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ORIGINAL RESEARCH

Assessmentofcervicalfunnellingandcervicallengthinpregnantwomenwiththreatenedpretermlabourandoutcome

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ABSTRACT

Introduction:Pretermdeliveryistheleadingcauseofneonatalmortality and morbidity. Worldwide, prematurity accounts for 10%ofneonatalmortality, or around 500,000 deaths peryear. Prematurely born infants are also at greater risk of havingsubsequentseriouschronichealthproblems.

Aimofthestudy: To assess the effect of funnelling of cervix andthelengthofthecervixinthreatenedpretermlabour

Materialsandmethods: Prospective,observationalstudy.All pregnant women with gestational age of 20 to 36 weeks withthreatenedpretermlabourwereincludedinthestudy.Allpregnantwomenwiththreatenedpretermlabourwithgestational age of20 to 36 weeks were included in the study.Cervicallengthandhighvaginalswabtakenaftertakinginformedconsent.Cervicallengthwasmeasuredusingtransvaginalultrasonography with the standard longitudinal view of cervix withemptybladder.GELVOLUSON730PROTVSprobeIC5-9Hinstrument with 5-9 mHz was used for measuring cervical lengthandcervicalfunneling. It was measured by keeping the probe3cm away from the posterior fornix. Thepatientswerefolloweduptilldeliveryandmaternalandneonataloutcomes werestudied.

Results:Inthisstudy53%ofthewomenbelongedtotheagegroupof21-25yrs,85%ofwomeninthestudygroupbelongedtoclass3socioeconomic status with a significant p value of 0.079. Most ofthe cases (75%) in this study were booked casesand 72% ofwomen with vaginal infections and short cervix delivered preterm.Inthestudygroup92% of women whodelivered preterm, hadshortcervix.Inthisstudy,83%ofwomenwithshortcervixdeliveredvaginallywithasignificantpvalueof0.05.This study showed short cervixis a good predictor of pretermdeliverywithasensitivityof100%,specificityof97.3%,positivepredictivevalue:92.5%andnegativepredictivevalue:100%.The study also showed funneling of cervix as a marker of pretermdelivery with sensitivity of80%,specificity of86.6%, positivepredictivevalueof16.66%andnegativepredictivevalueof73.86%

Conclusion:Cervical length and funneling is a sensitive marker ofpretermdelivery.Promptdiagnosisandtreatmentofthreatenedpretermlabour helpsin reducing the maternal morbidity andneonatalmorbidityandmortality.

Keywords:CL=Cervicallength,PTL=Pretermlabour,TVS=transvaginalsonography.

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INTRODUCTION

Preterm labour is defined as one where the labour starts after 28thweek and before the 37th completed week (<259 days), counting from the firstday of the last menstrual period. The prevalence widely varies and rangesbetween 5 – 10%.The shorter the term of pregnancy, the greater the risks ofmortality and morbidity for the baby primarily due to the related prematurity.Preterm-premature babies have an increased risk of death in the first year oflife,withmostofthatoccurringinthefirstmonthoflife.Worldwide,prematurityaccountsfor10%o fneonatalmortality,oraround500,000deathsperyear.

Prematurelyborninfantsarealsoatgreaterriskforhavingsubsequentserious chronichealthproblems. [1-3]

Pretermlabourisdiagnosedbypresenceofregularuterinecontractionswith or without pain (at least one in every 10 minutes), dilatation (>= 2 cms)andeffacement(80%)ofthecervix,lengthofthecervix(measuredbyTVS) <=2.5 cms and funnelling of the internal os(bulging of membranes >5mm),pelvicpressure(cervicaldynamictesting), backache andor vaginaldischarge orbleeding. [2-4]

Assessing risk from the patient's history or from digital examination ofthecervixarepoormethodsofpredictingwhichpatientwilldeliverprematurely,andprogrammesu singthesetechniqueshavefailedtolowertherateofpretermbirth.Riskscoringsystemsbasedonthepa tient'shistoryhaveapositivepredictivevalueofaround15-30%,serialdigitalexaminationsofthecervix aresubjective

Funnelling or the dilatation of the of the cervical internal os is anadditionalfindingoncervicalultrasoundscanningthathasalsobeenassociatedwithanincreasedri skofprematuredelivery.

