

Closure versus Non-Closure of the Rectus Muscle at Cesarean Section

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ABSTRACT

Background: A lower transverse abdominal scar and varying degrees of weakening of the abdominal muscles are both side effects of caesarean section (CS). Many methods have been documented, and there is considerable variation in approach from surgeon to surgeon. **Objective:** To compare closure and non-closure of the rectus muscle during primary CS as regard early postoperative outcomes and effect on abdominal contour.

Subjects and Methods: This research was conducted using a randomized controlled trial design. It took place between January 2015 and July 2015 at the Labor/delivery wards of Ain Shams University Maternity Hospital and El-Galaa Teaching Hospital. A total of 124 women were approached, of them 110 were eligible and were enrolled in the study and randomly allocated into 2 equal Groups, Group I Rectus closure and Group 2 Rectus non-closure, the finally analyzed cases were 52 and 49 respectively.

Results: The mean operative time was statistically significantly longer in women of group I. The mean time to postoperative bowel movement was statistically slightly longer in women of group I; the difference was, however, statistically insignificant [mean difference = 0.75 hours, 95% CI (-0.19 to 1.69), $p=0.115$]. **Conclusion:** Closure of the rectus muscles during CS seems to be associated with longer operative time and comparable postoperative pain, bowel recovery time and patient's satisfaction about her abdominal contour over 12 weeks postpartum.

Keywords: Closure, Rectus Muscle, Cesarean Section.

INTRODUCTION

Historically, caesarean section (CS) was only done on mothers who were close to death. And while vaginal birth remains the most prevalent obstetric intraperitoneal surgery, caesarean deliveries are on the rise around the world⁽¹⁾.

There can be reasons for the mother or the baby, or both, to have a caesarean section. Previous caesarean delivery, breech presentation, dystocia, and fetal distress are the most common reasons for a caesarean section. Roughly 85% of all caesareans are performed due to these causes⁽²⁾.

Cesarean sections are performed using a wide range of surgical procedures. There is still uncertainty as to whether any of these practices actually improve maternal and infant health because they have not been subjected to rigorous evaluation in randomized controlled studies. Given the prevalence of caesarean sections, even modest changes in postoperative morbidity rates between procedures have the potential to improve the health of a sizable proportion of women and reduce healthcare expenditures⁽³⁾.

The abdominal muscles of the patient, especially those that have undergone several caesarean deliveries, can become weak and the patient can develop a lower transverse scar after each delivery⁽⁴⁾. These alterations directly cause an altered abdominal shape⁽⁵⁾.

Despite this, many different methods have been documented for conducting a caesarean section, and there is significant variation in technique from one surgeon to the another⁽⁶⁾.

Goal of the study:

To compare closure and non-closure of the rectus muscle during primary cesarean section as regard

early postoperative outcomes and effect on abdominal contour.

SUBJECTS AND METHODS

Subjects:

This research was conducted using a randomized controlled trial design. It took place between January 2015 and July 2015 at the Labor/delivery wards of Ain Shams University Maternity Hospital and El-Galaa Teaching Hospital. A total of 124 women were contacted for the study, 110 consented to participate, and were randomly assigned to either Group I (rectus closure) or Group II (rectus non-closure).

Ethical consent:

Research Ethics Council approved the study as long as all participants provided informed consent forms. Every patient signed an informed written consent for acceptance of participation in the study. Ethics guidelines for human experimentation were adhered to by the World Medical Association's Helsinki Declaration.

Inclusion criteria: Women planned to undergo elective or scheduled primary cesarean section, either: (a) Elective cesarean section was defined as a cesarean section performed at a time that suits the woman and maternity team, with no maternal or fetal compromise. (b) Scheduled cesarean section is defined as the condition that needs early cesarean delivery with no maternal or fetal compromise. (c) Primary cesarean section is defined as cesarean section in a non-previously scarred uterus.

Exclusion criteria: (a) Women with previous laparotomies through a midline, para-median or low transverse incisions. (b) Women with over-sized uterus

e.g., multiple pregnancy and polyhydramnios. (c) Morbid-obese women who had a body mass index (BMI) ≥ 35 kg/m², BMI was calculated as the weight (kg) divided by the squared height (m²). (d) Women who had medical disorders with pregnancy that may impair wound healing e.g., diabetes mellitus and connective tissue diseases.

