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Comparative Study of Extraamniotic Saline Infusion with Transcervical Foleys Catheter and Intracervical PGE2 Gel in Cervical Ripening and Labor Induction

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Abstract

Background: Success of induction depends on the cervical favorability, which is quantified in points by Modified Bishop Score. *Aim:* This study compared the efficacy and safety of Extraamniotic Saline Instillation with Transcervical Foley Catheter and Vaginal PGE2 for improving Bishop score in term pregnant patients. *Materials and Methods:* It is a prospective and comparative study on 200 patients with various indications for induction with unfavorable cervix (Bishop score <6), satisfying inclusion and exclusion criteria, are the subjects of the study. All patients undergone vaginal examination, the patients were divided randomly into two groups. Group A: 100 Cases, in whom, PGE2 gel was instilled intracervically for preinduction cervical ripening. Group B: 100 Cases, in whom, extramniotic saline infusion was done along with transcervical Foley catheter. *Results:* The mean Bishop Score at Zero hour of both the groups was comparable 3.92±1.49 in Group A and 3.5±1.48 in Group B. Success of cervical ripening defined as improvement in Bishop score > 4 points at the end of 24hours. Cervical ripening failure was defined as a increase in Bishop's score < 4 points following 24 hours. There were 78% with successful ripening in Group A and 94% in Group B. The difference in the success rates among the two groups is significant ($p<0.05$). 25% in Group A and 37% in Group B had an instillation delivery interval between 24 & 48 hours. There is no significant difference in instillation delivery interval among the two groups. 83% in Group B and 58% in Group A had vaginal delivery. 43% in Group A and 16% in Group B had EMLSCS. Uterine tachysystole was seen 4% patients in Group A and no patient in Group B had tachysystole. There was no significant difference in the APGAR at 1min and 5mins in both the groups. 18% in Group A and 16% in Group B had NICU admissions. The indications for admissions were APGAR at 5min <7, Meconium stained liquor and respiratory distress. *Conclusions:* Extraamniotic saline Instillation with Transcervical Foley Catheter is better alternative to PGE2 in term higher success rate in improvement in Bishop score, shorter ripening time, fewer complications like uterine tachysystole.

Keywords: PGE2; Extraamniotic Saline Infusion; Transcervical Foleys Catheter; Cervical Ripening.

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Introduction

Obstetrics is the branch of medicine that deals with childbirth and the care and treatment of the mother before and after birth.The induction and management of labour is an integral part of the modern obstetric practice. The main objective is that every pregnancy culminates in a healthy mother and a healthy baby. The indications are maternal, most commonly postdatism hypertensive disorders, or fetal, when the risk of stillbirth or cesarean delivery is raised beyond 41 weeks of gestation. Together with growth restriction and diabetes, these are the most common indications; there is little research published about induction on request [1]. Cervical ripeness or

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favorability is important for successful induction. These situations prompt the search for methods of cervical ripening and labour induction that maximize the likelihood of a vaginal delivery within an acceptable time frame while minimizing adverse maternal, fetal and neonatal effects. Induction of labour is defined as the process of artificially stimulating the uterus to start labour.

The incidence of induction of labour varies from 4% to 40% in different hospitals. Cervical ripening refers to the pre-labour changes in the physical and biochemical configuration of collagen fibers in the uterine cervix that generally occur before the onset of contractions. Cervical ripening requires a downregulation of collagen assembly genes; increased synthesis of glycosaminoglycans that disrupt the matrix, such as hyaluronan; increased metabolism of progesterone; and changes in epithelial barrier properties. In the absence of a ripe or favorable cervix, a successful vaginal birth is less likely. Therefore, cervical ripening or preparedness for induction should be assessed before a regimen is selected [1].

PGE2 has been shown to stimulate interleukin-8, an inflammatory cytokine that promotes the influx of neutrophils and induces remodeling of the cervical extracellular matrix, and to induce functional progesterone withdrawal.

Extraamniotic Saline Infusion (EASI) for enhanced endogenous prostaglandin secretion can be used for cervical ripening [2]. The aim of this randomized prospective study is to compare the efficacy and safety of extraamniotic saline instillation with transcervical Foley catheter with vaginal prostaglandin E2 gel for improving Bishop Score at term. Our aim is to compare efficacy and safety of extraamniotic saline instillation with transcervical Foley catheter with vaginal prostaglandin E2 gel for improving Bishop Score at term.

