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"Transvaginal Ultrasound Measurement of Cervical Length versus Dehydroepiandrosterone Sulfate Level as Predictors of Successful Induction of Labor in Post-term Pregnancy."

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Abstract: Background: The postterm pregnancy occurs in 4-14% of pregnancies with an average about 10%. Successful induction of labor in such cases is reported to be related to the Bishop score and cervical length (CL). Dehydroepiandrosterone Sulfate (DHEAS) is a measurable biochemical marker of cervical maturation. It increases prostaglandin E2 synthesis and binds to type collagen fibrils; therefore, plays a role in matrix assembly to collagen and cervix maturation. This study was done to test the relationship between intrapartum endogenous DHEAS levels and clinical measures of cervical maturation as well as the success of labor induction in postterm pregnancies. **Patients and Methods:** This prospective longitudinal study was conducted on 60 multigravidas with prolonged pregnancy. All patients had vaginal examination to assess the Bishop score, transvaginal ultrasound for assessment of cervical length (CL) and measurement of serum DHEAS by Radioimmunoassay before being subjected to a common induction protocol for labor. **Results:** In our study cervical length ≤33mm and Bishop score ≤5.5 was associated with successful vaginal delivery with a sensitivity of 92.9% for both, specificity of 95.7% for CL (39.1%for Bishop score), positive predictive value of 86.7% for CL (31.7%for Bishop score), negative predictive value of 97.8%for CL(94.7%for Bishop score) and accuracy 95% for CL(51.7%for Bishop score)in the prediction of successful labor induction. Maternal serum DHEAS level more than 8.5 mcg/ml was associated with successful vaginal delivery showed a sensitivity of 92.9%, specificity of 89.1%, positive predictive value of 72.2% and negative predictive value of 97.6% in the prediction of successful labor induction. DHEAS concentration showed significant positive correlation with Bishop Score in all studied cases (p=0.035) as higher DHEAS levels are associated with higher Bishop scores. DHEAS concentration showed significant negative correlations with cervical length in all studied cases (p<0.001), all successful induction (p=0.001) and all failed induction cases (p=0.022). DHEAS concentration showed significant negative correlations with dose of oxytocin in all studied cases (p=0.005), total successful induction (p<0.001)and good responders(p<0.001). **Conclusion**: Increased DHEAS plasma level leading to more softening and ripening of the cervix leading to increased Bishop score and decrease cervical length so decrease required doses of oxytocin to succeed the induction. So the pre-induction level of DHEAS influence the outcome of an induction attempts.

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Key Words: Postterm pregnancy, induction of labor, Bishop score, cervical length, dehydroepiandrosterone sulfate.

1. Introduction:

Postterm pregnancy has usually been defined on the basis of completed 42 weeks from the first day of LMP, or 40 weeks from the time of conception (**Beazley, 1995).** The postterm pregnancy occurs in 4-14% of pregnancies with an average about 10%. The incidence of subsequent postterrm birth increases from 10 to 27% if first birth was postterm and to 39% if there had been 2 previous successive postterm deliveries **(Bakketeig et al., 2000).**

Prolonged pregnancy is associated with significant risks to the pregnant woman, including an increase in labor dystocia (9 - 12 % versus 2 – 7 % at term), an increase in severe perineal injury related to macrosomia (3.3 % versus 2.6 % at term), and a doubling in the rate of cesarean delivery **(Treger et al., 2006)**. It is also associated with significant risks to the fetus such as increased perinatal mortality rate , low umbilical artery pH levels at delivery and low 5-minute Apgar scores **(Kitlinski et al., 2003)**, and increased risk of umbilical cord compression from oligohydraminios, meconium aspiration and death within the first year of life, and a higher rates of stillbirth, macrosomia (birth weight >4000gm), birth injury and meconium aspiration syndrome **(Norwitz et al., 2007).**

Induction of labor is performed in about 20% of all pregnancies and successful induction is reported to be related to cervical characteristics, or '*ripeness'* **(Groenevelda et al, 2010)**.

On the other hand, labor induction may be complicated by uterine tachysystole, uterine hyperstimulation with fetal heart rate abnormalities or fetal distress, prolonged labor, prolonged membrane rupture, and chorioamnionitis. Because of the presence of underlying maternal or fetal medical conditions leading to induction and because the uterus and the cervix are often not prepared for labor when induction becomes necessary. labor induction may be associated with prolonged labor and a significantly increased risk of cesarean delivery when compared with the risk for women entering labor spontaneously **(Mercer, 2005).**

Some recent studies have reported that transvaginal sonographic assessment of the cervix may provide a more successful induction, compared to the Bishop score **(Ware and Raynor, 2006).**