AIMOFTHESTUDY

Toassesstheeffectoffunnellingofcervixandthelengthofthecervixinthreatenedpretermlabour

OBJECTIVESOFTHESTUDY

PRIMARYOBJECTIVES

- Toassessthesensitivityofcervicallengthasapredictorofpretermlabour.
- Toanalysethematernalandfetaloutcome.

SECONDARYOBJECTIVES

- Tostudytheusefulnessofcervicalencirclageinwomenwiththreatenedpretermlabor.
- Tostudytheeffectofvaginalinfectionsonpretermdelivery.

MATERIALSANDMETHODS

STUDYDESIGN

Prospective, observational study

SAMPLESIZEANDSOURCEOFDATA

Allpregnantwomenwithgestationalageof20to36weekswiththreatenedpretermlabourwereinclud edinthestudy.

DURATIONOFSTUDY

1stNovember2012to1stNovember2013Definitions:

Preterm labor: is defined as regular contractions of the uterus resulting inchangesinthecervixthatstartbefore37weeksofpregnancy.Changesinthecervix include

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effacement (the cervix thins out) and dilation (the cervix openssothatthefetus canenterthebirthcanal).
Threatenedpretermlabor:isdefinedasregularuterinecontractionsoccurringat the frequency of oncein 10 minutes with no effacement and dilatation ofcervix between20-37weeks.

INCLUSIONCRITERIA

- Pregnantwomenwithgestationalageof20-36wkswiththreatenedpretermlabour

EXCLUSIONCRITERIA

- Multiple pregnancy
- Abruptio placenta
- Placenta previa
- Congenital malformations of the fetus
- Chorioamnioitis
- PROM
- Medical disorders complicating

METHODOFCOLLECTIONOFDATA

Allpregnantwomen withthreatened preterm labour with gestational age of20 to 36 weeks were included in the study. Cervical length was measuredaftertakinginformed consent, using transvaginalultrasonography withthestandard longitudinal view ofcervix bothwithempty bladderwithGELVOLUSON730PROTVSprobeIC5-9Hinstrumentwith5-9mHzformeasuringcervical length andtoevaluatecervicalfunneling. It ismeasured by keeping the probe 3cm away from the posterior fornix. Thecervical length is defined as the length between the internal os and externalos.
Highvaginalswabwastakenusingasterilecottonswabafterthepatientwasplacedinlithotomyposition toexcludeinfections.
Aftertheinitialassessmentandinvestigations thepatientsweregiventocolytics-Isosuxprine20mgintravenousinfusionwith4-5microdrops/min for 24 hrs as tocolysis.Ifpatientsresponded well to the initial tocolytictherapy,theyweregivenoral tocolyticslike isosuxprineornifidepineandalsopatientsweregivencorticosteroidsforlungmaturityi.ebetamethasoneordexamethasone in women with gestational age of morethan28weeks.

RESULTS

Table1.Agewisedistribution

Age(yrs)	Frequency	Percentage(%)
18-20	25	25
21-25	53	53
26-30	21	21
31-35	0	0.0
36-40	1	1.0
TOTAL	100	100%

Table2.SocioeconomicstatusofwomenwithThreatened Preterm

SocioEconomicStatus	Cervicallength		Total	Fisher'sexactprobability
	≤25mm	>25mm		
Class2	2	13	15	

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Class3	30	55	85	0.079

Thistableshowsmostwomeninthestudygroupbelongedtoclass3socioeconomicstatus.

Table3NumberofBooked/ Unbookedcases

	Frequency	Percent(%)
Booked	75	75.0
Unbooked	25	25.0
Total	100	100.0

Thisdatashowsthat75%ofthepatientsinthisstudywerebookedcases.

Table4.Therelationshipbetweenpositivevaginalswabandpretermdelivery

Vaginal swabculture	Number(n=100)	TermDelivery	PretermDelivery
Positive	25	7	18
Negative	75	68	7

Inthisstudy72%ofwomenwithvaginalswabpositiveandshortcervixdeliveredpreterm.

