JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

https://doi.org/10.61919/b3jbqf54

*Original Article*

# A Comparative Study of Amniotic Membrane Stripping and Non-Stripping for Induction of Labor in Low-Risk Term Pregnancies

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**"Cite this Article" Received**: 09 April 2026; **Accepted**: 14 May 2026; **Published**: 25 May 2026

**Author Contributions:** Concept: SZ; Design: SZ, MN; Data Collection: SZ, MN, AA; Analysis: MF; Drafting: AA, HS; Critical Review: MF, HS; Final Approval: SZ, MN, AA, MF, HS. **Ethical Approval**: Town Hospital Mumtazabad, Multan, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

## ABSTRACT

Background: Amniotic membrane stripping is a simple, low-cost obstetric intervention that may promote spontaneous labor by stimulating endogenous prostaglandin release, but locally relevant evidence from low-risk term pregnancies remains limited. Objective: To compare serial membrane stripping with non-stripping care for spontaneous labor onset, delivery mode, intervention requirements, and maternal and neonatal safety in low-risk term pregnancies. Methods: This quasi-experimental comparative study was conducted at Sheikh Zayed Hospital, Rahim Yar Khan, from January to December 2024. A total of 140 women with uncomplicated singleton cephalic pregnancies at 38-40 weeks were allocated by systematic alternate assignment to membrane stripping (n=70) or non-stripping care (n=70). Stripping was scheduled on Days 1, 3, and 7 when clinically applicable. Outcomes included spontaneous labor within 7 days, time to labor onset, mode of delivery, oxytocin augmentation, formal induction, and complications. Results: Spontaneous labor within 7 days occurred more frequently with stripping than non-stripping care (74.3% vs 45.7%; RD 28.6%, 95% CI 13.0-44.1; p<0.001). Time to labor onset was shorter (3.4 ± 1.8 vs 7.2 ± 2.9 days; p<0.001), spontaneous vaginal delivery was higher (90.0% vs 75.7%; p=0.026), and cesarean delivery was lower (10.0% vs 24.3%; p=0.026). Serious maternal and neonatal outcomes were comparable. Conclusion: Serial membrane stripping improved labor efficiency and reduced intervention use without a significant increase in adverse outcomes. Keywords: Membrane stripping, membrane sweeping, induction of labor, spontaneous labor, term pregnancy, Bishop score.

## INTRODUCTION

Induction of labor is a common obstetric intervention used when the anticipated maternal or fetal risks of continuing pregnancy outweigh the benefits of expectant management, particularly as pregnancies approach or extend beyond term (1,2). Although pharmacological and mechanical induction methods are effective, they may require intensive monitoring, trained staff, medication availability, and careful surveillance for uterine tachysystole, fetal heart rate abnormalities, failed induction, and operative delivery (3,4). These considerations are especially relevant in high-volume and resource-constrained maternity units, where a simple, low-cost, minimally invasive intervention that promotes spontaneous labor without increasing maternal or neonatal morbidity would have considerable clinical value.

Amniotic membrane stripping, also referred to as membrane sweeping, involves digital separation of the fetal membranes from the lower uterine segment during vaginal examination, thereby stimulating local arachidonic acid metabolism and endogenous prostaglandin release, which may promote cervical

ripening and uterine contractility (5). Evidence from systematic reviews suggests that membrane sweeping at term increases the likelihood of spontaneous labor and reduces the need for formal induction, although certainty varies across outcomes because of differences in parity, gestational age at intervention, baseline cervical favorability, frequency of sweeping, and outcome definitions (6,7). Meta-analytic evidence has also suggested that membrane sweeping may improve spontaneous vaginal delivery when used alongside formal induction strategies, but the clinical magnitude of benefit appears to differ across populations and care settings (8).