As the supra-vaginal portion of the cervix makes up about 50% of the cervical length and varies from one woman to another. This portion of the cervix is difficult to estimate digitally and it makes assessment highly subjective **(Bouyer et al., 1986).**

Transvaginal ultrasonographic measurement of cervical length may be a more objective method for assessing cervical status **(Roman et al., 2004).**

Dehydroepiandrosterone sulfate (DHEAS) is an androgenic steroid produced by the adrenal cortex of the pregnant woman and her fetus. During pregnancy, maternal adrenal production rates of DHEAS are doubled. DHEAS is a major source for estrogen formation in the feto-placental unit in pregnancy. About one half of total estradiol (E2) produced in the placenta originates from maternal DHEAS **(Braunstein et al., 2005).**

DHEAS is a measurable biochemical marker of cervical maturation. It increases prostaglandin E2 synthesis, which leads to an increased proportion of decorin (a proteoglycan, which is a component of connective tissue, and binds to type collagen fibrils and plays a role in matrix assembly to collagen and cervix maturation **(Rechberger et al., 1996).**

There is a relationship between intrapartum endogenous DHEAS levels and clinical measures of cervical maturation as well as a relationship between DHEAS levels and the success of labor induction in postterm pregnancies. The proposed mechanism of action of DHEAS is that it decreases the cervical collagen content by increasing collagenase, elastase and gelatinase activity, thereby resulting in uterine connective tissue remodeling. The cervical collagenolytic effect of DHEAS may also be mediated by prostaglandin E2 **(Maradny et al., 1996).**

DHEAS levels can be an epiphenomenon reflecting the progression from prelabor to active labor, and they may be an important factor influencing labor efficiency and success of labor induction in postterm pregnancies **(Doganay et al., 2004).**

Aim of the study:

Is to compare between cervical length as detected by transvaginal ultrasound (TVS) and serum level of Dehydroepiandrosterone sulfate (DHEAS) as predictors of successful induction of labor in postterm pregnancy and to detect the most accurate cutoff level for both that correlates better with successful induction.

Patients and Methods:

This prospective longitudinal study was conducted on 60 multigravidas with prolonged pregnancy presented to obstetric department of Al-Zahraa Unioversity Hospital for induction of labor in the period from october 2014 to august 2015.

Inclusion criteria included maternal age 20-40 years old, multiparity, gestational age >41 weeks documented by first trimester US, singleton viable average size fetus with vertex presentation, Bishop score $\geq$ 3, patient not in labor with intact membranes.

Exclusion criteria included history of previous CS, presence of any contraindications to vaginal delivery, fetal growth restriction, fetal distress, fetal malformations….etc.

After taking their consent for participation, all patients was subjected to: Full history taking , clinical examination , per vaginal examination to assess the Bishop score , abdominal ultrasound , transvaginal ultrasound for Measurement of cervical length (which is considered the hyperechoic line extending from internal to external cervical os across the endocervical canal). The measurement was repeated three times and we recorded the shortest.

- Routine laboratory tests (CBC, FBS, 2hrs PPBS, Rh, urine analysis for proteins….etc).
- **Serum level of dehydroepiandrosterone sulfate (DHEAS)** was measured by Radioimmunoassay with commercial kit Coat-A-Count DHEAS supplied by DPC (Diagnostic Products Corporation, Los Angeles, CA, USA). The test can detect as little as 1.1 mcg/dl .The range of the kit in females was between 0- 800 mcg/dl. DHEAS measured by this kits in the unit of umol/L and converted to ug/ml by multiplying all the results by 2.71 according to the following

formula present in kits pamphlet : 1 ug/ml=2.71umol/L.

- All patients were subjected to Induction protocol for labor using 25mcg misoprostol (*vagiprost®* 25 microgram each tablet, manufactured by ADWIA CO. S.A.E Egypt) every 4 hours for a maximum of 4 doses followed by Augmentation by oxytocin as indicated.
- Partogram will record all the duration of induction from the starting time, latent phase and all stages of labor (1^{st},2^{nd},3^{rd},4^{th}). Cases with fetal distress(pathological fetal heart rate trace according to the previous 2 tables) occurrence after initiation of uterine contractions were excluded. Patients required C.S. due to any cause throughout the process of induction before or after reaching the active phase were excluded.
- According to patients response to induction they classified into 4 groups :

Group (1): Good responders (safe vaginal delivery within 24hours of induction).
Group (2): Poor responders (prolonged first stage of labor more than 24hours).
Group (3): Secondary arrest (arrested partogram).
Group (4): Non responders (total failure of response to induction).