Randomization and Allocation;

Eligible women were enrolled and randomly allocated into one of two groups:

- (a) Group I; including women who had rectus muscle closure before fascial closure, and
- (b) Group II; including women who had no rectus muscle closure before fascial closure.

The randomization process was carried out with the help of a computer-generated randomization mechanism. Before surgery, the surgeon would open a sealed opaque envelope with a unique serial number that would reveal the participants' assigned groups.

The following was done to each patient on admission:

- 1- **Full history was taken:** Personal history: name, age, occupation, marital status special habits and address. Complaint and present history. Obstetric history: parity, gravidity and mode of previous deliveries or abortions. Menstrual history: first day of the period (LMP). Past history: of diabetes mellitus (DM), Hypertension, cardiac problems, renal troubles, bleeding tendency, blood disease, Bronchial asthma, Glucoma, allergy or previous operations (especially previous uterine scare, and family history.
- 2- General examination.
- 3- Vaginal examination.
- 4- **Investigation:**
 - Blood typing (ABO Grouping) and antibody testing (Rh antibody), complete blood count (CBC).
 - Fasting blood glucose.
 - 2-hours oral glucose tolerance test.
- **Cesarean delivery procedure:**
 - a) **Anesthesia:** recruited women received either regional (spinal) or general anesthesia according to the choice of the attending

anesthesiologist after counseling of the patient and revising her medical history and condition.

- b) **Surgeon:** cesarean section procedures for women enrolled in the current study were all performed by obstetricians with 2- to 3-year training period (intermediate or senior registrars).
- c) **Abdominal Incision:** a low transverse abdominal incision according to the modified Joel-Cohen method was performed in all included women.
- d) **Cesarean Delivery:** Bladder flap was not routinely developed. The lower uterine segment was opened through a C- shaped incision. The fetus was delivered without any instrumental assistance. The uterine incision was closed in two layers, and the visceral peritoneum was not closed.
- e) **Anterior Abdominal Wall Closure:** the parietal peritoneum was not closed in all included women. In women of group I, the recti muscles were closed by interrupted No. 1 delayed absorbable polyglactin 910 (Vicryl®, Ethicon, USA) stitches. The fascial layer (anterior rectus sheath) was closed using continuous simple No. 1 delayed absorbable polyglactin 910 (Vicryl®, Ethicon, USA) sutures. Subcutaneous tissue was only closed if its depth was > 2 cm. The skin is closed using subcuticular No. 2/0 delayed absorbable polyglactin 910 (Vicryl®, Ethicon, USA) stitches.
- f) **Postoperative Wound Care:** the wound was kept dressed for 24-48 hours; it was uncovered and wiped with alcohol 70% 3 times per day for 5-7 days.

Study outcomes: Recruited women were followed up at the hospital during the first 48 hours. Women are the followed up 1-week postpartum (at the time of wound follow-up), and then 6- and 12-week postoperatively.

Primary outcome: was the postoperative pain, which was assessed using the semi-objective 10-cm visual analogue scale; with 0 denoting no pain, and 10 denoting the worst unbearable pain (**figure 1**). The pain was assessed 12-, 24- and 48-hours postoperatively.

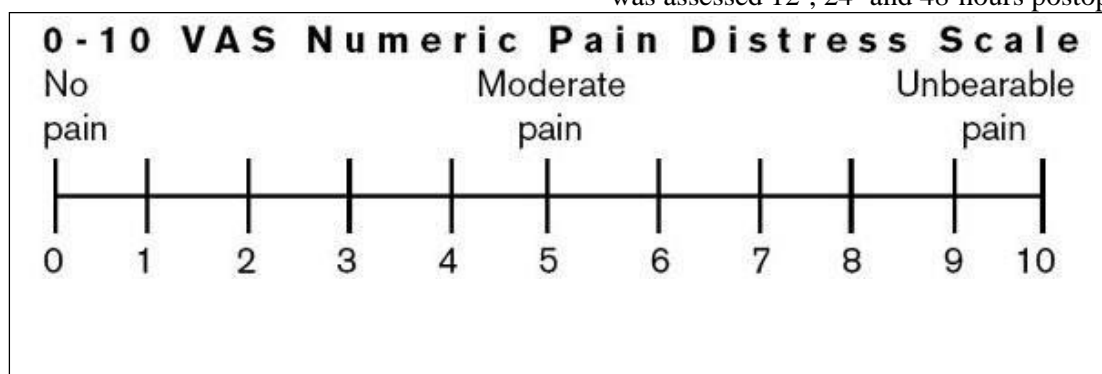


Figure (1): VAS numeric pain distress scale.

