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Original Article

Comparative Evaluation of Perioperative Outcomes Between Modified Misgav-Ladach Technique and Pfannenstiel Technique in Cesarean Section: A Quasi-Experimental Study

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Abstract

Background: Cesarean section is one of the most commonly performed surgical procedures worldwide, with increasing rates across both developed and developing countries. Advances in surgical techniques aim to improve operative efficiency, reduce complications, and enhance maternal outcomes. The Modified Misgav-Ladach (MML) technique has been proposed as a minimally invasive alternative to the conventional Pfannenstiel approach, potentially offering reduced operative time and blood loss.

Objective: To compare perioperative outcomes, specifically hemoglobin decline and skin incision to cord clamp time, between the Modified Misgav-Ladach technique and the Pfannenstiel technique in cesarean section.

Methodology: This quasi-experimental study was conducted in the Department of Obstetrics and Gynaecology, District Headquarters Hospital, Rawalpindi, over a six-month period (March–August 2024). A total of 60 women meeting inclusion criteria were allocated into two groups: Group A (Pfannenstiel technique, n=30) and Group B (Modified Misgav-Ladach technique, n=30). All procedures were performed under spinal anesthesia with standardized perioperative management. Primary outcomes included perioperative hemoglobin decline and skin incision to cord clamp time. Data were analyzed using SPSS version 24, and independent sample t-tests were applied, with $p \leq 0.05$ considered statistically significant.

Results: The mean postoperative hemoglobin level was significantly lower in Group A (11.33±1.23 g/dL) compared to Group B (12.25±0.98 g/dL) (p=0.002; 95% CI: 0.35–1.49). The mean perioperative hemoglobin decline was also greater in Group A (1.70±0.86 g/dL) than in Group B (1.13±0.91 g/dL) (p=0.016; 95% CI: 0.11–1.03). Additionally, the mean skin incision to cord clamp time was significantly longer in Group A (11.53±2.81 minutes) compared to Group B (4.17±1.29 minutes) (p<0.001; 95% CI: 6.23–8.49).

Conclusion: The Modified Misgav-Ladach technique demonstrated superior operative efficiency and reduced perioperative hemoglobin decline compared to the Pfannenstiel technique.

Keywords: Cesarean section, Hemoglobin decline, Modified Misgav-Ladach technique, Pfannenstiel incision, Perioperative outcomes.

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Introduction

Cesarean section is among the most frequently performed major abdominal surgeries in women worldwide, with a steadily increasing global prevalence [1]. Over recent decades, cesarean section rates have risen significantly across diverse healthcare settings, reflecting changes in obstetric practice, maternal preferences, and clinical indications [2]. Currently, the global cesarean section rate is estimated at approximately 21.1%, with marked regional variation, ranging from as low as 5% in sub-Saharan Africa to as high as 42.8% in Latin America and the Caribbean [3]. In South Asia, particularly in Pakistan, cesarean section rates have increased substantially, rising from 3.2% in the 1990s to nearly 20% in recent years [4].

Given the high frequency of this procedure, optimizing surgical techniques is essential to improve maternal outcomes, enhance operative efficiency, and reduce healthcare costs. Various surgical approaches have been developed to minimize intraoperative trauma, shorten operative duration, and decrease postoperative complications [5]. Among these, the Pfannenstiel technique remains the most widely used approach due to its favorable cosmetic outcomes and familiarity among surgeons [6]. This technique involves a transverse suprapubic incision, sharp dissection of tissues, double-layer uterine closure, and routine peritoneal closure.

Alternatively, techniques based on the Joel-Cohen principle, including the Misgav-Ladach method and its modified version, have gained attention due to their emphasis on minimal tissue handling and blunt dissection [7]. The Misgav-Ladach technique incorporates simplified surgical steps, such as reduced use of sharp instruments, single-layer uterine closure, and omission of peritoneal closure, thereby aiming to reduce operative time, blood loss, and postoperative morbidity [8,9]. The Modified Misgav-Ladach (MML) technique combines the cosmetic advantages of the Pfannenstiel incision with the tissue-sparing principles of the Joel-Cohen approach, representing a hybrid surgical method [9].

Emerging evidence suggests that the MML technique may offer several advantages over conventional methods, including shorter operative time, reduced intraoperative blood loss, decreased postoperative pain, and faster recovery [10–12]. Additionally, reduced skin incision to delivery time has been reported, which may be particularly beneficial in emergency cesarean sections where rapid fetal delivery is critical [5].

