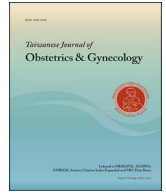




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Original Article

Comparison of transabdominal and transvaginal ultrasonography for the assessment of cervical length in the third trimester of pregnancy



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ABSTRACT

Objective: This study aimed to compare TA and transvaginal (TV) ultrasound assessment of cervical length (CL), as well as to assess the feasibility of the TA approach in the third trimester of pregnancy. **Materials and methods:** This was prospective study of low-risk women at 31–34 gestational weeks who underwent TA and TV CL measurements during a routine 3rd trimester scan. All examinations were performed by one operator who was blind to the measurements. Differences between the two methods were evaluated.

Results: 240 women were initially enrolled in the study. Paired TA and TV measurements were obtained in 123 (51.3%) women. The mean TV CL was 35.2 ± 6.8 mm and the mean TA CL was 34.7 ± 6.5 mm. There was a significant correlation between the CL measured by the two different methods ($r = 0.816$). No significant differences were identified between the mean CL measurements of the two techniques ($t = -1.360$; $p = 0.176$). Moreover, regarding the feasibility of TA technique, it was less likely to obtain TA CL images in cases with a cephalic fetal presentation ($p = 0.028$).

Conclusion: At 31–34 gestational weeks, with an empty bladder, the cervix can be visualized by the TA approach in only about half of the cases (51.3%). The TA CL measurements show a significant correlation with the TV ones. More research is needed to determine the potential predictive value of the TA ultrasound for preterm labor.

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Introduction

Prevention of preterm birth is still a challenge, while the incidence of spontaneous preterm labor continues to rise during the last decade [1]. Since prematurity remains a major cause of perinatal morbidity and mortality [2], the measurement of cervical length (CL) has proven to be the most accurate predictor of the risk for preterm delivery [3].

Sonography can identify cervical shortening and dilation at an earlier stage and more accurately than digital examination alone [4]. However, the appropriate screening method for cervical changes in low risk women remains debatable [5]. The CL can be assessed by the transvaginal (TV) [6–9], the transabdominal (TA) [10–13], the transperineal approach [14–16] or by digital examination [17].

Although the first descriptions of cervical scanning used the TA approach [18], TV ultrasound is now the reference standard for CL assessment [5]. Regarding the TA approach, it has been suggested that further research on screening and determination of an appropriate cut-off TA CL to classify a short CL is needed [13,19,20].

Very few studies have been conducted in the third trimester to evaluate the reliability of TA CL measurements [11,21,22]. Although not universally offered in most countries, this is the time when usually a growth scan is performed in our institution. The aim of this study was to evaluate the correlation between TA and TV ultrasonography in the assessment of CL at 31–34 weeks of gestation and to determine the feasibility of the TA sonography for CL.

Materials and methods

From June 2017 to March 2018, all pregnant women that attended the 3rd Academic Department of Obstetrics and Gynecology of the Aristotle University of Thessaloniki for a routine growth scan (at 31–34 gestational weeks according to local guidelines) were offered both a TA and a TV ultrasound for the

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assessment of the CL. Women with a placenta previa or a low-lying placenta, those with history of preterm birth and those treated with progesterone, cerclage or cervical pessary were excluded from the study. The ethics committee of the Aristotle University of Thessaloniki approved the study protocol; a comprehensive information leaflet was given, while an informed consent was also obtained from all individual participants of the study. Gestational age was estimated by the first-trimester ultrasound scan. Patients' characteristics and ultrasound findings were routinely recorded in a local database. All CL measurements were carried out by a sonographer (T.D.) who had received The Fetal Medicine Foundation Diploma. The sonographer was blinded to the exact measurements as the screen was partially covered.

The CL measurements were performed according to the protocol described by Kagan et al. [23]. Briefly, women were asked to empty their bladder and were placed in a supine position. For the TA ultrasonographic measurement, a 2–8 MHz curvilinear transducer was used (Voluson S6, GE Healthcare, Austria). The measurements of the CL were obtained in a midsagittal plane according to the cervical/vaginal interface, internal and external os and full length of the cervical canal [11]. For the TV ultrasonographic approach, a 4–9 MHz transducer was used. The patient, following voiding, was placed in a dorsal lithotomy position and a clean vaginal probe covered with a condom was inserted slowly into the anterior fornix of the vagina until the cervix was clearly visible in the sagittal plane, with an echogenic endocervical mucosa along the length of the cervical canal. The CL was measured from the internal to external os and the minimum probe pressure was applied, in order to avoid artificial lengthening of the cervix [23]. The shortest measurement that fulfilled the above-mentioned criteria was recorded.