- Data collected include:
  - Number of cases delivered vaginally (Group1, 2).
  - Number of cases delivered by C.S (Group3, 4).
  - Bishop score , sonographic cervical length and serum level of DHEAS for each group was calculated.
  - Serum DHEAS levels and cervical length was then correlated with the response to induction attempts.
  - Delivery data and perinatal outcome was recorded and statistically analysed at the end of the study.
- The outcome was evaluated as follow:

✓ **Primary outcome:** the success of induction when the patient reach the active phase of labor (4 cm or more) and develop regular effective uterine contractions (3-5 per 10 minutes each lasting 40 - 60 seconds).

✓ **Secondary outcome:**

1- The need for augmentation of 1st. stage of labor.
2- Induction- delivery interval (IDI).
3- Mode of delivery whether smooth vaginal delivery or C.S.
4- Neonatal outcome:

- Apgar score of the newborn.
- Actual fetal weight.
- Admission to NICU (number of days, cause, end result).

- The statistical analysis of data was done by using excel program (Microsoft Office 2013) and SPSS (Satatistical Package for Social Science) program (SPSS, Inc, Chicago, IL) version 2.

Results:

(Results are present at the end of this file)

Discussion:

The present study was conducted on 60 multigravida with prolonged pregnancy who met the inclusion criteria presented to Obstetrics/Gynecology Department of Al-Zahraa University Hospital for induction of labor.

All patients were subjected to Induction protocol for labour using 25mcg misoprostol every 4 hours for a maximum of 4 doses followed by Augmentation by oxytocin as indicated. Nine cases were excluded from the study because of they were converted to C.S before completing labor induction process, due to fetal distress (5 patients), maternal exhaustion (2 patients),cord prolapse (1 patient) and maternal convulsion(1 patient).

According to patients response to induction they classified into 4 groups; Group(1) or good responders(safe vaginal delivery within 24hours of induction); Group(2)or poor responders(prolonged first stage of labour more than24hours);Group(3)or secondary arrest (arrested partogram) and Group(4) or non responders (total failure of response to induction) (Table 1).

Delivery data and perinatal outcome were recorded and statistically analyzed at the end of the study.

In our study demographic and clinical data of The studied groups were matched as regards gravidity, parity, abortions, previous history of postterm, tocolytics and aspirin intake (table 2), with no significant differences between the studied groups .

The results of our study demonstrated that there was insignificant relationship between the age of the mother, gestational age with the successful induction of labor. ***Laencina et al. (2006)*** agreed with our results and found that maternal age and gestational age have limited influence on labor duration.

Our study showed that there were significant differences in the studied groups as regarding BMI (table 1). The lesser BMI, the more successful induction (i.e.: women with high height, low weight and low BMI had successful induction more than those with low height, high weight and high BMI).Those who failed induction (Mean=33.32) had significantly higher BMI than those who achieved successful induction (Mean=27.65).Moreover, poor responders(Mean=30.62) had significantly higher BMI when compared to good responders(Mean=26.6) , as well as non responders (Mean=34.68) had significantly higher BMI when compared to secondary arrest Mean=32.56) , with a statistically significant difference (p<0.001).

This agrees with the study done by ***Park et al., (2009)*** who stated that the mean BMI was significantly lower in women who had successfully induced labor and only BMI provided a significant contribution in predicting successful labor induction**.**

In the present study, 46(76.7%) of our 60 participants were delivered vaginally after successful induction of labor (34 of them delivered before 24 hour(Group1) and 12 delivered after 24 hour(Group2) .On the other hand 14(23.3%)women were delivered by C.S (9 of them due to failure of progress of labor(Group3) and 5 due to total failure of response to induction(Group4).The 9 patients in (group3)was subdivided to: 5 patients (55.6%) due to arrested dilatation of the cervix ,4 patients(44.4%) due to arrested descent of the head.

The percentage of the successful induction of labor in the present study was about 76.7 % and it agrees with **Liu et al., (1999)** which was about 81 % for successful induction. These results also agree with **Elhassan et al., (2004)** as the percentage of successful induction of labor by misoprostol was (73.3 %).

This agrees with the study done by ***Park et al., (2009)*** who stated that the mean BMI was significantly lower in women who had successfully induced labor and only BMI provided a significant contribution in predicting successful labor induction**.**

Our results disagreed with the results done by ***Bueno et al., (2005)*** who analyzed the clinical and sonographic variables that affect the success of labor induction. Bishop score, cervical length, and parity were studied in 196 pregnant women in the prediction of successful vaginal delivery within 24 hr of induction. The best statistic sequence that predicts the labor induction was found when they introduced parity in the first place. And also ***Laencina et al., (2007)*** found that parity provided independent contribution in the prediction of the likelihood of delivering vaginally within 60h.

In the present study there were a statistically significant difference between the studied groups as regards the Bishop scores (table).Bishop score was significantly higher in successful(Mean=5.3) than failed induction(Mean=4.2) with a statistically significant difference (p=0.012),and in good(Mean=5.5) than poor responders(Mean=4.6) with a statistically significant difference (p=0.027). This agrees with the study done by **Yanik *et al*., (2007)** who demonstrated that bishop score significantly predicts the success of induction and the mode of delivery.

