Prediction of Cervical Factor in Recurrent Pregnancy Loss by Transvaginal Sonography

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Abstract: This study was carried out to predict the cervical causes for recurrent pregnancy loss by transvaginal scan which in turn prevents fetal loss. This study was done in Government Maternity Hospital, Sultan Bazar, Hyderabad, during the period of June 2012 to May 2014. 60 pregnant women at high risk for preterm delivery were recruited into the study. After taking informed consent, they were followed up till delivery and the results were analyzed. Study group was divided into two groups depending on cervix length, internal os diameter and funnelling of cervix. Use of transvaginal sonographic study of cervix between 14-26 weeks combined with good obstetric history and proper clinical examination (vaginal examination) aided with appropriate treatment options like McDonald's encerclage increases fetal salvage rates to 87.5%. A properly performed transvaginal sonography with correct interpretation is the gold standard in the assessment of patients with cervical factor causing recurrent pregnancy loss. Accuracy of transvaginal sonography in our study is as follows: Sensitivity of about 97.36%; specificity of 86.36%; positive predictive value of 92.5%; negative predictive value of 95%; percentage of false positive cases is 13.63% and percentage of false negative cases is 2.63%..

Keywords: cervical incompetence, transvaginal sonography, recurrent pregnancy loss, McDonald's encerclage.

INTRODUCTION

Cervical incompetence is characterized by painless cervical dilatation in second trimester or early third trimester, with prolapse and ballooning of membranes into vagina followed by rupture of membranes and expulsion of a preterm fetus. The principal structural components in the cervix are smooth muscle, collagen and connective tissue i.e., the ground substance. In the ground substance, important constituents of the cervix, the glycosaminoglycan's i.e. dermatansulfate and hyaluronic acid. The smooth muscle content of the cervix varies from 25% to 60%.

AETIOLOGY of cervical incompetence:

- Previous trauma to the cervix i.e. Dilatation and curettage, Conization, Cauterization, Amputation of cervix, deep cervical laceration
- Abnormal cervical development i.e. Mullerian fusion anomalies, Exposure to diethyl stilbestrol in utero, Idiopathic dan forth and Buckingham [1] categorised cervical incompetence into 3 groups based on aetiology. Group I includes patients with mechanical disruption of fibrous ring due to trauma. Group II includes patients with histological deficit. Group III includes patients with dysfunctional cervical incompetence with no structural/histological defects and is presumed to be due to premature triggering of normal mechanism for cervical effacement and dilatation [2].

The certain way of diagnosing cervical incompetence is by history and vaginal examination. Digital examination provides valuable information, but it is subjective. Digital examination may also contribute to the following potential complications-

- Stimulation of premature contractions
- An increased risk of infection in women with premature rupture of membranes
- Bleeding in women with possible placenta praevia

Sonographic assessment can provide valuable information regarding the cervix, particularly for those women in whom digital examination is either contraindicated or is intentionally avoided. Unfortunately role of transabdominal sonography of

the cervix during second trimester is often limited because of overlying fetal parts. A full urinary bladder can improve visualization of cervix, although it distorts the cervical length. Additional manoeuvres like Trendelenburg position or suprapubic lift of fetal head will still fail to visualize the cervix in a few cases.

Transvaginal scan overcomes the limitations of transabdominal sonography including overlying fetal parts, large maternal habitus, and artifactual elongation of cervix from a distended bladder. Transvaginal scan of cervix / cervical biometry is objective and non-invasive, can be used repeatedly with safety, even during pregnancy . It is useful for screening and early detection of changes in supravaginal portion of cervix and internal Os which are not amenable to clinical examination. It does not require full bladder for cervical evaluation. Transvaginal scan has a few pitfalls like marked cervical effacement may be difficult to distinguish from cervical dilatation. Nabothian cysts/prominent cervical veins and large cervical myomas may cause poor visualisation of cervix for interpretation of findings.

