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Repeated Sweeping of Chorio-Amniotic Membranes as a Method of Induction of Labour in Term Pregnancies

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Abstract
Background: Induction of labour is one of the most frequently performed obstetric interventions in term pregnancy. Membrane sweeping is a simple mechanical technique that promotes endogenous prostaglandin release and may facilitate spontaneous labour while reducing the need for formal induction. This study evaluated the effectiveness and safety of repeated membrane sweeping in term pregnancies.
Methods: This prospective comparative study included 87 women with uncomplicated singleton term pregnancies at a tertiary care teaching hospital. Forty-four women underwent repeated membrane sweeping, while 43 received expectant management without membrane sweeping. Maternal characteristics, cervical ripening, labour outcomes, mode of delivery, maternal complications, and neonatal outcomes were compared using independent *t*-test and Chi-square test. Logistic and linear regression analyses were performed to identify independent predictors of spontaneous labour and interval to labour onset.
Results: Women who underwent membrane sweeping demonstrated significantly greater improvement in Bishop score (7.52 ± 1.42 vs. 4.23 ± 1.34; $P<0.001$), shorter interval to labour onset (38.26 ± 7.92 vs. 74.63 ± 14.74 hours; $P<0.001$), shorter duration of active labour (5.48 ± 1.13 vs. 7.52 ± 1.69 hours; $P<0.001$), and higher rates of spontaneous labour (81.8% vs. 60.5%; OR=2.94, $P=0.049$). The requirement for formal induction was significantly reduced (29.5% vs. 53.5%; OR=0.37, $P=0.040$). Membrane sweeping independently increased the likelihood of spontaneous labour (adjusted OR=2.94; $P=0.031$) and reduced the interval to labour onset by 36.38 hours ($P<0.001$). Rates of caesarean delivery, premature rupture of membranes, neonatal birth weight, Apgar scores, and NICU admission were comparable between groups, indicating no increase in maternal or neonatal adverse outcomes.
Conclusion: Repeated membrane sweeping is a safe, effective, and inexpensive mechanical method for promoting cervical ripening and spontaneous labour in term pregnancies. The findings support the incorporation of repeated membrane sweeping into routine antenatal care protocols for appropriately selected low-risk women, particularly in resource-limited settings.

Keywords: Membrane sweeping; Chorio-amniotic membrane; Induction of labour; Term pregnancy; Bishop score; Spontaneous labour; Cervical ripening; Obstetric outcomes; Mechanical induction

INTRODUCTION
In the present study, the term "chorio-amniotic membrane" is used to denote the fetal membranes comprising the chorion and amnion. In routine obstetric practice and in much of the existing literature, these structures are commonly referred to simply as "membranes." Both terms are used interchangeably to describe the same anatomical entity. The use of the term "chorio-amniotic membrane" in this study is intended to provide anatomical precision, while maintaining conceptual equivalence with the more widely used term "membranes," as described in standard obstetric texts and research articles.
Labour refers to a series of physiologic events leading to expulsion of the fetus along with placenta and membranes from the maternal uterus. The process involves cervical effacement, dilatation of cervix, uterine contraction and descent of the fetus through the genital passage. Labour induction in term pregnancy marks the final outcome of pregnancy and is governed by the interactions of various factors including hormonal changes, prostaglandin production, increased oxytocin receptors, and inflammation resulting in cervical ripening and uterine contraction [1].
Labour induction is defined as artificial induction of uterine contraction for the purpose of vaginal delivery. Induction of labour is one of the most common procedures performed in the field of obstetrics [2] . It is worth mentioning that the rates of induction of labour are rising in recent times especially in the developed nations. This can be attributed to better surveillance during pregnancy, higher maternal age, increased presence of maternal diseases and focus on prevention of perinatal mortality and morbidity [3] .
Worldwide, induction of labor accounts for approximately 20% - 30% of all pregnancies [4] . The prevalence rate of induction of labor in India is estimated to range between 9% - 20% [5] . The increase in prevalence rates indicates that there is an effort towards evidence-based management and reduction of complications arising due to prolongation of pregnancy. Labour induction is indicated when the benefit of delivery is greater than continuation of pregnancy. These situations arise due to various reasons. Some of the indications for labour induction include post term pregnancy, pre-labor rupture of membranes, hypertensive disorders of pregnancy, intrauterine growth restriction, maternal diabetes