Table5.Cervicallengthinwomenwiththreatenedpretermlabour

Cervicallength(cms)	Frequency	Percentage(%)
1.1-1.5	5	5
1.6-2	1	1
2.1-2.5	26	26
2.6-3	22	22
3.1-3.5	27	27
3.6-4	19	19
TOTAL	100	100%

Thischartshowsthat27womenhadcervicallengthrangingfrom3.1-3.5cmsand26ofthemhadcervicallengthrangingfrom2.1-2.5cms

Table6IncidenceofFunnelling

	Frequency	Percentage(%)
Nofunnelling	88	88.0
U	5	5.0
V	3	3.0
Y	4	4.0
Total	100	100.0

Table7Numberofwomenrequiringcervicalencirclage

	Frequency	Percentage(%)
No.ofpatientswhorequiringencirclage	24	24.0
No. of patients notrequiringencirclage	76	76.0
Total	100	100.0

Theabovedatashowsthat24%ofthepatientsunderwent cervicalencirclage

Table8Gestationalageatwhichcervicalencirclagewasdone

GA	Frequency	Percentage
20-25	24	100%
26-30	0	0%
31-35	0	0%

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Thisdatashowsthatallthepatientswhounderwentcervicalencirclagebelongedtogestation alagegroupof20-25weeks

Table9.Outcomeinwomenwhounderwentcervicalencirclage.

Cervicalencirclage	Term	Preterm
Withcervicalencirclage	24	0
Withoutcervicalencirclage	51	25

Inourstudy,allwomenwhounderwentcervicalencirclagedeliveredatterm.

Table10 Deliveryoutcomeofwomenwithshortcervix

Gestational ageatdelivery	Numberofshortcervix	Percentage(%)
Term	8	10.66%
Preterm	23	92%

Inthe studygroup92%ofwomenwho deliveredpretermhadshortcervix.

Table11Comparisonbetweencervicallengthandmodeofdelivery

Modeof	Cervicallength		Total	Chi-square	P-value
delivery	≤25mm	>25mm		value	
LSCS	2	15	17	3.854	0.05
Vaginal	30	53	83		
Total	32	68	100		

Thistableshows83%ofwomendeliveredvaginallywithasignificantPvalueof0.05.Itisstat isticallysignificant

Thusthereexistsasignificantpositivecorrelationbetweencervicallengthandthegestationalageatdel ivery

Table12.Correlationbetweencervicallengthandgestationalageatdelivery

Shortcervicallength	Preterm	Term	GrandTotal
Cervicallength≤2.5cms	25	7	32
Cervicallength>2.5cms	0	68	68
GrandTotal	**25**	**75**	**100**

Sensitivity:100%

Specificity:97.3%

Positive predictive value: 92.5%negativepredictivevalue:100%

Thistableshowscervicallengthisasensitivemarkerforpredictingpretermlabour, sensitivitybeing100%.

Table13.Correlationbetweenfunnellingofcervixandgestationalageatdelivery

Funelling	Pretermdelivery		GrandTotal
	Preterm	Term	
Withfunneling	12	0	12
Withoutfunnelling	13	75	88
GrandTotal	**25**	**75**	**100**

Sensitivity:80%

Specificity:86.6%

Positive predictive value: 16.66%negativepredictivevalue:73.86%

Inourstudy,allwomenwithfunnelingdeliveredpreterm.Sensitivityandspecificityinourstudyis80 %and86.6%respectively.

Thisshowsfunnelingisagoodpredictorofpretermdelivery.

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Table14.Neonataldemographicdetailsofpretermdeliveries

Neonatal demographic	Noofcases	Percentage
Periodofgestation		
>32weeks	13	52%
<32weeks	12	48%
Weight		
<1.5kgs	9	36%
>1.5kgs	16	64%
Modeofdelivery		
Vaginaldelivery	25	100%
LSCS	0	0%

Table15.IndicationsforNICUadmission

Indication	No.ofcases	Percentage(%)	<32weeks	>32weeks
Birthasphyxia	3	18.75%	2	1
Respiratorydistress	11	68.7%	7	4
Sepsis	2	12.5%	2	0

ThistableshowsthenumberofneonatesrequiringNICUadmissionsandtheirindications.

DISCUSSION

Ourstudyincludedhundredpregnantwomenwiththreatenedpreterm labour, majority of them(53%) belonging to the age group of21-25years.

SOCIOECONOMICSTATUSANDPRETERMLABOUR

It was found that 85% of the women in the study group belonged tosocioeconomicstatusclass III. P value being significant (0.079). Studies ofshubhadaetalshowedthat74.25%womenbelongedtosocioeconomicstatus class III and IV. [1,2]

In our study 72% ofwomenwith vaginal infections (positive vaginalswabculture)hadpretermdelivery.

