Borderline findings in obstetrical sonography

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No Disclosures

No financial, commercial, arrangements or affiliations
Sonographic features that may lead to either normal or abnormal outcome
Borderline Findings

- Thick NT with normal karyotype
- 2nd Tri GS “Markers” with neg cf-DNA
- Mild Ventriculomegaly
- Umbilical Vein Varix
- Hepatic Calcifications
- Chorionic Bump
Borderline Findings

- What is a reasonable work-up?
- What is the chance of the child being “normal”?
- What do we tell the patient?
Abnormal NT

Normal

Aneuploidy

Structural Defects/CHD

Syndromes
Live Birth without ABNL - Euploid fetuses

- 3.5-4.4: 86%
- 4.5-5.4: 77%
- 5.5-6.4: 67%
- ≥ 6.5: 31%
- Total: 77%

Souka et al. UOG 2001
Nuchal Translucency Neurodevelopmental Danish Registry 2008-2012

222,505 children: Mean 4.4 yrs

- Intellectual Dis.
- Autism (ASD)
- CP, Epilepsy
- Febrile seizures

<table>
<thead>
<tr>
<th>NT</th>
<th>N (%)</th>
<th>Abn (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 95%</td>
<td>97.6</td>
<td>4.68</td>
</tr>
<tr>
<td>95-99%</td>
<td>2.1</td>
<td>4.66</td>
</tr>
<tr>
<td>&gt; 99%</td>
<td>0.3</td>
<td>4.83</td>
</tr>
</tbody>
</table>

Excluded aneuploidy/syndromes
Structural Anomalies not excluded

Hellmuth et al. UOG 2017
No excess risk of NDD among euploid children with NT 95-99% c/w NT < 95%

No excess risk CP, Epilepsy, FS

Hellmuth et al. UOG 2017
<table>
<thead>
<tr>
<th>Abnl</th>
<th>(%)</th>
<th>OR</th>
<th># F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>.31</td>
<td>6.2</td>
<td>2/642</td>
</tr>
<tr>
<td>ASD</td>
<td>0.78</td>
<td>2.5</td>
<td>5/642</td>
</tr>
</tbody>
</table>

Low risk ID (.05% in NT < 95%)
Longer f/u ASD
No prenatal SA

Hellmuth et al. UOG 2017
Abnormal NT

- **First Tri AS**
  - ✔️ 50% anomalies

- **Diagnostic Test**
  - ✔️ Microarray

- **2nd Tri AS**
  - ✔️ 14-16 wk
  - ✔️ 18-22 wk
  - ✔️ Fetal Echo
Neurodevelopmental outcome of EUPLOID fetuses with increased NT

If NT 95-99% and normal detailed 2nd tri anatomic scan - the risk of adverse neonatal outcome/developmental delay is not increased.

If NT > 99% possible small inc. risk of ID or ASD but absolute risk low (< 1%)

Senat et al. AJOG 2007
Miloft et al. UOG 2012
Sotiriades et al. UOG 2012
Hellmuth et al. UOG 2017
Minor Markers: negative cf-DNA

- CPC
- EIF
- Short F
- UTD
- SUA

Isolated : After Detailed Scan

+LR 1-2 for T21/T18
Isolated Short Femur: <5%, -2SD

- Racial variation
- Technique in measurement

13% nl FL f/u scan

39-61% - Normal outcome

Isolated Short Femur: <5%, -2SD

- Genetic syndromes [not likely]
  - 45 X (10%)
  - FH-UFS
  - Focal Fem Hypoplasia
  - Russell-Silver [asymmetry]

- Skeletal dysplasia [not likely]
  - Achondroplasia/Hypo - nl FL < 22 wks
## Achondroplasia - 20 weeks

<table>
<thead>
<tr>
<th>2D Measurements</th>
<th>AUA</th>
<th>Value</th>
<th>m1</th>
<th>m2</th>
<th>m3</th>
<th>Meth.</th>
<th>GP</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPD (Hadlock)</td>
<td>✓</td>
<td>4.95 cm</td>
<td>4.94</td>
<td>4.99</td>
<td>4.93</td>
<td>avg.</td>
<td>66.4%</td>
<td>21w0d</td>
</tr>
<tr>
<td>FL (Hadlock)</td>
<td>✓</td>
<td>3.28 cm</td>
<td>3.21</td>
<td>3.35</td>
<td></td>
<td>avg.</td>
<td>30.2%</td>
<td>20w2d</td>
</tr>
<tr>
<td>HL (Jeanty)</td>
<td>✓</td>
<td>3.10 cm</td>
<td>3.11</td>
<td>3.09</td>
<td></td>
<td>avg.</td>
<td>38.4%</td>
<td>20w2d</td>
</tr>
<tr>
<td>2D Measurements</td>
<td>AUA</td>
<td>Value</td>
<td>m1</td>
<td>m2</td>
<td>m3</td>
<td>Meth.</td>
<td>GP</td>
<td>Age</td>
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</tr>
<tr>
<td>BPD (Hadlock)</td>
<td>✓</td>
<td>9.90 cm</td>
<td>9.95</td>
<td>9.80</td>
<td>9.96</td>
<td>avg.</td>
<td>96.3%</td>
<td>40w4d</td>
</tr>
<tr>
<td>FL (Hadlock)</td>
<td></td>
<td>6.04 cm</td>
<td>6.02</td>
<td>6.33</td>
<td>5.77</td>
<td>avg.</td>
<td>&lt;2.3%</td>
<td>31w3d</td>
</tr>
<tr>
<td>HL (Jeanty)</td>
<td></td>
<td>5.51 cm</td>
<td>5.49</td>
<td>5.61</td>
<td>5.43</td>
<td>avg.</td>
<td>&lt;5.0%</td>
<td>32w0d</td>
</tr>
</tbody>
</table>
Isolated Short Femur <5%, -2SD

