

# Evidence-based Analysis of Primary Caesarean Section Techniques Amongst Obstetricians: A Questionnaire-based Cross-sectional Study

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## ABSTRACT

**Introduction:** Caesarean Section (CS) despite being one of the most commonly performed surgeries in the world has a wide variation in its techniques. To improve the outcomes of CS through rectification of the surgical techniques, it is imperative to assess the current practices amongst the obstetricians and analyse the rationale behind their surgical preferences.

**Aim:** To assess the surgical techniques used for primary CS by obstetricians and review them with respect to the current evidence.

**Materials and Methods:** The present descriptive, questionnaire-based, cross-sectional study was carried out in the Department of Obstetrics and Gynaecology, Mayo Institute of Medical Sciences, Barabanki, Lucknow, Uttar Pradesh, India, in the month of May 2020. A total of 400 Obstetricians possessing diploma or degree in the speciality performing CS and willing to participate in the study were included. A pretested questionnaire majorly focused on the various surgical techniques of primary CS, performed by the obstetricians, was distributed online. A total 203 respondents completed the questionnaire and their response was recorded. Analysis of Variance (ANOVA),

Independent samples t-test and Pearson's correlation coefficients were used to analyse the data.

**Results:** Majority (n=140, 68.96%) of the respondents were between 25-40 years of age. In the study population, 8 (3.94%) were male respondents and 195 (96.06%) were female respondents. experience of <5 years. The most consistently used technique was the creation of bladder flap (187, 92.11%), while the least common was use of vertical incision (6, 2.9%) for opening the abdomen. There was a huge variation in the method of opening of the abdomen with 117 (57.6%) of obstetricians using blunt versus 86 (42.36%) using sharp dissection. The blunt extension of uterine incision was significantly associated with the increasing years of practice, whereas the preference to use Pfannensteil incision was significantly associated with the younger obstetricians.

**Conclusion:** There was heterogeneity and variation in the CS techniques being practiced by the obstetricians. These varied practices were the result of surgeon preferences, their training and difficulty in unlearning the long used surgical techniques. These are bound to continue until strong evidence-based guidelines for the techniques of CS are formulated.

**Keywords:** Bladder flap, Pfannensteil incision, Surgical techniques, Survey

## INTRODUCTION

The Caesarean Sections (CS) are one of the most commonly performed operations worldwide. The WHO recommends an acceptable caesarean section rate of 10-15% for any population [1]. While, as per the latest data from National Family Health Survey 2019-2020 (NFHS-5), the cesarean rate at population level in India is 21.5% [2]. Although CS is one of the most commonly practiced operation, a consensus on the most appropriate technique has not yet been reached, mostly because well-designed studies and solid evidences have been sparse [3]. This is mainly due to the fast evolving of CS techniques with rapidly changing evidence. Therefore, the techniques used for the procedure vary widely amongst surgeons. Besides lack of evidence the variations in the surgical technique can also be attributed to personal preferences and differences in training.

Standardised approach to caesarean delivery can possibly have three advantages. Firstly, it will improve safe, efficient, effective health care delivery to women. Secondly, it can bring more consistency in the training of obstetrics and gynaecology residents. Thirdly, it can help in strengthening of future trials on caesarean delivery techniques [4]. To improve the outcomes of CS through rectification of the surgical techniques, it is imperative to assess the current practices amongst the obstetricians and analyse the rationale behind their surgical preferences.

The aim of the present study was to review the surgical techniques used for CS by obstetricians and to evaluate and compare with the existing evidence. The surgical techniques chosen by different surgeons in relation to their level of seniority were also assessed. This study expected to give an insight into the ongoing practices and their level of adherence to the contemporary evidence.

## MATERIALS AND METHODS

This descriptive, questionnaire based, cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Mayo Institute of Medical Sciences, Barabanki, Lucknow, Uttar Pradesh, India, in the month of May, 2020. The ethical clearance was taken from Institutional Ethics Committee (Number- MIMS/EX/2020/101).

**Inclusion criteria:** Obstetricians holding diploma or degree in the speciality who performed CS and willing to participate in the study were included in the study.

**Exclusion criteria:** Those who did not give consent to participate were excluded from the study.

Participants were contacted through local Obstetrics and Gynaecology societies (Lucknow, Etawah, Agra). A pretested questionnaire, which was prepared on Google forms, was distributed to them online. One week time was given to fill up the questionnaire.

