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Original Research Article

Cervical typing in preterm delivery

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ABSTRACT

Introduction: Preterm delivery remains an enigma and is the leading cause of neonatal morbidity and mortality.**Aims:** To assess the cervix during pregnancy by clinical methods and cervical typing & to determine its use for the prediction of preterm delivery and cervical insufficiency.**Materials and Methods:** This was a prospective study conducted on 236 patients attending ANC clinic of the Department of Obstetrics & Gynaecology. Subjects were of different age, parity and gestation period from 16th-36th weeks. History and clinical examination was performed along with cervical typing by doing one PV examination randomly during their visit. Data was tabulated as per cervical typing and followed the patient upto delivery. The data was divided into two groups according to risk associated with the cervical typing (group1: I-V & group 2: VI-IX) and further according to preterm or term delivery. Then both the groups were compared according to cervical typing to know whether low risk or high risk. Statistical tests were applied know whether the difference in obstetrical outcome is statistically significant.**Results & Conclusions:** Out of 236, 210 patients delivered at term and 26 had preterm delivery. Chi-square Naïve Bayes ML algorithm were applied and showed that this classification according to cervical types is reliable for interpreting the possibility of preterm delivery and is easy to practice even by peripheral doctors at primary health centres in remote areas.This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.For reprints contact: reprint@ipinnovative.com

1. Introduction

In the era of modern obstetric there has been rapid advancement and innovation in all specialties, Preterm delivery still remains enigma for the obstetricians today and is the leading cause of neonatal morbidity and mortality. 2nd problem is recurrent pregnancy loss which is defined as the occurrence of three or more consecutive spontaneous clinically detectable pregnancy losses prior to 20th week of gestation. The American Society for reproductive medicine (ASRM) now considers 2 or more consecutive losses.¹

Both the problems are emotionally disturbing PTD due to fetal and neonatal problems and RPL due to emotional

problem and social stigma. Both the problems has got multifold etiological factors and one factor is common to both that is Cervical Insufficiency. So at the beginning of the 6th decade obstetricians all over world started focusing on cervix to know its role as etiological factors in above mentioned problems. The uterine cervix is an essential component in maintenance of pregnancy till term. Appropriate mechanical function of uterine cervix is critical and crucial for maintaining pregnancy to term and cervix must prepare itself for delivery at term which requires it to markedly soften and shorten, (effacement) and dilate which has been described in recent published article of mechanical role of cervix in pregnancy and has been called as Remodeling of the cervix.² For this cervix has to undergo many structural physiological and biochemical changes in

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it which has been activated by the hormones like estrogen, progesterone and relaxin.³

Dr. V N Shirodkar was the first person who came to the conclusion that this problem was related with cervical incompetence/insufficiency and in 1955 the first transvaginal cerclage as a treatment for above problem was introduced by Shirodkar at the conference in Paris which was followed by McDonald by different technique in 1957.^{4,5}

In the next generation the study on this topic was continued by Dr MN Parikh and Dr AC Mehta and in combination they published one article on this subject in 1962.⁶ Ultimately Dr. Ajit Mehta designed and published his first article on cervical typing during pregnancy. He explained nine types of cervical patterns specifically noting the effacement & dilatation which is basics of abortion and labour.⁷

1. Incompetent cervix – This is a typical syndrome of painless progressive dilatation of the cervix within 16-24 weeks and the basic defect is the weakness of the sphincter mechanism of the internal os. It is defined by American College of Obstetrician and Gynecologist as the inability of the uterine cervix to retain a pregnancy in the absence of signs and symptoms of clinical contraction or labor or both in the second trimester.⁸ It is possible that lesser degree of incompetency can postpone this procedure beyond limits of abortion period that is after 20 weeks which ultimately can lead to premature delivery.⁹
2. Preterm Labor – According to WHO preterm delivery is defined as the delivery before 37 weeks of gestation or 259 days from LMP. WHO fact sheets mentions that every year 15 millions babies are born prematurely and this 5 number is rising.¹⁰ It is a leading cause of death among children under 5 years of age responsible for about 16 million deaths in 2015.¹¹ Across 184 countries rate of PTB ranges from 5-18% and survivors face different 7 disability including learning visual, hearing problems and also associated with physical and psychological issues.¹² This cervical typing study is very useful in prediction of possibility of incompetent cervix and preterm labor.
3. As it also has got some important components of Bishop's scores, it is also helpful for assessment of inducibility. This score was totally designed on the basis of clinical findings. Due to its utility in ANC period and labor it became very popular. However, with introduction of Ultrasonography and & its availability, which started giving readymade package of information ultimately resulted in gradual decline of using this method of cervical typing.
4. Does it mean that the utility of this topic is finished? Not at all, because at the end of USG report they used to write the word 'correlate clinically'.