Despite these reported benefits, there remains a need for comparative studies in local clinical settings to evaluate the effectiveness and safety of the Modified Misgav-Ladach technique relative to the traditional Pfannenstiel approach. Therefore, this study aims to compare perioperative outcomes, specifically hemoglobin decline and skin incision to cord clamp time, between these two techniques to determine the most efficient and clinically advantageous method for cesarean delivery.

Methodology

Participants

The study included women aged 18–30 years who were undergoing their first cesarean section at term (37–40 weeks of gestation) with singleton pregnancies. Both elective and emergency cases were considered eligible. Participants were recruited using purposive sampling after obtaining informed consent. Women with prior abdominal or pelvic surgery, placenta previa, chorioamnionitis, endometritis, bleeding disorders, uterine atony, requirement of additional surgical procedures, preoperative blood transfusion, or massive hemorrhage requiring re-operation were excluded to minimize confounding and ensure homogeneity of the study population.

Interventions

Participants were allocated into two groups based on the surgical technique employed. Group A underwent cesarean section using the conventional Pfannenstiel technique, which involved sharp dissection, double-layer uterine closure, and peritoneal closure. Group B underwent cesarean section using the Modified Misgav-Ladach (MML) technique, characterized by blunt dissection, single-layer uterine closure, and non-closure of the peritoneum. All procedures were performed under spinal anesthesia, and a standardized prophylactic antibiotic regimen (Ceftriaxone 1 g) was administered prior to incision. Standardized operative steps were followed to maintain procedural consistency across both groups.

Outcomes

The primary outcomes assessed were:

Skin incision to cord clamp time, defined as the duration (in minutes) from initial skin incision to clamping of the umbilical cord, recorded intraoperatively by the first assistant.

Perioperative hemoglobin decline, calculated as the difference between preoperative hemoglobin levels and those measured 48 hours postoperatively, serving as an objective proxy for intraoperative blood loss.

Sample Size

The sample size was calculated using the WHO sample size calculator, assuming a 5% level of significance and 90% power. Based on previously reported mean ± SD values for hemoglobin decline (1.8 ± 1.1 in Group A and 0.7 ± 0.5 in Group B), a minimum of 30 participants per group was required, resulting in a total sample size of 60 participants.

Assignment Method

A non-randomized sequential allocation approach was used. The first 30 eligible participants were assigned to Group A (Pfannenstiel technique), followed by the next 30 participants assigned to Group B (Modified Misgav-Ladach technique). This quasi-experimental allocation reflects real-world clinical practice but may introduce selection bias.

Blinding

Blinding was not feasible due to the nature of surgical interventions. Surgeons were aware of the technique being used, and outcome assessors were part of the operative team. However, objective outcome measures (e.g., hemoglobin levels and operative time) were used to reduce measurement bias.

Unit of Analysis

The unit of analysis was the individual patient undergoing cesarean section. Each participant contributed one independent observation to the dataset, and comparisons were made between the two intervention groups.

Statistical Methods

Data were analyzed using SPSS version 24. Continuous variables (e.g., age, gestational age, hemoglobin levels, and incision-to-cord clamp time) were expressed as mean ± standard deviation (SD), while categorical variables were summarized as frequencies and percentages. Independent sample t-tests were used to compare mean differences between the two groups. Standard error (SE) was calculated as SD divided by the square root of the sample size, and 95% confidence intervals (CI) were computed using the t-distribution. A p-value ≤0.05 was considered statistically significant. Stratified analyses were also performed based on parity and type of cesarean (elective vs. emergency) to explore potential effect modifiers.

Results

Participant Flow

A total of 60 eligible participants were enrolled and allocated equally into two groups (n=30 each). All participants completed the study, and no losses to follow-up or exclusions after allocation were observed. Thus, all enrolled participants were included in the final analysis, ensuring complete data integrity

Recruitment:

Participants were recruited over a six-month period (March 2024 to August 2024) from the Department of Obstetrics and Gynaecology, District Headquarters Hospital, Rawalpindi. The majority of cases were emergency cesarean sections (80%), while elective procedures accounted for 20% of the sample, reflecting the real-world clinical case mix (see Table 4).