As regards relation between sonographic measurements and outcome of induction: Cervical length was longer in failed induction(Mean=37.7) when compared to successful induction(Mean=25.7) with a statistically significant difference (p<0.001).Also poor responders(Mean=30.9)had longer cervical length than good responders(Mean=23.8) with a statistically significant difference (p<0.001), as well as non-responders (Mean=41.6) had longer cervical length than secondary arrest(Mean=35.5) with a statistically significant difference (p<0.001). This agrees with the study done by ***Daskalakis et al., (2006)*** who found that cervical length proved to be an independent predictor of a successful labor induction.

Laboratory findings and DHEAS in the studied groups as shown in table (4) reveal that: Females with failed induction (Median=4.9) had significantly lower DHEAS levels when compared to those who achieved successful induction (Median=19.8) with a statistically significant difference (p<0.001).In addition poor responders (Median=10.7) had significantly lower DHEAS levels when compared to good responders(Median=24.4) with a statistically significant difference (p<0.001). Also the non-responders (Median=3.5) had lower DHEAS levels versus secondary arrest (Median=5.4) (p=0.067). Hemoglobin concentration, random blood glucose and positive Rh did not differ significantly between studied groups. Our results are also in agreement with the results of a study carried by **Liapis et al., (1993).** Their study included 45 pregnant women, for whom the successful induction rate was 59.6%, and failed induction rate was 40.4%. The mean DHEAS level was 48.63 mcg/dl for the successful induction cases and 26.86 mcg/dl for the failed induction ones. They reported that the level of pre-induction serum DHEAS influence the ultimate outcome of induction of labor (success or failure). Consequently, DHEAS may be an important predictor for the success of labor induction.

The same results were previously observed by a study carried by the University of Arizona Health Center **(Maciulla et al., 1998).** In that study, the levels of DHEAS were higher in women who achieved successful induction with a mean value of 109.01 mcg/dl compared with a mean of 58.78 mcg/dl in women with unsuccessful attempts.

Two studies carried out in Ain Shams University Maternity Hospital by **Abdel Hamid et al., (2000 and 2002),** also had showed different mean endogenous pre-induction DHEAS levels (98.2 mcg/dl and 63.04 mcg/dl respectively).

Third study was carried out by **Nathan, (2002)** on 40 pregnant women of more than 41 weeks' gestation; 80% of inductions were successful while 20% failed. The mean DHEAS level was 84.27 mcg/dl and 33.82 mcg/dl respectively.

Our study also agrees with a study carried out in Vali-e-asr Hospital, Tehran, Iran by **Modarres-Gilani and paykari, (2008),** on 45 women with post-term pregnancy, in which the mean ± SD DHEAS level was significantly higher in women with successful induction than in women with unsuccessful attempts (48.63±6.53 mcg/dl versus 26.86±5.17 mcg/dl respectively ($p = 0.035$) .

Regarding results of induction in studied groups: Failed induction required significantly higher doses of vagiprost in first stage when compared to successful induction($p<0.001$), as well as poor when compared to good responders($p<0.001$), and non responders when compared to secondary arrest($p=0.007$). Doses of oxytocin in first stage did not differ significantly between successful and failed induction, however it was significantly higher in poor than good responders($p<0.001$). Doses of cervicolytics was significantly higher in failed when compared to successful induction ($p<0.001$), as well as in poor than good responders($p<0.001$). Duration of first stage of labour did not differ significantly between successful and failed induction, however, it was significantly longer in poor than good responders($p<0.001$), and in secondary arrest than non-responders ($p=0.006$). Duration of second stage of labour was significantly longer in poor than good responders ($p<0.001$).

As regards neonatal outcome of the studied groups: Actual fetal weight was significantly heavier in failed than successful induction($p<0.001$).Fetal gender differed significantly between successful and failed induction groups ($p=0.023$). Female frequency was higher in mothers with successful induction and male frequency was higher in mothers with failed induction. Apgar score at 1minute was significantly higher in successful when compared to failed induction ($p=0.001$), as well as, in good when compared to poor responders ($p<0.001$). Apgar score at 5 minutes was significantly higher in successful when compared to failed induction ($p<0.001$), as well as, in good when compared to poor responders ($p=0.003$). However, Apgar score at 1, 5 minutes did not differ significantly between non responders and secondary arrest subgroups. NICU stay was significantly higher in failed induction when compared to successful one ($p=0.044$). Causes of NICU admission did not differ significantly between studied groups (Table 5).