Secondary outcome(s):

- (a) Operative time.
- (b) Wound complications: including infection and dehiscence.
- (c) Bowel function recovery time.
- (d) Postoperative abdominal contour, which was assessed 6- and 12-weeks postoperatively, using a patient-self questionnaire, which was modified from one used following bariatric surgeries for reconstruction of abdominal obesity.

Statistical analysis:

In order to analyze the data acquired, Statistical Package of Social Services (SPSS) version 20 was used to execute it on a computer. In order to convey the

findings, tables and graphs were employed. The quantitative data was presented in the form of the mean, median, standard deviation, and confidence intervals. The information was presented using qualitative statistics such as frequency and percentage. The student's t test (t) is used to assess the data while dealing with quantitative independent variables. Pearson Chi-Square and Chi-Square for Linear Trend (X^2) were used to assess qualitatively independent data. The significance of a P value of 0.05 or less was determined.

RESULTS

A total of 124 women were approached, of them 101 were eligible and were enrolled in the study. Figure (2) shows a flow diagram showing the study course as well as the excluded and dropped out cases.

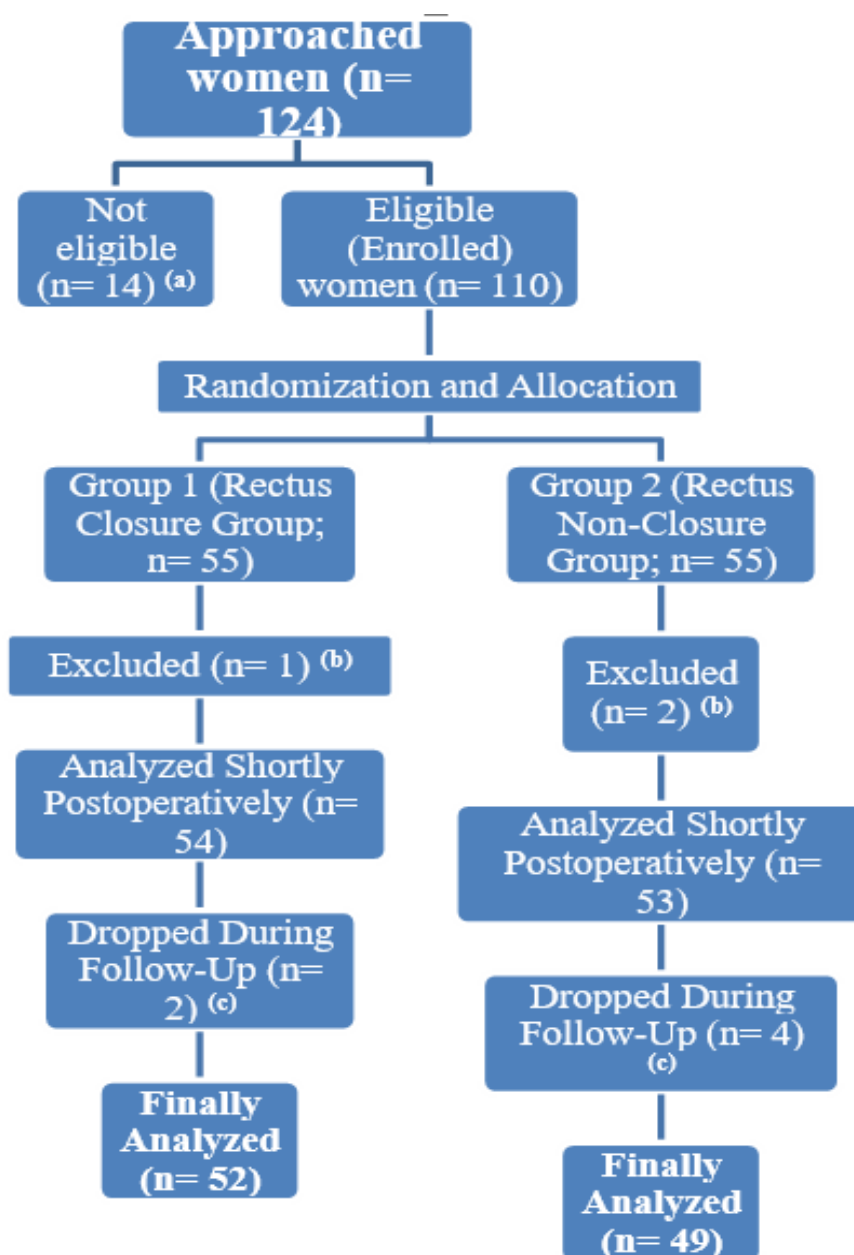


Figure (2): Flow diagram showing the study course.

