Technical Aspects of Nuchal Translucency Measurements

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First Trimester

Genetic Screening

- Biochemical screen
- Ultrasound markers
  - Nuchal translucency
  - Nasal bone
First Trimester

Biochemical Screening

• Pregnancy Associated Plasma Protein A - PAPP A
• Human Chorionic Gonadotropin – HCG
First Trimester

**PAPP A**

- Decreased in DS fetuses
- Median value 0.38 MoM
- DS detection rate: 42% (False +, 5%)

First Trimester

\( fB \ HCG \)

- Increased in DS fetuses
- Median value 1.83 MoM
- DS detection rate: 23\% (False +, 5\%)

First Trimester
Combining Serum Screening

- Age, PAPP A, fB HCG
- Independent markers
- DS detection rate: 62% (False +, 5%)

Definition

NT describes an anechoic area in the Posterior nuchal region of the fetus and is typically observed in the 1\textsuperscript{st} trimester.

NT screening provides a couple with an individual specific risk for having a child with DS, Tri 13 & tri 18.
FASTER Trial

• 33,557 pregnancies, 10 3/7 – 13 6/7 wks
• NT + 1st Trimester biochemistry
• Second trimester quad screen
• Septated cystic hygroma excluded
• Results reported at 16-18 weeks

FASTER Trial, SMFM 2004
<table>
<thead>
<tr>
<th></th>
<th>FPR (%) for Detection Rate of</th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80 %</td>
<td>85 %</td>
<td>90 %</td>
<td></td>
</tr>
<tr>
<td>NT Alone</td>
<td>14</td>
<td>17</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>NT + 1st Biochemical</td>
<td>3.4</td>
<td>7.6</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Triple screen</td>
<td>8.0</td>
<td>12</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Quad screen</td>
<td>5.0</td>
<td>10</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Serum integrated</td>
<td>3.4</td>
<td>6.8</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Fully integrated</td>
<td>1.4</td>
<td>2.8</td>
<td>5.4</td>
<td></td>
</tr>
</tbody>
</table>

FASTER Trial, SMFM 2004
## Median MOMs For DS Fetuses

<table>
<thead>
<tr>
<th></th>
<th>10 wks</th>
<th>11 wks</th>
<th>12 wks</th>
<th>13 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT</td>
<td>2.82</td>
<td>2.20</td>
<td>1.75</td>
<td>1.39</td>
</tr>
<tr>
<td>PAPP A</td>
<td>-</td>
<td>0.30</td>
<td>0.49</td>
<td>0.78</td>
</tr>
<tr>
<td>fB HCG</td>
<td>-</td>
<td>1.66</td>
<td>2.03</td>
<td>2.49</td>
</tr>
</tbody>
</table>

DS fetuses look more normal ~ 13 weeks

FASTER Trial - 2004
FASTER Trial

• NT performed best at 11 weeks
Road To Credentialing

Take NT course
Pass exam
Submit 10 NT images
Pass image review
Image Submission

- Submit 10 images
- From 10 individual fetuses
- Follow criteria on web

WWW.NTQR.ORG
NT Training

Why Bother?
Effect of Training

3991 high risk pregnancies
(No Training)

NT Successfully Obtained in 83 % (61 – 100 %)

DS Detection Rate 31 % (0 – 100 %)

NEJM 338:955;1998
Background risk T21: 1:63

Adjusted risk of T21: 1:123
Background risk T21: 1:63

Adjusted risk of T21: 1:28
Adjusted risk T21: 1:3700

Adjusted risk of T21: 1:100
Measurement Criteria

Margins of NT edges clear
Fetus in mid-sagittal plane
Fetus occupies majority of image
Fetal head in neutral position
Fetus observed away from amnion
(+), calipers used
Horizontal crossbars placed correctly
Calipers placed \(\perp\) to long axis of fetus
Measurement at widest NT space
Measurement Criteria

Criteria # 1

Margins of NT edges clear
Margins of NT edges clear

Criteria # 1

• Clear image
• Angle of insonation to NT space
• Clear NT lines
Margins of NT edges clear

Clear Image
Margins not clear
Measurement Criteria

Criteria # 2

Fetus in mid-sagittal plane
Fetus in mid-sagittal plane

Criteria # 2

• Mid-sagittal view of fetal spine seen in cervical & thoracic region
• Tip of nose seen in fetal profile
• Third & fourth ventricle seen in fetal CNS
Fetus in mid-sagittal plane

- Spine
- Brain
- Nose
- AS
Fetus in mid-sagittal plane
Fetus in mid-sagittal plane

Criteria # 2

Should not see

• Ribs
• Stomach
• Heart
Stomach
Heart
Ribs
Measurement Criteria

Criteria # 3

Fetus occupies majority of image
Criteria # 3

• Image predominantly filled by fetal head, neck and upper thorax
• The fetus should occupy > 50% of image
• A second fetus of the same magnitude should not fit in the surrounding space
Fetus occupies majority of image
Fetus occupies majority of image

**Scanning Tips:**

- Decrease depth
- Narrow sector width
- Use fetal echo settings if needed
- Turn off harmonics
- Use magnification box
- Magnify then freeze
Measurement Criteria

Criteria # 4

Fetal head in neutral position
Fetal head in neutral position

Criteria # 4

Neutral position:

Fetus without hyperflexion or hyperextension of head
Fetal head in neutral position