As shown in Table (6), the performance of the testing parameters. Bishop score had fair AUC for discrimination between failed and successful induction. Although the sensitivity was high, specificity and accuracy were disappointing. CL and DHEAS showed excellent AUC with high sensitivity, specificity, PPV, NPV and accuracy. So the Validity of cervical length, and Bishop Score as predictors of successful labor induction indicates that cervical length was the most accurate and specific predictor of successful labor induction than the Bishop score for the prediction of successful labor induction.

In our study cervical length ≤33mm and Bishop score ≤5.5 was associated with successful vaginal delivery with a sensitivity of 92.9% for both, specificity of 95.7% for CL (39.1%for Bishop score), positive predictive value of 86.7% for CL (31.7%for Bishop score), negative predictive value of 97.8%for CL (94.7%for Bishop score) and accuracy 95% for CL(51.7%for Bishop score)in the prediction of successful labor induction. Receiver operating characteristic (ROC) curve of cervical length and Bishop score showed that a cutoff value of 33mm for CL (5.5 for Bishop score) for prediction of successful labor induction has an area under the curve of 0.970 for CL(0.712 for Bishop score) and 95% confidence interval [CI] 0.931- 1 for CL(0.570-0.854 for Bishop score), with a statistically significant difference ($p<0.001$) (Table 7).

Our results are also in agreement with the results of a study carried by **(Ana María *et al*., 2011)** who found that women undergoing induction of labor, the predictive value of cervical length is clearly superior to that of the Bishop score. ***Rane et al., (2004)*** and **Pandis et al., (2001)** also reported similar findings in their studies.

According to ***Laencina et al., (2007) the*** best cut-off points for predicting successful induction using ROC curve were 24mm (33mm in our study) for cervical length and 4 (5.5 in our result) for the Bishop score. Also he stated that cervical length was a better predictor than the Bishop score (sensitivity and specificity of 66 and 77% versus 77 and 56%, respectively). On the contrary to our study, ***Rane et al., (2004)*** found in their study which consisted of 106 cases that cervical length was not better than Bishop Score as an indicator in determining delivery mode.

In our study, the cut-off value of DHEAS levels was 8.5 mcg/ml (85 mcg/dl). Below this level, unsuccessful induction was likely to increase progressively as the maternal plasma DHEAS level decreased. This value is in accordance with that found by **Maciulla et al., (1998),** as the cut-off value for DHEAS levels in their study was 70 mcg/ dl. And also with **Modarres-Gilani and Paykari, (2008),** as the cut-off value for DHEAS levels in their study was 60 mcg/ dl (Table7).

But it is different from that set up by **Nathan (2002),** as the cut-off value of serum DHEAS in their study was 41.1 mcg/dl. And also with **Doganay et *al* .,**

(2004) as the cut-off value for DHEAS levels in their study was 21.7 mcg/ dl. This can be explained by the diversity of the kits used. Maternal serum DHEAS level more than 8.5 mcg/ml was associated with successful vaginal delivery showed a sensitivity of 92.9%, specificity of 89.1%, positive predictive value of 72.2% and negative predictive value of 97.6% in the prediction of successful labor induction. Receiver operating characteristic curve of DHEAS showed that a cutoff value of 8.5 mcg/ml for prediction of successful labor induction has an area under the curve of 0.930 with accuracy 90%,with a statistically significant difference (p <0.001) as shown in table ().

As regards Correlation of DHEAS with cervical length, Bishop score and required dose of oxytocin in all studied groups (table 8). DHEAS concentration showed significant positive correlation with Bishop Score in all studied cases (p=0.035) as higher DHEAS levels are associated with higher Bishop scores. DHEAS concentration showed significant negative correlations with cervical length in all studied cases (p<0.001), all successful induction (p=0.001) and all failed induction cases (p=0.022). DHEAS concentration showed significant negative correlations with dose of oxytocin in all studied cases (p=0.005), total successful induction (p<0.001) and good responders(p<0.001). This may be explained by the fact that increased Bishop score denotes cervical ripening & DHEAS plays a role in cervical connective tissue function **(Imai et al., 1992)**. Meaning that increased DHEAS plasma level leading to more softening and ripening of the cervix leading to increased Bishop score and decrease cervical length so decrease required doses of oxytocin to succeed the induction. So the pre-induction level of DHEAS influence the outcome of an induction attempt (Table 9).

In conclusion, both DHEAS and cervical length measurements can be used clinically with comparative clinical accuracy as predictors of vaginal delivery in cases candidate for induction of labor in postterm pregnancy with an overall accuracy of 95% for a cutoff level of 33mm for cervical length and 90% for a serum level of 8.5mcg/ml for DHEAS.

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"Transvaginal Ultrasound Measurement of Cervical Length versus Dehydroepiandrosterone Sulfate Level as Predictors of Successful Induction of Labor in Post-term Pregnancy."

