International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Website: https://ijmpr.in/

Original Article

Comparative Analysis of Uterine Exteriorization Versus in Situ Repair During Caesarean Section at a Tertiary Care Center

Dr. Navyashree C.[1], Dr. Preshit Chate[2], Dr.Ganesh Tondge[3]

[1]Third year PG Resident, Obstetrics and gynaecology, S.R.T.R. Government Medical College, Ambajogai, Maharashtra
[2]Assistant Professor, Obstetrics and Gynaecology, S.R.T.R. Government Medical College Ambajogai, Maharashtra
[3]Associate Professor and HOD, Obstetrics and Gynaecology, S.R.T.R. Government Medical College Ambajogai, Maharashtra

OPEN ACCESS

Corresponding Author:

Dr. Navyashree C
Third year PG Resident, Obstetrics and gynaecology, S.R.T.R. Government Medical College, Ambajogai, Maharashtra

Received: 10-08-2025
Accepted: 26-09-2025
Available online: 08-10-2025

ABSTRACT

Background: Uterine repair during caesarean section can be performed either after exteriorization of the uterus or in situ. Each technique has potential advantages and disadvantages with respect to operative efficiency, blood loss, postoperative pain, and maternal morbidity.
Objectives: To compare intraoperative parameters (blood loss, uterine closure time, changes in vitals, nausea/vomiting, analgesic requirement) and postoperative maternal outcomes (pain scores, complications, hemoglobin drop, hospital stay) between uterine exteriorization and in situ repair.
Methods: This prospective comparative analytical study was conducted between July 2023 and June 2025 at a tertiary care hospital. Five hundred women undergoing caesarean section under spinal anaesthesia were randomized into two equal groups: Group A (uterine exteriorization, n = 250) and Group B (in situ repair, n = 250). Intraoperative and postoperative parameters were recorded and analyzed using independent t-tests and chi-square tests.
Results: Uterine closure time was significantly shorter in the exteriorization group (11.26 ± 2.18 vs. 13.45 ± 3.89 minutes, p = 0.001), and mean blood loss was lesser (755.8 ± 60.6 vs. 792.4 ± 51.7 mL, p< 0.001). Hemoglobin decline was smaller with exteriorization (1.95 vs. 2.68 g/dL, p< 0.001). However, postoperative analgesic requirement was higher (20.4% vs. 10.8%, p = 0.03). No significant differences were observed between groups in febrile morbidity, surgical site infection, endomyometritis, return of bowel activity, or hospital stay (5.51 ± 2.26 vs. 5.81 ± 2.19 days, p = 0.081).
Conclusion: From our study, Uterine exteriorization during caesarean section is a better option as it offers intraoperative advantages of shorter closure time, reduced blood loss, and smaller hemoglobin decline but is associated with increased postoperative pain. Uterine exteriorization gives additional surgical benefits like easy uterine massage, easy access to pouch of douglas, ease of uterine artery ligation/ B- lynch sutures, identification of uterine anomalies, less risk of bowel injury, easy suturing of uterine tears/ extension in lower uterine segment, less risk of missing haematoma and better visualization of posterior uterine wall pathology like fibroid/ endometriosis. In situ repair provides greater postoperative comfort. Both techniques showed similar outcomes for febrile morbidity, surgical site infection, endomyometritis, bowel recovery and hospital stay. Both techniques are safe and the choice should be individualized based on surgeon's expertise, the intraoperative field and patient specific factors.

KeyWords: Caesarean Section, Uterine Exteriorization, In Situ Repair, Maternal Outcomes, Postoperative Pain

INTRODUCTION

The rate of caesarean section has been increasing globally over the past three decades, with estimates rising from 6 % to 27 % in the least and most developed regions, and even higher in certain regions [1]. The World Health Organization (WHO) has emphasized that although caesarean section is a life-saving intervention, the procedure should be performed only when medically indicated, as unnecessary caesareans expose women and neonates to avoidable risks [2].

As the global burden of caesarean deliveries rises, optimizing surgical techniques has become a focus of clinical research. One area of debate is the management of peritoneal closure, abdominal wall repair, and uterine repair, with multiple Cochrane reviews evaluating their effect on maternal outcomes. For example, non-closure of the peritoneum has been shown to reduce operative time and short-term postoperative pain, but its long-term implications remain uncertain [3]. Similarly, the choice of suture materials and abdominal wall closure technique can influence wound healing and postoperative morbidity [4].