Criteria # 4

Hyperflexed head position:
Fetal head flexed with no free space (amniotic fluid) seen between lower chin and anterior neck
Fetal head in neutral position

Criteria # 4

Hyperextended head position:
Fetal head extended with an angle between lower chin and anterior neck of greater than 90 degrees
Fetal head in neutral position

Criteria # 4

• Flexed head will underestimate NT
• Extended head will overestimate NT
Neutral Head Position
Angle < 90°

Neutral Head Position
free space still seen

Neutral Head Position
No free space

Hyperflexed Head Position
Measurement Criteria

Criteria # 5

Fetus observed away from amnion
Fetus observed away from amnion

Criteria # 5

The amnion is seen separate from NT line
Criteria # 5

- Frequent source of error
- May overestimate NT
- Patience - allow for fetal movements
- Ensure proper MHz on transducer
- More difficult with spine – up fetuses
Fetus observed away from amnion
Fetus observed away from amnion
Caliper Placement

Criteria 6, 7, 8, 9
(+)

Calipers used for NT measurement

Criteria # 6

Use the (+) calipers
Horizontal crossbars placed correctly

Criteria # 7

Calipers placed on the inner borders of the nuchal membranes with none of the horizontal crossbars protruding into the NT space
Caliper Placement
Calipers placed to long axis of fetus

Criteria # 8

A vertical line connecting the 2 calipers should be perpendicular to the long axis of the fetus
Caliper Placement
Measurement at widest NT space

Criteria # 9

Measure at widest NT space
Caliper Placement

Measure widest area
Measurement Criteria

Caliper Placement

Use the + caliper
Place at inner border of NT
Placement to long axis of fetus
Measure the widest area
Avoid membrane shadows
Caliper Placement / Shadows

Avoid shadows
Measurement Tips

- Decrease depth
- Narrow sector width
- Use fetal echo settings if needed
- Turn off harmonics
- Use magnification box / zoom
- Orient perpendicular to NT
- Be patient, await fetal movements
- Magnify then freeze
- Measure carefully using + caliper
Measurement Criteria

Crown – Rump Length

Required Measurement
Crown – Rump Length
Crown – Rump Length

Measure the longest straight line
Use the average from 3 good measurements
Accuracy for EGA is 3 - 5 days
Uniform variability at 8% between 2 mm & 12 cm
Measurement Tips

In practice, measure NT 3 times and report the largest of the 3 acceptable measurements.
What about 3D Sonography?
What about 3D Sonography?

Good correlation with 2D measurements
Correlates best when volume obtained from sagittal plane
Be aware of effects of lateral resolution

Ultrasound Obstet Gynecol 2001;18:481
Ultrasound Obstet Gynecol 2001;18:475
Ultrasound Obstet Gynecol 2000;15:122
Commonly Asked Questions

Should the U/S approach be abdominal or endovaginal?
Should there be time limits on NT measurement in clinical practice?
Can screening involves NT alone?
Is there a critical NT cut-off?
Critical NT Cut-Off

As a marker for congenital abnormalities
(Cardiac defects)

NT > 3.4 mm
Pass Criteria

Each submitted image scores a minimum of 6/9
AND
Batch of images has a cumulative score of > 79 %
AND
None of the 9 criteria missed by all images
Fail Criteria

Any submitted image scores less than 6/9
OR
The batch of images has cumulative score of < 80 %
OR
One or more of the 9 criteria missed by all images
Internal Quality Review

All batches scoring 75 – 85 % get a second review

The second review determines the final score

Random review of 5 % of all batches
Resubmission of Images

- 3 images if final score between 70 – 79 %
- 5 images if final score between 60 – 69 %
- 10 images if final score less than 60 %
Nasal Bone
Tip of Nose
Skin at Nasal Bridge
Nasal Bone
Imaging Criteria

1) Clear fetal margins
2) Fetus occupies majority of image
3) Fetal face in mid-sagittal plane
4) Angle of insonation ~ 45 degrees with fetal profile
5) Brightness of NB equal or greater than overlying skin
Clear Fetal Margins

• Clear US image
• Fetal facial profile well defined
Criterion # 2

Fetus occupies majority of image

- Image predominantly filled by fetal head, neck and upper thorax
- The fetus should occupy > 50% of image
- A second fetus of the same magnitude should not fit in the surrounding space
Criterion # 3

Fetal face in mid-sagittal plane

- Tip of nose seen in fetal profile
- Third & fourth ventricle seen in fetal CNS
Criterion # 4

Angle of insonation 45 ° with fetal profile
Criterion # 5

Brightness of NB = or > than skin
Image Submission

• 5 Images from 5 individual fetuses
Pass Criteria

Pass NT credentialing
AND
Each submitted image scores a minimum of 4/5
AND
None of the 5 criteria missed by all images
Fail Criteria

Any submitted image scores a minimum of 4/5
AND
One or more of the 5 criteria missed by all images
Resubmission of Images

- 3 images if final score between 70 – 79 %
- 3 images if fail for one image or 1 criteria
- 5 images if final score less than 70 %
Quality Monitoring

- Performed locally, by the supervising, skilled and NB credentialed physician.
- Recommend 40 examinations per operator before clinical use
- Double reading could be considered as one option, when NB results will alter clinical management.
- Ongoing review of images by supervising physician
For More Info;

www.NTQR.org