Baseline Data:

The mean age of participants was 26.67±3.15 years, with most women (76.67%) aged between 25–30 years. The mean age was 25.90±3.16 years in Group A and 27.43±3.00 years in Group B. The mean gestational age was 39.13±0.90 weeks in Group A and 38.33±0.55 weeks in Group B. Preoperative hemoglobin levels were 13.03±1.33 g/dL and 13.38±1.22 g/dL in Groups A and B, respectively. Parity distribution showed that 83.3% of participants had parity <3 (see Table 1 and Figure 1: Parity distribution).

Baseline Equivalence:

Baseline characteristics including age, gestational age, parity, and preoperative hemoglobin levels were comparable between the two groups, with no statistically significant differences observed. This indicates adequate baseline equivalence between the groups prior to intervention (Table 1).

Numbers Analyzed

All 60 participants (30 in each group) were included in the final statistical analysis. There were no missing data or protocol deviations, and complete-case analysis was performed for all outcome variables.

Outcomes and Estimation:

Postoperative hemoglobin levels were significantly lower in Group A (11.33±1.23 g/dL) compared to Group B (12.25±0.98 g/dL), with a statistically significant mean difference (p=0.002; 95% CI: 0.35–1.49) (Table 2).

The mean perioperative hemoglobin decline was greater in Group A (1.70±0.86 g/dL) than in Group B (1.13±0.91 g/dL), also demonstrating a statistically significant difference (p=0.016; 95% CI: 0.11–1.03) (Table 3).

Furthermore, the mean skin incision to cord clamp time was substantially longer in Group A (11.53±2.81 minutes) compared to Group B (4.17±1.29 minutes), with a highly significant difference (p<0.001; 95% CI: 6.23–8.49) (Table 4).

These findings indicate improved operative efficiency and reduced perioperative blood loss in the Modified Misgav-Ladach group.

Ancillary Analyses:

Stratified analysis by parity revealed that postoperative hemoglobin levels were significantly different between groups in both parity categories (<3 and 3–4), while perioperative hemoglobin decline did not differ significantly within these subgroups. Skin incision to cord clamp time remained significantly shorter in the Modified Misgav-Ladach group across all parity categories (p<0.001) (see Table 5).

Further analysis based on the type of cesarean section demonstrated that postoperative hemoglobin levels and hemoglobin decline were significantly different between groups in emergency cases but not in elective cases. However, skin incision to cord clamp time was significantly shorter in Group B in both elective and emergency procedures (p<0.001) (see Table 6).

Adverse Events:

No major intraoperative or postoperative complications were reported in either group. There were no cases of severe hemorrhage, re-operation, or significant maternal morbidity, indicating that both surgical techniques were safe within the study population.

Table 1: Descriptive Statistics and Preoperative Hemoglobin in Both Groups

Variable	Group	Mean ± SD	Minimum	Maximum
Age (years)	Group A	25.90 ± 3.16	18	30
	Group B	27.43 ± 3.00	20	30
	Total	26.67 ± 3.15	18	30
Gestational Age (weeks)	Group A	39.13 ± 0.90	37	40
	Group B	38.33 ± 0.55	38	40
	Total	38.73 ± 0.84	37	40
Preoperative Hb (g/dL)	Group A	13.03 ± 1.33	10.5	15
	Group B	13.38 ± 1.22	10.5	15
	Total	13.21 ± 1.28	10.5	15