Of particular interest is the method of uterine repair. Traditionally, uterine closure may be performed intra-abdominally (in situ) or after exteriorization of the uterus onto the abdominal wall. Evidence from Cochrane reviews suggests that extra-abdominal (exteriorized) repair provides better surgical access, but questions remain regarding postoperative pain and morbidity [5]. Additional reviews have also highlighted variation in outcomes based on whether single-layer or double-layer closure is performed [6].

Several randomized controlled trials (RCTs) have compared uterine exteriorization with in situ repair. El-Khayat et al. demonstrated shorter operative times and less intraoperative blood loss with exteriorization, but noted increased postoperative pain [7]. Similarly, Coutinho et al. found improved visibility and ease of repair with exteriorization, though no consistent differences were observed in febrile morbidity or wound infection [8].

At the same time, population-level data highlight that maternal morbidity and readmission after caesarean section remain a substantial burden, with reported readmission rates of 2–7%, often due to postoperative pain, wound complications, and infections [9]. This underscores the importance of refining surgical methods to minimize intraoperative complications while ensuring favourable recovery profiles.

Given this context, our study was undertaken to compare uterine exteriorization versus in situ repair during caesarean section, with the aim of evaluating intraoperative parameters, postoperative morbidity, and overall maternal outcomes in a tertiary care setting.

OBJECTIVES

- To compare intraoperative parameters such as amount of blood loss, uterine closure time, changes in vitals, episodes of nausea/vomiting, and the need for additional analgesia.
- To evaluate postoperative maternal outcome such as pain score and need of additional analgesia.
- To assess postoperative complications such as fever, wound infection, and endomyometritis in both groups.
- To compare postoperative decrease in hemoglobin levels between the two groups.
- To determine the overall safety and clinical effectiveness of uterine exteriorization versus in situ repair of the uterus.

METHODS

Study Design and Setting

This was a prospective, hospital-based, comparative analytical study conducted in the Department of Obstetrics and Gynaecology at a tertiary care teaching hospital. The study was carried out over a defined period between July2023 to June 2025 after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment.

Study Population

A total of 500 women undergoing lower segment caesarean section (LSCS) were included and randomized into two groups:

- **Group A (n = 250):** Uterine exteriorization and repair outside the abdominal cavity.
- **Group B (n = 250):** In situ uterine repair within the abdominal cavity.

Inclusion Criteria

- Women with singleton pregnancies undergoing elective or emergency LSCS under spinal anaesthesia.
- Patient who has given consent for the study.

Exclusion Criteria

- Women with antepartum haemorrhage (e.g., placenta previa, abruption).
- Anaemia with hemoglobin less than 11 g%.
- Caesarean section under general anaesthesia.
- Ruptured uterus.
- Obstructed labour.
- Chorioamnionitis.
- Multiple pregnancy.

Randomization and Blinding
Participants were randomly allocated to either Group A or Group B using a computer-generated randomization table. Allocation concealment was maintained using sealed opaque envelopes. Surgeons could not be blinded to the technique, but outcome assessors for postoperative parameters were blinded to group assignment to minimize bias.

Surgical Technique
All caesarean sections were performed under regional anaesthesia (spinal anaesthesia) using a standard Joel cohen incision. After delivery of the foetus and placenta:

- In **Group A**, the uterus was exteriorized onto the abdominal wall, inspected, and repaired in double layers before repositioning into the peritoneal cavity.
- In **Group B**, uterine closure was performed intra-abdominally in situ without exteriorization.

Peritoneal and abdominal wall closure was performed using standard techniques as per institutional protocol.

Outcome Measures
The following parameters were assessed:

- Intraoperative outcomes: Uterine closure time, blood loss (measured by mop count and suction), changes in vital parameters, intraoperative nausea/vomiting, and requirement for additional analgesia.
- Postoperative outcomes: Hemoglobin drop (pre- and post-operative measurement after 48 hours), pain (inferred by requirement of additional analgesia), return of bowel activity, febrile morbidity, surgical site infection, and endomyometritis.
- Hospital stay: Duration of hospitalization in days.

Sample Size Calculation
The sample size of 500 (250 in each group) was calculated based on expected differences in mean blood loss between the two techniques, with 80% power and a 5% significance level, accounting for possible attrition.