CERVICALLENGTHANDPRETERMDELIVERY

In our study the sensitivity for preterm delivery in women with shortcervix is 100%andspecificityof97.3%.

Studies ofGuzman et al[2]showedReceiver operating characteristiccurveanalysesshowedthatacervicallengthof<or=2.5cmbetween15and24 weeks' gestation was equal to the other sonographic cervical parametersinitsabilitytopredictspontaneouspretermbirth.Thesensitivitiesfordeliveryat<28,<30, <32and<34weeks'gestationwere94%,91%,83%and76%,respectively,whilethenegativepredictivevalueswere99%,99%,98%and96%,respectively. The placement of the cerclage did not influence the positive andnegative predictive values in comparision to women with othewr risk

factorscervicallengthwasbestinthepredictionofpretermbirthof≤1.5cmshadsensitivitiesfordeliveryat<28,<30,<32and<34wksofgestationof100%,100%,92%,81% respectively.The rates of preterm delivery at <34wks ofgestationincreaseddramaticallywhenthecervicallengthof≤1.5cms.Cervicallength was the only independent variable that entered the logistic regressionmodel for theprediction of preterm delivery at <34wks of gestation. In high-risk singleton gestations a cervical length of

< or = 2.5 cm was equal to othersonographic cervical parameters in its ability to predict spontaneous pretermbirth and was better for the prediction of earlier forms of prematurity (at < 28and < 30 weeks) than later forms (at < 32 and < 34 weeks).The Optimalcervical length and their performance for predicting the prematurity may beinfluencedbyobstetricrisk factors.

Study	Sensitivity	Specificity
OurStudy	100%	97.3%
Owenetal [3]	89.7%	92.06%.

COMPARISONOFTHEPRIMARYOUTCOMEMEASURESWITHOTHER STUDIES

CERVICALLENGTHINPREDICTINGPRETERMBIRTH

	Guzmanetal [2]	Owenetal [3]	Ourstudy
Sensitivity	100%	89.7%	100%
Specificity	74%	92.06%	97.3

CERVICALLENGTHANDDELIVERYOUTCOME

In our study 92% of women with short cervix delivered preterm and itwas also noted that women withcervicallength of< 2.5 cmsdeliveredwithinoneweeksinceonsetofsymptoms.

Similarresultswereshowninotherstudies

Owen et al [3]conductedastudywherecervicallengthwasmeasuredbysonography at 23 weeks in 2567 singleton pregnancies in women attendingfor routine antenatal care. the relation between cervical length and pretermdelivery was examined and the risk of spontaneous delivery at ≤ 32 weekswasestimated.

Itwasfoundthatcervicallengthat23weekswas≤15mmin1.7% ofcases;thisgroupcontained86%,58%and20%ofpregnanciesthatdelivered spontaneously at ≤ 28, ≤ 32 and ≤ 36 weeks, respectively. The riskfor delivery at ≤ 32 weeks decreased from 78% at a cervical length of 5 mm to4%at 15 mmand0.5%at50mm.

Crane etal[5]conductedastudyon65womenwithshortcervix.Patients with a singleton pregnancy and a history of more than oneinducedabortionwereidentified.SubjectswerefollowedwithTVSmeasurement of cervix between 14 and 24 weeks of gestation and groupedintothosewithandthosewithouttheshortcervix:Acervicallengthof<25mmwasconsidered short.Thepregnancyoutcomewasspontaneouspretermbirthatlessthan35weeks.Thesensitivity,specificityandpositiveandnegative predictive values of a short cervix in the prediction of preterm birthwere 50%, 84%, 47% and 86%, respectively.

Itwasconcludedthatcervicallengthmeasuredbytransvaginalultrasonographypredictsspontaneouspretermbirthat<35weeks.

*CarvalhoMH*et al[6] conducted a prospective study of 55 cases,with36primigravidas(randomlyselected)and19multigravidas.

Patients underwent sonologic evaluation of the cervix first at 16 wks ofgestation, and second at about 20th – 22nd week of gestation for cervicallength,widthandinternalosdiameter.StatisticalanalysiswasdoneusingProportiontest.Ofthepatientswhowentintopretermlabour(14.5%),77.7% had a short cervix at the first or second sonographicexamination.50% had an opened internal os,an 55.5% had some degree offunnellingof membranes.