Controlled trials have reported mixed but generally favorable findings. Boulvain et al. showed that membrane sweeping reduced the need for formal induction in term pregnancies (9). Yildirim et al. reported a higher rate of spontaneous labor within 7 days among low-risk term patients who underwent membrane sweeping, whereas Kashanian et al. found no significant reduction in the interval from sweeping to delivery, suggesting that baseline cervical status and population characteristics may modify treatment response (10,11). Saichandran et al. and Emarah similarly reported higher spontaneous labor rates and favorable delivery outcomes after serial membrane sweeping, while Pakistani data from Nasim et al. showed higher vaginal delivery and lower cesarean delivery rates among women undergoing membrane stripping for post-date pregnancy (12-14). Additional evidence from post-term pregnancy cohorts has supported acceptable maternal and neonatal safety, although procedure-related discomfort and minor vaginal bleeding remain common expected adverse effects (15).

The biological plausibility of membrane stripping is closely linked to cervical favorability. The Bishop score remains a clinically important predictor of induction success, and lower baseline scores are associated with longer induction-to-delivery intervals and higher intervention requirements (16). Ultrasonographic cervical assessment has also been evaluated as a predictor of successful membrane sweeping, reinforcing the concept that response to sweeping may depend on pre-labor cervical characteristics rather than exposure to the procedure alone (17). In the local Pakistani context, evidence remains limited, with available studies mainly from selected institutional settings and insufficient data from southern Punjab, where tertiary hospitals manage large numbers of term and post-date pregnancies and where reducing avoidable pharmacological induction may have practical benefit (14,18). Safety data from randomized trials in comparable obstetric settings further support the need to evaluate whether membrane sweeping can improve labor outcomes without increasing maternal or neonatal complications in low-risk term pregnancies (19).

Using a PICO framework, the present study evaluated low-risk pregnant women at 38-40 weeks of gestation with singleton cephalic pregnancies and unfavorable cervices; the intervention was serial amniotic membrane stripping performed on Days 1, 3, and 7 when clinically applicable; the comparator was standard antenatal care without planned membrane stripping; and the outcomes were spontaneous onset of labor within 7 days, mode of delivery, time to labor onset, Bishop score progression, oxytocin augmentation, formal induction, and maternal and neonatal complications. The study was conducted to test the hypothesis that serial amniotic membrane stripping would increase spontaneous labor onset and spontaneous vaginal delivery while reducing formal induction and cesarean delivery, without a significant increase in maternal or fetal complications.

## MATERIALS AND METHODS

This quasi-experimental, two-arm comparative study was conducted in the Department of Obstetrics and Gynaecology, Sheikh Zayed Hospital, Rahim Yar Khan, from January 2024 to December 2024. The study compared serial amniotic membrane stripping with standard antenatal care without planned stripping among low-risk term pregnant women. A quasi-experimental design was selected because the intervention was delivered within routine obstetric outpatient and inpatient care pathways, while systematic alternate allocation allowed prospective comparison of two clinically relevant management approaches.

Consecutive eligible pregnant women presenting to the antenatal clinic or obstetric assessment area were screened according to predefined eligibility criteria. Women were eligible if they were 18-40 years of age, had an uncomplicated singleton pregnancy in cephalic presentation, had a confirmed gestational age of 38-40 weeks based on a reliable last menstrual period supported by first- or second-trimester ultrasonography, had intact membranes at enrollment, had reassuring fetal wellbeing on non-stress testing or biophysical profile, had no previous cesarean section or uterine surgery, and had an unfavorable cervix defined as a Bishop score below 4 with a closed or partially open cervical os. Women were excluded if they had multiple pregnancy, non-cephalic presentation, known fetal anomaly, active labor, ruptured membranes, placenta previa or other placental abnormality, clinically significant vaginal bleeding, suspected cephalopelvic disproportion, severe cervicitis or active vaginal infection, active genital herpes, severe preeclampsia, uncontrolled systemic disease, any contraindication to vaginal delivery, refusal to participate, or withdrawal of consent.