Statistical Analysis
Data were compiled and analyzed using SPSS version 24 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and compared using the independent *t*-test. Categorical variables were expressed as proportions and compared using the chi-square test or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

RESULTS
Baseline Characteristics
A total of 500 women undergoing caesarean section were enrolled and randomized equally into two groups: uterine exteriorization (Group A, $n = 250$) and in situ repair (Group B, $n = 250$). The demographic and obstetric characteristics were comparable between the two groups, with no statistically significant differences observed ($p > 0.05$).

The mean age of participants was 26.81 ± 3.82 years in Group A and 26.89 ± 3.83 years in Group B. Most women were in the 21–30 years age range in both groups, and the distribution of parity was also balanced, with 33.6% primiparous and 66.4% multiparous in Group A compared with 39.6% and 60.4% respectively in Group B. Socioeconomic status was evenly distributed across groups. The mean gestational age at delivery was similar (38.18 ± 1.03 weeks vs. 38.21 ± 0.93 weeks). Maternal anthropometric parameters—including weight, height, and body mass index (BMI)—did not differ significantly between the groups. The clinical indications for lower segment caesarean section (LSCS), such as fetal distress, non-progress of labour, and postdated pregnancy with poor Bishop's score, were distributed evenly across both groups.

These findings confirm that the study groups were homogeneous at baseline, permitting valid comparison of intraoperative and postoperative outcomes (Table 1, Figure 1).

Table 1. Baseline characteristics of study participants

Variable	Group A (Exteriorization) (n=250)	Group B (In situ) (n=250)	*p*-value
Age (years), mean ± SD	26.81 ± 3.82	26.89 ± 3.83	0.81
18–20 years	6.8% (n=17)	6.0% (n=15)	
21–25 years	45.2% (n=113)	48.4% (n=121)	
26–30 years	35.6% (n=89)	34.8% (n=87)	
31–35 years	8.4% (n=21)	8.0% (n=20)	
>35 years	4.0% (n=10)	4.8% (n=12)	
Parity			0.82
Primiparous	33.6% (n=84)	39.6% (n=99)	
Multiparous	66.4% (n=166)	60.4% (n=151)	

Socioeconomic status	Comparable across classes	Comparable across classes	0.81
Gestational age (weeks), mean ± SD	38.18 ± 1.03	38.21 ± 0.93	0.85
Weight (kg), mean ± SD	70.16 ± 5.35	63.32 ± 7.35	0.09
Height (cm), mean ± SD	154.82 ± 4.40	154.30 ± 3.94	0.89
BMI (kg/m²), mean ± SD	27.32 ± 3.17	28.10 ± 3.29	0.19
Common LSCS indications	Fetal distress (14.4%), Non-progress of labour(14%), Postdated pregnancy (12.4%)	Fetal distress (13.6%), Non-progress of labour(13.2%), Postdated pregnancy (13.6%)	>0.05 (all)

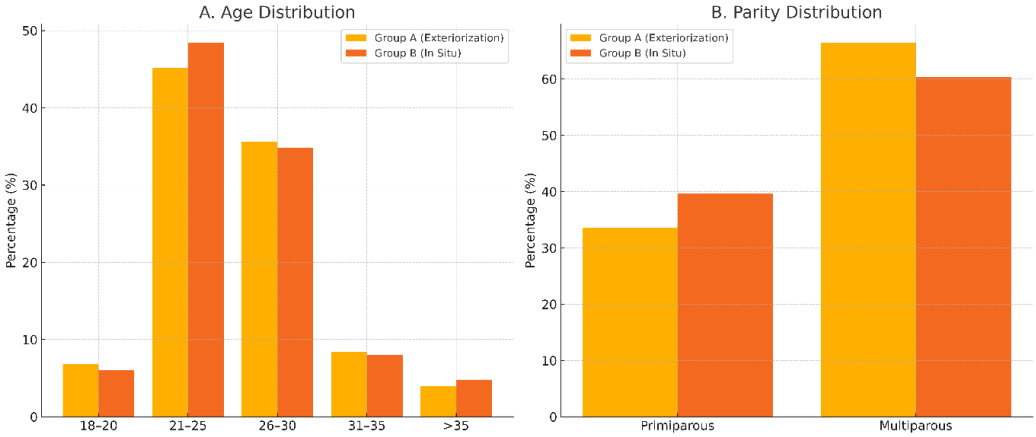

Figure 1. Age and parity distribution of study participants

Intraoperative Outcomes

The mean uterine closure time was significantly shorter in the exteriorization group compared with the in situ repair group (11.26 ± 2.18 minutes vs. 13.45 ± 3.89 minutes, p = 0.001). The mean intraoperative blood loss was also significantly lower in the exteriorization group (755.8 ± 60.63 ml) compared with in situ repair (792.4 ± 51.75 ml, p< 0.001).

