On first trimester Down syndrome screening

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Can measurement of the nuchal translucency thickness be introduced in a routine ultrasound practice?

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We determined the extra scanning time needed to measure the nuchal translucency thickness during ultrasound examination for dating of pregnancy. All women visiting our department for antenatal care at the time of booking scan, and who consented to have the nuchal translucency thickness measured, were included. All these women received written information about nuchal translucency screening in advance. Ultrasonographers that were trained and acknowledged by the Fetal Medicine Foundation performed the ultrasound scans. The ultrasound scans (n=160) were performed transabdominally, unless visualisation was poor in which case vaginal ultrasonography was used (n=2). Pictures were taken to document the beginning, the end and all the intermediate steps (CRL, BPD and NT) of the examination. The time difference between the pictures was recorded. The average time needed for a first trimester ultrasound scan including measurement of the nuchal translucency thickness was almost 9 minutes. The extra time needed for nuchal translucency measurement on top of a first trimester ultrasound scan was almost 5 minutes. No significant correlation was found between the scanning time and gestational age or maternal weight, but a clear variation during the day was noticed. We conclude that performance of nuchal translucency screening fits well within the time schedule of a routine ultrasound practice, assuming that the women are counselled in advance.

Submitted for publication.
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Introduction

In 1990 the association between a subcutaneous nuchal fluid accumulation in the first trimester and trisomy 21 was first reported (Szabo and Gellen). In 1992, Nicolaides et al. introduced the term “nuchal translucency” to describe the nuchal fluid collection, as this was the ultrasonographic feature being observed. In the first prospective study in a high-risk population a Down syndrome detection rate of 85% was reported, for a 4.5% false positive rate (FPR), using a combination of nuchal translucency measurement and maternal age (Nicolaides et al., 1994).

In our Center the Down syndrome detection rate achieved by measurement of the nuchal translucency thickness and maternal age was 69% at a FPR of 4.6 per cent, and the success rate to measure the nuchal translucency was 95.7% (Pajkrt et al., 1998a).

A few studies report a lower detection rate (Shulman et al., 1995; Bewley et al., 1995; Brambati et al., 1995; Kornman et al., 1996) and the latter concludes that nuchal translucency cannot be used as a screening test for chromosomal abnormalities in the first trimester of pregnancy in a routine ultrasound practice. Kornman et al. reported a detection rate for Down syndrome of 29%, and a success rate in measuring the nuchal translucency of only 58%. The latter may partly be due to the fact that many women were scanned before 10 weeks of gestation, whereas the optimal gestational age to measure the nuchal translucency is 12 weeks (Pajkrt et al., 1998b), and that 3 minutes was considered the maximum extra time that a busy ultrasound practice could afford for NT measurement.

The aim of this study was to determine the time needed to measure systematically the nuchal translucency thickness and to investigate the effect of gestational age and maternal weight on it.

Methods

All women visiting our antenatal clinic or prenatal diagnostic centre get information about first trimester ultrasound scan and nuchal translucency measurement as screening for Down syndrome. Prior to their first hospital visit an information leaflet is send to their home address. Consecutive women at a gestational age of 11 to 14 completed weeks, who gave written informed consent to have the nuchal translucency thickness measured, were included in this study (n=160).

In all cases a trans-abdominal ultrasound examination was performed with a curvilinear 3.5 MHz transducer (ATL 800 or Toshiba SSA 250A, Tokyo, Japan). When visualisation was poor a trans-vaginal 9.5 MHz transducer was used. The
Routine NT measurement

ultrasonographers performing the scans are trained and acknowledged by the Fetal Medicine Foundation.

The maximum thickness of the nuchal translucency was visualised in a sagittal plane of the fetus, which filled at least three-quarters of the ultrasound-screen. The callipers were placed on the white lines representing the fetal skin and the tissues overlying the occiput and the spine. Care was taken to distinguish between amnion and fetal skin.

Pictures were printed at the beginning of the ultrasound examination, after every biometric measurement (Crown-Rump-Length (CRL), Bi-Parietal Distance (BPD) and nuchal translucency thickness (NT)), and at the end of the examination. On each picture the actual time was displayed. In this way the total length of the examination, and the extra time necessary for NT measurement could be calculated. We investigated whether variables such as gestational age (according to CRL), maternal weight or time of the day could influence the time needed to perform a good nuchal translucency measurement. The measurement of the nuchal translucency thickness was scored retrospectively by using a scoring method developed by Herman et al. (1998).

Results

One hundred and sixty ultrasound examinations were included in the study. Four ultrasonographers participated in this study. The ultrasonographers were instructed to take sufficient scanning time for an optimal ultrasound examination and a good nuchal translucency measurement.

The average time needed for an ultrasound examination including a good NT measurement was 8 minutes and 47 second (range 1.31- 40.52 minutes, 5th to 95th percentile: 3.28 minutes-22.2 minutes). The extra time necessary to measure the nuchal translucency thickness on top of a dating scan could be precisely calculated from the time displayed on the prints. CRL and BPD were usually measured first (140 cases), apart from 20 cases in which NT measurement preceded the biometrical assessment. The extra time needed for a good NT measurement was 4.43 minutes (range 0.1- 31.51 minutes, 5th to 95th percentile: 0.55 minutes-15 minutes).

In 62 cases the NT was measured only once. A high score (6 or more) was achieved in 93% of the first attempts. In 98 cases the NT was measured repeatedly, the first measurement scored 6 or more in 70% of the cases. But the score improved at repeat measurement in 65% of the cases. The main problems encountered in obtaining an optimal view for NT measurement were an inappropriate fetal position or fetal immobility.
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The relationship between gestational age (according to CRL) and the time necessary for an ultrasound examination is reported in figure 1. No significant correlation was found between gestational age and scanning time.

