Cervical length measurement using an improvised cervicometer as a predictor of spontaneous preterm birth in uncomplicated pregnancies in a tertiary hospital in Southern Luzon in 2015: A cohort study*

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ABSTRACT

Background: Preterm birth is a major public health problem and cervical length measurement using transvaginal ultrasound is the gold standard for predicting its occurrence. However, its cost and the limited availability of equipment and trained sonologists has limited its use only for screening for high risk patients and those with history of preterm birth. Those patients without risk factors are not recommended for routine screening although they constitute the majority of spontaneous preterm deliveries. The newly marked cervicometer, Cervilenz©, an easy-to-use and cheaper device, has been found to be comparable to transvaginal ultrasound in predicting preterm birth and may be used to universally screen all patients regardless of their risk status, however, at present, it is only available in the United States.

Objective: This study aims to determine if an improvised cervicometer such as the insertion tube of an intrauterine device can also be used as a screening tool for predicting spontaneous preterm birth in uncomplicated pregnancies.

Methods: The cervical length of 126 patients at 14 to < 37 weeks age of gestation were measured and patients were followed up until delivery.

Results: It was found that those with short cervical length of < 25mm were not an increased risk of preterm birth (p-value > 0.05 at CI 95%). The negative predictive value was found to be 100%, 95%, and 88% at < 32, <34, and <37 weeks, respectively, in which those with normal cervical length were less likely to deliver prematurely, and this finding is comparable to the outcome of Cervilenz© studies.

Conclusion: An improvised cervicometer such as the insertion tube of an intrauterine device can be used as a screening tool for predicting spontaneous preterm birth in uncomplicated pregnancies.

Keywords: Cervical length, cervicometer, premature, preterm birth

INTRODUCTION

Preterm birth is defined as the delivery of an infant before 37 weeks age of gestation. It is a major cause of neonatal death and its reduction is one of the world's Millennium Development Goals. In the World Health Organization statistical report last November 2015, the Philippines ranks 8th in the most number of preterm births reported.[1] Aside from death, immediate complications of preterm birth include respiratory distress syndrome, necrotizing enterocolitis, intraventricular hemorrhage, and retinopathy of prematurity. The healthcare cost for a premature infant in the neonatal intensive care unit in the Philippines is estimated to be PhP 7,000-15,000 per day which greatly contributes to our country's economic burden.[2]

There are four major causes of preterm births, including delivery for maternal or fetal indications, preterm prelabor rupture of membranes, multiple gestation and spontaneous preterm births. The latter comprises 45% of the total preterm births and is associated with lifestyle, ethnic, genetic, fetal and maternal risk factors. In most studies, infection is the most commonly seen risk factor to cause preterm labor, however, interconceptional antibiotic use was not found to reduce the rate of subsequent preterm birth. Hence, it seems that other influences on the process of preterm labor such as genetics, nutrition, hormones, and other environmental factors such as cigarette smoking, drug use, and maternal work are also associated with the risk of preterm delivery. However, even in the majority of these patients, no risk factors can be identified. Efficient methods for risk assessment and screening, thus, is required in order to adequately prevent, diagnose, and treat spontaneous preterm birth.[2,3]

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REVIEW OF LITERATURE

Preterm birth is a major public health problem in terms of perinatal mortality, long-term morbidity and health economics. It is responsible for more than half of all neonatal deaths[3] and those premature babies who survive are at risk for serious complications including cerebral palsy, respiratory morbidity, blindness, deafness and cardiovascular disease.[4] Because of this, early diagnosis and treatment of preterm labor is needed to prevent preterm birth and its consequences. However, the clinical diagnosis of true preterm labor using the usual signs and symptoms and by digital internal examination remains unreliable resulting in significant over treatment of patients since only less than 10% of these symptomatic women will eventually deliver within 1 week or before 35 weeks with or without therapy. This is because self-perceived symptoms are subjective hence may vary in different individuals. On the other hand, digital examination in early labor less than 3 cm and less than 80% effacement was not found to predict that subsequent delivery will proceed irrespective of treatment, while those more than 3 cm dilated may not be amenable to treatment any longer. Hence, earlier modes of detection were studied to better predict preterm labor and subsequent delivery.[2,5]

It was found that in early preterm labor, a change in cervical length or effacement preceded a change in cervical dilation.[6] And it was shown that preterm birth is associated with shortened cervical length using transvaginal ultrasound at mid pregnancy.[5] Early effective intervention can then be instituted during this time to prevent true preterm labor before its onset, which at present is in the form of progesterone supplementation. Hence, transvaginal ultrasound is now considered the gold standard for cervical length assessment. However, the equipment, training, and its cost became the reason for limiting its use for screening only pregnancies at high risk of preterm birth, particularly in those with history of prior preterm birth and to those who are already symptomatic of preterm labor. Since about half of all preterm births happen in pregnancies considered low risk,[7] much research have been done to find an alternative technology which is more cost-effective and much easily available to screen all pregnancies regardless of their risk status.