Changes in vital parameters, the incidence of intraoperative nausea and vomiting, and the need for additional intraoperative analgesia were similar between the two groups, with no statistically significant differences observed (p> 0.05). These findings indicate that uterine exteriorization was associated with improved surgical efficiency and reduced blood loss, without increasing anaesthesia-related complications (Table 2, Figure 2).

Table 2. Intraoperative outcomes of study participants

Parameter	Group A (Exteriorization) (n=250)	Group B (In situ) (n=250)	*p*-value
Uterine closure time (min, mean ± SD)	11.26 ± 2.18	13.45 ± 3.89	0.001 **
Intraoperative blood loss (ml, mean ± SD)	755.8 ± 60.63	792.4 ± 51.75	<0.001 **
Changes in vitals (%)	4.8 (n=12)	4.4 (n=11)	0.62
Nausea/Vomiting (%)	14.0 (n=35)	9.6 (n=24)	0.64
Additional analgesia required intra-op (%)	3.6 (n=9)	3.2 (n=8)	0.68

Note: p< 0.05 considered statistically significant (**).

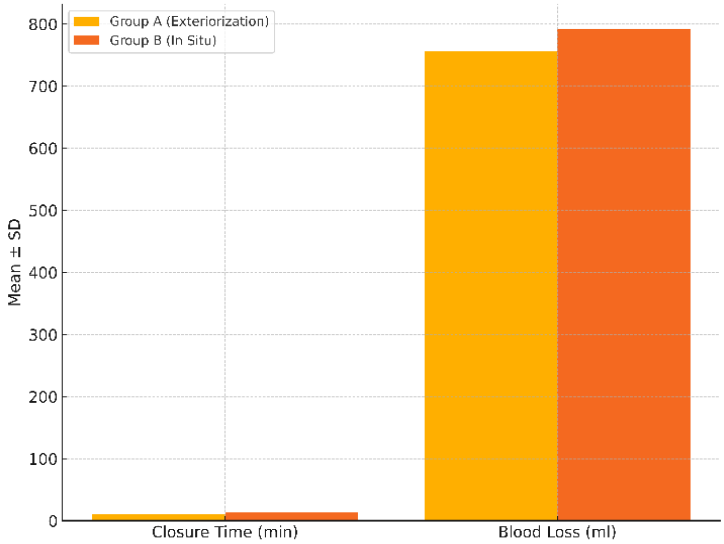

Figure 2. Intraoperative outcomes

Postoperative Outcomes

The mean preoperative hemoglobin levels were comparable between the two groups (12.15 ± 1.03 g/dL in Group A vs. 11.98 ± 1.12 g/dL in Group B, $p = 0.42$). However, postoperative hemoglobin was significantly lower in the in situ repair group (9.3 ± 0.73 g/dL) compared with the exteriorization group (10.2 ± 0.61 g/dL, $p < 0.001$). The corresponding hemoglobin drop was greater in the in situ group (2.68 g/dL) than in the exteriorization group (1.95 g/dL, $p < 0.001$).

The requirement for additional postoperative analgesia was significantly higher in the exteriorization group (20.4%) than in the in situ group (10.8%, $p = 0.03$), suggesting greater pain perception following exteriorization. In contrast, the return of bowel activity, incidence of postoperative fever, surgical site infection, and endomyometritis did not differ significantly between the groups ($p > 0.05$).

Overall, exteriorization was associated with less blood loss and smaller hemoglobin decline, whereas in situ repair was associated with less postoperative pain. Other postoperative morbidity outcomes were comparable between groups (Table 3, Figure 3).

