Centile charts of cervical length in singleton and twin pregnancies between 16 and 24 weeks of gestation

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Abstract

Objective: The aim of this study was to determine the standard mid-trimester cervical lengths of singleton and twin pregnancies.

Material and Methods: This study was conducted by retrospective analysis of mid-trimester transvaginal cervical measurements of women with singleton and twin pregnancies that were examined by a single perinatologist in a single center.

Results: A total of 4621 consecutive asymptomatic pregnant women admitting for advanced obstetric ultrasound screening were evaluated. Of these 4340 (93.9%) were second trimester singleton pregnancies and 281 (6.1%) were twin pregnancies and were included. Mean cervical length measurements of singleton and twin pregnancies were 6.5±38.2 mm and 7.2±37.6 mm respectively (p=0.17). Overall, the 5th percentile of cervical length measurement after analysing singleton and twin pregnancies together was 29.4 mm at 16 weeks, 30 mm at 17 weeks, 30 mm at 18 weeks, 30 mm at 19 weeks, 30 mm at 20 weeks, 30 mm at 21 weeks, 30 mm at 22 weeks, 30 mm at 23 weeks, 29 mm at 24 weeks.

Conclusion: In our population the 5th percentile value of cervical length which is 30 mm in singletons and 10th percentile cervical length which is 31 mm in twins can be used to follow-up and treat pregnant women at risk for preterm delivers. (J Turk Ger Gynecol Assoc 2023; 24: 114-9)

Keywords: Normogram, centile charts, cervical length, preterm birth

Introduction

In the last few decades, developments in obstetric care has led to a considerable decrease in both maternal and perinatal mortality and morbidity. Among these obstetric complications, preterm deliveries create an increased level of burden on the individual pregnant woman, on family and on even on society as a whole, by causing long-term consequences, such as growth retardation, mental retardation, chronic diseases and cognitive impairments (1-3). Nevertheless, preterm delivery constitutes between 7-11% of all deliveries and so remains one of the leading causes of neonatal morbidity and mortality in developed countries (4,5).

Short cervix is defined as a cervical measurement lesser than 25 mm before 24th week of pregnancy (2nd-3rd percentile) (6,7). A short cervix diagnosed before the 24th gestational week could predict preterm deliveries in later weeks of pregnancy. Risk of preterm delivery significantly increases in presence of a short cervix in women with a history of a previous preterm delivery (8-11). Therapeutic interventions, such as cervical...
cerclage placement, or medical measures, such as progesterone administration, initiated at early phases of pregnancy have been demonstrated to prevent preterm delivery in 30% to 40% of high risk patients (6,7,12). Globally, various values of cervical lengths have been proposed as a threshold level to initiate these therapeutic or prophylactic interventions throughout. Different clinical guidelines suggest cervical length shorter than 15 mm (0.5 percentile) or shorter than 20 mm (1st percentile) as threshold levels. Nonetheless, the American College of Gynecology recommends initiation of therapeutic or prophylactic interventions in case of a cervical length measurement shorter than 20 mm women without a history of preterm birth. Moreover, initiation of therapy was suggested for patients with a cervical length shorter than 25 mm in women with a previous history of preterm delivery before 34th week of pregnancy (13). These variations in optimal cut-off values of cervical lengths in predicting preterm delivery were primarily dependant on methodological discrepancies and different population of patients in the various studies. The level of evidence about models involving prediction of preterm delivery depending on cervical length in twin pregnancies is low. Therefore various modalities of management are applied among clinicians. Cervical length is routinely evaluated trans-abdominally in every pregnant women as part of detailed fetal anomaly screening sonography that is usually performed between the 18th-22nd gestational week. Inadequate imaging of cervix or a short cervical measurement in this examination warrants transvaginal cervical length measurement that would be repeated once for every two weeks between 16th and 24th weeks of pregnancy (14).

The aim of this study was to evaluate the cervical length of a high number of asymptomatic, consecutive, pregnant women between 16 and 24 weeks of gestation and produce a histogram and percentile charts of cervical length in this patient population.