Several studies have compared transvaginal ultrasound cervical length measurement with other forms of screening methods including transperineal and transabdominal ultrasound, but cervical length estimates had significant discrepancy compared to transvaginal ultrasound. Transabdominal ultrasound results are affected by maternal obesity, cervix position, shadowing by the fetal presenting part and bladder fullness, while transperineal ultrasound can only visualize the cervix in 80% of patients. Transvaginal ultrasound remains the most reliable method of determining the cervical length since it provides better imaging of the entire cervical length and does not require bladder filling nor is obstructed by any fetal part.[2] In studies, cervical length of <25mm at 28 and 35 weeks age of gestation has a relative risk of preterm delivery of 9.6 and 6.9, respectively. However, this is reliably done only by a trained sonologist and routine screening for all patients cannot be recommended due to its cost.[6-8]

In 2011, a new nonsonographic cervical length assessment tool or cervicometer called Cervilenz© was introduced in the United States which may be used to screen all pregnant patients for the risk of preterm birth. It is a disposable device for obtaining vaginal cervico-portio length measurement which is said to be cost-effective, sensitive and reproducible method of screening patients for short cervical length.[10] It contains a measuring probe with a movable flange to measure the distance from the lateral fornix of the vagina to the distal end of the cervix under direct visualization using a vaginal speculum (Figure 1). The use of Cervilenz© does not require expensive machinery nor advanced training in ultrasound and has the potential to be able to be broadly utilized by all obstetric providers, including obstetricians, general practitioners, nurses and midwives. Cervilenz© may serve as an appropriate screening test to be performed in the clinic, and those patients that were identified to have short cervix may be referred for a diagnostic transvaginal ultrasound cervical length measurement and potential

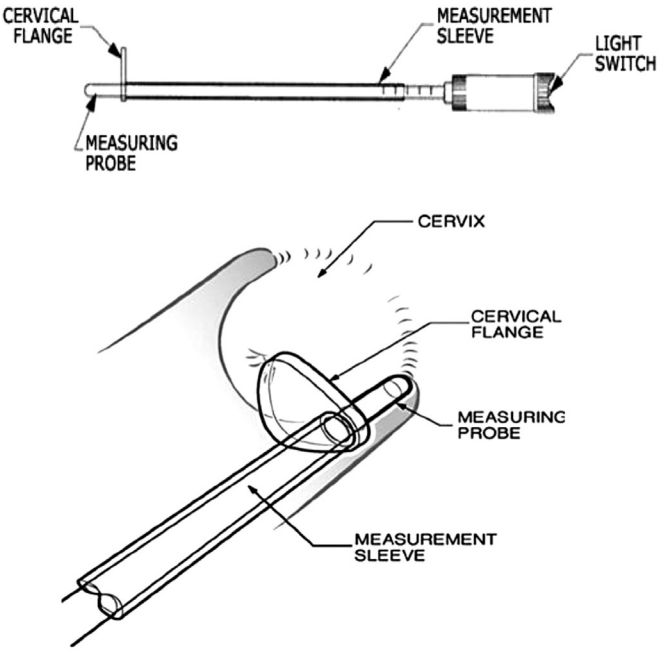

Figure 1. Cervilenz©7

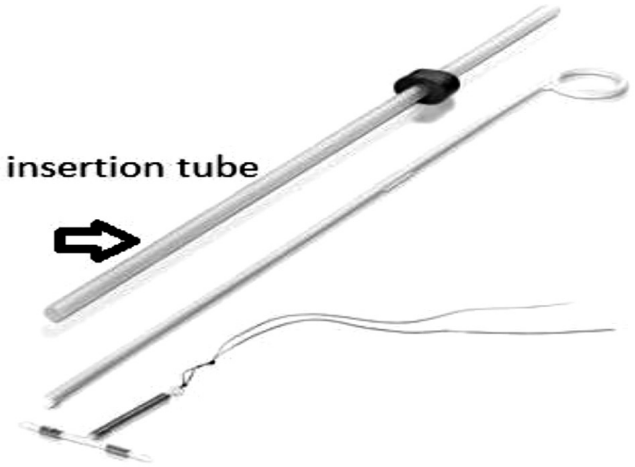

Figure 2. Insertion tube of an intrauterine device with a movable flange

therapy.[6] In studies, a measurement of 25 millimeters or more using Cervilenz© can rule out preterm birth before 34 weeks (97% negative predictive value).[11] However, this tool is only manufactured and distributed in the United States.