Three ultrasound signs are suggestive of cervical incompetence namely:1) length of cervix, 2) dilation of the internal os, 3)funnelling or prolapse of membranes into the cervix either spontaneously or induced by trans fundal pressure. Measurement of the distance between internal and external so represents the cervical length the internal cervical os is the point where the cervical canal as a blunt interface meets the amniotic sac in a non-dilated cervix. The external os is the point at which the cervical canal is no longer visible. To measure cervical length, a line was drawn from the centre of cervical canal which is often represented sonographically by an anechoic space of the centre of the cervix from the vaginal side of the decidua plate or the base of the membranes in front of the son graphical internal so. 1) Shortening of cervix in the absence of uterine contraction of <25mm between 14 - 26 weeks gestation.2) Dilatation of internal or open > 5mm before 30 weeks of gestation.3) Funnelling or prolapse of membranes into the cervix with shortening of functional cervical length.

The presence of these factors alone does not constitute the diagnosis. A patient has to suffer a pregnancy loss before the diagnosis is made. Depending on the degree of risk, surveillance should be carried out weekly or fortnightly. Ultrasound can be offered to reduce the indications of cerclage in numerous cases for which the situation is uncertain.

Palmer (1955) stressed the importance of hysterography for detection of incompetent Os but because of danger of radiation to gonads it is not routinely used. Jeffcoate and Wilson (1956) in hysterographic studies showed that a funnel cervix was associated with mid trimester miscarriage. McDonald (1970) inserted a purse –string suture of No.4 Mersilene tape externally at the level of internal Os [3, 4]. Trythal recorded cervical incompetence in 32% of primigravida with no history of traumatic aetiology.

Varma *et al.* studied 115 women at risk for cervical incompetence based on their previous history.75 patients were found to have a defective cervix by ultrasound examination. Of this group, 40 underwent cerclage, 16 aborted and 24 gave birth prematurely. The cervical length in this group of 75 women ranged between 2 to 3 cm compared to 3 to 4 cm in a group of 40 women who went to term. However, these authors did note that shortening of cervix is a physiological phenomenon of the mid trimester abortions and emphasised that the patients in their study with a short cervix (<2.5 cm) has a good prognosis overall, as long as dilatation was minimal (0.5cm).

MATERIALS AND METHODS

The present study was conducted from June 2012 to May 2014 at Government Maternity Hospital, Sultanbazar, and Hyderabad. 60 pregnant women at high risk for preterm delivery were recruited into the study between 14 – 26 weeks after taking informed consent. They were followed up till delivery.

Inclusion criteria
- Asymptomatic women with clinically short cervix
- Women with past history of mid trimester abortions and unexplained preterm delivery before 30 weeks of gestation.
- Women with symptoms suggestive of preterm labour.

Exclusion criteria
- Women with multiple gestation
- Women with polyhydramnios
- Women with intrauterine death/major fetal anomalies
- A detailed obstetric history was taken. Clinical Examination and investigations to exclude other factors of abortions was done, all women were further evaluated by transvaginal ultrasonographical examination of cervix.

Sonographic Criteria

Group-1: Funnelling of cervix present

Group-2: No funnelling of cervix even with fundal pressure, internal closed or if open <5mm

Group – I	Group – II
Cervix length< 2.5 cm Internal Os closed or open to < 5mm. Funneling of cervix present or absent	Cervix length>2.5 cm Internal Os close or <5mm no funneling on fundal pressure
Cervix lenth> 2.5 cm Internal Os open with funneling of cervix	Cervix length<2.5 cm Internal Os close or open<5 mm with no funneling of cervix on fundal pressure
Cervix length 2.5 – 2.9 cm Internal Os close or open to <5mm with funneling of cervical canal on fundal pressure	

All patients in Group I underwent cerclage.

RESULTS AND OBSERVATIONS
Total number of cases taken into study - 60.
Depending on the above transvaginal sonographic criteria ie. Cervix length and internal os status and funnelling, the study group was divided into group I and group II
Number of cases in group I = 40 (66.66%)
Number of cases in group II = 20 (33.33%)

Table-1: Number of cases with bad obstetric History

Previous Obstetric History	Group-1		Group-II		Total	
	No. of Cases	Percentage	No. of Cases	Percentage	No. of Cases	Percentage
Mid Trimester abortion	14	43.75%	8	50%	22	45.83%
Preterm deliveries	6	18.75%	5	31.25%	11	22.91%
Midtrimester abortions+ preterm delivery	5	15.62%	2	12.5%	7	14.58%
History of Cerclage	7	21.87%	1	4.54%	8	16.66%
Total	32		16		48	

P=0.365   Not Significant

This table reveals that bad obstetric history attributable to cervical incompetence may present as mid trimester abortions or preterm labour or both, leading to poor fetal outcome and increased burden on economy. Use of transvaginal sonographic study of cervix in second trimester combined with a good obstetric history and proper clinical examination aided with appropriate treatment option increases fetal salvage rates.