Funneling, expressed as dilation of the cervix, was visualized as a V- or U-shaped protrusion of the amniotic sac to the internal os [24]. If funneling was observed, the caliper was placed at the apex of the funnel to ensure reliability of the measurement [23]. The fetal presentation (cephalic versus non-cephalic) was also documented for all the participants.

For all the participants, the sonographer (T.D.) carried out first the TA scan (and after the TV scan) and the measurements were covered on the screen; the sonographer was blinded to the measurements. Following each examination, cervical images with the calipers (CL measurements) were obtained for subsequent analysis by another investigator (I.T.).

Statistical analysis

A sample size calculation was performed, which indicated that a minimum of 98 patients would be required to detect a statistically significant difference of 1.5 mm between the TA and TV CL, in response at P-value ($p = 0.05$), with a power of 80%. The Pearson correlation was used to determine a significant association between the TA and the TV CL measurement. A paired samples t-test was used to compare the mean CL between the two methods. Pearson's Chi-square test was used to identify differences in feasibility for categorical variables, while the Independent-samples t-test was used to identify differences in feasibility for continuous variables. Descriptive statistics were displayed as mean \pm SD for quantitative variables. A P-value <0.05 was counted as statistically significant. Data were analyzed with the SPSS software version 24.0.

Results

From a total of 245 pregnant women that met the inclusion criteria (women with placenta previa or a low-lying placenta,

history of preterm birth and those treated with progesterone, cerclage or cervical pessary were initially excluded from the study) at 31–34 (median 32) gestational weeks, 240 (98%) consented for both the TA and TV scan and were enrolled in the study. A TV sonographic image was acquired in all 240 patients, while satisfactory post-void TA images were obtained in 123 (51.3%) of the women; it was not possible to obtain TA CL measurements in 117 women due to feasibility issues (Fig. 1). In the 123 patients with paired measurements, the mean maternal age was 29.5 (± 6.2) years, the mean body mass index (BMI) was 24.8 (± 5.3) kg/m², 48 (39.0%) were nulliparous and 105 (85.4%) had a fetal cephalic presentation.

The mean TV CL was 35.2 (± 6.8) mm and the mean TA CL was 34.7 (± 6.5) mm; the 5th centiles were 22.2 mm and 24.0 mm for TA and TV CL respectively. There was a significant correlation between the CL measured by the two different methods (Fig. 2). The Pearson's correlation coefficient was 0.816 ($p < 0.001$; R^2 : 0.665) and the correlation can be determined by the following equation: TA CL = $0.782 \times$ TV CL + 7.176. According to this equation, a TV CL of 25.0 mm corresponded to a TA CL of 26.7 mm. As for the results of paired samples t-test, no significant differences were identified between the mean CL measurements of the two methods ($t = -1.360$; $p = 0.176$) (Fig. 3).

Nine cases had a short cervix (≤ 25.0 mm) by the TV approach. This cutoff was defined arbitrary by the authors, based on the cutoff used by most researchers in the second trimester [25]. No significant differences were identified between the two methods at this group of patients (mean TV CL: 20.0 mm; mean TA CL: 22.7 mm; $p = 0.125$). Presence of funneling was detected in 6 patients (4.9%) and was adequately observed by both the TA and the TV approach. In addition, regarding TA feasibility, it was less likely to obtain TA CL images in cases with a cephalic fetal presentation (48.8% - $n = 105$ measurements obtained in cephalic versus 72% - $n = 18$ in non-cephalic presentation; $p = 0.028$), while maternal age ($p = 0.095$), body mass index (BMI $p = 0.498$) and parity ($p = 0.056$) were not associated with feasibility (Table 1).

Discussion

This study showed that, at 31–34 gestational weeks, the cervix can be visualized adequately by post-void TA scan in about half of the cases and that the measurements of the CL obtained by this approach are similar to those obtained by the TV method. In general, there were identified no significant differences in the mean CL measurements between the two methods. A strong correlation between TA and TV measurements was also identified.