Results:

Table (1): Analysis of studied groups.

Successful induction (n=46)				Failed induction (n=14)			
Good responders		`Poor responders		Secondary arrest		Non responders	
N	%	N	%	N	%	N	%
34	56.7	12	20	9	15	5	8.3

In all tables: P1, Significance between good and poor responders; p2, significance between non responders and secondary arrest; p3, significance between successful and failed induction.

Table (2): Demographic and clinical data of the studied groups.

Variable	Total (n=60)		Successful induction (n=46)							Failed induction (n=14)							P^3
			Total successful induction (n=46)		Good responders (n=34)		Poor responders (n=12)		P^1	Total failed induction (n=14)		Secondary arrest (n=9)		Non responders (n=5)		P^2	
Age (year); mean SD	27.1	4.6	26.63	4.548	26.4	4.6	27.4	4.6	0.492	28.79	4.441	29	4.1	28.4	5.6	0.819	0.124
Gravidity; mean SD	4.2	1.3	4.24	1.353	4.15	1.306	4.50	1.508	0.443	4.07	1.207	4.11	1.269	4	1.225	0.111	0.679
Parity; mean SD	2.5	1.3	2.43	1.276	2.35	0.252	2.67	0.371	0.470	2.57	1.342	2.78	0.394	2.20	0.304	0.463	0.730
Abortion; mean SD	0.7	0.3	0.80	0.859	0.79	0.314	0.83	0.318	0.894	0.50	0.519	0.33	0.06	0.80	0.347	0.269	0.215
Gestational age (weeks) ; mean SD	41.1	0.5	40.99	0.504	40.89	0.418	41.28	0.626	0.064	41.27	0.601	41.28	0.632	41.26	0.611	0.960	0.090
BMI (kg/m^2) ; mean SD	28.9	3.3	27.650	2.514 7	26.6	2.026	30.625	0.702	<0.001	33.321	1.252	32.567	0.648	34.680	0.8167	<0.001	<0.001
Bishop score; mean SD	5.1	1.4	5.30	1.474	5.53	1.581	4.67	0.888	0.027	4.21	0.975	4.44	1.014	3.80	0.837	0.535	0.012
Previous history of post term; N, %	47	78.3	36	78.3	27	79.4	9	75.0	0.706	11	78.6	7	77.8	4	80	1	1
Previous history of tocolytics; N, %	30	50.0	24	52.2	16	47.1	8	66.7	0.242	6	42.9	3	33.3	3	60	0.580	0.542
Previous history of aspirin; N, %	19	31.7	15	32.6	11	32.4	4	33.3	1	4	28.6	3	33.3	1	20	1	1

Table (3): Relation between Cervical length and outcome of induction.

Variable	Total (n=60)		Successful induction (n=46)							Failed induction (n=14)							P^3
			Total successful induction (n=46)		Good responders (n=34)		Poor responders (n=12)		P^1	Total failed induction (n=14)		Secondary arrest (n=9)		Non responders (n=5)		P^2	
	mean	SD	Mean	SD	mean	SD	mean	SD		mean	SD	mean	SD	mean	SD		
CERVICAL length (CL) (mm)	28.50	6.645	25.70	4.381	23.85	3.164	30.92	2.875	<0.001	37.71	3.832	35.56	2.506	41.60	2.408	<0.001	<0.001

Table (4): DHEAS in the studied groups.

Variable	Total (n=60)		Successful induction (n=46)							Failed induction (n=14)							P^3
			Total successful induction (n=46)		Good responders (n=34)		Poor responders (n=12)		P^1	Total failed induction (n=14)		Secondary arrest (n=9)		Non responders (n=5)		P^2	
DHEAS (mcg/ml); median, range	16.88	1.35-75.1	19.8	3.2-75.1	24.4	4.9-75.1	10.7	3.2-13.8	<0.001	4.9	1.4-20.8	5.4	4.1-20.8	3.5	1.4-8.1	0.067	<0.001

Table (5): Neonatal outcome of the studied groups.

Variable		Total (n=60)		Successful induction (n=46)							Failed induction (n=14)							P^3
				Total successful induction (n=46)		Good responders (n=34)		Poor responders (n=12)		P^1	Total failed induction (n=14)		Secondary arrest (n=9)		Non responders (n=5)		P^2	
Actual fetal weight (grams); mean, SD				2976.5	178.8	2959.4	163.9	3025	215.8	0.279	3546.4	186.5	3505.6	179.3	3620	195.6	0.289	<0.001
Fetal sex;	Male	27	45	17	37	11	32.4	6	50	0.314	10	71.4	6	66.7	4	80	1	0.023
	Female	33	55	29	63	23	67.6	6	50		4	28.6	3	33.3	1	20		

