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## Does method of closure effect cesarean wound healing? Stapler versus absorbable sub-cuticular closure done in a tertiary hospital, Nepal

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### Abstract

**Introduction:** Postoperative wound complications for women undergoing cesarean delivery constitute a major cause of morbidity. Data on wound healing based on the type of cesarean wound closure is limited. In this study, we assess the outcome of stapler versus absorbable sub-cuticular suture for skin closure of the cesarean wound.

**Method:** Prospective observational study. All cesarean section patients during the period of six months (Dec 2019 to May 2020) at Patan Hospital, Nepal, whose skin closure was done by sub-cuticular suture or stapler technique were recruited in the study. Ethical approval was obtained. These patients were followed up postoperatively on the 10<sup>th</sup> day for wound outcome (redness, edema, hematoma, seroma, discharge, gaping). Number and proportion were calculated, chi-square test, and Fisher's exact test at 95% confidence interval were used to see the association and  $p < 0.05$  was considered significant.

**Result:** Out of 379 patients, 26(6.9%) were lost to follow-up. Among 353 patients, an unhealthy wound was seen in 7(1.98%) during follow-up. Of these unhealthy wounds, closure with stapler technique was 5(71.4%) and by sub-cuticular technique, 2(28.6%), statistically significant with a p-value of 0.014.

**Conclusion:** Cesarean wound closure by sub-cuticular technique had a better wound outcome compared to closure by staplers.

**Keywords:** Cesarean section, stapler, sub-cuticular suture, wound outcome

## Introduction

Cesarean section (CS) constitutes an important signal function of comprehensive obstetrics care. World Health Organization report in 2010 showed that globally, there are approximately 18.5 million CS performed yearly and CS accounts for up to 60% (77 million) of the total number of births.<sup>1</sup> Studies done in teaching hospitals of Nepal have shown the wound complication ranging from 12.6% to 15.2% in CS delivery.<sup>2,3</sup> Skin closures are done by sub-cuticular absorbable sutures, or non-absorbable interrupted sutures or skin staples.<sup>4</sup> The subcutaneous fascia closure and skin closure with absorbable sutures may increase wound infection after CS.<sup>5</sup> Various studies claim different outcomes and the best technique is not conclusive.<sup>4</sup> The choice of skin closure material, type, and place of wound, availability, physician expertise contribute to the choice of material of wound closure that determines overall wound outcome.<sup>6</sup> Trials show that cesarean wound complications are higher with skin closure done by stapler compared to sub-cuticular suture closure.<sup>6-10</sup> The cosmetic results of either method are reported to be equivalent.<sup>11</sup> Both methods are used in our setting on the preference of the surgeons. However, studies related to wound outcome-based methods of closure are lacking locally. In this study, we assessed the wound outcome of stapler versus absorbable sub-cuticular suture for skin closure of cesarean wound which will help to guide the choice of cesarean wound closure technique.

## Method

This was a prospective observational study done in the department of obstetrics and gynecology at Patan Hospital, Patan Academy of Health Sciences, Lalitpur, Nepal. Patan Hospital is a tertiary care referral center with annual delivery rates of approximately 6,225 per year, and a CS rate of 50.7% (3,157 out of 6225), and among CS, 11.2% (353) elective and 88.8% (2804) emergencies (department audit data).

All the patients who had undergone CS at Patan Hospital, and the skin closure either by sub-cuticular suture or stapler technique, during the period of six months from Dec 2019 to May 2020 were recruited in the study. As per hospital practice, CS cases without complications are discharged on the 3<sup>rd</sup> postoperative day. They are advised to follow up on the 10<sup>th</sup> post-operative day in the outpatient department of obstetrics and gynecology for wound evaluation. Thus, recruited women in the study were tracked using the hospital number during their follow-up visits. On the 10<sup>th</sup> postoperative day in the outpatient department, the detailed observation of the wound was done. The assessment of the wound was done using an aseptic technique with infection prevention measures.

In this study, we defined healthy and unhealthy wounds as follows: healthy if there was no redness, edema, seroma, hematoma, superficial necrosis, purulent discharge, and wound dehiscence during observation. If any one of these conditions were observed, the wound was defined to be unhealthy.

Ethical clearance was obtained from Patan Academy of Health Sciences Institutional Review Committee (Reference number: drs1911221309). Written informed consent was taken from the study participants after explaining the purpose of the study. The participants were explained that it is completely voluntary participation and their refusal to participate will not change the treatment they will receive. They were also explained that they can withdraw at any time from the study without having to clarify for the withdrawal.

Data were collected using the semi-structured proforma. After data collection was done, the patients were counseled about their wound status, and if found unhealthy wound outcomes they were treated as per the clinical protocol of the department.

Data were entered in Microsoft Excel 2007. The data were cleaned and exported to IBM Statistical Package for Social Sciences (SPSS) version 21. The hospital number of the patient was dropped during analysis to maintain the confidentiality of the patients. Number and proportion were calculated for descriptive statistics. For inferential statistics, the chi-square test with continuity correction and Fisher’s exact test at 95% confidence interval was used to find an association between type of wound closure and wound outcome. The data was stored in the password-protected computer of the principal investigator and access to the data was only given to the research team. The collected data was used only for research purposes.