These results are similar to those of previous studies [11,26,27]. Thus, Saul et al. [11], reported that the TA CL at 14–34 weeks, after voiding, was significantly correlated with the TV measurement. They suggested that the successful TA visualization of the cervix depended on individual sonographer training and experience and on equipment quality. Roh et al. [26] performed pre-void TA CL measurements at 20–29 gestational weeks and reported no significant differences between the two techniques. Additionally, Marren et al. [27] found that the TA approach with an empty bladder correlated well with the TV measurements.

On the other hand, several studies performed in the second trimester reported that with the TA approach, the cervix was significantly shorter than with the TV method [10,12,13]. Thus, To et al. [10] performed pre-void TA before TV CL assessment at 22–24 gestational weeks and reported that the TA CL was slightly shorter. Similarly, Stone et al. [12] performed TV and TA CL measurement at 18–20 weeks of gestation, both with an empty bladder. They also reported a shorter CL with the TA approach than with the TV. Collectively, the above-mentioned data suggest that TA and TV

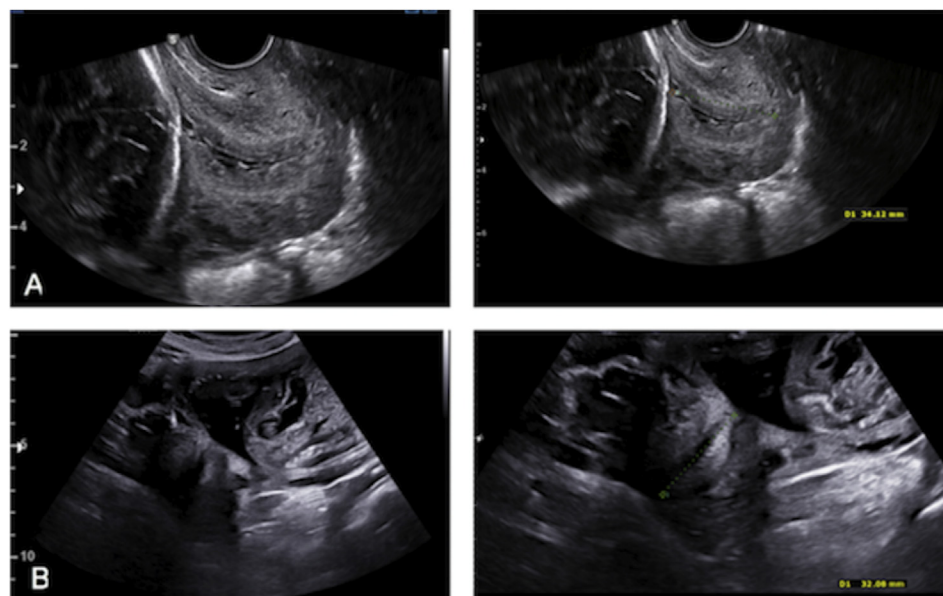


Fig. 1. Cervical length measurements. A. Transvaginal B. Transabdominal measurements.

measurements correlate in a gestational-age dependent model. In earlier gestations the CL may be underestimated by the TA approach, but this might get improved with higher gestational age. Hernandez-Andrade et al. [21] showed that the TA approach overestimated the CL in patients with short CL. In our study, nine women had a CL of 25 mm or less by the TV approach and no significant differences were identified between the two methods in this group of patients ($p > 0.05$).

Regarding the feasibility of the TA approach, maternal bladder filling status probably affects the CL measurements, while in our study cephalic fetal presentation had also a negative impact in obtaining successful CL images. A bladder that is not entirely empty may press and lengthen the cervix and thus lead to an overestimation of the TA CL measurement [8,28]. In our study, all the participants were examined with an empty bladder and we were able to measure the CL in 51.3% of the cases. These results are in accordance with the results of Andersen [8], where the feasibility of the TA approach was 46%, at 6 to 40 gestational weeks, when the

bladder was empty. Several studies stated that the TA CL measurement with an empty bladder was feasible in more than 80% of the cases at 17–24 gestational weeks [13,27,29]. On the contrary, Chaudhury et al. [30] reported low feasibility of the CL with the TA method when the bladder was empty (17%).