Table-2: Gestational Age of the cases at the initial TVS Evaluation

Gestational Age in Weeks	Group-1		Group-II		Total	
	No. of Cases	Percentage	No. of Cases	Percentage	No. of Cases	Percentage
12-16	8	20%	4	20%	12	20%
17-20	25	62.5%	12	60	37	61.6%
21-24	6	15%	3	15%	9	15%
25-28	1	2.5%	1	5%	2	3.5%
Total	40		20		60	

P=0.971   Not Significant

The above table shows that in 61.6% of the patients the changes in cervix observed by transvaginal sonography were more apparent in gestational age of 17 to 20 weeks. In the review of literature it is accepted that these changes are observed in these gestational age for the diagnosis of cervical incompetence.

Table-3: Distribution of cases in Group-I & II according to cervical length

Cervical Length in cms	Group – I	Percentage	Group-II	Percentage
<2.5	38	95%	3	15%
>2.5	2	5%	17	85%
TOTAL	40		20	

P= <0.001 highly significant

Analysis of the above table will reveal that in 95% of patients in group-I the cervical length as determined by transvaginal sonography was </= 2.5 cms which confirms to the international study groups criteria.

Table-4: Outcome of Cases with Bad Obstetric History (Group – I & II)

Outcome		Group – I		Group – II		Total	
		No. of Cases	Percen-tage	No. of Cases	Percen-tage	No. of Cases	Percen-tage
Number of term Deliveries		27	84.375	14	87.5	41	85.42
Number of pre term Deliveries	Due to Other reasons	3	9.375	1	6.25	4	8.33
	Due to Incompetent cervix	2	6.25	1	6.25	3	6.25
	Total	32		16		48	

P=<0.772 Not Significant

Table- 5: Outcome of Cases (Group – I & II)

Outcome	Group-1		Group-II		Total	
	No. of Cases	Percentage	No. of Cases	Percentage	No. of Cases	Percentage
Number of term deliveries	**35**	**87.5%**	**18**	**90%**	**53**	**90%**
Number of Preterm deliveries	**5**	**12.5%**	**2**	**10%**	**7**	**10%**
Total	**40**		**20**		**60**	

P=<0.776 Not Significant

Table- 6: Fatal Salvage Rate (Group-I & II)

	Total No. of Pregnancies	No. of Full Tem Deliveries	Infant Salvage Rate
Group – I	40	35	87.5%
Group – II	20	18	90%

In the present study the infant salvage rate of group I & II are 87.5% and 90% respectively. TVS has aided the diagnosis and fetal salvage rate almost on par with group – II

Table-7: Transvaginal sonography: Diagnostic Accuracy

TVS Result	Incompetent Cervix		Total
	Present	Absent	
Positive	37	3	40
Negative	1	19	20
Total	38	22	60

P=<0.001 highly significant

Accuracy of transvaginal sonography is very high; this study has sensitivity of about 97.36%; specificity of 86.36%; positive predictive value of 92.5%; negative predictive value of 95%; percentage of false positive cases is 13.63% and percentage of false negative cases is 2.63%.