Itwasthusconcludedthatpatientswithcervicalsonographicchangesand suspicious vaginal examination, had a 77.7 to 85% risk of going intopreterm labour. Cervical length £ 2.7 cm and funneling of internal os (12

mm)asasingleparameterorcombinedvariablehelpinpredictingpretermlabour.
Goodlin [7] conducted a study with2531patients who underwenttransvaginalsonographyat28weeksperiodofgestation. Itwasfoundthatthecorrespondingrelativerisksforpretermdeliverywere2.80(95percentconfidenceinterval,1.41to5.56),3.52(95percentconfidenceinterval,1.79to6.92),5.39(95percentconfidenceinterval,2.82to10.28), 9.57 (95 percent confidence interval, 5.24 to 17.48), 13.88 (95 percentconfidenceinterval, 7.68 to25.10),and24.94(95percentconfidenceinterval,13.81to45.04)(P<0.001forvaluesatorbelowthe50thpercentile,andP=0.003forvaluesatorbelowthe75thpercentile).Itwasconcludedthattheriskofspontaneouspreterm delivery is increased in women who are found tohaveashortcervixbyvaginalultrasonographyduringpregnancy.
Cervicallengthanddilationofinternalcervicalosdetectedbyvaginalultrasonographyasmarkersforpretermdelivery. Olatubam et al [8] measured cervical length by transvaginal ultrasonographyin32women(21primigravid,11multigravid)withthreatenedpreterm delivery, and in 177 normal singleton pregnancies between 18-37weeks' gestation. Regression analysis was used to create the nomogram.Student t test was used to compare the groups. A linear relationship wasfoundbetweencervicallengthandgestationalage(r = -0.4, P < .001). Comparison of cervical length on admission in the patientswith threatened preterm delivery showed that 11 preterm deliveries occurredinwomenwhohadameancervicallengthof23.2mm(range17-29),whereas21termdeliveriesoccurredinwomenwithameancervicallengthof31.7mm(range 21-42). The difference was significant (P < .001). A cervical length ofless than20 mm on 45 admission had a positive predictive value of 100%. These patients hadpretermdeliverydespitetocolytictherapyduringhospitalization.Theyconcluded that the risk of preterm delivery is high in women whose cervicallength on admission is less than 30 mm, and strict management is requiredforthosewithacervicallengthofless than20mm.
In our study, the positive and negative predictive values were found tobe92.5and100%respectively, when correlation betweencervical lengthandpretermlabourwas done.

CERVICALFUNNELINGANDPRETERMLABOUR

Berghella et al [1] conducted a study in 183 women of which 60(33%) hadafunnelingobservedonatleastoneoftheserialevaluations.These60womendeliveredatanearliergestationalagedeliverythanthe123womenwithout funneling(31.7±7.9weeks compared with 36.9±4.4weeks;P<0.001).In the 60women with funneling on atleast one evaluation,the progression over time ofinternal os cervical anatomy from a ‘T’ to a ‘V’ to a ‘U’ shape was associatedwithearliergestationalageatdelivery.Whereasresolutionof‘V”shapefunnels was associated with term delivery.Women with a shortened cervicallength <25mm(n=60) had a similar gestational age at birth weight with orwithoutfunneling(30.6±8.0weekscomparedwith31.9±6.6weeks;P=0.59).Aftercontrollingfortheshortestobservedcervicallength,largestfunnelpercentwasnotasignificantindependentriskfactor.Theyhaveconcludedthatthenaturalhistoryofsecondtrimesterfunneling has significant variability and a significant association with earliergestationalageat delivery.
In our study 12 womenhadfunnelingandall of themdeliveredwithin oneweek since onset of symtoms. It was also noted that in our studyfunnelingwasnotseeninwomenwithnormalcervicallengthi.e>2.5cms.thecorrelation offunnelling with pretermdeliveryhasa sensitivity of 80% andspecificityof86.6%.
Studies of Berghella et al[1] conducted a study on 43 patients inwhomtransvaginalscanwasdoneandwasfoundtohavecervicalfunnelling.Funnellingwasdetect