(a) Not Eligible as they did not fulfill the inclusion/exclusion criteria. (b) Excluded from analysis due to surgical trauma of the recti muscles during abdominal entry that necessitated extra stitches at closure. (c) Dropped out during follow-up due to loss of contact and absence at the follow-up visits at 6- and 12-weeks postoperatively.

A total of 124 women were approached, of them 110 were eligible and were enrolled in the study. The mean age of included women was 24.58 ± 4.42 years old. The mean BMI was 25.1 ± 3.61 kg/m². The mean gestational age at delivery was 39.11 ± 1.17 weeks.

Women in both groups did not differ significantly in terms of age, body mass index, or gestational age (**Table 1**).

Table (1): Initial characteristics.

	Group I [Closure Group] (n=54)	Group II [No Closure Group] (n=53)	P*
Age (years)	25.26 ± 4.95	23.91 ± 3.76	0.113
BMI (kg/m²)	24.88 ± 3.66	25.3 ± 3.57	0.549
Gestational Age (weeks)	39.27 ± 1.14	38.96 ± 1.19	0.159

*In-significant difference

The indications for CS in recruited women included malpresentation [in 48 (44.9%) women], infertility/ART [in 49 (45.8%) women], and advanced maternal age [in 10 (9.4%) women]. Women in both groups gave birth via cesarean section for similar reasons (**Table 2**).

Table (2): Indications of cesarean delivery.

Indication for Cesarean Delivery	Group I [Closure Group] (n=54)	Group II [No Closure Group] (n=53)	Total	P*
Malpresentation	25 (46.3%)	23 (43.4%)	48 (44.9%)	0.720
Infertility/ART	23 (42.1%)	26 (49.1%)	49 (44.9%)	
Advanced Maternal Age	6 (11.1%)	4 (7.5%)	10 (9.4%)	

ART; Assisted Reproduction Techniques

*In-significant difference

The mean operative time was statistically significantly longer in women of group I [mean difference = 1.75 min, 95% CI (0.33 to 3.17), $p=0.016$] (**Table 3**).

Table (3): Operative time.

	Group I [Closure Group] (n=54)	Group II [No Closure Group] (n=53)	P*	MD (95% CI)
Operative Time (min)	35.53 ± 4.16	33.78 ± 3.18	0.016	1.75(0.33-3.17)

*In-significant difference

There were no significant differences between the median values of 10-cm VAS for postoperative pain, 12-, 24- and 48-hours postoperatively [median (IQR): 6 (5–7) vs. 6 (5–7), $p=0.641$; and 5 (3–6) vs. 4 (3–5), $p=0.624$; and 4 (3–5) vs. 4 (3–5), $p=0.765$; respectively] (**Table 4**).

Table (4): Difference between groups regarding postoperative pain.

Postoperative pain (10-cm VAS)	Group I [Closure Group] (n=54)	Group II [No Closure Group] (n=53)	P*
After 12 hours	6 (5 – 7)	6 (5 – 7)	0.641
After 24 hours	5 (3 – 6)	4 (3 – 5)	0.624
After 48 hours	4 (3 – 5)	4 (3 – 5)	0.765

*In-significant difference

Women in Group I had a slightly longer average time to first postoperative bowel movement, but this difference was not statistically significant [mean difference = 0.75 hours, 95% CI (-0.19 to 1.69), $p=0.115$]; the difference was, however, statistically and clinically insignificant (**Table 5**).

Table (5): Time to postoperative bowel movement.

	Group I [Closure Group] (n=54)	Group II [No Closure Group] (n=53)	P*	MD (95% CI)
Time to Bowel Recovery (hours)	9.38 ± 1.91	8.63 ± 1.67	0.115	0.75 (-0.19 to 1.69)

***In-significant difference**

None of the included women had wound fascial dehiscence. Only 3 women had superficial wound breakdown (involving only the skin and subcutaneous layer) [1 (1.9%) in group I and 2 (3.8%) in group II] (**Table 6**).