After eligibility confirmation and written informed consent, participants were allocated by systematic alternate assignment in the order of presentation to Group A, the membrane stripping group, or Group B, the non-stripping control group. Seventy women were enrolled in each group, giving a total sample of 140 participants. Because alternate allocation is non-random and may be predictable, eligibility screening was completed before group assignment, baseline demographic and obstetric variables were recorded before intervention, and group comparability was assessed for maternal age, gestational age, parity, baseline Bishop score, cervical status, and fetal presentation.

In Group A, membrane stripping was performed by a trained consultant obstetrician or senior postgraduate resident using a standardized aseptic technique. The participant was placed in the dorsal lithotomy position, and baseline cervical assessment was performed using the Bishop scoring system. If the cervix admitted a finger, the examining finger was introduced through the cervical canal and a circumferential sweeping motion was performed between the fetal membranes and the lower uterine segment. If the cervix was closed and the membranes could not be reached, gentle circumferential cervical manipulation was performed without forced entry. The procedure was scheduled on Day 1 at enrollment, Day 3, and Day 7, but repeat stripping was performed only if the participant had not entered spontaneous labor, membranes remained intact, and no clinical contraindication had developed. Participants who entered labor, developed rupture of membranes, had significant vaginal bleeding, or required obstetric intervention before the next scheduled visit did not undergo further stripping.

Group B received standard antenatal care without planned digital membrane stripping. These participants underwent routine maternal and fetal surveillance according to institutional practice and were followed until delivery in the same obstetric unit. Clinically indicated vaginal examinations, fetal monitoring, oxytocin augmentation, formal induction, or cesarean delivery were performed according to usual departmental protocols when required for maternal or fetal indications. Formal induction beyond 7 days was recorded when labor had not started spontaneously within the prespecified follow-up interval.

The primary outcome was spontaneous onset of labor within 7 days of enrollment, defined as the onset of regular painful uterine contractions accompanied by progressive cervical dilatation without prior pharmacological or mechanical induction. Mode of delivery was also treated as a principal clinical outcome and classified as spontaneous vaginal delivery or cesarean section. Secondary outcomes included time interval from enrollment to onset of labor in days, Bishop score progression in the stripping group at scheduled procedural visits, requirement for oxytocin augmentation, requirement for formal induction beyond 7 days, and maternal and neonatal complications. Maternal adverse outcomes included procedure-related discomfort, post-procedure vaginal bleeding, premature rupture of membranes, postpartum hemorrhage, puerperal fever, and meconium-stained amniotic fluid. Neonatal outcomes included birth weight, Apgar score at 5 minutes, pathological fetal heart rate pattern, neonatal intensive care unit admission, and neonatal mortality.

Data were collected prospectively on a structured proforma at enrollment, each scheduled follow-up contact, onset of labor, delivery, and immediate postpartum assessment. Baseline variables included maternal age, gestational age, parity, Bishop score, cervical status, fetal presentation, membrane status, and fetal wellbeing assessment. Labor and delivery variables were recorded from clinical examination findings, labor ward notes, partograph records, operative notes where applicable, and neonatal records. To improve reproducibility and reduce measurement variation, cervical assessment and membrane stripping were performed by trained obstetric staff using the same procedural approach, and outcome definitions were applied uniformly to both groups.

The sample size was calculated for comparison of two independent proportions using the formula $n = (Z\alpha/2 + Z\beta)^2 \times [p_1(1-p_1) + p_2(1-p_2)] / (p_1-p_2)^2$. Based on prior evidence, the expected spontaneous onset of labor within 7 days was taken as 73.7% in the stripping group and 45.5% in the non-stripping group (10). With a two-sided significance level of 5%, 90% statistical power, and an allowance for approximately 10% attrition, the required sample size was 70 participants per group, yielding a total sample of 140 women.

Data were entered and analyzed using SPSS version 26.0. Continuous variables were summarized as mean ± standard deviation when normally distributed and as median with interquartile range when non-normally distributed. Normality was assessed using the Kolmogorov-Smirnov test and visual review of distribution patterns.