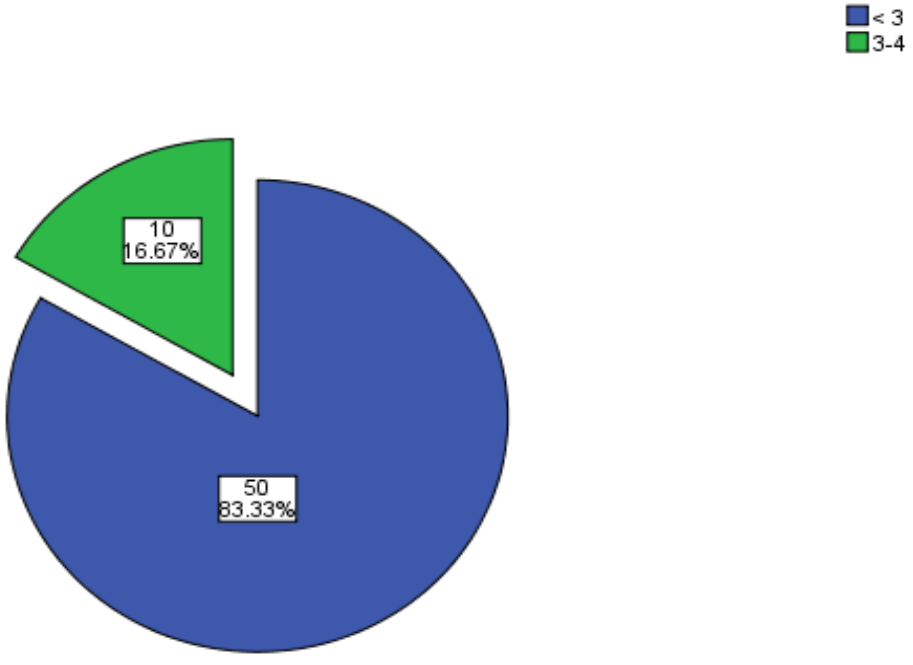


Figure 1: Parity of study participants

Table 2: Descriptive Statistics and Comparison of Postoperative Hemoglobin Levels

Outcome	Technique	Mean ± SD (g/dL)	95% CI (Mean)	Standard Error	t-value (df=58)	95% CI (Difference)	p-value
Postoperative Hb	Group A	11.33 ± 1.23	10.87 – 11.79	0.287	3.186	0.35 – 1.49	0.002
	Group B	12.25 ± 0.98	11.88 – 12.62	—	—	—	—
	Total	11.79	—	—	—	—	—

Table 3: Descriptive Statistics and Comparison of Perioperative Hemoglobin Fall

Outcome	Technique	Mean ± SD (g/dL)	95% CI (Mean)	Standard Error	t-value (df=58)	95% CI (Difference)	p-value
Perioperative Hb Fall	Group A	1.70 ± 0.86	1.38 – 2.02	0.23	2.48	0.11 – 1.03	0.016
	Group B	1.13 ± 0.91	0.79 – 1.47	—	—	—	—
	Total	1.42	—	—	—	—	—

Table 4: Descriptive Statistics and Comparison of Skin Incision to Cord Clamp Time

Outcome	Technique	Mean ± SD (minutes)	95% CI (Mean)	Standard Error	t-value (df=58)	95% CI (Difference)	p-value
Skin Incision to Cord Clamp Time	Group A	11.53 ± 2.81	10.48 – 12.53	0.56	13.04	6.23 – 8.49	<0.001
	Group B	4.17 ± 1.29	3.69 – 4.63	—	—	—	—
	Total	7.36	—	—	—	—	—

Table 5: Comparison of outcomes in both groups with respect to Parity

Outcome	Parity	Study Group	Mean	S.D	p-value
Post-operative Hb%	<3	Group-A	11.41	1.25	0.028
		Group-B	12.13	0.96	
	3-4	Group-A	10.67	1.04	0.024
		Group-B	12.64	1.03	
Peri-operative Hb% fall	<3	Group-A	1.69	0.81	0.095
		Group-B	1.26	0.95	
	3-4	Group-A	1.83	1.44	0.112
		Group-B	0.71	0.64	
Skin incision to cord clamp time	<3	Group-A	10.89	1.20	<0.001
		Group-B	4.17	12.7	
	3-4	Group-A	17.33	1.15	<0.001
		Group-B	4.14	1.46	

Table 6: Comparison of outcome in both groups with respect to Type of C-section

Outcome	Type of C-section	Study Group	Mean	S.D	p-value
Post-operative Hb%	**Elective**	Group-A	11.6	1.71	0.506
		Group-B	12.14	1.02	
	Emergency	Group-A	11.28	1.15	0.002
		Group-B	12.28	0.98	
Peri-operative Hb% fall	**Elective**	Group-A	1.7	1.09	0.723
		Group-B	4.43	0.787	
	Emergency	Group-A	1.70	0.82	0.010
		Group-B	1.02	0.92	
Skin incision to cord clamp time	**Elective**	Group-A	12.6	1.94	<0.001
		Group-B	4.43	0.787	
	Emergency	Group-A	11.32	2.90	<0.001
		Group-B	4.09	1.41	

Discussion

Cesarean section continues to be the most frequently performed major surgical procedure in obstetric practice worldwide, with rising rates necessitating continuous evaluation and optimization of surgical techniques [1,2]. The present quasi-experimental study compared perioperative outcomes between the Modified Misgav-Ladach (MML) technique and the conventional Pfannenstiel approach, focusing on objective measures such as perioperative hemoglobin decline and skin incision to cord clamp time.