Table (6): Wound complication.

	Group I [Closure Group] (n=54)	Group II [No Closure Group] (n=53)	P*
Superficial Wound Breakdown	1 (1.9%)	2 (3.8%)	0.987

***In-significant difference**

There were no significant differences between the median values of total questionnaire score 6- and 12-weeks postoperatively (**Table 7**).

Table (7): Difference between groups regarding total score for the questionnaire at 6- and 12- weeks postoperatively.

Total Questionnaire Score	Group I [Closure Group] (n=52)	Group II [No Closure Group] (n=49)	P*
After 6 weeks	132 (126 – 138)	135 (130 – 137)	0.236
After 12 weeks	143 (136 – 147)	144 (139 – 146)	0.989

***In-significant difference**

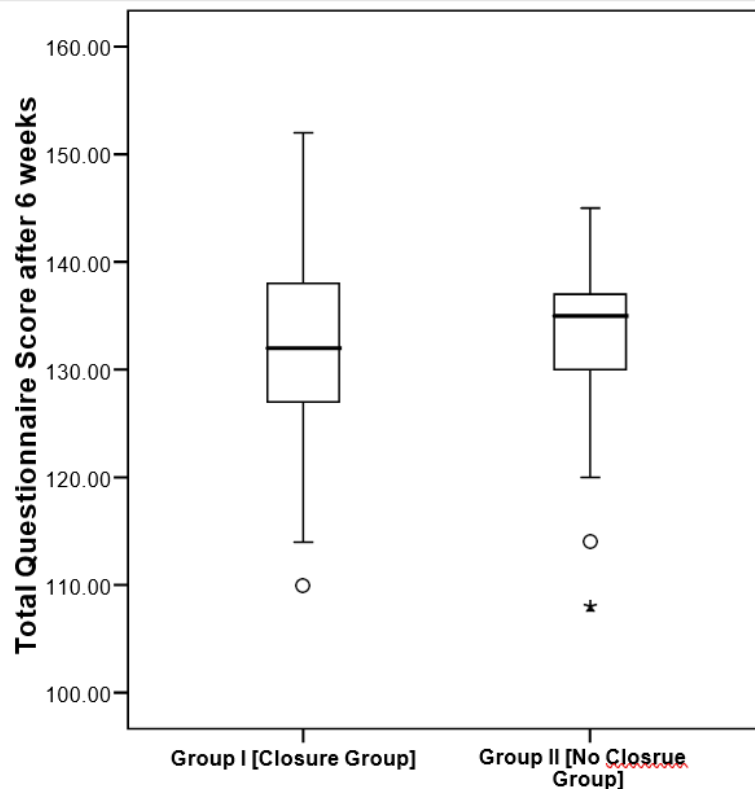


Figure (3): Box-Plot chart showing difference between groups regarding total score for the questionnaire 6 weeks postoperatively.

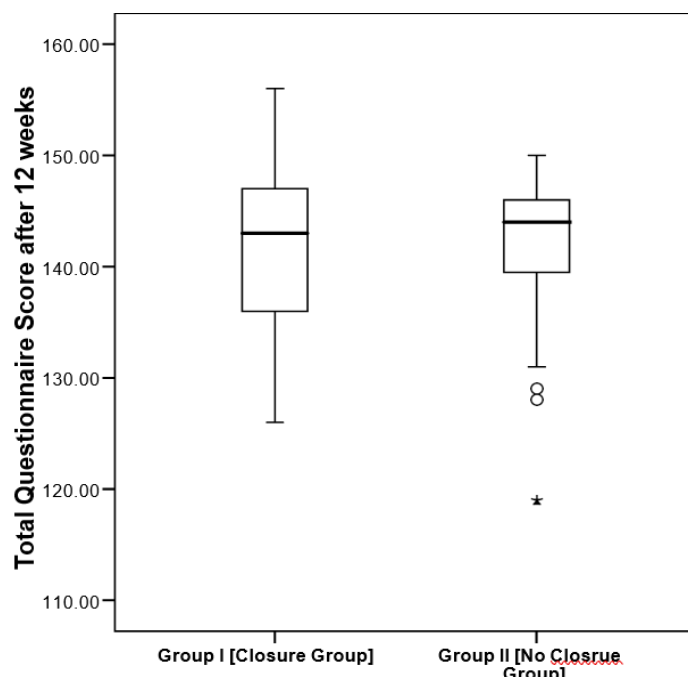


Figure (4): Box-Plot chart showing difference between groups regarding total score for the questionnaire 12 weeks postoperatively.

