On first trimester Down syndrome screening

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The influence of fetal position on nuchal translucency thickness

Irene M. de Graaf, Anouk A. van Zuylen-Vië, Otto P. Bleker and Caterina M. Bilardo

We determined if nuchal translucency thickness is influenced by the fetal position at ultrasound examination. A transabdominal ultrasound examination for dating of the pregnancy and measurement of the nuchal translucency thickness was performed at 10 to 14 weeks' gestation in all women attending the antenatal clinic of our hospital. Special attention was paid to when during the scan the fetus changed from a prone to a supine position or vice versa. Every time the fetus turned from a prone to a supine position or vice versa, the measurement of the nuchal translucency thickness was repeated for each position. Every measurement was scored on picture. An image-scoring method was used and evaluated by three independent reviewers. A total of 62 fetuses were included in this study. The mean thickness of the nuchal translucency for fetuses lying on the back was 1.77 mm as compared to 1.76 mm for fetuses lying on the abdomen. The mean quality-score was 7.02 for fetuses lying on the back and 7.05 for fetuses lying on the abdomen. These results were not statistically significant. We conclude that fetal position has no influence on the measurement of the nuchal translucency thickness.

Submitted for publication.
Chapter 6

Introduction

High-resolution ultrasound scanning has enabled the identification of a thin translucent area comprised between the skin outline and the soft tissues overlying the occiput and the upper posterior part of the spine. This finding has been named nuchal translucency according to its ultrasound appearance (Nicolaides et al., 1992) and can be imaged routinely in normal fetuses in the late first and early second trimester of pregnancy (Hertzberg et al., 1989). Several studies have reported a significant association between an enlarged nuchal translucency and fetal aneuploidies, mainly trisomies (Nicolaides et al., 1994; Savoldelli et al., 1993; Pajkrt et al., 1998). Since its introduction in 1992 (Nicolaides et al., 1992) measurement of the nuchal translucency has been shown to be effective in screening for trisomy 21 and other chromosomal anomalies with detection rates varying from 29% to 84% (Nicolaides et al., 1994; Kornman et al., 1996). This variation in study results can be accounted for by various factors. Besides differences in study design (Pajkrt et al., 1998; Mol et al., 1996), methodological and technical differences in the way the measurement is performed can also cause discrepancies.

The Fetal Medicine Foundation promotes the concept of first trimester ultrasound screening and has developed technical guidelines for the nuchal translucency measurement (Snijders et al., 1996). A mid-saggital section should be obtained, with the image of the fetus filling at least ¾ of the screen. Care should be taken to distinguish between fetal skin and amnion. The head of the fetus should not be extended nor flexed. The maximum thickness of the nuchal translucency is measured by placing the callipers on the white lines representing the skin and the tissues overlying the occiput and spine. These guidelines do not refer to the position of the fetus for an optimal measurement, suggesting that fetal position does not influence the measurement. To our knowledge the effect on the measurement of the nuchal translucency thickness of a fetus lying in prone or supine position has not yet been examined.

The need for an accurate measurement is obvious, since minor variations can have enormous clinical consequences. Therefore proper training in the technique of this ultrasound measurement is necessary, but also a continuous audit is required to meet the agreed standards. We used, and evaluated, the image-scoring method developed by Herman et al. (1998) to judge the quality of our nuchal translucency measurements.

The aim of the present study was to evaluate if nuchal translucency thickness is influenced by fetal position in utero at ultrasound examination.
Fetal position and NT measurement

Patients and Methods

Our study population consisted of 62 women at 10-14 completed weeks of gestation attending the antenatal clinic of the Academic Medical Centre in Amsterdam. The nuchal translucency thickness was measured at the time of the first routine ultrasound scan for dating. Transabdominal ultrasound examination was performed with a curvilinear 3.5 or 5-MHz probe. The maximum thickness of the nuchal translucency was measured in a sagittal section of the fetus. The image of the fetus was enlarged so that it filled at least ¾ of the screen. To distinguish the fetal skin from the amnion, a fetal movement away from the amnion was awaited. The calipers were positioned on the white lines proximal to the sonolucent area and the measurements were expressed in decimals of millimetres. Experienced ultrasonographers, all trained and acknowledged by the Fetal Medicine Foundation, performed the ultrasound examinations.

This study includes nuchal translucency measurements (NT) of fetuses that turned from a prone to a supine position or vice versa during the ultrasound examination (figure 1). 