2. Aim

To assess and evaluate the cervical status with a novel method by clinical examination and cervical typing in pregnancy to predict the possibility of preterm delivery and cervical insufficiency.

3. Objective

1. To make prediction about the cervical incompetency.
2. To predict possibility of preterm deliveries.

4. Materials and Methods

The study was conducted in a renowned medical college, research centre and teaching institution, amongst ANC patients attending OPD.

The period of study was January 2018 to June 2019.

Initially, a sample of 240 pt. were enrolled in the study out of which 04 patients were dropped due to different.

The exclusion criteria were as follows

Patients having congenital malformation of genital organs like bicornuate/bicollis uterus, hypoplasia etc.

1. Infra vaginal elongation of the cervix.
2. Missed abortions & Intrauterine deaths.
3. Congenital anomalies in the fetus.
4. Multiple pregnancies.
5. Cervical injury/tear/surgery (amputations).

After thorough counseling the patient's written consent was taken. The permission of ethical committee of the institution was obtained already. The finding of PV examination (which was done randomly) was recorded in details as per protocol given in figure 1 with respect to the gestational age, parity and type of cervix. They were followed upto delivery and details of delivery record was also maintained particularly the gestational period at the time of delivery to know whether it is at term or preterm delivery.

4.1. Statistics

In the study published by Dr. Ajit Mehta under the heading 'prematurity and cervical status' in 1976, he summarized his findings as Type IV indicates reasonable effacement & Type V at least 1cm dilatation, it is only Type VI and above which herald the changes of dilatation, effacement & softening necessary before labor.


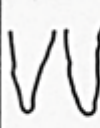
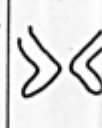
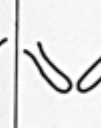
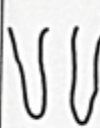
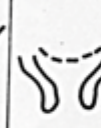
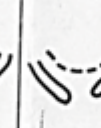
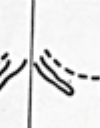

We divided the delivered patients in two groups separately i.e. Term Deliveries & Preterm Deliveries and their relation with cervical typing so as to know whether the second group patients has got tendency for prematurity and will be confirmed by statistically significant tests.

Chi Square test with the help of software win Pepi v11.

Naïve Bayes ML Algorithm will be tested.

Group 1 included patients having cervical types I II III IV V and Group 2 included VI VII VIII IX.

CERVICAL PATTERNS DURING PREGNANCY FOR
(1) DETECTION OF INCOMPETENT CERVIX
(2) PREVENTION OF PREMATURITY AND (3) ASSESSMENT OF INDUCIBILITY

TYPES OF C _x								
CLOSED ← C _x → OPEN								
I	II	III	IV	V	VI	VII	VIII	IX
								
NON-PREGNANT	MULTIPARA EARLY PREGNANCY	MULTIPARA III TRIMESTER	PRIMIPARA AFTER 32 WKS	FREQUENT AFTER 32 WKS IN MULTIPAROUS	MULTIPAROUS AFTER 34 WKS	RIPE FOR DELIVERY FREQUENT AFTER 36 WKS	LABOUR DOMINANT FREQUENT IN MULTIPAROUS AFTER 36 WKS	AS IF IN LABOUR
CANAL CLOSED	CANAL OPEN	CANAL OPEN	CERVIX CLOSED	CANAL OPEN LONG	DILATATION 1 - 1.5 cm	DILATATION 1.5 - 2.5 cm	DILATATION 1 - 2.5 cm	DILATATION 3 - 5 cm
EFF NIL	EFF NIL	EFF 40%-50%	EFF > 40%	EFF 0 TO 50%	EFF 50%-60%	EFF -70%	EFF -80%	EFF 80% +
FIRM	FIRM	FIRM TO MED	FIRM TO MED	FIRM TO MED	MED TO SOFT	SOFT	SOFT	SOFT

DEVELOPED & DESIGNED BY
AJIT C. MEHTA M. D.
N. WADIA MATERNITY HOSPITAL BOMBAY

Fig. 1:

4.2. Observations

1. The Parity zero patients were found to be maximum and maximum number of PV examination was done in the gestational period of 33-36 weeks due to randomization.
2. After this table as per Dr Mehta's protocol for the simplicity and according to clinical finding we made 4 groups of 9 types of cervixes as follows and prepared Cervix type I & II: No dilatation and effacement. Cervix type III & IV: only effacement. Cervix type V : dilatation of at least 1 cm. Cervix type VI to IX : dilatation and effacement both.
3. Study of both in combination shows that in all three groups of parity P0 P1 P2 and above, at early gestational age of 16 to 20 weeks maximum cases of cervical type I & II were observed that is no effacement and dilatation group 100% 92% and 83% respectively. Then it shows gradually decreasing trend with increasing gestational age that is at 32 to 36 weeks GA, 38% 29% 43% respectively for P0, P1 and P2 and above groups.
4. From the observation of the above tables, it seems that a PV examination prior to 24 weeks of pregnancy will not reveal any changes of the cervical ripening suggested by dilatation and effacement in all parity groups.
5. It is also noted that nearly 30% of the dilatation and effacement were observed in all three groups of parity i.e. P0 - 29.26%, P1-35.29%, P2-28.57% at gestational period of 33-36 weeks 54 our findings are in agreement with Dr. Mehta's study.