In our country, clinical practice guidelines for preterm labor and delivery still recommends the routine transvaginal cervical length measurement to be done only to high risk pregnancies at mid-pregnancy.[2] With this limitation, perhaps an improvised cervicometer may be of help to screen and predict preterm birth even in low risk pregnancies.

An intrauterine device kit contains an insertion tube with a flange which is normally used to aid for interval intrauterine device insertion. In its other uses such as for postpartum and intracesarean intrauterine device insertion, this insertion tube is not used (Figure 2). This study aims to know if an improvised cervicometer such as the insertion tube of an intrauterine device can also be used to screen uncomplicated pregnancies for preterm birth.

OBJECTIVES

General Objective

This study aims to determine if cervical length measurement using an improvised cervicometer can predict preterm birth in uncomplicated pregnant patients seen in the Out Patient Department in a tertiary hospital in Southern Luzon in 2015.

Specific Objectives

1. To determine the demographic data of the study population
2. To measure the cervical length of the study population
3. To determine the proportion of the study population who will deliver before 32, 34, and 37 weeks age of gestation
4. To correlate the cervical length and risk of preterm delivery in the study population
5. To correlate the outcome of this study with other research

MATERIALS AND METHODS

This study made use of cohort research design which was approved by the Ethics committee of the hospital. The study population is composed of pregnant women with uncomplicated pregnancies at 14 to < 37 weeks age of gestation by last normal menstrual period who consulted for the first time in the Out Patient Department in a tertiary hospital in Southern Luzon in the year 2015. Sample size is 126 which was computed using percent frequency in a population (9% prevalence of preterm birth in Asia), at 95% confidence interval. Random sampling method was employed using random number generator (3 patients per researcher's clinic day, using numbers 1-50) from www.openepi.com.

The patients were interviewed, examined and their charts reviewed solely by the researcher. Informed consent was obtained and data were recorded using a data gathering tool.

Inclusion Criteria

Age of gestation of 14 to < 37 weeks is based on the last normal menstrual period in a pregnant patient with regular cycles and sure of dates, with or without ultrasound results.

Uncomplicated pregnancies are those without preexisting maternal, fetal, or placental abnormality, and those without prior preterm birth, nor any other risk factors that will categorize a patient as having high risk pregnancy such as hypertension, diabetes mellitus, bronchial asthma, toxic goiter, cardiac disease, autoimmune disease, renal disease, multiple gestation, polyhydramnios and congenital malformation, etc., except for those who are only high risk for age and for grandmultiparity.

Exclusion Criteria

Patients with family history of hypertension, diabetes mellitus, autoimmune diseases, heart disease and other heredofamilial illnesses, and those who are current smokers, with illicit drug use or are employed were excluded in the study.

All patients with signs and symptoms of infection or preterm labor during history taking and physical examination including abdominal pain, uterine contractions, vaginal bleeding, dysuria, presence of yellowish, greenish or foul-smelling vaginal discharge,

open cervix, and leaking bag of waters were also excluded.

Patients with ultrasound findings of fetal or placental abnormality or those with discrepant fundic height measurement or ultrasound aging compared to age of gestation by last normal menstrual period were excluded. Also, any other abnormalities in the physical examination findings such as elevated blood pressure, fever, murmurs, crackles, etc, were excluded in the study.

Study Variables

Data collected were age, marital status (single or married), gravidity, age of gestation during cervical length assessment, and cervical length (<25 mm or ≥25mm).

The cervical length was measured by inserting a vaginal speculum to visualize the cervix then the insertion tube was applied at the 3 o'clock position of the cervix along its lateral wall until there is slight resistance at the vaginal fornix (Figure 3). The flange was adjusted using Kelly forceps until it rests gently on the cervix. The tube was removed and a ruler was used as a scale to measure the cervical length (in millimeters). The insertion tube was kept sterile and aseptic technique was employed at all times.

All patients were informed regarding proper nutrition, hydration and vitamin intake, hygiene, and avoidance of strenuous activities. No other interventions were done subsequently.

At the end of the year, all the names and hospital numbers of the patients were retrieved from the hospital's computer data base and their charts were reviewed. The age of gestation at delivery and the mode of delivery were determined. Patients who had no records of delivery (presumed to have delivered in other institutions) and those who delivered via cesarean section for any indication were excluded in the interpretation of the final results.