**Sample size calculation:** The following formula was used to calculate the required sample size:

$$n = (z)^2 p (1-p)/d^2$$

n = sample size

z = level of confidence according to the standard normal distribution (for a level of confidence of 95%, z=1.96)

p = estimated proportion of the population that presents the characteristic

d = tolerated margin of error

Based on a previous study, where the prevalence of double-layer hysterotomy closure, the most frequently used techniques for uterine closure among obstetricians, was 73% with a confidence interval of 95% and 7% margin of error, the minimum sample size required was 154 [5].

## Questionnaire

The questionnaire was designed in English language and divided into two sections. The first part of the questionnaire includes four questions regarding demographic variables of the respondents like their age, gender, whether working in private or public health facility and years of postresidency practice. The second part dealt with the CS techniques which the participants follow in practice. The participants were asked to answer the questions with respect to an uncomplicated CS of a primi gravida. It had 14 questions which analysed the various steps involved in the CS operation including the rationale behind their surgical preference. Pretest of the questionnaires in English language was carried out on 10 obstetricians. All information obtained from this study was kept confidential.

## STATISTICAL ANALYSIS

Data analysis was done using Analysis of Variance (ANOVA), Independent samples t-test and Chi-square test. The data was analysed using Statistical Package for Social Sciences (SPSS) software version 21.0. A p-value less than 0.05 was considered as statistically significant.

## RESULTS

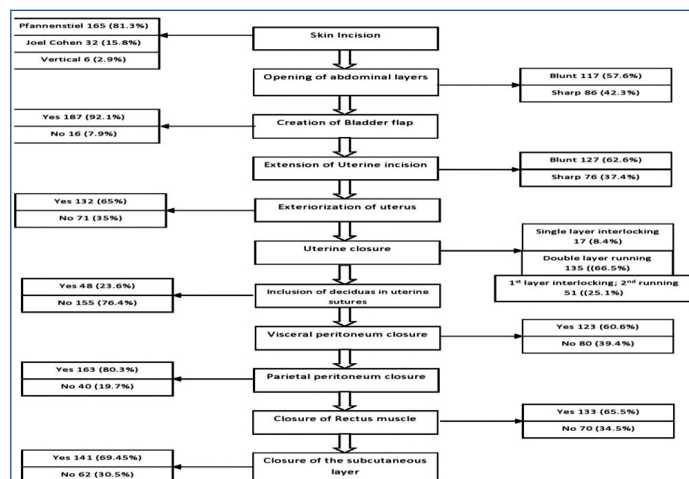
A total of 400 Obstetricians were contacted through local obstetrics and gynaecology societies and requested to fill the survey questionnaire online. A total of 203/400 respondents (50.75% response rate) completed the questionnaire and were enrolled in the study. Age of respondents ranged from 26 to 71 years. Majority (n=76, 37.43%) of respondents were aged <30 years. Out of total, eight (3.94%) were male respondents, and 195 (96.06%) were females. Majority 112 (55.17%) of respondents had a post-Postgraduation (PG) experience of <5. Number of respondents from private sector were 85 (41.88%) and public sector were 118 (58.12%), which was almost comparable [Table/Fig-1].

Majority (n=130, 64.03%) of the respondents preferred to give preoperative antibiotic one hour prior to surgery, 70 (34.48%) on the operation table and 3 (1.47%) after clamping of the cord. Thirty seven (18.23%) respondents did not practice parts preparation prior to surgery, 94 (46.31%) preferred trimming while 72 (35.46%) shaving as a method of parts preparation. More than half of the obstetricians 120 (59.11%) preferred patient's vaginal preparation with povidone iodine and 83 (40.88%) did not prefer.

[Table/Fig-2] depicts the frequency of practiced surgical techniques of CS among respondents. The most consistently used technique in CS amongst obstetricians in North India is the creation of bladder flap (n=187, 92.11%), while the least commonly practiced technique is use of vertical incision (n=6, 2.9%) for opening of the abdomen in an uncomplicated CS of a primi gravida. There was a huge variation in the method of opening of the abdomen with 57.6% of obstetricians using blunt versus 42.36% using sharp dissection. The preference to extend the uterine incision bluntly was significantly associated with the increasing years of practice, whereas the preference to use Pfannensteil incision was significantly associated with the younger obstetricians, who had relatively lesser years of practice.