5. Results

Out of 236, 210 patients had full term deliveries and their distribution was P0=97; P1=63; P2+=50. 26 deliveries were preterm and their distribution was P0=11; P1=08; P2+=07. Overall our average incidence of preterm delivery was 11.01% P0=10.18% P1=11.26% P2+=12.28%. So there was not much difference in the average percentage of all premature deliveries in the different parity groups As mentioned above, we have made two separate groups record of cervical type up to I- V and another being Type VI-IX and number of deliveries in each group as

Table 1: Distribution cases showing cases with respect to gestational period and parity

Gestational period	Parity (0)	Parity (1)	Parity (2 and 2 +)	Total
16-20	18	13	12	43
21-24	7	8	8	23
25-28	21	14	8	43
29-32	25	19	13	57
33-36	37	17	16	70
Total	108	71	57	236

Table 2: Distribution of 236 cases according to weeks, parity & cervix type

Parity	Weeks	Total	Types of cervix											
			I-II	III	IV	V	VI-VII	VIII-IX						
0	16-20	18	18	100%	-	-	-	-	-	-	-	-	-	-
	21-24	7	6	85.70%	-	-	-	-	1	14.3%	-	-	-	-
	25-28	21	19	90.47%	1	4.76%	1	4.76%	-	-	-	-	-	-
	29-32	25	14	56%	1	4%	6	24%	1	4	3	12%	-	-
	32-36	37	14	37.8%	1	2.7%	7	18.9%	4	10.8%	8	21.16%	-	-
1	16-20	13	12	92.32%	1	7.68%	-	-	-	-	-	-	-	-
	21-24	08	7	87.5%	1	12.5%	-	-	-	-	-	-	-	-
	25-28	14	9	64.38%	2	14.28%	1	7.4%	1	7.4%	-	-	1	7.4%
	29-32	19	8	42.1%	4	21.05%	3	15.78%	10	10.5%	1	5.25%	1	5.25%
	32-36	17	5	29.4%	1	5.88%	2	11.76%	3	17.64%	6	35.20%	-	-
2+	16-20	12	10	83.33%	1	8.33%	1	8.33%	-	-	-	-	-	-
	21-24	9	7	77.77%	1	11.11%	-	-	-	-	-	-	1	11.11%
	25-28	9	6	66.66%	1	11.11%	-	-	-	-	1	11.11%	1	11.11%
	29-32	13	5	38.41%	1	7.69%	1	7.69%	3	23.07%	2	15.38%	1	7.69%
	32-36	14	6	42.85%	1	7.14%	-	-	3	21.42%	4	28.27%	-	-

seen in following table and compared them whether there is statistically significant difference ($p < 0.05$).

Number of Deliveries	Term Deliveries	Preterm Deliveries
Low risk score (Cx type I-V)	188	18
High risk score (Cx type VI & above)	22	8
Total	210	26

(Chi-Square test-shows chi-sq = 6.855, Degree of freedom = 1, p-value = 0.009 highly significant, wini Pepi version 11.65 was used)

Which, means that this statistical difference between the two groups is highly significant meaning that the patient with group of cervical type VI- IX are definitely showing more chances of preterm delivery than cervical type I-V.

We also tested Naïve Bayes ML algorithm to predict the possibility of preterm deliveries for that we used two parameters as input and predicted the type of delivery as output. The P-type was one hot encoded to avoid any biases to seep into the model. This is a probabilistic based model and is convenient for such small data and characteristics and gave pretty good results.

We had the data of 236 patients and the model predicted the outcome with 100% accuracy. Thus, we can conclude that the data retrieved from the research can be used to

Table 3: The probability of detection for cervical dilatation & effacement in each parity group at various gestational ages

Parity	Weeks	No D%E	E. only	D. only	D+E
	21-24	85.70%	-	14.30%	-
	25-28	90.47%	9.53%	-	-
	29-32	56%	28%	4%	12%
	33-36	37.83%	21.6%	10.8%	29.26%
1	16-20	92.13%	7.60%	-	-
	21-24	87.5%	12.5%	-	-
	25-28	64.38%	21.68%	7.4%	7.4%
	29-32	42.1%	36.83%	10.5%	10.5%
	33-36	29.4%	17.64%	17.64%	35.29%
2 & 2+	16-20	83.33%	16.66%	-	-
	21-24	77.77%	11.11%	-	11.11%
	25-28	66.66%	11.11%	-	22.22%
	29-32	38.41%	15.88%	23.07%	23.67%
	33-36	42.85%	7.14%	21.42%	28.57%