DISCUSSION

Various descriptions of the individual steps during a CS, both traditional and contemporary, have been published. Most of these descriptions rely on personal surgical experience, rather than being subjected to any sort of clinical trials, which are the nowadays- acceptable way of assessment of medical interventions ⁽⁷⁾.

One of the most debatable areas during a CS procedure is the way and layers to close the anterior abdominal wall; whether to close the visceral peritoneum, parietal peritoneum, recti muscles and subcutaneous tissue; as well as, how and using which material we should close them, if any ⁽⁸⁾.

Even meticulous review of the literature reveals no published well-designed randomized controlled trials that evaluate the value of certain steps in CS procedure. It was the call of a recent systematic review conducted over a time interval of nearly 8 years (between January 2005 and September 2012) that “adequately powered trials on the specific technical aspects of Cesarean delivery are warranted” ⁽⁹⁾.

In addition, and in order to uniform the closure of recti muscles in the allocated group of women, women who had surgical trauma to the muscles at abdominal entry and needed suturing of the recti muscle tissue were excluded from analysis.

Eligible women were enrolled and randomly allocated into one of two groups: group I, including women who had rectus muscle closure before fascial closure; and group II, including women who had no rectus muscle closure before fascial closure. In order to minimize selection bias, concealed allocation was adopted. All CS procedures for women enrolled in the current study were performed by intermediate or senior registrars, with at least 2-3 years of obstetric training.

After delivery of the fetus, placenta and membranes, closure of the uterine incision, and ensuring hemostasis, the parietal peritoneum was not closed in all included women. In women of group I, the recti muscles were closed by interrupted No. 1 delayed absorbable polyglactin 910 (Vicryl®, Ethicon, USA) stitches.

The primary outcome was the postoperative pain, assessed using the semi-objective 10-cm visual analogue scale (VAS); 12-, 24- and 48-hours postoperatively. Secondary outcomes included operative time, wound complications, bowel function recovery time, and postoperative abdominal contour, which was assessed 6- and 12-weeks postoperatively, using a patient-self questionnaire, which was modified from one used following bariatric surgeries for reconstruction of abdominal obesity.

A total of 124 women were approached, of them 110 were eligible and were enrolled in the study. The mean age of included women was 24.58 ± 4.42 years old. The mean BMI was 25.1 ± 3.61 kg/m². The mean gestational age at delivery was 39.11 ± 1.17 weeks. Females in both groups did not differ significantly from one another in terms of age, body mass index, or gestational age.

The indications for CS in recruited women included malpresentation [in 48 (44.9%) women], infertility/ART [in 49 (45.8%) women], and advanced maternal age [in 10 (9.4%) women]. Women in both groups gave birth via Cesarean section for similar reasons. There were no significant differences between the median values of 10-cm VAS for postoperative pain, 12-, 24- and 48-hours postoperatively [median (IQR): 6 (5 – 7) vs. 6 (5 – 7), $p=0.641$; and 5 (3 – 6) vs. 4 (3 – 5), $p=0.624$; and 4 (3 – 5) vs. 4 (3 – 5), $p=0.765$; respectively]. None of the included women had fascial dehiscence. Only 3 women had superficial wound

breakdown [1 (1.9%) in group I and 2 (3.8%) in group II]; the difference was obviously clinically and statistically insignificant. The mean time to bowel movement was slightly higher in women of group I [mean difference=0.75 hours, 95% CI (-0.19 to 1.69), $p=0.115$]; the difference was, however, statistically and clinically insignificant.

The results of the current trial, therefore, shows that closure of the rectus muscles during CS seems to be associated with longer operative time and comparable postoperative pain, bowel recovery time and patient's satisfaction about her abdominal contour over 12 weeks postpartum.

Our results were also in agreement with **Komoto *et al.*** ⁽¹⁰⁾ who showed that the operating time of the closure group was significantly longer than that of the non-closure-group.