N, %																		
Apgar score 1 minute; mean SD		6.7	1.3	6.98	1.183	7.32	1.01	6	1.128	<0.001	5.64	1.216	5.56	1.236	5.80	1.304	0.734	0.001
Apgar score 5 minutes; mean SD		8.8	1.2	9.11	0.971	9.35	0.884	8.42	0.9	0.003	7.71	1.267	7.56	1.333	8	1.225	0.551	<0.001
NICU (days) ; median, range		0	0-10	0	0-6	0	0-6	0	0-6	0.459	0	0-10	0	0-10	0	0-7	0.436	0.018
NICU (positive); N (%)		10	16.7	5	10.9	3	8.8	2	16.7	0.594	5	35.7	4	44.4	1	20	0.580	0.044
Cause	**Respiratory distress**	3	5.0	2	4.3	1	2.9	1	8.3	1	1	7.1	1	11.1	0	0	1	1
	Meconium aspiration	5	8.3	2	4.3	1	2.9	1	8.3		3	21.4	2	22.2	1	20		
	Neonatal sepsis	1	1.7	1	2.2	1	2.9	0	0		0	0	0	0	0	0		

Table (6): The performance of the testing parameters.

	AUC	95% CI	*P*	Cut off	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Bishop score	0.712	0.570-0.854	0.017	5.5	92.9	39.1	31.7	94.7	51.7
CL (mm)	0.970	0.931-1	<0.001	33	92.9	95.7	86.7	97.8	95
DHEAS (mcg/ml)	0.930	0.849-1	<0.001	8.5	92.9	89.1	72.2	97.6	90

Table (7): Induction outcome according to cut off values of Cervical length, DHEAS and Bishop score.

	Successful induction	Failed induction
Bishop score>5.5	18	1
Bishop score<5.5	28	13
CL<33	44	1
CL>33	2	13
DHEAS>8.5	41	1
DHEAS<8.5	5	13

Table (8): Correlation of DHEAS with cervical length, Bishop score and required doses of oxytocin in all studied groups.

Variable	Total (n=60)		Successful induction (n=46)						Failed induction (n=14)					
			Total successful induction (n=46)		Good responders (n=34)		Poor responders (n=12)		Total failed induction (n=14)		Secondary arrest (n=9)		Non responders (n=5)	
	R	*p*	*R*	*p*	*r*	*p*	*r*	*P*	*R*	*p*	*r*	*p*	*r*	*P*
cervical length	-0.704	<0.001	-0.492	0.001	0.072	0.686	0.043	0.895	-0.604	0.022	-0.553	0.122	-0.308	0.614
Bishop score	0.273	0.035	0.105	0.487	-0.098	0.583	-0.252	0.430	0.178	0.543	0.410	0.273	-0.406	0.498
doses of oxytocin	-0.359	0.005	-0.741	<0.001	-0.651	<0.001	-0.472	0.121	0.419	0.136	-0.068	0.861	.	.

Table (9): Correlation between doses of vagiprost in first stage of labour and DHEAS, CL, BISHOP SCORE.

Variable	Total (n=60)		Successful induction (n=46)						Failed induction (n=14)					
			Total successful induction (n=46)		Good responders (n=34)		Poor responders (n=12)		Total failed induction (n=14)		Secondary arrest (n=9)		Non responders (n=5)	
	R	*p*	*R*	*p*	*r*	*P*	*r*	*P*	*R*	*p*	*r*	*p*	*r*	*P*
cervical length	0.622	<0.001	0.473	0.001	0.166	0.348	-0.037	0.910	0.271	0.349	-0.710	0.032	-	-
Bishop score	0.454	<0.001	0.446	0.002	0.353	0.041	0.434	0.159	-0.255	0.380	-0.555	0.121	-	-
DHEAS	0.477	<0.001	0.187	0.214	-0.007	0.969	-0.171	0.594	0.191	0.513	0.069	0.859	-	-

There were significant positive correlation between doses of vagiprost in first stage of labour versus CL in total, successful induction groups, as well as, significant positive correlation with Bishop score in total, successful induction and good responders groups. Moreover, There were negative correlation between doses of vagiprost in first stage of labour versus DHEAS in good and poor responders .

Table (10): Correlation of induction delivery interval with Cervical length, Bishop score, DHEAS and other variables.

