment. Patient satisfaction with cosmesis of the surgical wound was noted by using a visual analog scale (VAS) before discharge from the hospital. A VAS is a horizontal line of 100-mm long. At the beginning and the end, there were two descriptors representing extremes of satisfaction (i.e. no satisfaction and extremes of satisfaction). The patient rated her satisfaction by making a vertical mark on the 100mm line, as shown in *Figure 1*. The exact question was,"How much are you satisfied with the skin closure method?

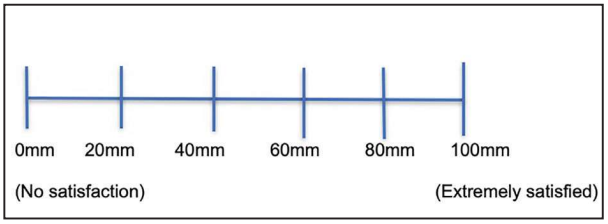


**Figure 1:** 100 mm visual analogue scale

The cesarean scar was assessed for the cosmetic outcome of the wound at 6 weeks following CD using a validated scale: Modified Hollander Cosmesis Scale. It has 6 variables: step-off borders, contour irregularities, wound margin separation, edge inversion, excessive inflammation, and overall appearance. A total cosmetic score was derived by adding the scores of the variables. A score of 1 was given to each variable if present in the wound, and a score of 0 was given to each variable if not present in the wound. So, a score of 6 was considered as worst, while a score of 0 was considered as best.

Secondary outcomes were skin closure time(calculated from the beginning of first stitch to the end of last stitch in minutes) and wound complication rate (seroma or hematoma, wound gapping, infection, re-suturing) after CD.After 48 hours in the postoperative period, every patient's wound was examined for any discharge (seroma, hematoma) and signs of inflammation. In case of wound discharge, wound swabs were taken for culture and

sensitivity, and sensitive antibiotics were started. Daily dressing and wound resuturing were performed in wound dehiscence.

Statistical analysis - Data was stored in password password protected database and was analysed for statistical significance. Descriptive statistics were elaborated in the form of means/standard deviations and medians/ IQRs for continuous variables and frequencies and percentages for categorical variables. Group comparisons for continuously distributed data were made using the independent sample 't-test' when comparing two groups. If data were found to be non-normally distributed, appropriate non-parametric tests in the form of the Wilcoxon test were used. Chi-squared test was used for group comparisons of categorical data. Statistical significance was kept at $p < 0.05$.

## RESULTS

A prospective comparative study was conducted to compare poliglecaprone 25 monofilament suture and polyamide monofilament suture for skin closure following CD. A total of 132 women who met the eligibility criteria were included in the study. Out of these, 66 women had skin closure with Polyamide suture, and another 66 women had skin closure with Poliglecaprone 25 suture.The baseline socio-demographic characteristics were similar in both groups,as shown in *Table 1*. However, the polyamide suture group had the larger proportion of previous CDs.

**Table 1:** Baseline socio-demographic characteristics of both groups

| Parameters | Polyamide group (n=66) | Poliglecaprone 25 group (n=66) | P value |
|---|---|---|---|
| Age (Year) | 28.47 ± 4.56 | 27.88 ± 3.78 | |
| 18-30 Years | 48(72.7%) | 52 (78.8%) | 0.606[1] |
| 31-40 Years | 17 (25.8%) | 14 (21.2%) | |
| 41-50 Yeas | 1 (1.5%) | 0 (0.0%) | |
| Socio-economic status | | | |
| Upper | 5 (7.6%) | 2 (3.0%) | |
| Upper middle | 33 (50.0%) | 30 (45.5%) | 0.006[2] |
| Lower middle | 21 (31.8%) | 34 (51.5%) | |
| Upper lower | 7 (10.6%) | 0 (0.0%) | |
| BMI | 22.30 ± 2.79 | 22.26 ± 2.51 | 0.985[1] |
| Parity | | | |
| Primigravida | 6 (9.1%) | 37 (56.1%) | <0.001[3] |
| Multigravida | 60 (90.9%) | 29 (43.9%) | |
| Period of gestation (weeks) | 38.25 ± 1.87 | 38.67 ± 1.24 | 0.106[1] |
| High risk factors | 12(18.2%) | 13(19.7%) | 0.824[3] |
| Previous history of CD | 46(69.7%) | 7(10.6%) | <0.001[3] |
| Co-morbidities | 5(7.6%) | 5(7.6%) | 1.000[3] |

***Significant at p<0.05, 1: Wilcoxon-Mann-Whitney U Test, 2: Fisher's Exact Test, 3: Chi-Squared Test

**Abbreviations:** BMI - body mass index; CD - cesarean delivery

Pregnancy associated co-morbidities like anemia, thrombocytopenia, oligo / anhydramnios, deranged liver and kidney function test (LFT & KFT), intra-hepatic cholestasis of pregnancy (IHCP), gestational hypertension, preeclampsia, gestational diabetes mellitus (GDM), intrauterine growth restriction (IUGR), antepartum hemorrhage (APH) and prelabour rupture of membrane (PROM) were equally distributed in both groups (*table 2*).