Table 4: The distribution of term deliveries according to parity, gestational period and cervical types

Gest Period Weeks	Term Deliveries																		
	Parity 0 Types of cervix						Parity 1 Types of cervix						Parity 2+ Types of cervix						
	I-II	III	IV	V	VI-VII	VIII-IX	I-II	III	IV	V	VI-VII	VIII-IX	I-II	III	IV	V	VI-VII	VIII-IX	
16-20	16	-	-	-	-	-	12	-	-	-	-	-	9	1	-	-	-	-	
24-24	06	-	-	1	-	-	7	-	-	-	-	-	6	1	-	-	-	-	
28-28	14	1	1	-	1	-	9	2	1	-	1	1	4	-	-	1	1	-	
29-32	10	1	6	5	1	1	7	4	3	1	1	1	6	1	1	2	1	-	
33-36	14	1	3	9	6	-	5	1	2	2	3	-	6	3	-	3	3	1	
Total	60	03	10	15	08	01	40	07	06	03	05	02	31	06	01	06	05	01	
		88			09			56			07			44			06		

Table 5: The distribution of preterm deliveries according to parity gestational and cervical types

Gest Period Weeks	Preterm Deliveries																		
	Parity 0 Types of cervix						Parity 1 Types of cervix						Parity 2+ Types of cervix						
	I-II	III	IV	V	VI-VII	VIII-IX	I-II	III	IV	V	VI-VII	VIII-IX	I-II	III	IV	V	VI-VII	VIII-IX	
16-20	2	-	-	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	
21-24	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	
25-28	2	-	-	-	-	-	-	1	-	1	-	-	1	-	-	-	-	-	
29-32	-	-	1	-	-	1	1	-	-	1	-	-	-	-	1	-	-	-	
33-36	1	-	-	-	3	-	-	-	-	-	2	-	-	-	-	1	1	-	
Total	05	00	01	01	03	01	03	01	00	02	02	00	02	01	01	01	02	00	
		07			04			06			02			05			02		

determine the outcome of delivery effectively.

6. Discussion

There is no doubt that whatever advancements comes in medical field the significance of clinical examination & history can't be undermined because there are many limitations for the new investigations which are upcoming in future like availability, training of personals, cost factors and baseline infrastructure and so on which are the basic problems in developing countries like us. With the help of these protocols and guidelines we can train the peripheral doctors so that they will be able to scrutinize high risk cases like premature delivery and cervical insufficiency after which they will be able to refer them to tertiary centers in proper time where all the above modalities are expected to be available and proper management can be done accordingly. The importance of interpretation / identification of possibility of preterm deliveries is the most crucial factor to reduce intra natal, neonatal, perinatal morbidity & mortality related to the prematurity which can be achieved by training the health staffs practicing at peripheral areas, PHC, remote areas by practicing this score.

The ultrasonography reports are always to be correlated with the clinical findings so that patient can be diagnosed and managed properly.

In modern era the important findings of cervix in relation to our topic are as follows:

1. Cervical length of 26mm represents 26th percentile and 35mm is 50%. CL < 25mm (below the 10th percentile is associated with 75% risk of preterm delivery.¹³
2. Premature opening of internal os at rest or in response to fundal pressure predicts early incompetent cervix and bulging of membranes into open os confirms the incompetent cervix.
3. Cervical length <25mm before 24 weeks in women of RPL or prior history of PTD has got high predictability for cervical insufficiency.

The principle and methodology of this study is based on the research done by previous doctors.

The basic criteria for study in USG machine were cervical length and internal os dilation observation which are very much similar to the classification designed by Dr. Ajit Mehta which signifies the importance of cervical typing.

The ultrasonography was introduced as an investigation tool in 1978,¹⁴ the guidelines about how to record the findings of the machines were given by the knowledge which is based on the previous studies which includes cervical length and internal OS diameter which is also the basis of cervical typing.

7. Conclusion

If one learns & knows this classification by heart he can confidently take important decisions like prediction of high risk problems (incompetent cervix & preterm delivery), the decision about induction of labour & much importantly to treat cases of 2nd trimester Recurrent Pregnancy Loss due to incompetent cervix which is the necessity of doctors practicing in remote area and PHC where USG machine is not available. In short though the electromagnetic gas lighter has replaced the matchbox in kitchens in the big cities the, significance of matchbox is still persisting as its used by 70% of the citizens belonging to the rural areas

In short the study is useful in low resource setting and validates the importance of clinical acumen.

8. Source of Funding

None.

9. Conflict of Interest

The authors declare no conflict of interest.

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