Demographic variable	n (%)
<b>Age (in years)</b>	
<30	76 (37.44)
31-40	64 (31.53)
41-50	19 (9.36)
51-60	6 (2.95)
>60	38 (18.72)
<b>Gender</b>	
Female	195 (96.06)
Male	8 (3.94)
<b>Post-postgraduate experience (in years)</b>	
<5	112 (55.17)
5-15	49 (24.13)
16-25	18 (8.87)
>25	24 (11.83)
<b>Place of working</b>	
Public health facility	118 (58.12)
Private health facility	85 (41.88)

[Table/Fig-1]: Demographic data of the respondents.



[Table/Fig-2]: Depicts the frequency of the surgical techniques that are practised by the participants.

significantly associated with the younger obstetricians, who had relatively lesser years of practice [Table/Fig-3a,b]. The preferred surgical techniques along with the reasons for choosing those techniques are enumerated in [Table/Fig-4].

## DISCUSSION

The CS despite being one of the most commonly performed surgeries in the world has a wide variation in its techniques. There is heterogeneity and variation in the CS techniques being practised among the obstetricians. This study was conducted with the aim to assess the surgical techniques used for primary CS by Obstetricians and review them with respect to the current evidence. The present study demonstrated that the most consistently used technique in CS amongst obstetricians in North India is the creation of bladder flap (n=187, 92.11%), while the least commonly practiced technique is use of vertical incision (n=6, 2.9%) for opening of the abdomen in an uncomplicated CS of a primi gravida. There was a huge variation in the method of opening of the abdomen with 57.6% of obstetricians using blunt versus 42.36% using sharp dissection. The preference to extend the uterine incision bluntly was significantly associated with the increasing years of practice, whereas the preference to use Pfannensteil incision was significantly associated with the younger obstetricians, who had relatively lesser years of practice.

Almost all of the participants choose to give antibiotic prior to surgery, two-thirds preferred one hour prior and one-third on the operation table. The current guidelines support a single dose of a

Surgical techniques	Responses N=203	Years of experience				Chi-square value	p-value
		<5 years	5-15 years	16-25 years	>25 years		
1. Which skin incision do you prefer?	Pfannenstiel (n=165; 81.29%)	93 (45.81)	38 (18.72)	14 (6.90)	20 (9.85)	13.15	.040715*
	Joel Cohen (n=32; 15.76%)	17 (8.37)	11 (5.41)	3 (1.47)	1 (0.49)		
	Vertical (n=6; 2.95%)	1 (0.49)	1 (0.49)	1 (0.49)	3 (1.47)		
2. How do you prefer opening of abdominal layers?	Sharp (n=86; 42.36%)	48 (23.64)	21 (10.3)	4 (1.97)	13 (6.40)	4.376	.223622
	Blunt (n=117, 57.64%)	64 (31.52)	28 (13.79)	14 (6.90)	11 (5.41)		
3. Do you create bladder flap?	Yes (n=187, 92.11%)	101 (49.7)	47 (23.15)	17 (8.37)	22 (10.83)	1.887	.596192
	No (n=16, 7.89%)	10 (4.92)	2 (0.98)	1 (0.49)	3 (1.47)		
4. How do you prefer to extend the uterine incision?	Sharp (n=76, 37.43%)	55 (27.09)	15 (7.38)	2 (0.98)	4 (1.97)	18.1586	.000408*
	Blunt (n=127, 62.57%)	56 (27.58)	34 (16.75)	16 (7.88)	21 (10.3)		
5. Do you exteriorise the uterus while closure?	Yes (n=132, 65.02%)	64 (31.52)	35 (17.24)	14 (6.90)	19 (9.35)	6.9509	.073478
	No (n=71, 34.98%)	48 (23.64)	14 (6.90)	4 (1.97)	5 (2.46)		

**[Table/Fig-3a]:** The surgical techniques preferred by the obstetricians and the correlation of the techniques with their years of practice. All figures in parenthesis is presented as n (%); \*p-value <0.05 considered as statistically significant