Materials and Methods

The present study is undertaken on patients admitted in Niloufer Hospital for women and children, Hyderabad, during the period from January 2016 to January 2017. It is a prospective comparative study.

200 patients with various indications for induction with unfavourable cervix (Bishop score <6), satisfying inclusion and exclusion criteria, are the subjects of the study.

Inclusion Criteria

≥ 37 weeks gestation, had a singleton pregnancy with the fetus in cephalic presentation, unfavorable cervix, defined as a Bishop score <6, intact membranes and reassuring fetal heart rate tracing, no more than two painful contractions in a 20 minute period.

Exclusion Criteria

Significant vaginal bleeding, fetal chorioamnionitis, contraindication to vaginal delivery, previous uterine scar, Fetal heart rate abnormalities. A contraindication to receiving prostaglandins (history of heart disease, glaucoma or asthma), Multiple gestation, Malpresentation and Latex Allergy.

Having given their written consent for participation in the study and after undergoing vaginal examination, the patients were divided randomly into two groups.

Group A:

100 Cases, in whom, PGE2 gel was instilled intracervically for preinduction cervical ripening.

Group B:

100 Cases, in whom, extramniotic saline infusion was done along with transcervical Foley catheter.

At admission detailed history as per proforma attached including age, parity, gestational age. Indication for induction noted after general physical examination and systemic examination.

Per abdomen examination

Fetal lie, presentation, position, fetal heart rate noted.

Per Vaginal examination

Pelvic assessment done to rule out CPD and Bishop score noted.

Bishop Score

Score 0-13.

Score <6 considered unfavourable.

Detailed speculum examination was carried out and cervix was swabbed with povidone iodine. Fetal heart tracing was taken for 20 minutes preinduction.

Group A: (Vaginal PGE2 Gel)

In this group 0.5 mg of PGE2 stored at 2-8°C was used.

Method

Patient positioned in dorsal lithotomy position, parts cleaned and draped. Posterior vaginal wall retracted with Sims speculum. Cervix and vagina cleaned of any mucous or discharge. After holding anterior lip of cervix with sponge holding forceps, PGE2 gel was instilled into vagina (posterior fornix) with a prefilled syringe. Patient kept in supine position for 30min. Fetal heart rate and uterine contractions monitored. Patient reassessed after 6 hours of instillation of PGE2 gel. When the Bishop score < 6, a second dose of 0.5mg was administered. Bishop score reassessed after 6 hrs. If it is less than 6, third dose was administered. Maximum of three doses were used. External electronic fetal heart rate monitoring was recorded before and for 40 minutes after each PGE2 insertion. Artificial rupture of membranes was performed and oxytocin infusion was administered, if labor did not commence after two doses. Oxytocin was withheld for 6 hours following administration of vaginal prostaglandins, in order to minimize uterine hypertonus.

Criteria for successful ripening is a Bishop score > 6 at the end.

Group B: (Extra Amniotic Saline Instillation with Transcervical Foley Catheter)

In this group 120 ml of normal saline instilled into the extraamniotic space at the rate of 60 ml/ hr through a 16 Fr trancervical Foley catheter with the ballon of the catheter inflated with 60 ml of normal saline.

Results

Maximum number of patients were in the age group 21-25 years in both the groups.

p value is >0.05 which indicates that there is no significant difference in the age distribution of the two groups.

In both Group A and Group B, Primi gravida constitute the majority.

Gestational age of both the groups are comparable, there is no significant difference (p>0.05). (Table 1).

Most common indication for induction was Postdatism (Full Term+ Late Term) (A:B::46%:40%), followed by pre-eclampsia (A:B::18%:12%), oligohydramnios (A:B::14%:16%) and FGR (A:B::12%:16%). (Figure 1).

Maximum number of patients in both Group A and Group B had initial Bishop score between 3 and 5 (A: B: 60%:74%). Since p value > 0.05, there is no significant difference in the initial Bishop score in both the groups. There is no significant difference in the Bishop score at the end of 24hrs in both the groups. 72% in Group A and 94% in Group B had an increase in Bishop Score of more than 4 points at the end of 24 hours. 15% in Group A and 29% in Group B had an improvement of score by more than