**Result**

Out of 379 cases that fulfilled the inclusion criteria, 26(6.9%) were lost to follow-up. There were 353 patients available on the 10<sup>th</sup> follow-up day and hence subjected to study analysis.

Cesarean wound outcome in the study population (353) was found to be healthy in 346(98.2%); stapler technique 86(94.5%) and subcuticular technique 260(99.2%). Unhealthy wound outcome was seen in 7(1.98%); stapler technique in 5(5.4%) and subcuticular technique 2(0.8%), Table 1.

Among seven patients with unhealthy wound outcomes, 3(42.85%) had redness and 4(57.15%) had wound gaping. In addition to wound gaping, one patient had edema and two had a purulent discharge. The discharge was sent for culture and sensitivity testing. There was no hematoma, seroma, superficial necrosis, or wound dehiscence observed.

Among seven unhealthy wound outcomes, wound closure with stapler technique was done in 5(71.4%) and by a sub-cuticular suture in 2(28.6%) patients. This was statistically significant with the chi-square test with continuity correction, a p-value of 0.014 at 95% confidence interval, Table 2.

Among seven unhealthy wound outcomes, four were wound gapping, stapler 3(75%), and sub-cuticular suture 1(25%), Table 3.

**Table 1. Type of skin closure in cesarean wound outcome on 10thpost-operative day at Patan Hospital Nepal, N=353**

Wound outcome	Method of skin closure		Total Number(%)
	Stapler Number(%)	Sub-cuticular Number(%)	
Healthy wound (353)			
Healthy	86(94.5%)	260(99.2%)	346(98.20%)
Unhealthy	5(5.4%)	2(0.8%)	7(1.98%)
Total	91(100.0%)	262(100.0%)	353(100.0%)
Unhealthy wound (7)			
Redness	2(40.0%)	1(50.0%)	3(42.85%)
Wound gaping	3(60.0%)	1(50.0%)	4(57.15%)
Total	5(100.0%)	2(100.0%)	7(100.0%)
Status of wound gaping (n=4)			
Wound gaping with edema	1(20.0%)	0(0.0%)	1(25.0%)
Wound gaping without edema or purulent discharge	1(20.0%)	0(0.0%)	1(25.0%)
Wound gaping with purulent discharge	1(20.0%)	1(50.0%)	2(50.0%)
Total	3(100.0%)	1(100.0%)	4(100.0%)

**Table 2. Table 2: Association between method of cesarean skin closure and wound outcome on 10th postoperative day, N=353**

Method of skin closure	Unhealthy Wound N(%)	Healthy Wound N(%)	Total N(%)	Chi-square test with continuity correction p-value at 95% CI
Stapler	5(71.4%)	86(24.9%)	91(25.7%)	0.014
Subcuticular	2(28.6%)	260(75.1%)	262(74.3%)	
Total	7(100.0%)	346(100.0%)	353(100.0)	

**Table 3. Association between method of cesarean skin closure and unhealthy wound outcome on 10th postoperative day, N=7**

Method of skin closure	Wound gaping	No wound gaping	Total	Fischer’s exact test p-value at 95% CI
Stapler	3(75.0%)	2(66.67%)	5(71.4%)	1.000
Subcuticular	1(25.0%)	1(33.33%)	2(28.6%)	
Total	4(100.0%)	3(100.0%)	7(100.0)	

**Discussion**

Our study found that the rate of unhealthy wound outcomes was 7(1.98%) among 353 CS wounds. This is slightly lower than the earlier study done during Mar 2002 to Jan 2003 in our hospital that showed the incidence of wound infections in CS was 2.7%.<sup>13</sup> This similarity shows that the CS wound infection at our center has remained constantly low over two decades despite different techniques of skin closure.

Our study showed a lower rate of wound complication as compared to a randomized trial done in Chitwan Medical College, Nepal from May to Oct 2012 which found a much higher overall wound complications rate of 15.1%.<sup>4</sup> The differences could be due to differences in the suture technique, infection prevention measures, and prophylactic practices.

Our study showed a relatively lower rate of wound infection as compared to the prospective population-based cohort in Norway from Sep 2003 to Sept 2004 which showed cesarean surgical site infection of 8.9%.<sup>14</sup> Multi-centric cohort studies done in England from April to Sep 2009 showed postsurgical infection following CS in 9.6% of the women with 0.6% readmission rates for the treatment of the infection.<sup>15</sup> The differences could be due to the differences in the definitions, suture technique, infection

prevention measures, prophylactic practices, and follow-up periods.