Categorical variables were summarized as frequencies and percentages. Between-group comparisons for continuous variables were performed using the independent samples t-test for normally distributed data and the Mann-Whitney U test for non-parametric data. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Effect sizes were planned for key outcomes, including risk difference, relative risk, odds ratio, mean difference, and corresponding 95% confidence intervals where applicable. A two-sided p-value of $\leq 0.05$ was considered statistically significant for primary outcomes, while secondary outcomes were interpreted with attention to effect size, confidence interval width, and clinical relevance.

Potential confounding was addressed by recording clinically important baseline variables before allocation and assessing balance between groups. Maternal age, gestational age, parity, baseline Bishop score, and cervical status were considered a priori variables with potential influence on spontaneous labor onset and delivery mode.

Participants were analyzed in their assigned groups. Missing data were assessed by variable, checked against source records where possible, and handled using complete-case analysis for the relevant outcome. Data quality was supported through structured data collection, review of proformas for completeness before entry, consistency checks for outlying or incompatible values, and verification of delivery and neonatal outcomes against hospital records.

Ethical approval was obtained from the Institutional Ethical Review Board of Sheikh Zayed Hospital, Rahim Yar Khan, before commencement of the study. Written informed consent was obtained from all participants after explanation of the study purpose, procedures, expected discomfort, potential benefits, and possible risks. Participation was voluntary, refusal did not affect routine care, and participants could withdraw at any time. Confidentiality was maintained by using coded study records and restricting access to study data to the research team.

## RESULTS

A total of 140 low-risk term pregnant women were enrolled, with 70 participants allocated to membrane stripping and 70 to standard antenatal care without membrane stripping. All enrolled participants completed follow-up until delivery, and no attrition was recorded. Baseline maternal and obstetric characteristics were comparable between groups. The mean maternal age was 26.4 ± 5.2 years in Group A and 27.1 ± 4.9 years in Group B, with a mean difference of -0.7 years (95% CI: -2.37 to 0.97; p=0.376).

Mean gestational age was also similar between groups (39.2 ± 0.7 vs 39.1 ± 0.8 weeks; mean difference: 0.10 weeks, 95% CI: -0.15 to 0.35; p=0.419). Nulliparity was present in 42 women (60.0%) in Group A and 44 women (62.9%) in Group B, with no significant difference between groups (OR: 0.89, 95% CI: 0.45 to 1.75; p=0.724). Baseline Bishop score and cervical status were likewise balanced, supporting comparability of the two study arms before intervention.

*Table 1. Baseline Demographic and Obstetric Characteristics of Study Participants*

| Variable | Group A: Stripping (n=70) | Group B: Non-Stripping (n=70) | Effect Estimate, Group A vs Group B (95% CI) | p-value |
|---|---|---|---|---|
| **Age, years, mean ± SD** | 26.4 ± 5.2 | 27.1 ± 4.9 | MD -0.70 (-2.37 to 0.97) | 0.376 |
| **Gestational age, weeks, mean ± SD** | 39.2 ± 0.7 | 39.1 ± 0.8 | MD 0.10 (-0.15 to 0.35) | 0.419 |
| **Nulliparous, n (%)** | 42 (60.0) | 44 (62.9) | OR 0.89 (0.45 to 1.75) | 0.724 |
| **Multiparous, n (%)** | 28 (40.0) | 26 (37.1) | Reference complement of parity category | — |
| **Baseline Bishop score, mean ± SD** | 2.8 ± 0.9 | 2.7 ± 0.8 | MD 0.10 (-0.18 to 0.38) | 0.463 |
| **Closed cervical os, n (%)** | 52 (74.3) | 53 (75.7) | OR 0.93 (0.43 to 1.99) | 0.845 |
| **Partially open cervical os, n (%)** | 18 (25.7) | 17 (24.3) | Reference complement of cervical status category | — |
| **Cephalic presentation, n (%)** | 70 (100.0) | 70 (100.0) | No between-group variation | — |