The findings of this study demonstrate that the Modified Misgav-Ladach technique is associated with significantly improved operative efficiency, as evidenced by a markedly shorter skin incision to cord clamp time.[14,15] This observation aligns with previous literature suggesting that the Joel-Cohen–based approaches facilitate faster entry into the abdominal cavity through blunt dissection and reduced tissue handling [7,9]. The reduction in incision-to-delivery time is clinically important, particularly in emergency cesarean sections where rapid fetal extraction is essential to minimize fetal hypoxia and improve neonatal outcomes [5,13].

In addition to improved operative speed, the present study also demonstrated a significantly smaller perioperative decline in hemoglobin levels in the MML group compared to the Pfannenstiel group. This finding suggests reduced intraoperative blood loss, which may be attributed to limited tissue trauma, minimal use of sharp dissection, and avoidance of unnecessary suturing steps inherent in the MML technique [8,9]. Similar findings have been reported in previous comparative and randomized studies, where the Misgav-Ladach technique was associated with lower blood loss and reduced postoperative anemia without increasing complication rates [16–19].

The results of this study are consistent with international evidence. For instance, randomized controlled trials and comparative studies have reported shorter operative duration, decreased need for analgesia, and faster postoperative recovery with the Misgav-Ladach technique compared to conventional methods [16–20]. A study conducted in Nigeria demonstrated reduced blood loss, shorter delivery time, and fewer postoperative complications in patients undergoing Misgav-Ladach cesarean section [17]. Similarly, findings from studies conducted in Iran and Europe support the superiority of this technique in terms of operative efficiency and perioperative outcomes [18,19].

An important clinical implication of reduced perioperative hemoglobin decline is the potential decrease in postoperative anemia and reduced need for blood transfusion. This is particularly relevant in resource-limited settings where blood products may not be readily available. Furthermore, shorter operative duration may contribute to improved operating room efficiency, reduced exposure to anesthesia, and overall better maternal recovery.

The consistency of findings across subgroup analyses further strengthens the robustness of the results. The Modified Misgav-Ladach technique demonstrated superior performance across different parity groups and in both elective and emergency cesarean sections, particularly in reducing operative time. This suggests that the benefits of the technique are not limited to specific patient subsets but may be broadly applicable in clinical practice.

The findings of this study reinforce the growing body of evidence supporting the Modified Misgav-Ladach technique as a safe, efficient, and clinically advantageous alternative to the traditional Pfannenstiel approach. While both techniques remain acceptable, the simplified surgical steps and improved perioperative profile of the MML technique may offer significant benefits in modern obstetric practice.

Limitations

Despite its strengths, this study has several limitations that should be considered when interpreting the findings. First, the quasi-experimental design without randomization introduces the possibility of selection bias and limits the ability to establish causality. Although baseline characteristics were comparable between groups, residual confounding cannot be entirely excluded. Second, the relatively small sample size (n=60) may limit the generalizability of the findings and reduce the statistical power to detect smaller differences between groups. Larger multicenter studies are needed to validate these results across diverse populations and clinical settings.

Third, certain clinically relevant variables such as surgeon experience, intraoperative adhesions, body mass index, and variations in emergency versus elective procedures were not fully controlled and may have influenced operative outcomes. Additionally, perioperative hemoglobin decline, although an objective measure, may be affected by perioperative fluid shifts and hemodilution, and may not perfectly reflect actual blood loss. Furthermore, the study did not assess important secondary outcomes such as postoperative pain, duration of hospital stay, wound complications, neonatal outcomes, and long-term maternal recovery. These factors are essential for a comprehensive evaluation of surgical techniques and should be included in future research.

Conclusion

Within the limitations of this study, the Modified Misgav-Ladach technique demonstrated superior operative efficiency and a significantly smaller perioperative decline in hemoglobin levels compared to the conventional Pfannenstiel approach. The reduced skin incision to cord clamp time highlights its potential advantage in emergency clinical situations where rapid fetal delivery is critical.

These findings suggest that the Modified Misgav-Ladach technique is a safe and effective alternative to the traditional Pfannenstiel method, offering benefits in terms of reduced tissue handling, decreased blood loss, and improved surgical efficiency. While both techniques remain viable options for cesarean delivery, the growing evidence supports the adoption of the Modified Misgav-Ladach technique in routine obstetric practice.

However, further large-scale, randomized, and multicenter studies are required to confirm these findings and to evaluate additional maternal and neonatal outcomes before establishing definitive clinical guidelines.

Authors' Contributions:

All authors meet the ICMJE criteria for authorship.

Author 1: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 2: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 3: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 4: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

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