Material and Methods

In this study, trans-vaginal cervical measurement of women, consecutively admitted to a single clinic, were retrospectively evaluated. A single perinatologist (EC) carried out all of the measurements between 2016 and 2021 using transvaginal ultrasound (Voluson E8 4Mhz probe, GE company). Cervical measurements were performed in the lithotomy position following the emptying of the maternal bladder by urinary catheterization to standardize all patients. The cervix was visualized in sagittal axis and endocervical length, appearing as a weak linear echodensity between the internal and external cervical ostia, was measured. All of the measurements were performed without applying excess pressure to cervix and a mean of three measurements obtained from a single patient was recorded as cervical length.

Independent risk factors such as age, body mass index, ethnicity, parity, conception via assisted reproduction, history of previous surgeries, chronic diseases, and secondary obstetrical complications were not taken into account. Mean ± standard deviation (SD), median (range) and percentile values of cervical lengths were reported, by gestational age in weeks. This study was following approval by Alanya Alaaddin Keykubat University Faculty of Medicine Clinical Research Ethics Committee (approval number: 2022/12, date: 25.05.2022). Informed consents were obtained from all participants.

Statistical analysis

Statistical analysis was performed using IBM SPSS, version 23.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics are expressed as mean ± SD for normally distributed data and as median (minimum-maximum) for non-normally distributed data. Categorical variables are expressed as numbers and percentages (%).

Results

Overall 4,647 patient records were evaluated. Twenty-one triplet pregnancies and five women with a history of cervical conization or loop electrosurgical excision procedure were excluded from the study. Thus, 4340 singleton pregnancies and 281 twin pregnancies that were eligible were included in the study. The demographic data of the study population is given in Table 1. Women with twin pregnancies were significantly younger, more frequently nulliparous and had in vitro fertilization treatment for the present pregnancy compared with the singleton pregnancy group.

Overall cervical length measurements of singleton pregnancies were 38.3±6.5 (0-67) mm and 37.6±7.3 (9-59) mm respectively (p=0.17). Comparison of cervical length measurement between singleton and twin pregnancies across 16-24 weeks are presented in Table 2. The percentiles of cervical length in singleton pregnancies is given in Table 3. The 5th percentile of cervical length was between 29-31 mm throughout the period 16-24 weeks of gestation. The percentiles of cervical length in twin pregnancies is given in Table 4. The 5th percentile of cervical length was 27-30 mm between 16-18 weeks and 21-26 mm between 18-24 weeks. Chart analysis and and histogram of

Table 1. The demographic data of the study population

<table>
<thead>
<tr>
<th>Variable</th>
<th>Singleton, (n=4340)</th>
<th>Twin, (n=281)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>28.2±4.7</td>
<td>27.5±5.1</td>
<td>0.01</td>
</tr>
<tr>
<td>Nulliparous</td>
<td>2690 (62%)</td>
<td>221 (78.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Multiparous</td>
<td>1650 (38%)</td>
<td>60 (21.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>In vitro fertilisation</td>
<td>303 (7%)</td>
<td>236 (84%)</td>
<td>&lt;0.001</td>
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cervical length in singleton and twin pregnancies are given in Figure 1. Overall cervical length percentiles, including singleton and twin pregnancies together, is given in Figure 2. The 5th percentile was 29.4 mm at 16 weeks, 30 mm at 17 weeks, 30 mm at 18 weeks, 30 mm at 19 weeks, 30 mm at 20 weeks, 30 mm at 21 weeks, 30 mm at 22 weeks, 31 mm at 23 weeks, 29 mm at 24 weeks. When all 4340 singleton pregnancies in the period 16-24 gestational weeks was considered, the 2.5th percentile was 28 mm, the 5th percentile was 30 mm and the 10th percentile was 31 mm. When 281 twin pregnancies during