Variable	Total (n=60)		Successful induction (n=46)						Failed induction (n=14)					
			Total successful induction (n=46)		Good responders (n=34)		Poor responders (n=12)		Total failed induction (n=14)		Secondary arrest (n=9)		Non responders (n=5)	
	R	*p*	*R*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*P*	*r*	*P*
cervical length	.314	.014	.430	.003	.092	.607	.224	.483	.150	.608	.137	.725	.051	.935
Bishop score	- .226	.082	.049-	.747	.156	.377	.285	.369	.188	.520	.036	.927	.703	.185
DHEAS	- .133	.310	.703-	<0.001	.539-	.001	.220	.491	.567-	.035	.267-	.488	- .921	.026

There were significant positive correlation between induction delivery interval and Cervical length. And negative correlation with DHEAS in all subjects, total successful induction group, good responders, total failed induction group, secondary arrested and non responders.There were also negative correlation between induction delivery interval and Bishop score.

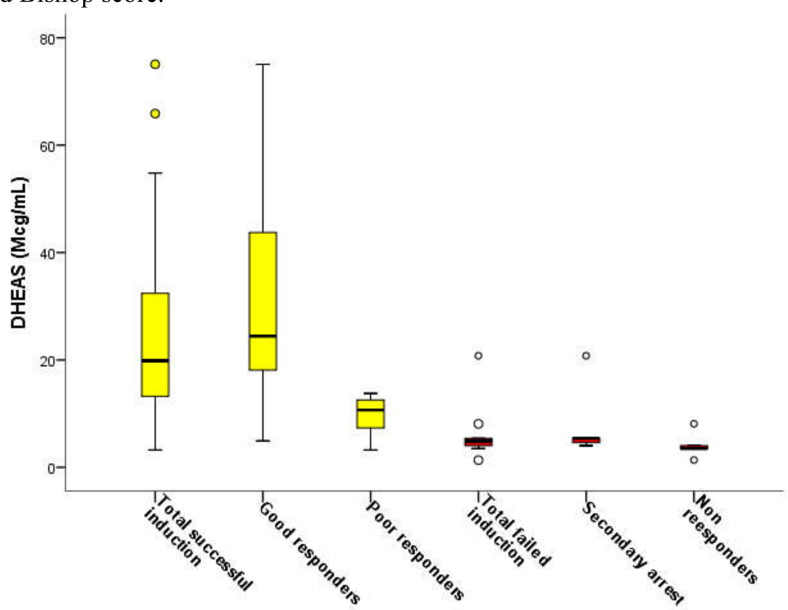

Figure (1): DHEAS concentrations in all studied groups.

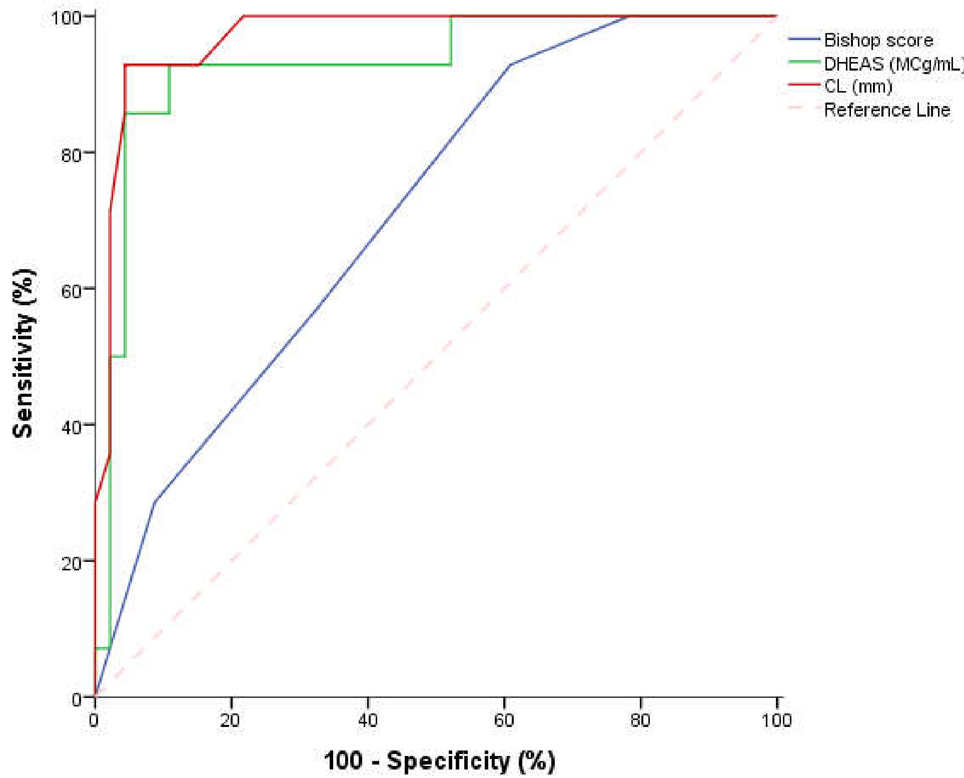

Figure (2): ROC for Bishop score, DHEAS and CL for discrimination between successful and failed induction.

10/16/2022