Table 1: Demographic Distribution of Cases

Age Distribution	Group A (n=100)		Group B (n=100)	
	Number	Percentage	Number	Percentage
≤ 20	27	27%	31	31%
21 - 25	49	49%	50	50%
26 - 30	19	19%	15	15%
31 - 35	3	3%	4	4%
≥ 36	2	2%	0	0%
	22.86±4.0153		22.38±3.331	
P-Value		0.524		
Gravida				
PRIMI	61	61%	50	50%
G2	18	18%	34	34%
G3	16	16%	10	10%
G4	3	3%	4	4%
G5	2	2%	1	1%
G6	1	1%	1	1%
Gestation				
37W to 39W	10	20%	38	38%
39W 1D to 41W	64	64%	36	36%
41W 1D To 42W	14	14%	22	22%
> 42W	2	2%	4	4%
Mean+SD	39.788	1.447	39.63	1.616
P-value		0.103		

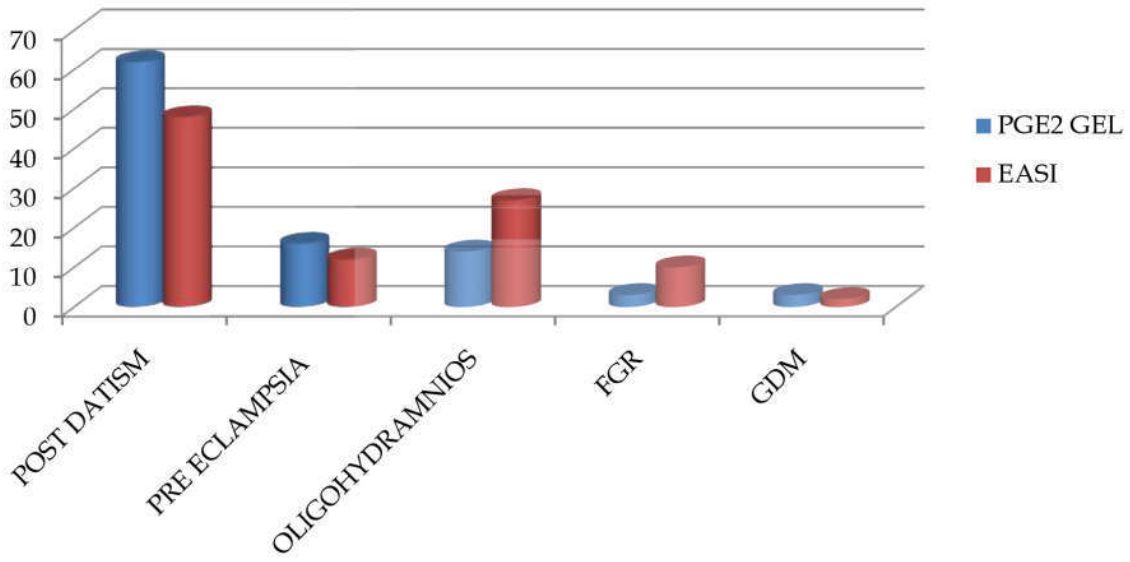

Fig. 1: Distribution of patients according indication of Induction

Table 2: Distribution of cases according Bishop Score at 0 hour

Bishop Score When Admitted	Group A (n=100)		Group B (n=100)	
	Number	Percentage	Number	Percentage
0-2	27	27%	21	21%
3-5	60	60%	74	74%
6	12	12%	5.	5%
Mean+SD	3.92	1.496	3.5	1.488
P-value	0.377			
Final Bishop Score				
≤6	28	28%	11	6%
>6	72	72%	89	94%
Mean+SD	1.1	2.156	11.1	2.160
P-value	0.9800			
Increase in Bishop Score (in points)				
≤4	44	44%	26	26%
5-8	41	41%	45	45%
>8	15	15%	29	29%
Mean+SD	6.0	2.906	7.5	2.418
P-value	0.0001			
Mean Change in Bishop Score after 24 hrs				
0-2	8.42		10.18	
3-5	9.96		11.25	
6	11.77		11.75	

8 points. There is a statistically significant difference in the change in Bishop score (increase by 4 or more points at the end of 24 hours) ($p < 0.05$). 89% of patients in Group B had a bishop score >6 at the end of cervical ripening compared to 72% in Group A. 28% had a Bishop Score <6 in Group A and 11% had a Bishop Score <6 at the end of 24 hours. The mean change in Bishop Score at the end of 24 hours in those with an initial Bishop Score of 0-2 in Group B was greater than that in Group A, which shows that EASI causes significant improvement in Bishop score in extremely unfavorable cervix. (Table 2)

Success of cervical ripening defined as improvement in Bishop score > 4 points at the end of 24hours. Cervical ripening failure was defined as a increase in Bishop's score < 4 points following 24 hours. There were 78% with successful ripening in

Table 3: Distribution of cases according to success of cervical ripening by increase in Bishop's

Cervical Ripening	Group A (n=100)		Group B (n=100)		p
	Number	Percentage	Number	Percentage	
Successful	78	78%	94	94%	
Failure	22	22%	6	6%	0.02
Total	100	100%	100	100%	

Group A and 94% in Group B. The difference in the success rates among the two groups is significant ($p<0.05$). (Table 3).