<table>
<thead>
<tr>
<th>GA (week)</th>
<th>Singleton (n)</th>
<th>Mean (SD)</th>
<th>Median (range)</th>
<th>Twin (n)</th>
<th>Mean (SD)</th>
<th>Median (range)</th>
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<tbody>
<tr>
<td>16</td>
<td>78</td>
<td>38.2 (6.1)</td>
<td>37.0 (19-55)</td>
<td>10</td>
<td>40.9 (10.6)</td>
<td>38.0 (27-59)</td>
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<td>17</td>
<td>158</td>
<td>38.7 (6.8)</td>
<td>38.0 (23-59)</td>
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<td>38.9 (4.3)</td>
<td>37.0 (30-51)</td>
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<td>18</td>
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<td>37.8 (7.2)</td>
<td>37.0 (2.9-62)</td>
<td>34</td>
<td>38.02 (6.6)</td>
<td>35.5 (30-54)</td>
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<tr>
<td>19</td>
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<td>38.4 (7.2)</td>
<td>38.0 (3.3-65)</td>
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<td>20</td>
<td>907</td>
<td>38.3 (6.3)</td>
<td>38.0 (4.2-60)</td>
<td>62</td>
<td>36.6 (6.7)</td>
<td>35.5 (16.5-58)</td>
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<tr>
<td>21</td>
<td>914</td>
<td>38.1 (6.3)</td>
<td>38.0 (3-67)</td>
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<td>38.0 (9-60)</td>
<td>42</td>
<td>38.0 (6.7)</td>
<td>38.5 (23-55)</td>
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<td>38.0 (0-59)</td>
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<td>39.0 (23-51)</td>
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<td>37.9 (6.5)</td>
<td>37.0 (9-60)</td>
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<td>36.0 (24-50)</td>
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<tr>
<td>Total</td>
<td>4340</td>
<td>38.2 (6.5)</td>
<td>37.6 (0-67)</td>
<td>281</td>
<td>37.6 (7.2)</td>
<td>37.1 (9-59)</td>
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GA: Gestational age, n: number of observations. Lengths are given in mm. SD: Standard deviation

Table 3. Percentile values according to gestational week in singleton pregnant

<table>
<thead>
<tr>
<th>GA (weeks)</th>
<th>n</th>
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<th>10th</th>
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GA: Gestational age

Table 4. Percentile values according to gestational week in twin pregnant

<table>
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<tr>
<th>GA (weeks)</th>
<th>n</th>
<th>1st</th>
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GA: Gestational age
the same period were evaluated, the 2.5th percentile was 24 mm, the 5th percentile was 26 mm and the 10th percentile was 31 mm. Distribution of cervical lengths in singleton and twin pregnancies are shown in Figure 3. Incidence of short cervix increased as the gestation progressed.

**Discussion**

Contemporary predictive models for preterm delivery includes a comparison of each patient's cervical measurement with standard normograms. Reliability of these models partially depends on accurate determination of cervical length percentile and, as normal values for cervical length could be expected to vary in different populations, in this study we aimed to evaluate the normal ranges of cervical lengths in a Turkish population and establish a standard cervical length normogram for this specific population.

To avoid the limitations of a trans-abdominal approach in cervical length measurement, such as difficulty in cervical visualization and lengthening of cervix due to a filled bladder, in this study we preferred to assess records of patients that were evaluated solely by a trans-vaginal approach. Although cervical measurements could be performed from the 14th week of pregnancy, measurements made between 16th and 18th
gestational weeks at the time that the cervix separates from
the lower uterine segment are considered more consistent and
accurate (15). In normal conditions cervical length remains
stable between the 14th and 28th gestational weeks and thus
changes in cervical length in this period of pregnancy are
described with a bell-curve.

The published definitions of short cervix are somewhat obscure.
A wide variety of cervical lengths, from 10-35 mm, were studied
as empirical cut-off values for prediction of spontaneous
preterm birth in singleton pregnancies (16). The same cut-off
values were empirically used for twin pregnancies, while a
limited number of studies have reported the value of cervical
shortening as an important predictor of spontaneous preterm
delivery in mathematical models.