MD: mean difference; OR: odds ratio; CI: confidence interval. Spontaneous onset of labor within 7 days occurred in 52 women (74.3%) in Group A compared with 32 women (45.7%) in Group B. This corresponded to an absolute increase of 28.6 percentage points (95% CI: 13.0 to 44.1), with women in the stripping group having a 62% higher probability of spontaneous labor within 7 days than controls (RR: 1.62, 95% CI: 1.22 to 2.17; OR: 3.43, 95% CI: 1.68 to 7.00; p<0.001). The mean time to labor onset was significantly shorter after membrane stripping, at 3.4 ± 1.8 days versus 7.2 ± 2.9 days, yielding a mean difference of -3.8 days (95% CI: -4.60 to -3.00; p<0.001). Spontaneous vaginal delivery was achieved in 63 women (90.0%) in Group A and 53 women (75.7%) in Group B, while cesarean delivery occurred in 7 women (10.0%) versus 17 women (24.3%), respectively. The absolute reduction in cesarean delivery was 14.3 percentage points (95% CI: -26.5 to -2.0), with a relative risk of 0.41 (95% CI: 0.18 to 0.93; p=0.026). Oxytocin augmentation and formal induction beyond 7 days were also significantly less frequent in Group A.

*Table 2. Labor and Delivery Outcomes by Study Group*

| Outcome | Group A: Stripping (n=70) | Group B: Non-Stripping (n=70) | Risk Difference or Mean Difference (95% CI) | Relative Risk (95% CI) | Odds Ratio (95% CI) | p-value |
|---|---|---|---|---|---|---|
| **Spontaneous labor within 7 days, n (%)** | 52 (74.3) | 32 (45.7) | RD 28.6% (13.0 to 44.1) | 1.62 (1.22 to 2.17) | 3.43 (1.68 to 7.00) | <0.001 |
| **Time to labor onset, days, mean ± SD** | 3.4 ± 1.8 | 7.2 ± 2.9 | MD -3.80 (-4.60 to -3.00) | — | — | <0.001 |
| **Spontaneous vaginal delivery, n (%)** | 63 (90.0) | 53 (75.7) | RD 14.3% (2.0 to 26.5) | 1.19 (1.02 to 1.39) | 2.89 (1.11 to 7.49) | 0.026 |
| **Cesarean delivery, n (%)** | 7 (10.0) | 17 (24.3) | RD -14.3% (-26.5 to -2.0) | 0.41 (0.18 to 0.93) | 0.35 (0.13 to 0.90) | 0.026 |
| **Oxytocin augmentation required, n (%)** | 28 (40.0) | 47 (67.1) | RD -27.1% (-43.0 to -11.2) | 0.60 (0.43 to 0.83) | 0.33 (0.16 to 0.65) | <0.001 |
| **Formal induction beyond 7 days, n (%)** | 18 (25.7) | 38 (54.3) | RD -28.6% (-44.1 to -13.0) | 0.47 (0.30 to 0.74) | 0.29 (0.14 to 0.59) | <0.001 |

RD: risk difference; MD: mean difference; RR: relative risk; OR: odds ratio; CI: confidence interval.

Among women in Group A who remained eligible for scheduled cervical reassessment, serial membrane stripping was associated with progressive improvement in Bishop score. The mean Bishop score increased from 2.8 ± 0.9 at baseline to 3.6 ± 1.0 after the Day 1 procedure, 4.8 ± 1.1 after the Day 3 procedure, and 5.9 ± 1.2 after the Day 7 procedure. This represented an overall descriptive increase of 3.1 Bishop score points from baseline to Day 7 among women who had not already entered spontaneous labor.

*Table 3. Bishop Score Progression in the Membrane Stripping Group*

| Assessment Time Point | Group A: Stripping, Bishop Score Mean ± SD | Absolute Change From Baseline |
|---|---|---|
| **Baseline, Day 1 pre-procedure** | 2.8 ± 0.9 | Reference |
| **Post-Day 1 stripping** | 3.6 ± 1.0 | +0.8 |
| **Post-Day 3 stripping** | 4.8 ± 1.1 | +2.0 |
| **Post-Day 7 stripping** | 5.9 ± 1.2 | +3.1 |

Bishop score progression was summarized descriptively for the stripping group because repeat cervical scoring was part of the intervention protocol.