mellitus, oligohydramnios, and certain fetal conditions [6] . The most common indication of labour induction is post term pregnancy.
Post term pregnancy refers to any pregnancy beyond 42 weeks of gestation. There are multiple complications associated with post term pregnancies. These include fetal macrosomia, meconium aspiration syndrome, oligohydramnios, placental insufficiency, shoulder dystocia, operative delivery and increased perinatal mortality [7] . The rate of perinatal mortality gradually increases after 40 weeks gestation and this rise is even more pronounced in later stages [8] . It has been observed that there is increased perinatal mortality in post term pregnancies beyond 41 weeks of gestation. Therefore, most clinical guidelines recommend induction of labour before or at 41 weeks.
Different modalities are used for induction of labour. Some of the most popular methods include pharmacological induction and mechanical induction of labour. Pharmacological induction of labour includes use of prostaglandins like misoprostol and dinoprostone and oxytocin infusion. Transcervical balloon catheterization, membrane sweeping, and artificial rupture of membranes are examples of mechanical induction of labour [9] . Pharmacological induction of labour is very effective but has certain risks associated. These include uterine hyperstimulation, fetal distress, increased requirement for operative delivery, and rarely uterine rupture [10] . On the other hand, mechanical induction of labour is safer for selected patients as they are associated with lower risks of uterine hyperstimulation and systemic side effects [11] .
Membrane sweeping, also known as membrane stripping or cervical sweeping, is a mechanical procedure to promote the onset of labor. During this procedure, a health practitioner passes a finger through the cervical opening and rolls around the cervical walls to strip off the chorioamniotic membranes from the lower uterine segment. The underlying principle behind membrane sweeping is that this procedure stimulates secretion of endogenous prostaglandins mainly prostaglandin F2α, which induces cervical ripening and uterine contraction [12] . Membrane sweeping acts by stimulating the physiological mechanisms involved in inducing labor. Separation of membranes causes increased activity of phospholipase A2. Phospholipase activation results in formation of prostaglandins. Prostaglandins facilitate cervical ripening by altering the extracellular matrix, degradation of collagens and causing dilatation [13] . Further, prostaglandins induce uterine smooth muscle contractility [14] .
Membrane sweeping is known since several decades as a way to induce labor in post-term pregnancy. Several reports in the mid twentieth century highlight the ease of procedure, safety and efficacy of membrane sweeping [15] . The advent of pharmacological substances such as prostaglandins and oxytocin resulted in decreased popularity of mechanical methods. Recently, membrane sweeping gained attention due to concerns of uterine hyperstimulation and increased cesarean section rates with the use of pharmacological induction. Therefore, the present study was conducted with the aim of evaluating the effectiveness of repeated membrane sweeping in induction of labour in term pregnancies and its effect on maternal and neonatal outcomes.

METHODOLOGY:

Study Design and Overview

The present research was conducted as a prospective comparative study designed to evaluate the efficacy of repeated membrane sweeping as a mechanical method for induction of labour in term pregnancies. The core objective of this investigation was to compare the obstetric and neonatal outcomes between women undergoing repeated membrane sweeping and those managed expectantly without any mechanical intervention. This comparative framework was selected to generate robust evidence regarding the clinical utility of repeated sweeping, particularly in reducing the need for formal pharmacological induction while ensuring maternal and fetal safety.

Study Setting and Duration

The study was carried out in the Department of Obstetrics and Gynaecology at Sree Balaji Medical College and Hospital, Chennai—a tertiary care teaching institution that serves a diverse antenatal population drawn from both rural and urban communities. The hospital is well-equipped with comprehensive obstetric facilities, including dedicated antenatal, intranatal, and postnatal wards, high-risk pregnancy units, operative delivery suites, and neonatal care services, thereby ensuring complete management of all enrolled participants throughout their pregnancy and delivery. The total duration of the study spanned 18 months, during which patient recruitment, scheduled follow-up visits, data collection, and subsequent statistical analysis were systematically completed. All participants were enrolled and followed continuously until the time of delivery, ensuring complete capture of maternal and neonatal outcome data.

Study Population and Eligibility Criteria

The study subjects were selected from pregnant women attending the antenatal outpatient department or admitted to the labour ward of the study institution. The target population comprised women with uncomplicated, singleton, term pregnancies who were willing to participate in the research. To maintain homogeneity and reduce confounding variables, stringent inclusion and exclusion criteria were applied. Women were included if they had a gestational age of 37 completed weeks or more (ranging from 38 to 41 weeks), a singleton pregnancy, no contraindications to vaginal delivery, no contraindications to membrane sweeping, willingness to undergo the repeated sweeping procedure, ability to provide written informed consent, and availability for regular follow-up until delivery.