**Table 2:** Pregnancy-associated maternal co-morbidities in both groups

| Parameters | Polyamide group (n=66) | Poliglecaprone 25 group (n=66) | P value |
|---|---|---|---|
| Anemia | 4 (6.1%) | 5 (7.6%) | 1.000[2] |
| Thrombocytopenia | 1 (1.5%) | 0 (0.0%) | 1.000[2] |
| Hypothyroidism | 4 (6.1%) | 4 (6.1%) | 1.000[2] |
| Oligohydramnios/Anhydramnios | 5 (7.6%) | 7 (10.6%) | 0.545[3] |
| Deranged LFT | 0 (0.0%) | 2 (3.0%) | 2 (3.0%) |
| Deranged KFT | 0 (0.0%) | 0 (0.0%) | 1.000[3] |
| IHCP | 4 (6.1%) | 8 (12.1%) | 0.226[3] |
| Gestational Hypertension | 3 (4.5%) | 3 (4.5%) | 1.000[2] |
| Preeclampsia/eclampsia | 6 (9.1%) | 5 (7.6%) | 0.753[3] |
| GDM | 1 (1.5%) | 4 (6.1%) | 0.365[2] |
| IUGR | 6 (9.1%) | 4 (6.1%) | 0.511[3] |
| APH | 3 (4.5%) | 4 (6.1%) | 1.000[2] |
| PROM | 3 (4.5%) | 4 (6.1%) | 1.000[2] |
| PPROM | 1 (1.5%) | 1 (1.5%) | 1.000[2] |

***Significant at p<0.05, 1: Wilcoxon-Mann-Whitney U Test, 2: Fisher's Exact Test, 3: Chi-Squared Test

**Abbreviations:** LFT - liver function test; KFT - kidney function test; IHCP - intrahepatic cholestasis of pregnancy; GDM - gestational diabetes mellitus; IUGR - intrauterine growth restriction; APH - antepartum hemorrhage; PROM - prelabourrupture of membrane; PPROM - preterm prelabour rupture of membrane.

Table 3 depicts the intraoperative parameters like skin closure time, patient satisfaction score, wound outcomes, and scar assessment at 6 weeks in both groups. Skin closure time was significantly higher in the poliglecaprone 25 suture group (p<0.001). The mean patient satisfaction score (VAS) was highest in the poliglecaprone 25 suture group (p<0.001). Wound seroma, wound gap and wound infection rates were comparable in both groups. None of the patients in both groups developed wound hematoma. Approximately 6.3% of patients in the polyamide suture group required wound resuturing. The Modified Hollander cosmetic scale score was significantly higher in the polyamide suture group (p<0.001), so the cosmetic appearance was significantly better in the poliglecaprone 25 suture group than in the polyamide suture group.

**Table 3:** Intraoperative parameters and postoperative wound outcomes in both groups

| Parameters | Polyamide group (n=66) | Poliglecaprone 25 group (n=66) | P value |
|---|---|---|---|
| Skin closure time | 7.41 ± 0.82 | 9.09 ± 1.11 | <0.001[1] |
| Patient satisfaction score (VAS) | 74.29 ± 8.17 | 90.30 ± 6.56 | <0.001[1] |
| Wound complications | | | |
| Seroma | 4 (6.3%) | 5 (8.2%) | 0.741[2] |
| Hematoma | 0 (0.0%) | 0 (0.0%) | 1.000[3] |
| Gaping | 5 (7.9%) | 2 (3.3%) | 0.440[2] |
| Infection | 5 (7.9%) | 2 (3.3%) | 0.440[2] |
| Re-suturing | 4 (6.3%) | 0 (0.0%) | 0.119[2] |
| Modified Hollander Wound assessment score | 0.49 ± 0.91 | 0.07 ± 0.51 | <0.001[1] |

***Significant at p<0.05, 1: Wilcoxon-Mann-Whitney U Test, 2: Fisher's Exact Test, 3: Chi-Squared Test, 4: VAS - visual analog score

## DISCUSSION

The CD is by far one of the most common obstetric surgery performed worldwide. Most of CD are performed through Pfannenstiel incision. Postpartum surgical site infection is the major cause of prolonged hospital stay and a burden to the health care system and patients. Various skin closure techniques and suture materials have been tried so far with variable results like stapler vs monocryl [4,11], polypropylene vs monocryl,[12] vicryl vs polyprophylene[13], vicryl vs monocryl,[14] caprosyn vs prolene,[15] and vicryl vs nylon.[16,17] Although the search for ideal suture material for pfannensteil incision in CD continues, synthetic absorbable monofilament suture is emerging as the best suture material with appropriate approximation, adequate healing and better cosmesis.