Procedure-related discomfort was reported by 36 women (51.4%) in Group A, and mild post-procedure vaginal bleeding occurred in 18 women (25.7%). These events were limited to the stripping group and were categorized as expected procedural adverse effects rather than serious maternal complications. Premature rupture of membranes occurred in 5 women (7.1%) in Group A and 3 women (4.3%) in Group B, with no statistically significant difference (RD: 2.9%, 95% CI: -4.8 to 10.5; RR: 1.67, 95% CI: 0.41 to 6.71; p=0.464).

Postpartum hemorrhage, puerperal fever, and meconium-stained amniotic fluid were also comparable between groups. Any serious maternal complication occurred in 8 women (11.4%) in Group A and 6 women (8.6%) in Group B, corresponding to a non-significant risk difference of 2.9 percentage points (95% CI: -7.1 to 12.8; p=0.563).

*Table 4. Maternal Complications and Procedural Adverse Effects*

| Outcome | Group A: Stripping (n=70) | Group B: Non-Stripping (n=70) | Risk Difference (95% CI) | Relative Risk (95% CI) | Odds Ratio (95% CI) | p-value |
|---|---|---|---|---|---|---|
| **Discomfort during procedure, n (%)** | 36 (51.4) | Not applicable | Procedural outcome only | — | — | — |
| **Post-stripping vaginal bleeding, n (%)** | 18 (25.7) | Not applicable | Procedural outcome only | — | — | — |
| **Premature rupture of membranes, n (%)** | 5 (7.1) | 3 (4.3) | RD 2.9% (-4.8 to 10.5) | 1.67 (0.41 to 6.71) | 1.72 (0.39 to 7.48) | 0.464 |
| **Postpartum hemorrhage, n (%)** | 3 (4.3) | 2 (2.9) | RD 1.4% (-4.7 to 7.6) | 1.50 (0.26 to 8.70) | 1.52 (0.25 to 9.40) | 0.647 |
| **Puerperal fever, n (%)** | 2 (2.9) | 1 (1.4) | RD 1.4% (-3.4 to 6.2) | 2.00 (0.19 to 21.56) | 2.03 (0.18 to 22.91) | 0.559 |
| **Meconium-stained amniotic fluid, n (%)** | 8 (11.4) | 11 (15.7) | RD -4.3% (-15.6 to 7.0) | 0.73 (0.31 to 1.70) | 0.69 (0.26 to 1.84) | 0.450 |
| **Any serious maternal complication, n (%)** | 8 (11.4) | 6 (8.6) | RD 2.9% (-7.1 to 12.8) | 1.33 (0.49 to 3.64) | 1.38 (0.45 to 4.20) | 0.563 |

Neonatal outcomes were similar between groups. Mean birth weight was 3124 ± 285 g in Group A and 3089 ± 312 g in Group B, with a mean difference of 35 g (95% CI: -63.99 to 133.99; p=0.457). Apgar score of 7 or higher at 5 minutes was recorded in 66 neonates (94.3%) in Group A and 65 neonates (92.9%) in Group B. Low Apgar score at 5 minutes, pathological fetal heart rate pattern, NICU admission, and neonatal mortality did not differ significantly between groups. NICU admission occurred in 3 neonates (4.3%) in Group A and 5 neonates (7.1%) in Group B, with a risk difference of -2.9 percentage points (95% CI: -10.5 to 4.8; p=0.464). No neonatal deaths were recorded in either group.