Conversely, women were excluded from the study if they presented with any of the following conditions: gestational age less than 37 weeks, multiple gestation, high-risk pregnancy features, previous cesarean section, fetal malpresentation (such as breech or transverse lie), placenta previa, suspected fetal compromise, ruptured membranes, major cephalopelvic disproportion, cervical carcinoma, or active genital herpes infection. These exclusion criteria were meticulously applied to eliminate potential safety concerns and to ensure that the study population represented a low-risk cohort suitable for expectant management or mechanical induction.

Sampling Strategy and Sample Size Estimation

A consecutive sampling method was adopted for participant recruitment. All eligible pregnant women who attended the antenatal outpatient department or were admitted to the labour ward during the 18-month study period and who met the predefined inclusion criteria were enrolled consecutively until the required sample size was achieved. This non-probability sampling technique was chosen for its feasibility and efficiency in a clinical setting, allowing for the sequential enrolment of all eligible patients without selection bias.

The sample size was calculated using the standard formula for estimating proportions: $n = Z^2pq / d^2$, where Z represents the standard normal deviate corresponding to the 95% confidence interval (1.96), p was taken as 6% (based on anticipated incidence from prior literature) [16], q = 94%, and d represented the allowable error set at 5%. Applying these values, the minimum required sample size was determined to be 87 participants. All eligible women meeting the inclusion criteria during the designated study period were recruited until this target number was attained, thereby ensuring adequate statistical power for meaningful comparisons between the study and control groups.

Study Groups and Intervention Protocol

The enrolled participants were allocated into two distinct groups for comparative analysis. The study group comprised women who underwent induction of labour by repeated membrane sweeping at scheduled intervals. The control group comprised women who did not undergo membrane sweeping and were managed expectantly with standard antenatal monitoring; in this group, only gentle per-vaginal examinations were performed for the sole purpose of assessing the Bishop score, without any attempt at mechanical membrane separation.

In the study group, membrane sweeping was performed under strict aseptic precautions. Each participant was placed in the lithotomy position, and the examiner, wearing sterile gloves, introduced the index finger through the cervical opening. A systematic circular movement encompassing 360 degrees was made to separate the chorioamniotic membranes from the lower uterine segment. The initial sweeping was performed at 38 weeks of gestation. Subsequently, the procedure was repeated weekly until 40 weeks. Beyond 40 weeks, membrane sweeping was performed twice weekly until 41 weeks of gestation or until the spontaneous onset of labour, whichever occurred earlier. This stepped protocol was designed to maximise the cumulative prostaglandin release and cervical ripening effect over time.

Post-Procedural Care and Participant Monitoring

Following each membrane sweeping session, participants in the study group were allowed to return home after a brief period of observation. They were thoroughly counselled regarding expected post-procedure symptoms, which included mild vaginal bleeding, passage of the mucus plug (show), irregular uterine contractions, and occasional leakage per vaginam. Women were specifically instructed to monitor daily fetal movements and to report immediately to the hospital if they experienced any concerning features such as reduced fetal movements, persistent or heavy vaginal bleeding, continuous leaking of fluid, regular painful uterine contractions, or any other unusual symptoms. This proactive counselling ensured early detection of potential complications and timely intervention. Participants in the control group received standard antenatal advice without any specific post-procedure restrictions.

Outcome Measures and Assessment Tools

The study evaluated both primary and secondary outcome measures to comprehensively assess the effectiveness of repeated membrane sweeping. The primary outcomes were: (1) the occurrence of spontaneous labour following the intervention, and (2) the change in the modified Bishop score after each membrane sweeping session compared to baseline. The secondary outcomes included the total duration of pregnancy (gestational age at delivery), the interval between the last membrane sweeping and the onset of labour, the duration of active labour, the incidence of premature rupture of membranes, the mode of delivery (vaginal or caesarean), and the neonatal Apgar score at birth.

Cervical status was serially assessed using the modified Bishop score, which evaluates five parameters: cervical dilatation, effacement, consistency, position, and fetal station. Based on the total score, the cervix was categorised as unfavourable (score <4), intermediate (score 5–8), or favourable (score ≥9). This scoring system guided the interpretation of cervical readiness and the likelihood of successful induction.

Data Collection, Follow-up, and Statistical Analysis

All relevant data were collected using a structured case record proforma designed specifically for this study. The proforma captured comprehensive information including demographic details (maternal age, parity, and registration status), obstetric history, clinical examination findings, serial Bishop scores, procedural details, labour and delivery outcomes, and neonatal parameters. All participants were followed continuously from recruitment until delivery, and both maternal and neonatal outcomes were meticulously documented.