Exposed – the study population with cervical length < 25mm

Unexposed – the study population with cervical length ≥ 25mm

With Disease – the study population who delivered before 32, 34, and 37 weeks age of gestation

Without Disease – the study population who delivered after 32, 34 and 37 weeks age of gestation

Frequency, percentage, mean and standard deviation were used to describe the study population. The inferential statistics employed were t-test and chi square test using Epi Info. The relative risk, sensitivity, specificity, positive and negative predictive value and accuracy were computed.

RESULTS

There were 126 patients included in the study population, 88 of which underwent vaginal spontaneous delivery (69.84%), 7 had cesarean section (5.56%) and 31 had no record of delivery (24.6%). From those who underwent cesarean section, 4 were due to dystocia, 2 for malpresentation and 1 for uncontrolled hypertension.

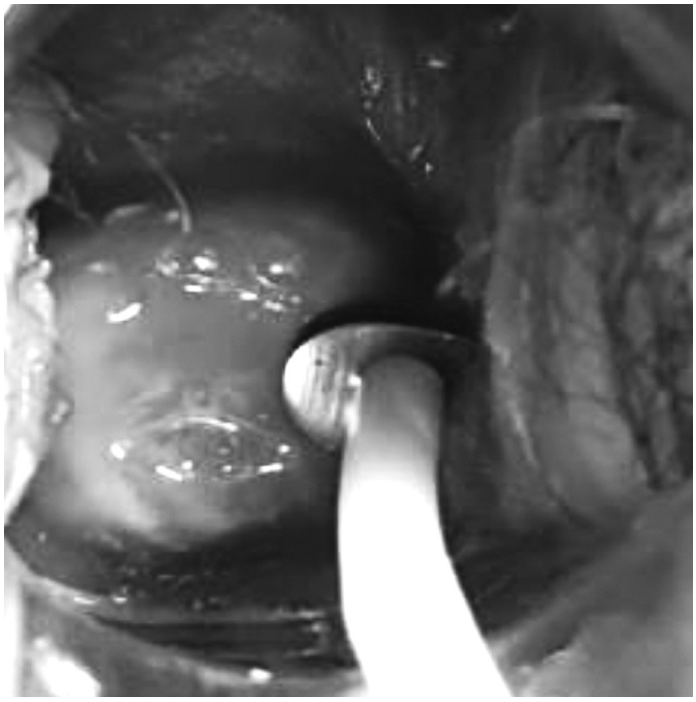

Figure 3. Measurement of the cervico-portio length using the IUD insertion tube

Table 1

	Short Cervix (n=45 [35.71%])	Long Cervix (n=43 [34.13%])	p-value (95% CI)
Age (years)	24.93 ± 0.9	23.86 ± 0.88	<0.001
Single mothers	25 (55.56%)	24 (55.81%)	
Gravidity	2.04 ± 0.16	2.03 ± 0.21	0.802
AOG (weeks) during Measurement	30 ± 0.66	29.25 ± 0.91	<0.001

Data are in mean ± standard deviation and n (%)

The 88 patients who underwent vaginal spontaneous delivery were divided to the exposed and unexposed groups according to the cervical length measurement (short cervix <25mm and long cervix ≥25mm respectively). In both research groups, most patients were 18-34 years old (mean of 24.93 and 23 respectively), most were single (both groups at 55%), multigravidas (Gravida 2 in both groups) and were at 28 to <34 weeks age of gestation at the time of cervical length measurement (mean of 30 and 29.25 weeks age of gestation, respectively). (Table 1)

The number of study population who delivered and did not deliver prematurely at 32, 34 and 37 weeks age of gestation were compared. In both groups, most patients

Table 2

	Short Cervix (n=45 [35.71%])	Long Cervix (n=43 [34.13%])	p-value (95% CI)	Relative Risk (95% CI)
< 32 weeks	1 (2.22%)	0(0 %)	0.163	2.293
< 34 weeks	4(8.89%)	2 (4.65%)	0.215	1.911
< 37 weeks	11 (24.44%)	5 (11.63%)	0.060	2.102

Data are in n(%)

delivered term, however, there were more subjects who delivered before 37 weeks in the short cervix group (24.4% versus 11.63%). Similarly, there were also more patients in this group who delivered before 34 weeks and 32 weeks (8.89 versus 4.65%, and 2.2% versus 0%, respectively).In all patients who delivered prematurely in both groups, all were due to spontaneous preterm labor (100%) and were not induced. However, the p-value (at 95% confidence interval) were all > 0.05, and the relative risk for preterm delivery in the short cervix group at 32, 34, and 37 weeks age of gestation were 2.2, 1.9 and 2.1 respectively. (Table 2)