![Figure 1. Fetus in supine position (A) and the same fetus in prone position (B).](image)

The measurement was repeated and documented on print for each position. Each image was reviewed and scored according to the image-scoring method described by Herman et al. (1998). That scoring method includes the following criteria: fetal section, continuity of the fetal skin line, caliper placement (the 3 major criteria) and image size, head position and visibility of the amnion (the 3 minor criteria). For a major criterion a score of 0 or 2 can be given, for a minor criterion a score of 0 or 1. An added up score of 8 or 9 was considered an “excellent” NT measurement, implying maximal scores in almost all criteria. A “reasonable” NT measurement is one with a score of 4 to 7, requiring at least two major, or one major and two minor criteria. The “intermediate” group comprised of measurements with a score of 2 or 3, which required at least one
major or two minor criteria. Cases with a score of 0 or 1 were classified as unacceptable. In our study all measurements scoring less than 5 points according to at least two reviewers were excluded, since an NT measurement with a score of 4 or less points could not be classified as “intermediate” or even “reasonable”, but in our opinion is unacceptable. Three independent reviewers assessed the inter-reviewer agreement for this scoring method.

Results

In 62 cases the fetus turned during ultrasound examination from a prone to a supine position (figure 1). In all cases the 2 pictures were evaluated for the quality of the measurements. Five fetuses with an enlarged nuchal translucency were included; three turned out to be affected by Down syndrome.

The mean nuchal translucency measurement for fetuses lying on the back (supine position) was 1.77 mm (95% Confidence interval (CI): 1.56-1.96 mm) as compared to 1.76 mm (95% CI: 1.57-1.97 mm) for fetuses lying in prone position. This difference is not statistically significant.

![Figure 2. Difference between NT measurement in prone and supine position plotted against the average.](image)

The mean difference in the measurements was 0.01 mm, with a standard deviation of 0.39. In figure 2 the difference between the NT measurements in prone and supine position are plotted against the average.
Table 1: Inter-reviewer agreement.

Reviewer I (column) versus Reviewer II (row); Weighted kappa: 0.34

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Reviewer III (column) versus Reviewer I (row); Weighted kappa: 0.39

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Reviewer III (column) versus Reviewer II (row); Weighted kappa: 0.50

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In 29 cases (48%) the nuchal translucency measurement was smaller when the fetus was lying on the back, in 26 cases the measurement was smaller when the fetus was lying on the abdomen, and in 6 cases the measurement was exactly the same. When using the image scoring method of Herman et al. (1998), the mean quality-score was 7.02 in fetuses lying on the back and 7.05 in fetuses lying on the abdomen. In table 1 the inter-reviewer agreement (weighed kappa), within the framework of the different quality groups, is shown. In our study the reviewers categorised many cases identical. We can say that there is a fair to moderate agreement between the reviewers. Simultaneously, our own scoring method was used. This scoring method is based on the criteria as defined by the Fetal Medicine Foundation: fetal section, calliper placement, image size and head position. Our scoring method gave much disagreement (low weighted kappa values), and it was noticed that unsatisfactory images could give a reasonable final score by gathering points.
Discussion

This study demonstrates that the nuchal translucency thickness is not influenced by fetal position, as well as the quality of the measurement is not influenced by it. The need for an accurate nuchal translucency measurement is obvious. Minor variations in the measurement can have enormous clinical consequences on the rate of invasive testing for fetal karyotyping. Therefor proper training in the technique of this ultrasound measurement is necessary (Braitwaite et al., 1996), but also continuous audit after implementing it as a screenings program is required to meet the agreed standards.

The role of fetal position as a possible source of variance in repeat nuchal translucency measurement has been previously suggested (Pajkrt et al., 1998). It may be speculated that the influence of gravitation on the shape and thickness of the nuchal fluid collection at supine or prone fetal position may affect the measurement. In this study no significant difference between both positions was demonstrable, implying that gravitation may not influence the nuchal translucency thickness of the fetus in utero. Assuming that nuchal translucency represents a free fluid collection, than gravity may well play a role in utero. One would than expect the nuchal translucency to be greater in supine position due to drooping of the fluid. Consequently, the measurement should have a tendency to be smaller when the fetus is lying in prone position. This was not observed during this study.

The exact morphological background and the aetiology of the nuchal translucency remain unclear. Some authors suggest that nuchal translucency is an accumulation of fluid which may be associated with a transient over-perfusion of the developing fetal brain (Moscoso, 1995). Alternatively, nuchal fluid accumulation may be the consequence of hemodynamic readjustments during cardiovascular development. In a recent article by Hyett et al. (1999), 56% of fetuses with major defects of the heart and great arteries showed at 10 to 14 weeks' gestation an enlarged nuchal translucency thickness. More research is needed to clarify these etiological uncertainties. In fact a better understanding of this ultrasound feature enables a higher accuracy in this screening method and consequently increases its usefulness in clinical practice.

In summary, the described study focused on the influence of fetal position on the nuchal translucency thickness. No significant difference was found in the nuchal translucency thickness of a fetus lying in prone or supine position.
References


Chapter 6