*Table 5. Fetal and Neonatal Outcomes by Study Group*

| Neonatal Outcome | Group A: Stripping (n=70) | Group B: Non-Stripping (n=70) | Risk Difference or Mean Difference (95% CI) | Relative Risk (95% CI) | Odds Ratio (95% CI) | p-value |
|---|---|---|---|---|---|---|
| **Birth weight, g, mean ± SD** | 3124 ± 285 | 3089 ± 312 | MD 35.00 (-63.99 to 133.99) | — | — | 0.457 |
| **Apgar score ≤7 at 5 minutes, n (%)** | 4 (5.7) | 5 (7.1) | RD -1.4% (-9.6 to 6.7) | 0.80 (0.22 to 2.86) | 0.79 (0.20 to 3.07) | 0.723 |
| **Apgar score ≥7 at 5 minutes, n (%)** | 66 (94.3) | 65 (92.9) | RD 1.4% (-6.7 to 9.6) | 1.02 (0.93 to 1.11) | 1.27 (0.33 to 4.94) | 0.723 |
| **Pathological fetal heart rate pattern, n (%)** | 5 (7.1) | 7 (10.0) | RD -2.9% (-12.1 to 6.4) | 0.71 (0.24 to 2.14) | 0.69 (0.21 to 2.30) | 0.541 |
| **NICU admission, n (%)** | 3 (4.3) | 5 (7.1) | RD -2.9% (-10.5 to 4.8) | 0.60 (0.15 to 2.41) | 0.58 (0.13 to 2.54) | 0.464 |
| **Neonatal mortality, n (%)** | 0 (0.0) | 0 (0.0) | RD 0.0% | Not estimable | Not estimable | — |

NICU: neonatal intensive care unit. Confidence intervals were derived from aggregated study data; p-values are shown for between-group comparisons where applicable.

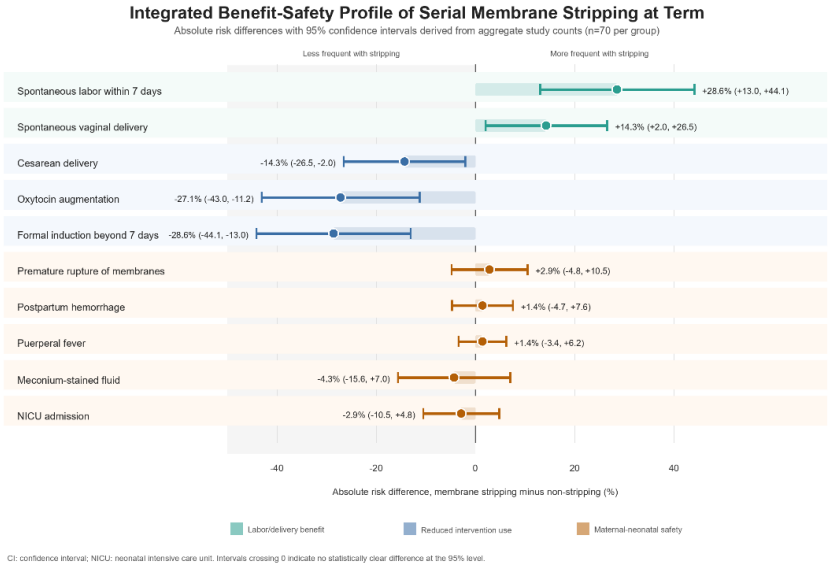


*Figure 1 Integrated Benefit-Safety Profile of Serial Membrane Stripping at Term*

## DISCUSSION

The present quasi-experimental study showed that serial amniotic membrane stripping at 38–40 weeks was associated with a higher rate of spontaneous labor within 7 days, shorter time to labor onset, higher spontaneous vaginal delivery rate, and lower need for formal induction compared with non-stripping care. The absolute increase in spontaneous labor was clinically meaningful at 28.6%, and the mean time to labor onset was reduced by 3.8 days. These findings are consistent with systematic review evidence showing that membrane sweeping at term increases spontaneous labor and reduces formal induction, although the magnitude of benefit varies by population, parity, cervical favorability, and timing of intervention (6,7). Similar favorable effects have been reported by Boulvain et al., Yildirim et al., Saichandran et al., Emarah, and Nasim et al., supporting the clinical usefulness of membrane stripping in carefully selected low-risk term pregnancies (9,10,12-14).