Table 3. Postoperative outcomes of study participants

Parameter	Group A (Exteriorization) (n=250)	Group B (In situ) (n=250)	*p*-value
Hemoglobin (g/dL, mean ± SD)			
Pre-operative	12.15 ± 1.03	11.98 ± 1.12	0.42
Post-operative	10.2 ± 0.61	9.3 ± 0.73	<0.001 **
Drop	1.95	2.68	<0.001 **
Additional analgesia required (%)	20.4 (n=51)	10.8 (n=27)	0.03 **
Return of bowel activity (%)	89.2 (n=223)	93.2 (n=233)	0.78
Fever (%)	2.8 (n=7)	2.4 (n=6)	0.63
Surgical site infection (%)	3.2 (n=8)	2.8 (n=7)	0.67
Endomyometritis (%)	0.8 (n=2)	0.8 (n=2)	NS

Note: $p < 0.05$ considered statistically significant (**)

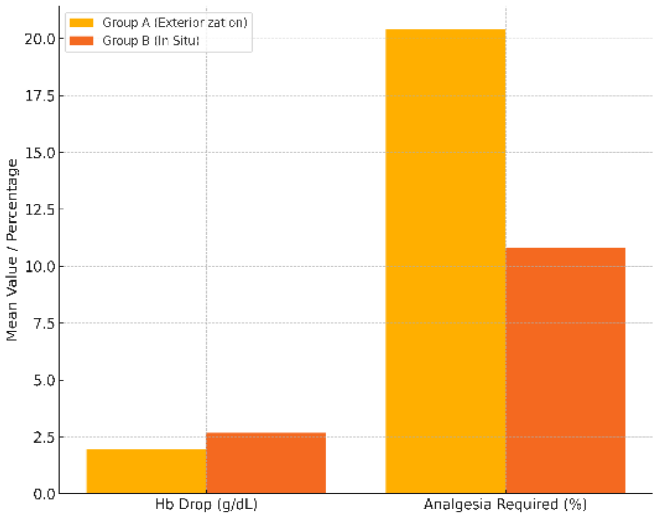

Figure 3. Postoperative outcomes

Hospital Stay

The mean duration of hospital stay was 5.51 ± 2.26 days in the exteriorization group and 5.81 ± 2.19 days in the in situ repair group. This difference was not statistically significant (p = 0.081). Thus, both surgical techniques were associated with similar lengths of postoperative hospitalization (Table 4, Figure 4).

Table 4. Duration of hospital stay in study participants

Parameter	Group A (Exteriorization) (n=250)	Group B (In situ) (n=250)	*p*-value
Hospital stay (days, mean ± SD)	5.51 ± 2.26	5.81 ± 2.19	0.081

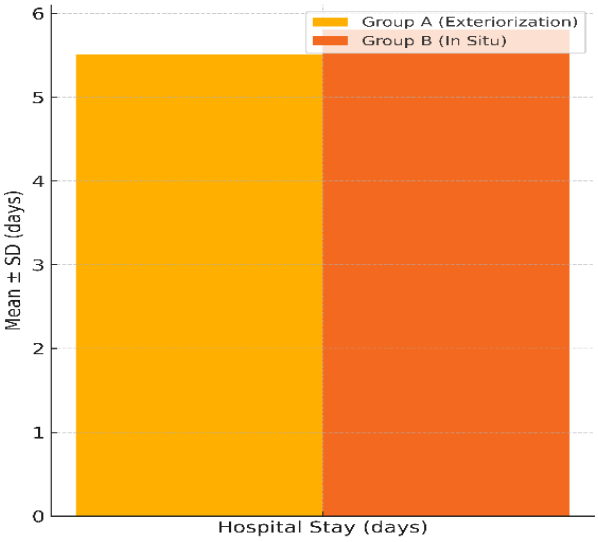

Figure 4. Hospital stay comparison

DISCUSSION

In this comparative study, uterine exteriorization was associated with shorter uterine closure time (11.26 ± 2.18 vs. 13.45 ± 3.89 minutes, p = 0.001) and reduced blood loss (755.8 ± 60.6 vs. 792.4 ± 51.7 mL, p< 0.001) compared with in situ repair. These findings are consistent with the surgical principle outlined by Mathai and Hofmeyr, who emphasized that modifications in abdominal incisions and technique can reduce operative time and blood loss during caesarean delivery

[10]. Hofmeyr further reinforced that uterine incision technique and accessibility play a pivotal role in surgical efficiency and haemostasis [11].

Regarding postoperative recovery, our data show that exteriorization led to a smaller decline in hemoglobin (1.95 vs. 2.68 g/dL, $p< 0.001$), a result aligning with Blumenfeld et al., who identified surgical factors as important predictors of maternal recovery and postoperative length of stay [12]. Mukherjee also highlighted the clinical relevance of reducing morbidity as caesarean rates rise globally [13].