Surgical techniques	Responses N=203	Years of experience				Chi-square value	p-value
		<5 years	5-15 years	16-25 years	>25 years		
6. Which technique of uterine closure do you follow?	Single layer interrupted (n=17, 8.37%)	9 (4.43)	4 (1.97)	3 (1.47)	1 (0.49)	5.3933	0.494442
	Double layer running (n=135, 66.50%)	79 (38.91)	28 (13.79)	11 (5.41)	17 (8.37)		
	1st layer interlocking 2nd running (n=51, 25.13%)	24 (11.82)	17 (8.37)	4 (1.97)	6 (2.95)		
7. Do you include deciduas in uterine sutures?	Yes (n=48, 23.64%)	33 (16.26)	8 (3.94%)	4 (1.97)	3 (1.47)	5.3814	0.145909
	No (n=155, 76.36%)	79 (38.91)	41 (20.19)	14 (6.90)	21 (10.3)		
8. Do you close visceral peritoneum/ third layer?	Yes (n=123, 60.59%)	69 (33.99)	33 (16.25)	10 (4.92)	11 (5.41)	3.3287	0.343667
	No (n=80, 39.40%)	43 (21.18)	16 (7.88)	8 (3.94)	13 (6.40)		
9. Do you close parietal peritoneum?	Yes (n=163, 80.29%)	92 (45.32)	38 (18.72)	16 (7.88)	17 (8.37)	2.6201	0.453982
	No (n=40, 19.71%)	20 (9.85)	11 (5.41)	2 (0.98)	7 (3.45)		
10. Do you close Rectus muscle?	Yes (n=133, 65.51%)	78 (38.42)	28 (13.79)	12 (5.91)	15 (7.38)	3.2218	0.358672
	No (n=70, 34.49%)	33 (16.25)	22 (10.83)	6 (2.95)	9 (4.43)		
11. Do you close the subcutaneous layer?	Yes (n=141, 69.45%)	80 (39.40)	34 (16.74)	14 (6.90)	13 (6.40)	3.163	0.367172
	No (n=62, 30.55%)	31 (15.27)	15 (7.38)	5 (2.46)	11 (5.41)		

**[Table/Fig-3b]:** The surgical techniques preferred by the obstetricians and the correlation of the techniques with their years of practice. All figures in parenthesis is presented as n (%); \*p-value <0.05 considered as statistically significant

Surgical techniques	Responses N=203	Most frequent response	Second most frequent response	Third most frequent response
1. Do you create bladder flap?	Yes	Reduces bladder injury (136)	It is how I was taught (55)	Reduced operative time (34)
	No	Reduced operative time (11)	Reduces bladder injury (3); Decreases blood loss (3)	It is how I was taught (1)
2. How do you prefer to extend the uterine incision?	Sharp	Decreases unwanted extension of incision (63)	It is how I was taught (17)	It is evidence based (9)
	Blunt	Decreases blood loss (71)	Decreases unwanted extension of incision (50)	Reduced operative time (44)
3. Do you exteriorise the uterus while closure?	Yes	Better exposure of uterus (106)	It is how I was taught (40)	Reduced operative time (36) Easy to assess uterine tone (36)
	No	Less handling of uterus (44)	Anatomical position maintained (42)	It is evidence based (16)

4. Which technique of uterine closure do you follow?	Single layer interrupted	Better haemostasis (10)	Reduced operative time (8)	It is how I was taught (2)
	Double layer running	Better scar integrity (79)	Better haemostasis (62)	It is how I was taught (45)
	1st layer interlocking 2nd running	Better scar integrity (34)	Better haemostasis (25)	It is how I was taught (14)
5. Do you include deciduas in uterine sutures?	Yes	Better haemostasis (22)	It is how I was taught (16)	Better scar integrity (14)
	No	Better scar integrity (125)	Decreased incidence of scar endometriosis (113)	It is how I was taught (25) It is evidence based (25)
6. Do you close visceral peritoneum/ third layer?	Yes	Reduces adhesions (104)	It is how I was taught (33)	Better haemostasis (27)
	No	Reduced operative time (42)	Reduces adhesions (29)	It is evidence based (21)
7. Do you close parietal peritoneum?	Yes	Reduces adhesions (127)	It is how I was taught (60)	It is evidence based (18) Better haemostasis (18)
	No	Reduced operative time (17) Reduces adhesions (17)	It is evidence based (15)	It is how I was taught (9)

**[Table/Fig-4]:** The preferred surgical techniques along with the reasons for choosing those techniques.

first-generation cephalosporin given 15 to 60 minutes prior to skin incision as per NICE guidelines 2021 [6]. In a systematic review done by Bollig C et al., preoperative administration of antibiotic was associated with a significant reduction in the rate of endometritis compared with intraoperative administration [7]. Thus, this practice was at par with the guidelines.