The collected data were entered into a Microsoft Excel spreadsheet and subsequently analysed using appropriate statistical software. Descriptive statistics were employed to summarise baseline demographic and clinical variables; continuous variables were expressed as means with standard deviations, while categorical variables were presented as frequencies and percentages. For comparative analysis between the study and control groups, the Chi-square test was applied for categorical variables, and the independent t-test was used for continuous variables. A p-value of less than 0.05 was considered statistically significant for all analyses.

Ethical Considerations, Funding, and Oversight

Prior to commencement, the study protocol received formal approval from the Institutional Ethics Committee of Sree Balaji Medical College and Hospital. Written informed consent was obtained from every participant after a clear explanation of the study's purpose, procedures, potential benefits, and risks. Participation was entirely voluntary, and participants were explicitly informed of their right to withdraw from the study at any point without any impact on their routine medical care. Strict confidentiality of all patient information and clinical data was maintained throughout the research process.

RESULTS:

Table 1. Baseline Maternal and Obstetric Characteristics among the study participants (n=87)

Variable	Membrane Sweeping (n=44)	Control (n=43)	t-value/ Chi	P value
Age (years)	25.43 ± 2.76	25.93 ± 2.93	-0.817	0.417
Gestational age (weeks)	39.10 ± 0.92	39.63 ± 0.76	-2.945	0.004
Bishop score at recruitment	3.64 ± 1.18	3.40 ± 1.22	0.936	0.352
Cervical dilatation at admission (cm)	3.49 ± 0.97	1.95 ± 0.69	8.472	<0.001
Primigravida	28 (63.6%)	22 (51.2%)	1.46	0.13
Multigravida	16 (36.4%)	21 (48.8%)		

Baseline maternal and obstetric characteristics were generally comparable between the two groups (Table 1). Maternal age, parity distribution, and baseline Bishop scores did not differ significantly, indicating good baseline comparability. Women in the membrane sweeping group had a slightly lower gestational age at recruitment (39.10 ± 0.92 vs. 39.63 ± 0.76 weeks; *P*=0.004) and significantly greater cervical dilatation at admission (3.49 ± 0.97 vs. 1.95 ± 0.69 cm; *P*<0.001).

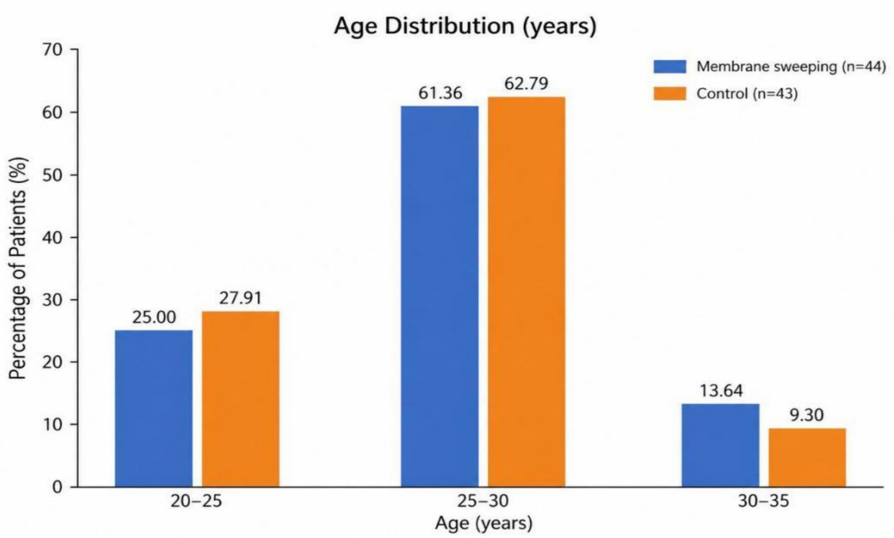

Figure 1: Age distribution among the study participants

Table 2. Primary Outcomes and Labour Characteristics among the study participants (n=87)

Variable	Membrane Sweeping (n=44)	Control (n=43)	P value
Spontaneous labour	36 (81.8%)	26 (60.5%)	0.049
Bishop score after intervention	7.52 ± 1.42	4.23 ± 1.34	<0.001
Interval from sweep to labour (hours)	38.26 ± 7.92	74.63 ± 14.74	<0.001
Duration of active labour (hours)	5.48 ± 1.13	7.52 ± 1.69	<0.001
Need for formal induction	13 (29.5%)	23 (53.5%)	0.040

Membrane sweeping significantly improved cervical ripening and labour outcomes (Table 2). Women undergoing membrane sweeping had higher Bishop scores following intervention and were significantly more likely to enter spontaneous labour than controls (81.8% vs. 60.5%; P=0.049). The intervention shortened the interval from sweeping to labour onset by approximately 36 hours and reduced the duration of active labour by nearly 2 hours (P<0.001 for both). Additionally, the requirement for formal induction was significantly lower among women receiving membrane sweeping (29.5% vs. 53.5%; P=0.040).