![Figure 1](image)

Figure 1. Scanning time in relation to gestational age. Open bars represent the NT measurement time, and the solid bars represent the total scanning time.

Similarly no correlation could be found between maternal weight and scanning time, given that only a few women in this study weighted more than 100 kg.

In almost all cases the NT could be measured satisfactorily using a transabdominal probe. In 2 cases (0.8%), a transvaginal approach had to be used because of poor vision. To switch from a transabdominal to a transvaginal approach took on average 20 minutes. Also the time needed for the fetus to assume a suitable position for an optimal NT measurement took longer (9.30 minutes) with this approach than when using a transabdominal probe.

The effect of hour of the day on the duration of the scanning session are shown in figure 2. In our clinic ultrasound examinations are scheduled from 8.00 to 17.00 hour, every 15 minutes. Between 12.00 and 14.00 hour less examinations are scheduled because of the lunch break.

In table 1 a time schedule is given. If scanning time is limited to 15 minutes, in 140 cases (87.5%) fetal biometry and NT assessment would be obtained. This means that 20 appointments should have been rebooked. Without measuring the NT, in almost all cases (157) fetal biometry was obtained within 15 minutes. For this study every 20 minutes a new patient was booked, which can explain that after 20 minutes for only 5 patients a new appointment had to be made.
Routine NT measurement

Figure 2. Scanning time in relation to hour of the day. Open bars represent the NT measurement time, and the solid bars represent the total scanning time.

Table 1. Time-scheme.

<table>
<thead>
<tr>
<th>Scanning time (min.)</th>
<th>US with NT No. (%)</th>
<th>No. rebooked</th>
<th>US without NT No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>42 (26)</td>
<td>118</td>
<td>118 (74)</td>
</tr>
<tr>
<td>10</td>
<td>116 (73)</td>
<td>44</td>
<td>154 (96)</td>
</tr>
<tr>
<td>15</td>
<td>140 (88)</td>
<td>20</td>
<td>157 (98)</td>
</tr>
<tr>
<td>20</td>
<td>159 (97)</td>
<td>11</td>
<td>160 (100)</td>
</tr>
<tr>
<td>&gt;20</td>
<td>160 (100)</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

This study demonstrates that a first trimester ultrasound scan including measurement of the NT thickness takes almost 9 minutes. The extra time needed for NT measurement was almost 5 minutes. Routine nuchal translucency measurement can fit within the time schedule of a busy routine ultrasound practice.

Our study-population consisted of previously informed women. An information leaflet was send to the patient’s home a (few) week(s) before the ultrasound examination, with information on first trimester ultrasound examination and the nuchal translucency screening. Women can choose for an ultrasound examination with or without measurement of the nuchal translucency thickness. In the information leaflet it is clearly
emphasised that measuring the NT is optional and will not be carried out without informed consent of the patient. It can be argued that explaining the principles of NT measurement, and its implications, may be quite time consuming, taking on its own already most of the time available for the ultrasound examination. From a recent discussion in the British Medical Journal (Venn-Treloar, 1998) we understand that in some practices in the UK the NT is measured routinely, without informing the patient of this screening test. In our opinion patients need to be informed about nuchal translucency screening and about the implications beforehand and not only if the NT thickness is enlarged.

In this study the majority of patients were at a gestational age between 12 and 13 weeks, and the success rate in measuring the NT was 100%. In another study (Kornman et al., 1996) a much lower success rate is reported. Possible explanations are the gestational age at which the measurements were done, many women came before 10 weeks’ gestation, and a fixed time limit to measure the NT set at 3 minutes. In our study the success rate in measuring the NT within this time limit would also be as low as 49% for an optimal measurement, and 73% for any measurement.

Informing the patients in advance enables scheduling of appointments for ultrasound examination between 11 and 13 weeks of gestation, which is the optimal time to measure the NT. In a previous study (Pajkrt et al., 1998b), in which the longitudinal course of the nuchal translucency thickness was studied, we reported that after 76 days of gestation a visible NT was found in 97% of the fetuses, and after 84 days’ gestation in 100%.

In our study we did not find an optimal gestational age at which to measure the nuchal translucency for time sparing. Ergün et al. (1998) reported the mean duration to obtain the best view of the fetus for NT measurement and gross fetal anatomy to be 8.32, 6.51, 3.12, 7.24, and 10.31 minutes at 10, 11, 12, 13, and 14 weeks’ gestation, respectively. The authors did not specify what was meant with studying gross fetal anatomy. This could explain why this enormous variation with gestation could not be reproduced in our study.

The variation we found regarding the time of the day and the average scanning time may be explained by a low maternal blood glucose level which may influence fetal movements. When measuring the NT thickness, a fetal movement away from the amnion is awaited. An immobile fetus can extend the scanning time significantly. No information about the maternal blood glucose levels during ultrasound examination was available to support or exclude this hypothesis. Another possible explanation is a circadian rhythm in fetal rest-activity status. However, data on first trimester fetuses are, to our knowledge, not available.
In conclusion, this study investigates the extra time needed for a good measurement of the nuchal translucency thickness. To imply this ultrasound screening method into a busy routine ultrasound practice, women should be informed in advance. If an ultrasound examination is scheduled every 15 minutes, the nuchal translucency measurement fits well within the schedule.

References


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