Recent systematic reviews have evaluated caesarean surgical techniques. Gialdini et al. summarized evidence across multiple Cochrane and non-Cochrane reviews, concluding that exteriorization improves intraoperative visibility and haemostatic control, while postoperative comfort measures require individualized consideration [14]. Thangamani et al. reported that intraoperative parameters such as blood loss were consistently lower in the exteriorization group, although postoperative pain scores were higher, mirroring our findings where 20.4% of exteriorized patients required additional analgesia compared with 10.8% in the in situ group ($p = 0.03$) [15]. Similarly, Chauhan et al. found significantly increased pain perception following exteriorization (24% vs. 12%), while blood loss was reduced by approximately 30–40 mL compared to in situ repair [16].

Meta-analytic evidence by Zaphiratos et al. indicated that, across pooled studies, exteriorization was associated with modest reductions in blood loss (mean difference ~40–60 mL) and hemoglobin decline, but heterogeneity across trials prevented universal conclusions [17]. Magann et al. also found that exteriorization was associated with less blood loss and greater ease of placental removal, supporting the haemostatic advantage seen in our cohort [18]. Edi-Osagie et al., in one of the earlier randomized trials, similarly observed superior visibility and haemostatic control with exteriorization, although they noted no difference in postoperative infectious morbidity [19].

More recent regional studies continue to corroborate these findings. Saleem et al. reported reduced hemoglobin decline with exteriorization (drop ~1.1 vs. 1.7 g/dL) but greater postoperative pain scores, paralleling our data [20]. Priya et al. observed that exteriorization was faster and associated with less blood loss, though the difference in pain outcomes was smaller (18% vs. 14% analgesic requirement) [21]. Kumari et al. confirmed these trends in a tertiary care setting, concluding that exteriorization consistently offered intraoperative advantages with comparable rates of postoperative fever, wound infection, and endomyometritis [22].

Finally, the American College of Obstetricians and Gynaecologists (ACOG) Practice Bulletin emphasizes that choice of caesarean technique should be individualized, balancing intraoperative ease and blood conservation against maternal comfort and postoperative recovery [23]. Our findings echo this nuanced position: exteriorization offers measurable intraoperative benefits but increases postoperative pain, while in situ repair reduces pain but requires longer closure time and entails greater blood loss.

Limitations

This study was conducted at a single tertiary care centre, which may limit the generalizability of the findings to other populations. Postoperative pain assessment relied on additional analgesic requirement as a proxy, which may be influenced by subjective pain tolerance and provider practices. Long-term maternal outcomes, such as adhesion formation or subsequent caesarean complications, were not evaluated.

Conclusion

From our study, Uterine exteriorization during caesarean section was better as it was associated with shorter uterine closure time, reduced intraoperative blood loss, and smaller hemoglobin decline, but with higher postoperative analgesic requirements compared with in situ repair. Uterine exteriorization gives additional surgical benefits like easy uterine massage, easy access to pouch of douglas, ease of uterine artery ligation/ B- lynch sutures, identification of uterine anomalies, less risk of bowel injury, easy suturing of uterine tears/ extension in lower uterine segment, less risk of missing haematoma and better visualization of posterior uterine wall pathology like fibroid/ endometriosis. Both techniques showed similar outcomes for febrile morbidity, surgical site infection, endomyometritis, bowel recovery and hospital stay. These findings suggest that while exteriorization confers intraoperative advantages, in situ repair may provide greater postoperative comfort. The choice of technique should therefore be individualized, taking into account the surgeon's expertise, the intraoperative field and patient specific factors.

REFERENCES:

1. Betran AP, Ye J, Moller AB, Zhang J, Gulmezoglu AM, Torloni MR. The increasing trend in cesarean section rates: global, regional and national estimates: 1990–2014. *PLoS One.* 2016;11(2):e0148343.
2. World Health Organization. WHO statement on cesarean section rates. Geneva: World Health Organization; 2022.
3. Bamigboye AA, Hofmeyr GJ. Closure versus non-closure of the peritoneum at cesarean section. *Cochrane Database Syst Rev.* 2003;(4):CD000163.
4. Anderson ER, Gates S. Techniques and materials for closure of the abdominal wall in cesarean section. *Cochrane Database Syst Rev.* 2004;(4):CD000073.