Recent Cochrane review suggests that hair removal at surgical site does not lower Surgical Site Infections (SSI), however if necessary to remove hair, the existing evidence suggests that clippers/chemical depilation are associated with fewer SSIs than shaving [8]. In present study, 94 (46.31%) preferred trimming while 72 (35.46%) opted shaving as a method of parts preparation and 37 (18.23%) respondents did not practice preoperative parts preparation. So, this practice does not seem to be in accord with recent evidence. The reason for same might be the difficulty in “unlearning” the long term practices.

Authors that more than half of the respondents preferred preoperative vaginal preparation with iodine. According to National Institute for Health and Care Excellence (NICE) guidelines, use of aqueous iodine vaginal preparation before caesarean birth in women with ruptured membranes help to reduce the risk of endometritis. If aqueous iodine vaginal preparation is not available or is contraindicated, aqueous chlorhexidine vaginal preparation can be used [6]. Haas DM et al., did a Cochrane based systematic review and concluded that vaginal preparation with povidone-iodine immediately before cesarean delivery probably reduces the risk of postcesarean endometritis [9]. Also, supported by Guidelines for intraoperative care in caesarean delivery: Enhanced Recovery after Surgery Society Recommendations (Part 2) [10]. So, this practice seems to be in accordance with the recent guidelines.

Almost all the obstetricians use a transverse incision, 80% prefer Pfannenstiel while 15% choose Joel Cohen, similar to the findings of Tully L et al., in a survey done in UK where Pfannenstiel incision was preferred by over 80% of the obstetricians [11].

The National Institute of Health and Care Excellence (NICE) guidelines recommend a transverse incision rather than vertical (preferably Joel Cohen) as it is associated with less postoperative pain, improved cosmetic effect, shorter operating times and reduced postoperative febrile morbidity [6]. The number of respondents opening the abdominal wall layers by blunt dissection was similar to those who use sharp dissection. In Randomised Control Trials (RCTs) and Cochrane reviews, sharp dissection versus blunt dissection and expansion of tissue layers after the skin incision was compared, with primary outcomes including operative time, postoperative analgesia requirements, febrile morbidity, blood loss, and duration of hospital stay. Techniques that incorporated sharp dissection and blunt tissue expansion and entry were favored and supported by the Cochrane Review [4]. We found a significant association between the preference to use Pfannenstiel incision and the number of years of practice with younger obstetricians opting for Pfannenstiel incision. Young obstetricians opting for transverse incision may reflect the effect of training, with those who received training in recent years were trained for transverse incision.

More than 90% of the participants created a bladder flap during CS and the most common reason quoted for the same was reduction in the incidence of bladder injury. However, in a study done by Cetin BA et al., concluded that intraoperative results and operation time are not affected by creation of bladder flap, however short-term urinary complaints, such as postoperative urinary retention and dysuria are increased [12]. This was also supported by Jan-Simon Lanowski and Constantin S [3]. According to them, intraoperative or postoperative complications such as blood loss, postoperative micro haematuria, postoperative pain, hospital days, endometritis, or urinary tract infection are not increased if formation of bladder flap is omitted both in primary and repeat CS but this shortened incision to delivery time. Thus, as per the current evidence, the

routine bladder flap development and closure of the visceral peritoneum of the bladder flap cannot be recommended, but trials have been underpowered to assess morbidity such as bladder injury and adhesion formation [3,4]. In the present study, there seems to be a huge gap in knowledge and practice related to bladder flap development and thus recognises the difficulty in “unlearning” long used surgical techniques.