There is no statistically significant difference in the need for augmentation between Group A and Group B ($p=0.8255,>0.05$) (Table 4).

Twenty five (25)% in Group A and 37% in Group B had an instillation delivery interval between 24 & 48 hours. There is no significant difference in instillation delivery interval among the two groups. (Table 5).

Eighty four (83)% of Group B delivered through Vaginal Route compared to 58% in Group A. 43% in Group A underwent LSCS compared to 16% in Group B. The need for LSCS is greater in Group A compared to Group B ($p=0.00481, <0.05$) which is statistically significant. In Group A, 43 patients underwent LSCS, of which 29 had Failed Induction and 10 had Fetal Distress as an indication and 2 had Dystocia. In Group B, 16 Patients underwent LSCS, of which 14 Had Failed Induction, 7 had Fetal Distress and 1 had Dystocia. (Table 6).

In Group A, 4 patients had tachysystole compared to nopatients in Group B. 4 patients in both Group A and Group B had Postpartum Hemorrhage. No reports of Maternal infection noted. (Table 7).

Majority in Group A and Group B had a birth weight of 2.5kg to 3kg. There is no significant difference in birth weights among both groups. ($p=0.96,>0.05$). (Table 8).

Table 4: Distribution of cases according to need for augmentation with respect to initial Bishop Score

Bishop Score at 0 hrs	Need for Augmentation based on Initial Bishop Score			
	No		Yes	
	A	B	A	B
0-2	2	3	11	8
3-5	7	9	21	26
>6	6	2	3	2

Table 5: Distribution of cases according to instillation delivery interval

Instillation Delivery Interval	Distribution According to Instillation Delivery Interval			
	Group A (n=100)		Group B (n=100)	
	Number	Percentage	Number	Percentage
<12 hrs	32	32%	21	21%
12-24 hrs	25	25%	37	37%
24-48 hrs	35	35%	36	36%
48-72 hrs	8	8%	6	6%
Total	100	100%	100	100%
Mean +SD	20.9+10.9	0.0330	22.6+8.8	

Table 6: Distribution of cases according to mode of delivery

Mode of Delivery	Group A (n=100)		Group B (n=100)	
Vaginal	52	58%	83	83%
Outlet Forceps	4	8%	1	1%
EM LSCS	43	43%	16	16%
Indication for LSCS				
Failed Induction	29	29%	14	14%
Fetal Distress	10	10%	7	7%
Dystocia	2	2%	1	1%

Table 7: Distribution of cases according to maternal side effects and complications

Maternal Side Effects	Group A (n=100)		Group B (n=100)	
	Number	Percentage	Number	Percentage
Tachysystole	4	4%	-	-
PPH	4	4%	1	1%
Rupture of Membranes	3	3%	1	1%
Infection	-	-	-	-
No Complications	89	86%	98	96%

Table 8: Birth weight of Newborns in both groups

Weight of Neonate (gms)	Number	Percentage	Number	Percentage
1500-2000	2	4%	4	8%
2001-2500	11	22%	11	22%
2500-3000	20	40%	23	46%
3001-3500	15	30%	10	20%
>3500	2	4%	2	4%
Mean +SD	2.83+0.403		2.78+0.96	

Eighteen (18)% neonates in, Group A, had NICU admissions compared to 16% in Group B. No cases of fetal or neonatal infection reported. Neonatal outcome is comparable. (Table 9).

Table 9: Neonatal outcome distribution is as follows

Neonatal Outcome	Group A	Group B
NICU Admissions	18%	16%
APGAR<7 at 5min	8%	8%
Meconium Passage	18%	4%
Infections	-	-
Respiratory Distress	2%	4%

Discussion

The clinical requirement for Induction of labour arises from circumstances in which it is believed that the outcome of pregnancy will be better if it is artificially interrupted rather than being left to follow its natural course. Induction of labor is common in obstetric practice. According to the most current studies, the rate varies from 9.5 to 33.7 percent of all pregnancies annually [2].