This study has certain limitations. First, the final size is relatively small, as the feasibility of the TA approach was quite low. Second, there is a risk for measurement bias; in order to support maximum objectivity, the CL values were kept secret from the sonographer. Third, the study is based on a single center experience, however with experienced operators. Furthermore, the results cannot be generalized in every trimester of pregnancy, as this study specifically addressed the cervical assessment at 31–34 weeks. In addition, the predictive value of CL in the third trimester is not yet established, so CL measurements are not routinely recommended. Finally, the lack of all pregnancy outcomes data is another limitation, however this was not relevant to the aim of this study.

There is no consensus on the best approach to cervical assessment and specifically as to whether all women should have a TV scan or whether this should be restricted to those with a short CL in the TA method [11–13]. Friedman et al. [13] reported that the TA

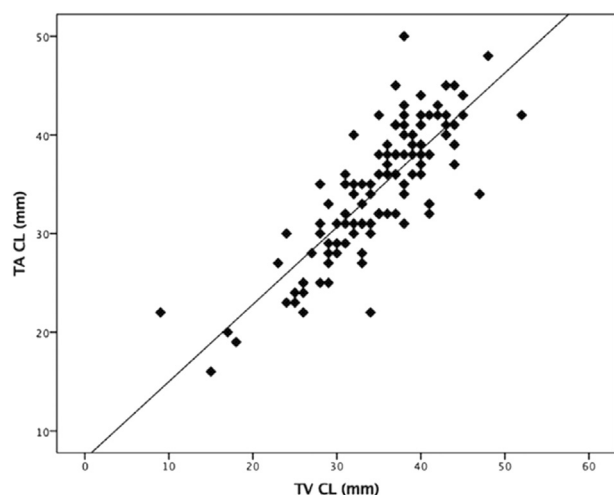


Fig. 2. Association between TA and TV CL measurements in the 123 patients with paired measurements. Equation: $TA\ CL = 0.782 \times TV\ CL + 7.176$.

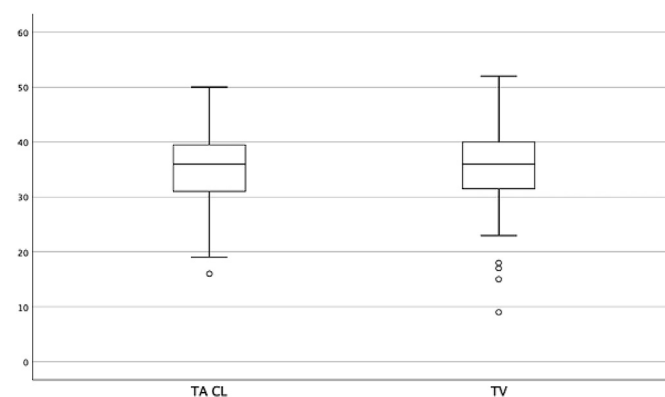


Fig. 3. Association of the mean TA and mean TV CL measurements in the 123 patients ($t = -1.360$; $p = 0.176$).

Table 1

Demographic and obstetric characteristics of the initial sample (240 women).

Parameter	Feasible TA measurements (n = 123)	Non feasible TA measurements (n = 117)	P value
Maternal age (years)	29.5 ± 6.2	31 ± 6.9	0.095
Body mass index (kg/m ²)	24.8 ± 5.3	24.2 ± 7.9	0.498
Nulliparity	39%	51.3%	0.056
Cephalic presentation	85.4%	94%	0.028

TA = transabdominal.

Bold signifies p < 0.05.

approach may reduce the burden of universal CL screening by allowing approximately 40% of women to avoid the TV method. On the other hand, there is some concern that TA CL measurement may overestimate the CL in the setting of a true short cervix [11]. In addition, a universal TV scan seems to be more cost-effective under some assumptions; thus, optimizing TA testing characteristics may yield an initial TA approach to be cost-effective [20].

In conclusion, this study showed that at 31–34 weeks of gestation, at the time of a routine growth scan, the CL may be measured effectively using the TA approach in about half of the women, if the bladder is empty. Further studies are necessary to be conducted in order to determine the role of TA CL screening in the third trimester as a predictor of spontaneous preterm delivery.

Conflicts of interest

None.

Acknowledgment

None.

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