Table 3. Maternal and Neonatal Outcomes among the study participants (n=87)

Outcome	Membrane Sweeping (n=44)	Control (n=43)	P value
Vaginal delivery	31 (70.5%)	24 (55.8%)	0.233
LSCS	13 (29.5%)	19 (44.2%)	0.233
PROM	4 (9.1%)	6 (14.0%)	0.708
Birth weight (kg)	2.94 ± 0.40	2.87 ± 0.49	0.441
Apgar score at 1 minute	8.64 ± 0.89	8.63 ± 0.93	0.966
NICU admission	7 (15.9%)	9 (20.9%)	0.743

Maternal and neonatal outcomes were comparable between the membrane sweeping and control groups (Table 3). Vaginal delivery occurred more frequently in the membrane sweeping group (31/44, 70.5%) than in the control group (24/43, 55.8%), while lower segment caesarean section (LSCS) was performed in 13/44 (29.5%) and 19/43 (44.2%) women, respectively; however, these differences were not statistically significant (P = 0.233). Premature rupture of membranes (PROM) occurred in 4/44 (9.1%) women in the membrane sweeping group and 6/43 (14.0%) in the control group (P = 0.708). Neonatal outcomes were also similar between the groups, with comparable mean birth weights (2.94 ± 0.40 kg vs. 2.87 ± 0.49 kg; P = 0.441) and Apgar scores at 1 minute (8.64 ± 0.89 vs. 8.63 ± 0.93; P = 0.966). NICU admission was required for 7/44 (15.9%) neonates in the membrane sweeping group and 9/43 (20.9%) in the control group (P = 0.743).

Table 4. Comparative Analysis of Maternal, Labour and Neonatal Outcomes Between the Membrane Sweeping and Control Groups

Variable	Membrane Sweeping (n = 44)	Control (n = 43)	Test Statistic	P value	Effect Size / OR
Continuous variables					
Age (years)	25.43 ± 2.76	25.93 ± 2.93	t = -0.817	0.417	Cohen's d = -0.175
Gestational age (weeks)	39.10 ± 0.92	39.63 ± 0.76	t = -2.945	0.004	Cohen's d = -0.632
Baseline Bishop score	3.64 ± 1.18	3.40 ± 1.22	t = 0.936	0.352	Cohen's d = 0.201
Bishop score after intervention	7.52 ± 1.42	4.23 ± 1.34	t = 11.092	<0.001	Cohen's d = 2.378
Cervical dilatation at admission (cm)	3.49 ± 0.97	1.95 ± 0.69	t = 8.472	<0.001	Cohen's d = 1.817
Interval to onset of labour (hours)	38.26 ± 7.92	74.63 ± 14.74	t = -14.383	<0.001	Cohen's d = -3.084
Duration of active labour (hours)	5.48 ± 1.13	7.52 ± 1.69	t = -6.636	<0.001	Cohen's d = -1.423
Birth weight (kg)	2.94 ± 0.40	2.87 ± 0.49	t = 0.774	0.441	Cohen's d = 0.166
Apgar score at 1 minute	8.64 ± 0.89	8.63 ± 0.93	t = 0.043	0.966	Cohen's d = 0.009
Categorical outcomes					
Spontaneous labour	36 (81.8%)	26 (60.5%)	χ^2 = 3.855	0.049	OR = 2.94
Need for formal induction	13 (29.5%)	23 (53.5%)	χ^2 = 4.200	0.040	OR = 0.37
Vaginal delivery	31 (70.5%)	24 (55.8%)	χ^2 = 1.424	0.233	OR = 1.89
PROM	4 (9.1%)	6 (14.0%)	χ^2 = 0.140	0.708	OR = 0.62

NICU admission	7 (15.9%)	9 (20.9%)	$\chi^2 = 0.107$	0.743	OR = 0.72

Table 4 summarizes the comparative maternal, labour, and neonatal outcomes between the two study groups. Baseline maternal age and Bishop scores were comparable, whereas the membrane sweeping group had a slightly lower gestational age at recruitment (P=0.004). Following intervention, women who underwent membrane sweeping demonstrated significantly higher Bishop scores, greater cervical dilatation at admission, a markedly shorter interval to spontaneous labour onset, and a reduced duration of active labour compared with controls (all P<0.001), with large to very large effect sizes (Cohen's d = 1.42–3.08). Membrane sweeping was also associated with significantly higher rates of spontaneous labour (81.8% vs. 60.5%; OR=2.94, P=0.049) and significantly lower requirements for formal induction (29.5% vs. 53.5%; OR=0.37, P=0.040). In contrast, mode of delivery, PROM, neonatal birth weight, Apgar scores at 1 minute, and NICU admission rates were similar between the groups, indicating that membrane sweeping improved labour outcomes without adversely affecting neonatal safety.