edatameangestationalageof21weeks.
This study concluded that presence of funneling in correlation with pretermlabour had a sensitivity of 80%, specificity of 86%, a positive predicitive valueof80%andanegativepredictivevalueof86%.
In the 60 women with funneling on at least one evaluation, the progressionover time of internal os cervical anatomy from a "T" to a "V" to a "U" shapewas associated with earlier gestational age at delivery, whereas resolution of"V"shapefunnelswasassociatedwithtermdelivery.Womenwithashortenedcervicallengthlesst han25mm(n60)hadasimilargestationalageat birth with or without funneling (30.68.0 weekscompared with 31.96.6weeks;P.59).Aftercontrollingfortheshortestobservedcervicallength,largest funnel percent was not a significant independent risk factor. Thus itwas concluded that the natural history of second-trimester funneling hassignificantvariabilityandasignificantassociationwithearliergestationalageat delivery. As an independent finding, funneling does not add appreciably totheriskofearlygestationalageatdeliveryassociatedwithashortenedcervicallength
Berghella et al [1] conducted a study in 183 women ,of which 60[33%] had afunneling observed on atleast one of the serial evaluations .These 60 womendeliveredatanearliergestationalageatdeliverythanthe123womenwithoutfunneling [31.7+_7.9weeks compared with36.9+_4.4 week;P<.001].In the 60womenwithfunnelingonatleastoneevaluation,theprogressionovertimeofinternaloscervicalan atomyfromaTtoaVtoaUshapewasassociatedwithearlier gestational age at delivery.wheras resolution of V shape funnel wasassociated with term delivery .Women with a shortened cervical length <25mm [n=60]had a similar gestational age at birth with or without funneling[30.6+_8 weeks compared with 31.9+_6.6 weeks ;P=.59]After controlling forthe shortest observed cervical length largest funnel percent was not asignificantindependentriskfactor.
They have concluded that the natural history of second trimesterfunnelinghassignificantvariabilityandasignificantassociationwithearliergestationalage atdelivery.

CERVICALENCIRCLAGEANDPRETERMLABOUR

In our study 24women whounderwentcervical encirclagedeliveredatterm.
Studies of Novy MJ[73] showed that women who underwent cervical encirclageforshortcervixatanearliergestationalagehadbettermaternalandneonataloutcomes with a significant p value. They have concluded that diagnosis ofprematurecervicalchangesbyultrasonographywascorrelatedwithtreatmentearlieringestationan dwithafavourableimpactonperinataloutcomeinbothpatientstreatedwithcerclageandthosetreated conservatively.Cervicalcerclagewasassociatedwithanimprovedperinataloutcome.(incomparisi onwith conservative therapy) in women with early cervical changes detected byultrasonography and in patients withadvanced cervical dilation and visiblemembranes.

NEONATALOUTCOMEINPRETERMDELIVERY

In our study 52% ofthe women with short cervix delivered before 32weeksofgestation,48%deliveredafter32weeksofgestation.36% of the babies had birthweight less than 1.5 kg, 64% had birthweight > 1.5kgs.
Allpretermdeliverieswerespontaneousvaginaldeliveries(100%).Atotalof16pretermbabieswerea dmittedinNICU,18.7%hadbirthasphyxia,16.7% had respiratory distress, 12.5% had sepsis. Most of the babies withbirthasphyxiaandRDShadhyperbilirubinemia.

Studies of Kwee et al [9]showed that62.82% were > 32 weeks ofgestation,67.39%weremale,57.60%were>1.5kgbyweight,57.17%delivered vaginally and 80.86% were born alive. Neonatal morbidity was morecommoninneonateslessthan32weeksofgestation.Perinatalmortalitywas10.48%inthisstudy .

CONCLUSION

- Cervicallengthandfunnelingisasensitivemarkerofpretermdelivery.
- Promptdiagnosisandtreatmentofthreatenedpretermlabourhelpsinreducingthematernalmorbidityandneonatalmorbidityandmortality.
- Timely cervical encirclage helps in prolonging the pregnancytill term and thus reducing the morbidity and mortality ofneonates.
- High vaginal swab should be taken as a routine in all womenwiththreatenedpretermlabourtohelpearlyinitiationoftreatment andreduce the risk of preterm delivery, therebyreducingthematernalandneonatalmorbidity.

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CONFLICT OF INTEREST

None

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