The degree of cervical ripening correlates with success of induction and duration of labour [4].

Cervical ripening has been defined by ICMR as morphological, biochemical and functional changes in the cervix, where by it softens stretches, effaces and dilates.

In present study characteristics of women in both groups were comparable in relation to age, parity, period of gestation, indication of induction and initial Bishop score.

In the present study, the mean age and standard deviation of the patients was 22.86±4.0153 in Group A and 22.38±3.331 in Group B, respectively, which reflects the peak reproductive age group. No significant difference in both groups (p>0. 05) was found in both the groups.

In study by Guinn, et al. [5] the mean age and standard deviaton was 23±5.7 in Group B and 23.3± 5.9 in Group A, which is comparable with the present study. Majority in the study by Divya Rouben et al. [7] were between 25-30 years.

Parity of the Patient

Of the total 200 cases, 111 cases were nulliparous and 89 cases are multiparous. In the present study, 38% in Group A and 50% in Group B were nulliparous. Also, in the present study Group A had 61 primigravida and 50 primigravida in Group B. In the study by Helmin et al. [6] 50% in Group A and 46.5% in Group B were nulliparous which is comparable to the present study.

In the study by Rouben D et al. [7] where 48% of patients in Group A 46% in Group B were nulliparous.In present study both the groups were comparable in relation to parity.

Period of Gestation

The mean gestational age in Group A is 39.7 and 39.6 in Group B, which is similar to the study by Hemlin et al. [6] with the mean age in Group A as 39.3 and 39.4 in Group B.

In present study, 46% patients in Group A and 36% patients in Group B were between 39 weeks and 41 weeks of gestation.

In the study by Rouben D et al. [7] mean gestational age in Group A was 39.8 and 40.0 in Group B. Rouben D et al. [7] reported 60.7% in Group A between 40 and 42 weeks gestational age and 82.6% in Group B between 40 and 42 weeks gestational age.

Indication for Induction of Labour

Post datism was the commonest indication in both Group A (62%) and Group B (48%).

In the study by Hemlin et al. [6] post datism was the commonest indicaton in both Group A (38%) and Group B (44%). Second most common indication was pre-eclampsia in Group A and oligohydramnios and FGR in Group B. In the study by Rouben D et al. [7], the commonest indication for induction was post term pregnancy followed by preeclampsia.

Bishop Score at Zero Hour

The mean Bishop score at zero hour in Group A is 3.92 and in 3.5 in Group B. The two groups are comparable in terms of mean Bishop score at 0 hour. In the study by Hemlin et al. [6] the mean Bishop score in Group A was 2.2 and in Group B was 2.4, both the groups were comparable. In the present study, 56% in Group A and 70% in Group B had an initial Bishop score between 3 and 5. In the study by Rouben D et al. [7], 64% in Group A and 62% in Group B had an initial score between 3 and 4.

Number of Prostaglandin E2 Doses Required

Thirty six (36)% patients required 3 doses of PGE 2 doses, 18% required 2 doses and 46% required 1 dose.This is not cost effective.

Mean Bishop Score at the End of Cervical Ripening

Mean Bishop score at the end in Group A was 11.098 as compared to 11.06 in Group B. The difference was not significant statistically ($p=0.98$, i.e. $p>0.05$).

Mean Change in Bishop Score

Mean change in Bishop Score in points at the end of cervical ripening in Group A was 6.0 and was 7.5 in Group B. The change in Bishop score in points is statistically significant. ($p=0.00013$, $p<0.05$).25% in Group A and 37% in Group B had a increase in Bishop Score by more than 4 points at the end of 24 hours. In the study by Rouben D et al. [7] there was statistically significant improvement in Bishop score in the EASI group compared to PGE2 gel (66%:19.6%).This indicates that the change in Bishop score was higher in the extraamniotic saline instillation with Foley catheter group compared to the vaginal prostaglandin group.

Time taken for successful ripening

In the present study, the mean time for successful ripening was 7.5 hrs in PGE2 group and 6.5 hrs in EASI with Foley catheter group. It indicates that EASI causes cervical ripening earlier than PGE2 gel but the difference in mean time was not statistically significant. 20 patients in Group A and 31 patients in Group B had successful ripening in <6 hours. In the study by Hemlin et al. [6] the mean treatment time in the EASI group was 4 hrs 15 min (Range 1–10hrs).