Table 5. Regression Analysis of the Effect of Membrane Sweeping on Labour Outcomes

Outcome	Predictor	Coefficient (β)	SE	Test statistic	P value	Estimate (95% CI)
Logistic regression: Spontaneous labour	Membrane sweeping (vs. Control)	1.079	0.500	z = 2.158	0.031	Adjusted OR = 2.94
	Constant	0.425	0.312	z = 1.362	0.173	OR = 1.53
Linear regression: Interval to onset of labour	Membrane sweeping (vs. Control)	-36.38	2.53	t = -14.38	<0.001	-36.38 hours (95% CI: -41.40 to -31.35)
	Constant	74.63	1.80	t = 41.49	<0.001	95% CI: 71.06 to 78.21

Regression analyses confirmed membrane sweeping as an independent predictor of favourable labour outcomes (Table 5). Logistic regression demonstrated that women undergoing membrane sweeping had 2.94-fold higher odds of achieving spontaneous labour compared with controls after adjustment (*Adjusted OR*=2.94, P=0.031). Linear regression further showed that membrane sweeping independently reduced the interval to labour onset by 36.38 hours (β = -36.38, 95% CI: -41.40 to -31.35; P<0.001). These findings indicate that membrane sweeping not only increases the likelihood of spontaneous labour but also substantially accelerates the onset of labour without increasing adverse maternal or neonatal outcomes.

Discussion

The primary aim of the present study was to evaluate the effectiveness of mechanical labour stimulation through repeated membrane sweeping in term pregnant women, specifically with regard to cervical favourability, timing of labour onset, need for formal pharmacological induction, labour duration, mode of delivery, and maternal and neonatal outcomes. The findings of this investigation clearly demonstrate that membrane sweeping significantly enhances cervical favour ability, reduces the time interval to labour onset, facilitates spontaneous onset of labour, decreases the requirement for pharmacological induction, and does not increase maternal or neonatal morbidity. These results are broadly consistent with national and international literature, thereby reinforcing the position of mechanical labour stimulation as an effective, safe, and physiologically appropriate technique for labour promotion in carefully selected candidates.

It is pertinent to interpret the findings of the current study within the broader context of the evolving philosophy of labour induction. Over the past two decades, the balance between achieving timely delivery and minimising the necessity of pharmacological intervention has become a subject of considerable debate among obstetricians. Although pharmacological induction methods remain widely prevalent, concerns regarding tachysystole, fetal distress, prolonged hospital stays, and high resource utilisation have prompted a renewed search for less harmful techniques for labour promotion, including membrane sweeping [17,18]. Among all existing labour induction techniques, membrane sweeping occupies a unique position because it stimulates the body's natural biological processes to initiate labour, rather than relying on exogenous pharmacological agents.

The current study demonstrates a significant positive effect of membrane sweeping on cervical favour ability. Cervical ripening is essentially a complex biochemical and physical transformation involving increased collagen breakdown, elevated hyaluronic acid concentrations, and leukocyte infiltration. Prostaglandins play a pivotal role in this process, and membrane sweeping appears to stimulate endogenous production of these substances, thereby simulating the natural cascade of labour initiation. Prior international randomised trials have shown that the impact of membrane sweeping on Bishop scores varies according to different criteria, primarily parity and gestational age [19,20]. It has been observed that nulliparous women demonstrate a slightly lower cervical response to membrane sweeping compared to multiparous women [20] . Despite this, the overall Bishop scores in the current study increased significantly across both groups, confirming the overall effectiveness of the procedure in promoting cervical ripening irrespective of parity.

One of the most clinically valuable findings of this study is the shortened waiting period to spontaneous labour onset. In busy tertiary care hospitals, patients with post-term pregnancies often require repeated outpatient visits, continuous antenatal monitoring, and consequently experience heightened anxiety due to prolonged waiting periods. The current study demonstrated a reduction in the waiting period of approximately 36 hours, a finding that appears more pronounced than in some Western trials. This disparity may be attributed to differences in patient selection criteria, lower gestational age at intervention, and higher baseline cervical favour ability, as Indian populations generally exhibit faster engagement of the fetal head in labour. This observation underscores the critical importance of generating locally-specific evidence to guide clinical practice in diverse populations.