The sensitivity, specificity, positive predictive value and diagnostic accuracy of the cervical length measurement to predict preterm delivery in less than 32, 34, and 37 weeks age of gestation were also computed. The sensitivity was >66%, specificity was >49%, the positive predictive value was >2%, the negative predictive value was >88% and the accuracy was >50% in these cases. (Table 3)

Table 3

	Senstivity	Specificity	PPV	NPV	Accuracy
< 32 weeks	100%	49.43%	2.22	100%	50%
< 34 weeks	66.67%	50%	8.89%	95.35%	51.14%
< 37 weeks	68.75%	52.78%	24.44%	88.37%	55.68%

Data are in n(%)

DISCUSSION

From the total initial population of 126 patients screened for cervical length measurement, majority underwent vaginal spontaneous delivery (69.84%), however, there were patients whose delivery records cannot be retrieved in the hospital's data base (24.6%). This significant number of subjects can greatly affect the outcome of the study. However, it cannot be presumed that they delivered term and without complications at home or in other institutions. Also, from those who has undergone cesarean section (5.56%), age of gestation at delivery cannot be incorporated in their results because of the intervention done during delivery.

On the other hand, those who underwent spontaneous vaginal delivery, which was only the remaining 69% of the total sample population, most of the demographic data of both groups were comparable. The p-value of the mean and standard deviation of ages and age of gestation at the time of cervical length measurement were at p-value <0.05 (CI 95%). The number of single mothers were also the same at 55% in both groups, and the mean gravidity are both gravida 2. Hence both groups are similar in characteristics and may be compared.

In analyzing the outcome of the study for both groups, the p-value of preterm delivery at < 32, 34 and 37weeks age of gestation were all not statistically significant at p-value > 0.05 (CI 95%). The relative risk of preterm birth was also lower compared to transvaginal sonography (1.9-2.2 versus 6.9, respectively), which means that having a short cervical length < 25 mm using the insertion tube isonly 2 times at increased risk of preterm delivery.

However, both Cervilenz© and the insertion tube, showed to have high negative predictive value (97% versus 95.35%, respectively) such that those with cervical length > 25mm are less likely to deliver at < 34 weeks age of gestation. The negative predictive value increases as the age of gestation decreases (100, 95 and 88% NPV respectively at 32, 34, and 37 weeks AOG at delivery), which means that longer cervical length ≥ 25mm is less likely to deliver at an earlier age of gestation compared to with those with shorter cervical length.

CONCLUSION

In conclusion, the use of an improvised cervicometer such as the insertion tube of an intrauterine device to measure the cervical length of pregnant patients with uncomplicated pregnancies at 14 to < 37 weeks age of gestation is not predictive of preterm delivery before 32, 34 and 37 weeks age of gestation. However, its negative

predictive value is comparable to Cervilenz© especially in predicting earlier preterm delivery. In settings where trained sonologists for transvaginal ultrasound are not available or when the patient is financially incapable, an improvised cervicometer such that used in this study may be of value to predict that a longer cervical length (≥ 25mm) is less likely to delivery prematurely, hence treatment may not be given. But on the other hand, it does not detect if preterm birth will surely progress in patients with shortened cervices (< 25mm), hence these patients may be referred to other specialists for transvaginal cervical length monitoring and possible treatment.

LIMITATION

This research only included pregnant patients with uncomplicated pregnancies since these group are the ones less likely to be screened for preterm delivery. While there are patients who are at higher risk for preterm delivery such as those with previous preterm birth, multiple gestation, and with comorbid conditions, they were not included in this study to decrease the confounders and make the study population uniform. Similarly, the study population is limited to those patients consulting in the outpatient department of only 1 hospital in Southern Luzon and those seen for a period of 1 year.

RECOMMENDATIONS

This research is a pilot study intended to make use of improvised tools which are more cost-effective and readily available to help screen for the risk of preterm delivery in those without risk factors. In the United States, Cervilenz© is already proven to be effective in predicting preterm delivery, which uses the same technique as what was done in this study. However, the Cervilenz© flange adjustor is built-in and easier to control with its own calibration for exact measurement. Perhaps, the use of a better tool to eliminate errors in measurement will produce better outcome than this study. Moreover, it is recommended that transvaginal ultrasound and Cervilenz© measurements of cervical length be compared to that obtained from this tool in order to verify and adjust the cut-off values with this improvised tool. Also, more study population, earlier measurement of cervical length before midpregnancy, and more frequent cervical length monitoring is recommended in order to understand the association better and make the research more accurate. The use of regression analysis is also recommended to better correlatethe cervical length per age of gestation and time interval between measurement and delivery.

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