Normograms prepared by using specific populations may
demonstrate variations and might have a negative impact
on prediction of preterm delivery. For instance, in a study
conducted in North America, mean cervical length of women
in the 24th gestational week was estimated to be 34.0±7.8 mm
(17). In contrast, a similar study conducted in Iran demonstrated
that mean cervical length was 38.3±5.61 mm and another
conducted in Switzerland was found mean cervical length
in the 24th week to be 39.1± 5.6 (18,19). Considering the
discrepancies in these data, normograms prepared based on
North American data could be expected to have higher false
negativity in prediction of preterm delivery for a patient from
Switzerland or Iran. In the present study, the mean cervical
length for Turkish women in the 24th gestational week was
37.9±6.5 mm.

Singleton normograms enable comparison of 5th percentile
values between the different populations. The 5th percentile
for cervical length between 16-24 weeks of gestation was found
to be 27 mm in Chicago, 30 mm in an American Hispanic
population, 30.6 mm in a Thai population, 28 to 29 mm in South
Africa, 25 mm in Switzerland, 32-25 mm in Paris, 30 mm in Iran,
and between 30-33 mm in Brasil (9,20-25). In our large cohort,
The overall 5th percentile of cervical length was 30 mm between
16-24 weeks of gestation, including both singleton and twin
pregnancies. Small variations in different populations result
from the sample sizes and the weight of pregnant women
between 16-19 weeks or 20-24 weeks. The cervical length tend
to be a few millimeters shorter as the pregnancy approaches
the 24th week of gestation.

Data involving normal range of cervical length in twin
pregnancies is scarce, in comparison to that for singleton
pregnancies. A study conducted on 172 patients in Brazil found
median cervical length of women with twin gestation to be 39
mm (37-40) (26). In the present study, the estimated median
value of cervical length in twin pregnancies was 36 mm (24-50).
Normogram data for cervical length in twin gestations are also
rare. As preterm delivery rate of twins are higher, studies tend
to take the 10th percentile of cervical length as a cut-off for short
cervix (27). The 10th percentile of cervical length was reported
to be 30 mm in Canada and 25 mm in Poland (27,28). The 5th
percentile of cervical length was 21-25 mm at 18-22 weeks in
Brasil (29). In the present study in a Turkish population these
values were 26 mm and 31 mm for cervical length at the 5th and
10th percentile in one of the largest twin cohorts so far reported.
Cervical length is dynamic throughout the pregnancy. Studies
have shown that multiple variable can affect cervical length
dynamics and affect preterm delivery (30). Both 25 mm and
30 mm cut-off values may be used in our population to test
interventions for preventing preterm births in twin pregnancies.

Study Limitations
The limitation of this study is that not all patients were followed-
up until delivery, so the predictive value of the present data was
not calculated. However, in two prior studies from our center
an empirical 30 mm cervical length cut-off value was used to
prevent early preterm delivery <32 weeks of gestation (31,32). In
our population weekly follow-up of singleton pregnant women
by cervical length, and emergency cerclage when indicated,
presented 62.5% of preterm deliveries earlier than 32 weeks
(31). Vaginal progesterone treatment in singleton pregnant
women with cervical length less than 30 mm and emergency
ultrasound-indicated cerclage was used when indicated
postponed 98.7% of the deliveries beyond 34 weeks of gestation
(32). In this context, comparing an individual patients’ cervical
length with the population-appropriate normal values may
assist in increasing the accuracy of preterm delivery prediction.

Conclusion
The 5th percentile value of cervical length was 30 mm in
singleton, while the 10th percentile cervical length was 31 mm
in twin pregnancies in this Turkish population. These values
can be used to follow-up and treat pregnant women at risk for
preterm delivers.

Ethics Committee Approval: This study was following
approval by Alanya Alaaddin Keykubat University Faculty
of Medicine Clinical Research Ethics Committee (approval
number: 2022/12, date: 25.05.2022).

Informed Consent: Informed consents were obtained from all
participants.

Peer-review: Externally peer-reviewed.

Author Contributions: Surgical and Medical Practices: E.Ç.;
Concept: B.A., Y.C.; Design: B.A., Y.C., E.K.; Data Collection or