The increased proportion of spontaneous labour onset observed in the current study is consistent with the conclusions of systematic reviews. Boulvain et al. reported that membrane sweeping decreases the percentage of formal pharmacological inductions by 15–20% [19] . The results of the present study confirm this conclusion. Furthermore, these findings must be viewed from the standpoint of clinical governance and hospital resource management. Even a modest reduction in formal induction cases can significantly reduce the burden on labour units, which often face constraints in terms of continuous cardiotocographic monitoring, intravenous therapy, pharmacological agents, and skilled supervision. The World Health Organization guidelines explicitly emphasise the use of low-cost, safe methods whenever appropriate [21] . Membrane sweeping, being an inexpensive outpatient procedure, aligns perfectly with this global recommendation.

Another important consideration is labour efficiency. A favourable cervix is typically associated with a reduced need for oxytocin augmentation and shorter labour patterns [22] . Although augmented labours were not separately analysed in the current study, the significantly decreased duration of the active phase in the study group compared to controls provides compelling evidence of better labour efficiency. It is biologically plausible that a ripened cervix responds more effectively to endogenous oxytocin. International studies analysing mechanical induction of labour have similarly reported shortened labour phases when the cervix is favourable at the start of induction. The absence of any increase in the incidence of caesarean sections in the study group further reinforces the physiological nature of labour onset provoked by membrane sweeping. Previous concerns that induction might increase caesarean delivery rates, particularly with pharmacological agents, have been well documented [23]. The current findings confirm that such an adverse outcome is unlikely with mechanical stimulation, a conclusion supported by numerous studies reporting no significant difference in caesarean section rates between membrane sweeping and control groups [17-19] .

Safety remains an absolute priority in obstetrics. In the present study, no complications related to membrane rupture, infection, or adverse neonatal outcomes were observed, which is indicative of the overall safety of the procedure. Although minor discomfort and spotting are common, serious complications following membrane sweeping are rare [24] . Microbiological studies have shown no increased incidence of chorioamnionitis after membrane sweeping [25,26] . Thus, as long as the procedure is conducted under strict sterile conditions in the indicated population, it appears to be a safe practice. Special attention must also be paid to neonatal outcomes. Apgar scores and NICU admission rates were not significantly different between the study and control groups, confirming that the intervention does not cause fetal distress. Unlike pharmacological prostaglandins, membrane sweeping does not induce tachysystole, which contributes to better neonatal outcomes [27] .

From a public health and epidemiological standpoint, the prevention of post-term pregnancy is an important goal. Perinatal mortality rises continuously beyond 41 weeks of gestation, and increasing the likelihood of spontaneous labour onset can help mitigate this risk. Though the current study lacks data on perinatal mortality due to limited sample size, it contributes meaningfully to the broader strategy of preventing post-term complications. Cost-effectiveness is another crucial consideration. Pharmacological induction entails substantial expenditures on medications, hospitalisation, and extended monitoring, whereas mechanical stimulation can be performed in an outpatient setting at minimal cost [28] . Therefore, from an economic perspective, membrane sweeping represents an advantageous intervention.

Despite the encouraging results, several limitations of the present study must be acknowledged. First, being a single-centre study, the generalisability of the findings may be limited, as institutional protocols, patient demographics, and clinical practices can vary considerably across different healthcare settings. Second, although patient satisfaction is a crucial factor in assessing the acceptability of any obstetric intervention, patient-reported outcome measures were not included in the current study. Incorporating validated patient satisfaction scales in future research would yield valuable complementary information. Third, causality could be more firmly established through multivariable regression analyses adjusted for potential confounders such as parity, gestational age, and baseline Bishop scores. While the current study indicates that membrane sweeping is a strong predictor of spontaneous labour, further confirmatory analyses are warranted.

Despite these limitations, the clinical implications of this study are substantial. The findings provide robust evidence supporting the routine integration of repeated membrane sweeping into antenatal care protocols for term pregnancies, particularly in resource-constrained settings where pharmacological agents may be expensive or less accessible. The procedure empowers obstetricians with a safe, inexpensive, and physiologically sound tool to reduce the need for formal induction, alleviate patient anxiety associated with prolonged pregnancies, and optimise resource utilisation. Future multicentric randomised controlled trials in the Indian population, incorporating longer follow-up periods and health economic analyses, would be instrumental in strengthening the evidence base and facilitating the widespread adoption of this technique.