The rationale claimed by the opponents of rectus muscle closure branches from a number of points. First, most clinicians believe that rectus muscles re-approximate naturally postoperatively ⁽¹¹⁾. Second, the unnecessary suturing, in their point of view, frequently causes increased postoperative pain and hematoma. In addition, there is definitely added cost and added operative time, even if these elevations are marginal ⁽⁷⁾.

The first point was in agreement to the results of the current trial, which showed comparable abdominal contour outcomes (which implies anatomical restoration of the rectus muscles approximation).

The second point was not, however, shown by the results of the current trial, which showed comparable postoperative pain scores in both closure and non-closure of the rectus muscles. The third point was, in part, in agreement to the results of the current study, which showed statistically significant operative time; yet from the clinical point of view, a mean difference of 1.75 min is of no clinical value. The rationale claimed by proponents of rectus muscles closure branches from two major points of view. The first point is actually philosophical one, which is that a surgeon should ethically restore what he cuts. The second point is that dense abdominal adhesions were shown to be reduced when the rectus muscles were re-approximated. In a secondary analysis of a prospective observational study, performed by **Lyell *et al.*** ⁽⁸⁾. Rectus muscle closure was linked with less combined filmy and dense adhesions overall (27.5% vs. 46.5%; $p=0.04$) and fewer dense adhesions overall in a study of 173 women undergoing their first repeat CS ⁽⁸⁾. This latter study, however, did not analyze the short-term outcomes including the postoperative pain and incidence of sub-fascial hematoma.

CONCLUSION

Rectus muscle closure is comparable to non-closure in all measured parameters. However, the sparse data published regarding the individual steps of CS procedure, in general; and regarding the value of rectus

muscle closure, in particular; as well as the reliance of most of these data upon personal views and experiences, rather than clinical trials, make reaching conclusions regarding the value of such steps very hard.

RECOMMENDATION

Further randomized clinical trials are needed to compare both short-term and long-term outcomes of rectus muscle closure and of all other steps in CS procedure.

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Author contribution: Authors contributed equally in the study.

REFERENCES

1. **Malvasi A, Tinelli A, Farine D *et al.* (2009):** Effects of visceral peritoneal closure on scar formation at cesarean delivery. *Int J Gynaecol Obstet.*, 105(2):131-5.
2. **Placek P, Taffel S (1988):** Recent patterns in cesarean delivery in the United States. *Obstet Gynecol Clin North Am.*, 15(4): 607-27.
3. **The CORONIS Trial Collaborative Group (2013):** The CORONIS Trial. International study of caesarean section surgical techniques: a randomised fractional, factorial trial. *BMC Pregnancy and Childbirth*, 7: 24-32.
4. **Coldron Y, Stokes M, Newham D *et al.* (2008):** Postpartum characteristics of rectus abdominis on ultrasound imaging. *Man Ther.*, 13(2):112-21.
5. **Borg-Stein J, Dugan S (2007):** Musculoskeletal disorders of pregnancy, delivery and postpartum. *Phys Med Rehabil Clin N Am.*, 18(3):459-76.
6. **Walsh C (2010):** Evidence-based cesarean technique. *Curr Opin Obstet Gynecol.*, 22(2):110-15.
7. **Clapp M, Barth W (2017):** The Future of Cesarean Delivery Rates in the United States. *Clin Obstet Gynecol.*, 60(4):829-839.
8. **Lyell D, Caughey A, Hu E (2012):** Rectus muscle and visceral peritoneum closure at cesarean delivery and intraabdominal adhesions. *Am J Obstet Gynecol.*, 206:515-19.
9. **Dahlke J, Mendez-Figueroa H, Rouse D *et al.* (2013):** Evidence-based surgery for cesarean delivery: an updated systematic review. *Am J Obstet Gynecol.*, 209(4):294-306.
10. **Komoto Y, Shimoya K, Shimizu T *et al.* (2006):** Prospective study of non-closure or closure of the peritoneum at cesarean delivery in 124 women: Impact of prior peritoneal closure at primary cesarean on the interval time between first cesarean section and the next pregnancy and significant adhesion at second cesarean. *The Journal of Obstetrics and Gynaecology Research*, 32(4), 396-402.
11. **Dahlke J, Mendez-Figueroa H, Shim H *et al.* (2015):** Preferences in cesarean delivery surgical technique: a survey of maternal-fetal medicine fellows. *J Matern Fetal Neonatal Med.*, 28(1):77-81.