Success of Cervical Ripening

Successful cervical ripening was seen in 78% patients in Group A and 94% N Group B.

Failed cervical induction was seen in 22% in Group A and 6% in Group B. The difference in failure rate was statistically significant ($p<0.05$), which indicates EASI with Foley catheter is a better ripening agent compared to PGE2 gel.

In the study by Hemlin et al. [6] there was no failure of ripening at the end of 24 hours in the EASI group and 19% failed ripening was seen in the PGE2 group. Majority (36%) patients required 3 doses of PGE2 gel, which is not cost effective. This is similar to the study by Rouben D et al. [7].

Need for Augmentation

The need for augmentation was similar in both groups 34 patients in Group A and 36 patients in group B needed augmentation of labour. There is no statistically significant difference in the need for augmentation.

Instillation Delivery Interval

The mean instillation delivery interval in Group A was 20.9 hrs and 22.5 hrs in Group B. Though the difference was significant, the mean time for cervical ripening was shorter in the group with EASI with transcervical Foley catheter. The average induction delivery interval was also significantly shorter, 12.6 hours compared to 19.0, in the prostaglandin group ($p \leq 0.05$) in the study by Hemlin et al. [6].

Mode of Delivery

83% in group with EASI with Foley and 52% in group with PGE2 Gel had vaginal delivery. LSCS rate was 43% in Group A and 16% in Group B. The most common indication for LSCS in Group A was "Failed induction". 29 out of 41 patients in Group A and 14 out of 22 in Group B.

The LSCS rate was significantly higher in PGE2 group compared to EASI group(p=0.04,<0.05). Study by Rouben D et al. [7], showed no difference in the caesarean rates between Group A and Group B.

Maternal Side Effects x

In Group A, 4(4%) patients had tachysystole compared to no patients in Group B. But the symptoms resolved with administration of tocolytic. In the study by Schreyer et al. [8], 13% in the PGE2 group had hypertonic uterine contractions compared to 0% in EASI group.

Two (2) patients in both Group A and 1 in Group B had postpartum hemorrhage. In Group A, 1 patient had Nausea while in Group B, 1 had rupture of membranes while saline infusion. There was no evidence of infection to the mother or the fetus in both the groups.

Neonatal Outcome

There was no significant difference in birth weights among those delivered in Group A and Group B and between those delivered by cesarean and vaginal route. These are consistent with the study by Rouben D et al. [7]. The mean birth weight in Group A was 2.83 kg and in group B was 2.7 kg, there was no statistically significant difference.

Eighteen (18)% neonates in Group A had NICU admissions compared to 16% in group B. Indications for admission were APGAR<7 at 5 mins, meconium stained liquor and respiratory distress. Neonatal outcome is comparable. 6 neonates in Group A and 5 in Group B had an APGAR of <7 at 5mins. Hence, EASI with Foley catheter appears to be a better ripening agent in terms of efficacy. Both EASI and PGE2 did not show significant difference in need for augmentation, induction delivery interval, need for cesarean section and neonatal outcome and no increased risk of infection. The advantages of Extraamniotic saline infusion with transcervical Foley catheter are increased efficacy, low cost and easy to use, no incidence of infection and less incidence of uterine tachysystole and fetal distress compared to PGE2 gel.

Conclusion

It is concluded from this study that Extraamniotic Saline Instillation with Transcervical Foley Catheter is an effective method of improving Bishop's score in term pregnant women. The success rate of EASI in improving Bishop score by 4 or more points at the end of 24 hours was significantly more compared to Vaginal PGE2 gel. The mean time for cervical ripening was short in the EASI group compared to PGE2 gel, the LSCS rates and the incidence of uterine tachysystole was less in the EASI group compared to PGE2 gel. The most common indication for induction was past dates in both the groups followed by preeclampsia in the EASI group and Oligohydramnios in the PGE2 group. Though the mean Bishop's score at the end of 24 hours was similar in both the groups, 36% patients required 3 doses of PGE2 gel which is not cost effective. There was no incidence of uterine tachysystole in the EASI group compared to 4 patients in the group with PGE2 gel.

Hence Extraamniotic saline Instillation with Transcervical Foley Catheter is better alternative to PGE2 in term higher success rate in improvement in Bishop score, shorter ripening time, fewer complications like uterine tachysystole, cost effectiveness, no requirement of a cold chain especially in resource poor settings.

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