CONCLUSION

In conclusion, this study confirms that repeated membrane sweeping in term pregnancies is a safe, effective, and cost-effective mechanical method for promoting cervical ripening, shortening the time to labour onset, increasing the rate of spontaneous labour, and significantly reducing the need for formal pharmacological induction. Importantly, it does not increase the risk of caesarean section, maternal infectious morbidity, or adverse neonatal outcomes. Given its proven safety profile, ease of implementation, low cost, and positive impact on both maternal and neonatal outcomes, membrane sweeping should be considered a preferred initial strategy for labour promotion in appropriate candidates.

REFERENCES:

1. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, et al. Williams Obstetrics. 25th ed. New York: McGraw Hill; 2018.
2. World Health Organization. WHO recommendations for induction of labour. Geneva: WHO; 2011.
3. Martin JA, Hamilton BE, Osterman MJ. Births in the United States, 2018. NCHS Data Brief. 2019;346:1–8.
4. Vogel JP, et al. Use of labour induction and risk of cesarean delivery. PLoS Med. 2013;10(10):e1001466.
5. Grobman WA, et al. Induction of labour and perinatal outcomes. Obstet Gynecol. 2018;131:123–31.
6. ACOG Practice Bulletin No. 107: Induction of labor. Obstet Gynecol. 2009;114:386–97.
7. Divon MY, et al. Fetal and neonatal mortality in the post-term pregnancy. Obstet Gynecol. 1998;91:361–5.
8. Caughey AB, et al. Safe prevention of the primary cesarean delivery. Obstet Gynecol. 2014;123:693–711.
9. Ten Eikelder ML, et al. Mechanical methods for induction of labour. Cochrane Database Syst Rev. 2016;10:CD001233.
10. Boulvain M, et al. Induction of labour versus expectant management. Lancet. 2015;385:2600–5.
11. Jozwiak M, et al. Mechanical methods for induction of labour. BJOG. 2012;119:145–53.
12. Keirse MJ. Natural prostaglandins for induction. Clin Obstet Gynecol. 1989;32:35–44.
13. Challis JR, et al. Prostaglandins and the onset of labour. Clin Obstet Gynecol. 2000;43:478–91.
14. Smith R. Parturition. N Engl J Med. 2007;356:271–83.
15. O'Driscoll K, et al. Active management of labour. Lancet. 1969;2:477–9.
16. Boulvain M, Stan C, Irion O. Membrane sweeping for induction of labour. Cochrane Database Syst Rev. 2005;(1):CD000451.
17. Boulvain M, Stan C, Irion O. Membrane sweeping for induction of labour. Cochrane Database Syst Rev. 2005;(1):CD000451.
18. Ten Eikelder MLG, Oude Rengerink K, Jozwiak M, De Groot CJM, Feitsma H, Van Pampus MG, et al. Mechanical methods for induction of labour. Cochrane Database Syst Rev. 2016;(10):CD001233.
19. de Miranda E, van der Bom JG, Bonsel GJ, Bleker OP, Rosendaal FR. Membrane sweeping and prevention of post-term pregnancy in low-risk women: a randomized controlled trial. BJOG. 2006;113(4):402–8.
20. Tan PC, Jacob R, Omar SZ. Membrane sweeping at term: a randomized controlled trial. Obstet Gynecol. 2006;108(5):113–8.
21. World Health Organization. WHO recommendations for induction of labour. Geneva: World Health Organization; 2011.
22. Challis JR, Matthews SG, Gibb W, Lye SJ. Endocrine and paracrine regulation of birth at term and preterm. Endocr Rev. 2000;21(5):514–50.
23. Berghella V, Saccone G. Mechanical methods for induction. Am J Obstet Gynecol. 2018;219(1):24-31.
24. Gupta JK, Johnson N. Membrane sweeping for induction of labour: maternal discomfort and complications. BJOG. 2006;113(4):403–8.
25. Jozwiak M, Bloemenkamp KW, Kelly AJ, et al. Mechanical methods for induction of labour. BJOG. 2012;119(5):536-546.
26. Kashanian M, Akbarian AR. Membrane sweeping at term pregnancy. Arch Gynecol Obstet. 2006;274(4):201-204.
27. Keirse MJNC. Natural prostaglandins for induction of labor and preinduction cervical ripening. Clin Obstet Gynecol. 1989;32(1):35–44.
28. Adeyemi AB, Akinola SE. Membrane sweeping in low-resource settings. Afr J Reprod Health. 2018;22(2):89-95.