The observed improvement in labor onset is biologically plausible because membrane stripping separates the chorioamniotic membranes from the lower uterine segment and stimulates local prostaglandin release, promoting cervical ripening and uterine activity (5). In the present study, the

Bishop score increased progressively from 2.8 ± 0.9 at baseline to 5.9 ± 1.2 after serial stripping among women who had not entered labor, suggesting a clinically relevant cervical ripening pattern. However, because repeat Bishop scoring was protocol-based only in the stripping arm, this change should be interpreted as being consistent with the expected physiological effect of stripping rather than as definitive proof of causality. Baseline cervical status remains an important predictor of induction success, and both clinical Bishop scoring and ultrasound-based cervical assessment have been shown to influence response to labor-promoting interventions (16,17).

The reduction in cesarean delivery from 24.3% to 10.0% and the reduction in oxytocin augmentation from 67.1% to 40.0% are important from a clinical and service-delivery perspective. Lower intervention use may reduce monitoring burden, medication exposure, and the likelihood of escalation to operative delivery in busy obstetric units. These findings align with meta-analytic evidence suggesting that membrane sweeping can reduce formal induction and may improve spontaneous vaginal delivery when used as part of term pregnancy management (8,9). The similarity of the present cesarean findings to Pakistani data reported by Nasim et al. strengthens local relevance, although differences in institutional protocols and patient selection must be considered when comparing outcomes across studies (14).

Maternal and neonatal safety outcomes were comparable between groups. Procedure-related discomfort and mild vaginal bleeding were common in the stripping arm, but serious maternal complications, premature rupture of membranes, postpartum hemorrhage, puerperal fever, meconium-stained fluid, pathological fetal heart rate pattern, NICU admission, and neonatal mortality did not differ significantly. This safety profile is consistent with previous systematic review and clinical trial evidence indicating that membrane sweeping is generally safe when performed in appropriately selected patients with intact membranes and no contraindication to vaginal delivery (6,15,19). Because women with previous cesarean section or uterine surgery were excluded, the findings should not be generalized to trial-of-labor-after-cesarean populations, where separate evidence and risk assessment are required (20).

The main limitations are the quasi-experimental design, systematic alternate allocation, absence of allocation concealment, and single-center recruitment. Alternate assignment may introduce selection bias because allocation can become predictable. Although baseline characteristics were balanced, residual confounding by parity, cervical favorability, provider practice, and institutional induction thresholds cannot be excluded. The study also did not include adjusted regression analysis or parity-stratified outcome estimates, both of which would strengthen causal interpretation. Despite these limitations, the complete follow-up, clearly defined intervention schedule, clinically relevant outcomes, and inclusion of maternal and neonatal safety endpoints support the usefulness of the findings for low-risk term pregnancies in comparable tertiary obstetric settings.

## CONCLUSION

Serial amniotic membrane stripping in low-risk term pregnancies was associated with significantly higher spontaneous labor within 7 days, shorter time to labor onset, higher spontaneous vaginal delivery, and lower cesarean delivery, oxytocin augmentation, and formal induction rates compared with non-stripping care. Maternal and neonatal complications were not significantly increased, although transient discomfort and mild vaginal bleeding were frequent expected procedural effects. These findings support membrane stripping as a low-cost, practical, and generally safe adjunct for selected term pregnancies, while recognizing that stronger evidence from randomized, concealed-allocation, multicenter studies with adjusted and parity-stratified analyses is needed before broad protocol-level implementation.

## TRANSPARENCY STATEMENTS

Ethical approval was obtained from the Institutional Ethical Review Board of Sheikh Zayed Hospital, Rahim Yar Khan. Written informed consent was obtained from all participants. No external funding was

declared. The authors declare no conflict of interest. De-identified aggregate data may be requested from the corresponding author. The study was not reported as registered in a clinical trial registry.

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