In the present study, more than half the obstetricians choose to extend the uterine incision bluntly due to reduction in blood loss. The NICE guidelines also cite that when lower uterine segment is well formed, blunt rather than sharp extension of the uterine incision should be used as it decreases blood loss, incidence of postpartum haemorrhage and the need for transfusion at CS [3,4,6]. This practice of blunt extension of the uterine incision was associated significantly with the years of practice of the obstetricians with senior obstetricians more in favour of blunt dissection. So, this practice seems to be at par with the guidelines.

Two-third of the respondents choose to exteriorise the uterus for repair of uterine incision since they felt it provided better exposure. The current evidence by NICE guidelines promotes intraperitoneal repair of the uterus because exteriorisation is associated with more pain and does not improve operative outcomes such as haemorrhage and infection [6]. However, a RCT concluded that there is higher operative blood loss while performing the intraperitoneal repair of uterine incision compared to uterine exteriorisation. Rest of the operative and postoperative complication rates was found to be similar in both the groups [13]. Thus, due to the lack of sufficient evidence to definitely recommend for or against routine exteriorisation, the findings in the present study remain as per surgeon preference. In present study, double layer running suture was the most commonly used technique for uterine closure followed by 1<sup>st</sup> layer interlocking and 2<sup>nd</sup> layer running. Similar to the results found by Lyell DJ et al., and Tully L et al., in their United States of America (USA) and the United Kingdom (UK) survey based surveys respectively, where most obstetricians were found to use double layer hysterotomy closure [5,11]. Contrary to a survey done by Demers S et al., in Quebec where 1<sup>st</sup> layer interlocking and 2<sup>nd</sup> layer running followed by double layer running sutures were preferred [14]. In CORONIS trial single versus double layer closure of the uterus showed no evidence of a difference in maternal death or a composite of pregnancy complications [15]; whereas the NICE guidelines and Enhanced Recovery After Surgery (ERAS) quotes that the effectiveness and safety of single layer closure of the uterine incision is uncertain, and the uterine incision should be sutured with two layers without specifying the preferred suture technique [6,10,16]. Three-fourth of the participants were not found to practice the inclusion of deciduas while closing the uterus as they believe that it results in better scar integrity. Amongst the 25% of obstetricians who did not include the deciduas while suturing felt that this practice resulted in better haemostasis. Bujold E, suggested suture technique aiming to a correct approximation of the cut margins (decidua-to-decidua, myometrium to myometrium) leads to improved scar healing evident by ultrasound findings done six months following cesarean [17].

A greater number of obstetricians preferred to close the visceral as well as parietal peritoneum as most of them believed that it reduces the resulting adhesions. Contrary to the findings of Lyell DJ et al., where only 12% of the surgeons closed the visceral peritoneum while surgeons were almost equally divided in terms of closure of parietal peritoneum [5]. The NICE guidelines and ERAS also support that neither the visceral nor the parietal peritoneum should be sutured at CS because this reduces operating time and the need for postoperative analgesia, and improves maternal satisfaction [6,10]. So, this practice of closure of both the peritoneum without any demonstrable benefit.

Rectus muscle closure was done by more than half of the study participants. In the US survey done by Leyll DJ et al., practices were found to be varied with respect to closure of the rectus muscle where almost similar number of respondents opted for both [5]. Lyell DJ et al., also found that there is paucity of literature on rectus muscle approximation and hence no definite recommendations can be made regarding the same [5]. Although author conducted a randomised controlled trial in 2017 and found that Rectus muscle re-approximation increased immediate postoperative pain without differences in operative time, surgical complications, or maternal satisfaction [18]. About 70% of surveyed obstetricians preferred to close the subcutaneous layer. However, both the NICE guidelines updated in 2021 and ERAS cite against the routine closure of the subcutaneous tissue space and advise it only if the woman has more than 2 cm subcutaneous fat [6,10]. So, this practice does not seem to be at par with the current guidelines.

### Limitation(s)

Practicing obstetrician from only the northern region was included in the study. Also, the response rate was low. This limits generalisability of results.

### CONCLUSION(S)

The CS despite being one of the most commonly performed surgeries in the world has a wide variation in its techniques as evident by the indexed study. The existing guidelines are not uniform regarding multiple issues due to paucity of data which is probably the reason for the heterogeneity of the surgical techniques being practised among the obstetricians. The other reasons responsible for such variation are the different ways in which obstetricians were trained and surgeon's preference. These varied practices are bound to continue until strong evidence based guidelines for the techniques of CS are formulated.

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