5. Jacobs-Jokhan D, Hofmeyr GJ. Extra-abdominal versus intra-abdominal repair of uterine incision at cesarean section. *Cochrane Database Syst Rev.* 2010;(4):CD000781.
6. Dodd JM, Anderson ER, Gates S. Surgical techniques for uterine incision and uterine closure at the time of cesarean section. *Cochrane Database Syst Rev.* 2014;7:4732-38.
7. El-Khayat W, Elsharkawi M, Hassan A. A randomized controlled trial of uterine exteriorization versus in situ repair of the uterine incision during cesarean delivery. *Int J Gynaecol Obstet.* 2014;127(2):163-166.
8. Coutinho IC, Amorim MM, Katz L, De Ferraz AAB. Uterine exteriorization compared with in situ repair at cesarean delivery: a randomized controlled trial. *Obstet Gynecol.* 2008;112:183.
9. Yuan C, Gaskins AJ, Blaine J, et al. Hospital readmission following cesarean delivery: incidence, trends, causes, and risk factors. *Am J Obstet Gynecol.* 2017;216(5 Suppl):S224.
10. Mathai M, Hofmeyr GJ. Abdominal surgical incisions for cesarean section. *Cochrane Database Syst Rev.* 2007;(1):CD004453. doi:10.1002/14651858.CD004453.pub2.
11. Hofmeyr GJ. Uterine incision for cesarean section. *Best Pract Res Clin Obstet Gynaecol.* 2001;15(1):27-41. doi:10.1053/beog.2000.0150.
12. Blumenfeld YJ, El-Sayed YY, Lyell DJ, Nelson LM, Butwick AJ. Risk Factors for Prolonged Postpartum Length of Stay Following Cesarean Delivery. *Am J Perinatol.* 2015;32(9):825–32. doi:10.1055/s-0034-1543953.
13. Mukherjee SN. Rising caesarean section rate. *J Obstet Gynecol India.* 2006;56(4):298-300.
14. Gialdini C, Chamillard M, Diaz V, Pasquale J, Thangaratinam S, Abalos E, Torloni MR, Betran AP. Evidence-based surgical procedures to optimize caesarean outcomes: an overview of systematic reviews. *EClinicalMedicine.* 2024 Jun 1;72.
15. Thangamani S, Brinda P, Divya K. Influence of uterine exteriorization and in situ repair on caesarean morbidity. *Int J Reprod Contracept Obstet Gynecol.* 2017;6(11):4880-5.
16. Chauhan S, Devi P, Singh N, Yadav G, Chaudhary V. Comparison of intraoperative and postoperative complications of uterine exteriorization versus in situ repair during cesarean section. *Int J Reprod Contracept Obstet Gynecol.* 2017;6(8):3480-4.
17. Zaphiratos V, George RB, Boyd JC, Habib AS. Uterine exteriorization compared with in situ repair for cesarean delivery: a meta-analysis. *Obstet Gynecol.* 2015;125(5):1097-108.
18. Magann EF, Dodson MK, Chauhan SP, Nolan TE, Morrison JC, Sullivan DL, et al. Blood loss at the time of cesarean section by method of placental removal and exteriorization versus in situ repair of the uterine incision. *Surg Gynecol Obstet.* 1993;177(5):389-92.
19. Edi-Osagie EC, Hopkins RE, Ogbo VI. Uterine exteriorization at caesarean section: a randomised controlled trial. *BJOG.* 1998;105(10):1070-6.
20. Saleem S, Samina, Bano R, Rizwan N. Comparison of maternal morbidity between exteriorization and in situ repair of uterus during cesarean section. *Pak J Med Sci.* 2022;38(3):549-54.
21. Priya L, RR, B L. Comparative study of uterine repair during caesarean section: exteriorization repair versus in-situ repair. *Int J Reprod Contracept Obstet Gynecol.* 2017;6(4):1426–9.
22. Kumari R, Ali HS, Gul R. Uterine Exteriorization vs. In situ Repair of Cesarean Section: A Comparative Study at a Tertiary Care Hospital. *Pak J Med Dent.* 2020;9(1):66-70.
23. ACOG Practice Bulletin No. 205: Vaginal Birth After Cesarean Delivery. *Obstet Gynecol.* 2019;133(2):e110–27