There are only a few studies published in the literature which compared poliglecaprone 25 absorbable monofilament suture and polyamide non-absorbable monofilament suture for skin closure in CD. We could only find 6 studies, 5 of them were done in skin incision following CD,[3,7-10] and one more study was done in patients planned for excision of swellings like lipoma, sebaceous cyst, dermoid cyst and simple cyst.[18]

In our study, patients with previous CD were significantly ($p<0.001$) higher in the polyamide suture group than the poliglecaprone 25 group. Akhila V. *et al*.[7] and Shridevi A.S. *et al*.[9] also noted a significantly higher number of patients with previous surgical history in polyamide suture group.

The distribution of anemia and GDM was similar in both groups of our study. Similarly, both groups were comparable in terms of anemia and GDM in studies by Akhila V. *et al*.,[7] Shridevi A.S. *et al*.[9], and Nayak G.B. *et al*.[3] Additionally, we noted the distribution of obesity, thrombocytopenia, anhydramnios, derranged LFT and KFT, preeclampsia, APH, and PROMin both groups, which was comparable in both groups. This is the first study to compare various maternal co-morbidities associated with pregnancy in both groups. This is the reason we couldn't compare our results with other studies. This analysis was important as all these co-morbidities can act as confounding factors and could have influenced the wound outcome, such as a higher rate of wound complications (seroma, infection and wound gap).

The primary outcome of our study was patient satisfaction with surgical wound. Similar to our study, Shridevi A.S. *et al*.[9]also used VAS to assess patient satisfaction. Whereas, Akhila V. *et al*.[7] used a patient scar assessment scale, Nayak G.B. *et al*.[3] used a Likert scale to assess patient satisfaction. Patient satisfaction was significantly higher in poliglecaprone 25 group (90.30±6.56) compared to polyamide group (74.29±8.17) in our study. Likewise, Nayak G.B. *et al*.,[3] Akhila V. *et al*.,[7] Shridevi A.S. *et al*.,[9] and Dasanayake D.L.W. *et al*.[10] reported comparable results to our study. This reflects overall less postoperative pain in the patients with subcuticular stitches using poliglecaprone 25 suture than patients with interrupted stitches using polyamide suture. This is probably due to multiple skin and subcutaneous tissue pricks and an increased number of suture knots during mattress suturing with polyamide, and no skin pricks in subcuticular suturing with poliglecaprone 25.

In accordance with previous studies,[3,7,9,10], the occurrence of wound complications, i.e. seroma and hematoma, was comparable in both groups in present study. A wound gap was noted in 5 patients in polyamide group and 2 patients in poliglecaprone 25 group ($p=0.440$) in present study. Nayak G.B. *et al*.[3] and Dasanayake D.L.W. *et al*.[10] also documented similar results. On the contrary, Akhila V. *et al*.[7] and Shridevi A.S. *et al*.[9] reporteda significantly higher rate of wound gap in polyamide group.

The wound infection was documented more in polyamide group in our study ($p=0.440$) and by Nayak G.B. *et al*.[3] and Akhila V *et al*.[7]. However, Shridevi A.S. *et al*.[9] andDasanayake DLW *et al*.[10] noted a statistically significant difference. Wound re-suturing was required only in polyamide group ($p=0.119$) in our study. Shridevi A.S. *et al*.[9] noted significantly more wound resuturing in polyamide group. While, Nayak G.B. *et al*.[3] described re-suturing in only one patient of poliglecaprone 25 group.

The cosmetic appearance was significantly better in poliglecaprone 25 group than polyamide group in our study and in a study done by Shridevi A.S. *et al*.[9] Akhila V. *et al*.[7] had shown comparable results in both groups. To the best of our knowledge, this is the first study to use the Modified Hollander Cosmesis Scale for wound assessment.

Another study done by Lima R.J. *et al*.[8] assessed the cesarean scar after 6 months with Trimbos scale composed of hypertrophy, color and width of the scar. They revealed that the scar of poliglecaprone 25 suture group had significantly less hypertrophic (p=0.001), thinner (p=0.019) and had more acceptable color than polyamide suture. Akhila V. *et al*.[7] used Patient and Observer Scar Assessment Scale (POSAS) for wound assessment at 6 weeks, and Shridevi A.S. *et al*.[9] did not use a validated scale for wound assessment.

The collective result of our study as well as previous similar studies, is that poliglecaprone 25 suture causes significantly fewer wound complications, less postoperative pain, cosmetically appealing scar, and higher wound satisfaction compared to polyamide suture[7-10].

Strengths and limitations - The non-randomized nature, small sample size, and being a single-centric study were the major limitations of our study. There was a selection bias as more patients with previous CD were in the polyamide suture group, which could have contributed to a greater number of wound gaps and re-suturing in the polyamide suture group. However, the prospective design of the study and statistically determined sample size would contribute to the reproducibility of our findings.

## CONCLUSION

Subcuticular stitch using poliglecaprone 25 absorbable suture is superior to the interrupted mattress stitch using polyamide suture for Pfannenstiel skin closure following CD with respect to patient satisfaction, cosmetic appearance and better wound outcomes.

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