DISCUSSION

Detailed review of literature with different studies since 1992 will be compared with the findings of our study and an assessment will be based on comparative findings .The development of transvaginal sonography has resulted in a clearer image of the internal cervical Os. All the studies are unanimous on the point that changes observed on transvaginal sonography are a continuous process rather than categoric invariable and is indicated indirectly by measurement of length of cervix. Our study has attempted to correlate the observations history and ultrasonographically determined cervical length between 14-26 weeks which was also done by Guzman *et al,* in 1998 (retrospective cohort study) [5] which was performed in singleton pregnancies of multigravida with normal and abnormal obstetric history who underwent sonographic evaluation for determination of endocervical canal length between 15-24 weeks. The gestational age of the maximum cases at initial transvaginal sonography in both groups of our study was between 17-20 weeks which correlates well with study of Guzman *et al*. [6, 7]. In a study done by Funai *et al*. [8] where serial follow up measurement of cervical length was done to predict pregnancy outcome, the mean cervical length was 2.72 cm which correlates well with our study. Regarding obstetric outcome with respect to cases in group-I which were treated by McDonald cerclage, 87.5% of the patients continued pregnancy until term and in 9.3% of patients there was no response to the interventions, reasons being, these patients had an extremely short cervical length<1.5cm with presence of funnelling.

Comparative analysis of the group-wise division [9]:

	Present study	Balde M D Stolz W study
Percentage of ultrasound indicated cerclage cases(Group-I)	80%	80%
Cases managed Conservatively(Group –II)	20%	20%

Similar percentage of cases were distributed in group I and group II in the above comparison.

Pregnancy outcomes in transvaginal sonography indicated cervical cerclage group-I [10]:

	Present study	Guzman ER, Forster,J.K
Percentage of preterm deliveries	12.5%	36.8%

Failure percentage of our study in group-I is less when compared to Guzman ER's study, which is probably due to lesser cut off length (<2cm) for short cervix

According to Stolz, Balde MD, Unteregger B, Wall Wiener D, Bastert G [11], from University of Offravenklinik Heidelberg (1989) Transvaginal ultrasound provides detailed information, which cannot be obtained by routine manual vaginal examination. By measuring the outside –inside distance (from Os externum to Os internum) we can determine the actual length of the cervix. By depicting the cervical canal, we can identify early dilatation, visualising the internal os with the funnelling helps reveal an incompetent cervix. A total of 485 measurements of the cervix were carried out.50 patients with normal clinical findings between 28 and 32 weeks of pregnancy with a clinical diagnosis of an incompetent cervix. A cervical length of 46.3-39.3mm was found in normal pregnancies and length of 34.0-21.4mm when a clinically incompetent cervix had been diagnosed.

Balde MD Stolz W published an article stating that besides its contribution to the diagnosis, the vaginal sonography is a remarkable support in the indication of treatment of cervical incompetence by Cerclage. The study group consisted of 40 patients, their gestational age between 16 and 29 weeks admitted in the department for clinical incompetence. After transvaginal ultrasound examination combined to the results of clinical evaluation, 32 cases were retained for cervical cerclage. The other cases were given only medical treatment.

Iams and co-workers (1995) [12] performed a cross sectional study of cervical length measured by transvaginal sonography in women with prior preterm delivery, those with cervical incompetence and normal controls delivered at term. Gestational age at first preterm delivery significantly correlated with cervical length in pregnancy evaluated at each gestational age between 20 and 30 weeks.

CONCLUSIONS

All cases of recurrent pregnancy loss (second trimester loss/ preterm delivery) should be assessed and analysed by repeated transvaginal sonography between 14-26 weeks of gestation. The use of transvaginal sonography has resulted in a clearer image of the internal cervical Os which may indirectly have beneficial effect on outcome. The rapid development of cervical dilatation in some cases necessitates frequent ultrasonographic monitoring. The transvaginal ultrasonographic assessment of cervix (the abnormal findings) correlates well with the adverse pregnancy

outcome. Our study proves conclusively that there is a correlation between bad obstetric history and ultrasonographic findings obtained between 14-26 weeks of gestation. Transvaginal sonographic surveillance of cervix helps us to use the cervical cerclage more selectively i.e. when cervical length is </= 2.5 cm, internal Os open /close with funnelling of cervical canal.

In conclusion, a detailed obstetric history combined with clinical examination (per vaginal examination combined with transvaginal sonography between 14-26 weeks followed by interventions like McDonald cerclage will result in foetal salvage rate of 87.5%.Therefore a properly performed and properly analysed transvaginal sonography with correct interpretation is the gold standard in the assessment of patients with recurrent pregnancy loss.

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