In our setting, we routinely prepare the surgical site with betadine. We preferably use Pfannenstiel incision for CS. Our routine practice in the department is to give one dose of prophylactic antibiotic intra-operatively (after delivery of a baby). This timing of the administration of antibiotics is differently practiced across the globe with concerns to a neonatal health outcome. Cochrane review on the timing of prophylactic antibiotic use showed that intravenous prophylactic antibiotics administered preoperatively as compared to administration after cord clamp had reduced maternal infectious morbidities while short-term and long-term adverse effects on neonates are yet to be clear and needs further research.<sup>16</sup>

In our setting, we routinely assess the wound during morning regular ward rounds for any complications and open the wound for dressing on the 3<sup>rd</sup> postoperative day before discharge. In high-risk cases, we give antibiotics for seven days in the postoperative period. Any complaint of excess pain or discharge from the site is addressed promptly by inspection of the wound. On the 3<sup>rd</sup> postoperative day patients with the healthy wound (i.e. no redness, edema, seroma, hematoma, superficial necrosis, purulent discharge, or wound dehiscence) are discharged. Our practice corroborates with

the median hospital stay of three days as shown in a multicentric cohort study done among women undergoing CS.<sup>15</sup>

On discharge, patients are advised for follow-up on the 10th postoperative day in the outpatient department for wound evaluation, and later at 6 w postpartum for routine checkup and vaccination for the child. For the treatment of the wound complication, our routine practice includes: starting of antibiotics for redness and edema; for seroma, culture is sent and dressing is applied; evacuation of hematoma and resuturing for healthy-looking wound and if it looks infected, daily dressing. For purulent discharge, pus culture is sent and daily dressing is done, antibiotics started as per the culture and susceptibility testing.

Cochrane review done in 2014 on antibiotic prophylaxis for CS showed that use of prophylactic antibiotics in women undergoing CS substantially reduced the incidence of wound infection along with reduction of endometritis and maternal serious infectious complications after CS.<sup>17</sup> Study shows that prophylactic antibiotics administered before skin incision, chlorhexidine-alcohol for skin antisepsis, closure of subcutaneous layer, and subcuticular skin closure with suture collectively reduced post-cesarean wound complications and surgical site infections.<sup>18</sup> The lower rates of unhealthy wound outcomes in our study can be a proxy indicator of our clinical practice of patient management where we combine prophylactic antibiotics, skin antiseptics and maintain infection prevention measures.

Our findings were similar to the results of the randomized control trial done in Alabama from August 2009 to November 2010 which showed higher infection rates in cesarean wound closed using metallic stapler as compared to the ones closed using subcuticular suture both during hospital discharge and at 4-6 w follow up (p-value <0.001 at discharge and p-value 0.008 at 4-6 w follow up).<sup>8</sup> Our findings of more infection in the stapler group are similar to the results

of the meta-analysis and systematic review which showed that the stapler closure was associated with a higher risk of wound complications, including wound infection or separation when compared with subcuticular suture closure.<sup>9-10</sup> Operating time of more than or equal to 38 minutes was demonstrated as an independent risk factor for post-cesarean surgical site infection.<sup>14</sup> Studies showed that the time taken for stapler is shorter than the time taken for subcuticular suture.<sup>19</sup> This may be one of the factors for preference of the staples in a busy tertiary center.

The exact reason behind unhealthy wound outcomes among the stapler group is not clear. It may be due to increased bacterial migration to the incision site because of the gap between staples and/or the decreased inflammatory reaction with staples relative to sutures that may result in less tissue remodeling and healing of the incision. In addition, subcuticular sutures may better approximate the skin. When the epidermis is closed it avoids direct needle contact with the skin surface, allowing better healing. However, implementing strategies to prevent, diagnose, and treat infection in time are all vital steps for reducing the occurrence of cesarean wound infection and its consequences.<sup>20</sup> This in turn has the potential to contribute to a reduction in maternal morbidity and mortality related to it.<sup>20</sup>

Comorbidities like obesity<sup>21</sup>, diabetes mellitus<sup>22</sup>, thyroid dysfunction<sup>22</sup>, smoking<sup>23</sup>, and nutritional status<sup>24</sup> of women may have implications on wound healing and wound outcome. Most surgical wound complications are related to an increased hospital stay.<sup>25</sup> Longer stays are associated with an increased direct cost to the patients and burden to overall health care facilities as well.<sup>26</sup> At the individual level, infection occurring after delivery can have a substantial physical and emotional burden to the mother herself.<sup>27</sup>

Some of the limitations of our study maybe we did not analyze comorbidities and confounders like duration of surgery,

surgeons' learning curve, microbiological assessment, cost associated with wound outcome, etc. Our main aim was to analyze the wound outcome of two methods of skin closure following cesarean section that are performed by experienced surgeons as department policy. A prospective multi-centric study with analysis of co-morbidities and other factors may add value.

## Conclusion

Our study concludes that among patients with cesarean wound closure, unhealthy wound outcomes had a low incidence of 1.98%. The unhealthy wound outcome was higher in the stapler technique compared to the subcuticular suture technique.

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## Conflict of Interest

None

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## Author Contribution

Concept, design, planning: ALL; Literature review: RS; Data collection: RS, SDS; Data analysis: ALL; Draft manuscript: RS; Revision of draft: ALL; Final manuscript: ALL; Accountability of the work: ALL; Guarantor: RS.

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