- Early Onset IUGR
  - 40% IUGR
  - 90% abnl utAD
  - 36% PET
  - 33% IUFD
- SGA (OR 4.3)
- PTD (OR 4.2)
- Pre-Eclampsia

Urinary Tract Dilation

1-5% fetuses

Nguyen et al. JPU 2014
12% postnatal uropathy

UTD-A1

Prenatal Period:
- One additional US
  - ≥ 32 weeks
  - ≥ 7 mm

After Birth:
- Two additional US:
  1. > 48 hrs to 1 month
  2. 1-6 months later

Lee et al. Peds 2006
Nguyen et al. J Ped Urol 2014
Hyperechoic Bowel: .2-1.8% 2nd tri US

- Bright as Bone (Iliac)
- Transducer Frequency
  - 5 MHz or lower
  - No Harmonics

80% resolve and have normal outcome

Bromley et al. OG 1994
Scotet et al. AJOG 2010
Ronin et al. EJOGRB 2017
• Bleeding
• iLR T21 ~ 1.6-6
• CF ~ 3-8%
• Infx ~ 3-6%
• IUGR ~ 4-20%
• IUFD* ~ 3-6%
• GI abnormalities
Hyperechoic Bowel (HEB)

Retrospective 2003-2013 (N=409)
223 (54.5%) *Isolated at dx*

7/223 (3%) 

- Bowel Atresia (1)
- CF (2)
- CMV (1)
- Sex CA (3)

Ronin et al. EJOGRB 2017
HEB: Cystic Fibrosis
HEB: Obstruction
### HEB: IUGR and IUFD

**Retrospective Cohort Study 1990-2008**

166* cases iHEB and 43,677 w/o HEB

<table>
<thead>
<tr>
<th>Finding</th>
<th>HEB (%)</th>
<th>-HEB (%)</th>
<th>RR</th>
<th>aOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>IUGR</td>
<td>18.0</td>
<td>12.8</td>
<td>1.4</td>
<td>1.9</td>
</tr>
<tr>
<td>IUFD</td>
<td>4.2</td>
<td>0.8</td>
<td>5.3</td>
<td>6.2</td>
</tr>
<tr>
<td>IUFD + IUGR</td>
<td>3.0</td>
<td>0.2</td>
<td>17.3</td>
<td></td>
</tr>
<tr>
<td>IUFD-IUGR</td>
<td>1.2</td>
<td>0.2</td>
<td>6.4</td>
<td></td>
</tr>
</tbody>
</table>

Goetzinger et al. OG 2011
HEB: Prenatal Eval. (neg cf-DNA)

- Detailed survey
  - GB
- Infection
  - CMV, ? Parvo/Tox
- Third Trimester Growth
- Resolution -nl outcome

Duguépéroux et al. PD 2012
Ronin et al. EJOG RB 2017
HEB: Normal Newborn at Discharge

Retrospective study: Oxford Register

103 HB

83 f/u at 1-4 yrs.

GP questionnaire

No serious GI issues

Patel et al. PD 2004
Mild Venticulomegaly

- Axial Scan
- Atrial diameter at the choroid
- Stable aLV
- VM ≥ 10 mm
- Off-axis 10% FP

Reference:
Cardoza et al. Rad 1988
Heiserman et al. JUM 1991
Mild Ventriculomegaly: 10-12 mm (15)
MVM - Detailed imaging

30-40% additional findings

Gaglioti et al. UOG 2005
Pagani et al. UOG 2014
Isolated MVM - Aneuploidy

Trisomy 21 most common

- 2.8-5% overall
- LR 3.8 T21
- CMA-nl karyo*
  - ✓ 6.1% isolated
  - ✓ 7.5% Mild

Devaseelan et al. JPM 2010
Agathokleous et al. UOG 2012
Pagani et al. UOG 2014
* Li et al. 2017
Isolated MVM - Natural History

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>34%</td>
</tr>
<tr>
<td>Stable</td>
<td>56%</td>
</tr>
<tr>
<td>Progression</td>
<td>16%</td>
</tr>
</tbody>
</table>

*Exclusion of cases with incomplete outcome (termination/lost f/u)

13% new findings F/u scan

Melchiorre et al. UOG 2009
- Adds in 5-14* % cases
  - Corpus Callosum
    - C/P ACC
    - Hypogenesis
- Cerebral gyrations (late gestation)
- Dx Accuracy
  - US 94.4%
  - MRI 99.2%

Melchiorre et al. UOG 2009
Griffiths et al. UOG 2017
Mild Ventriculomegaly

- Detailed AS
  - CC and Heart
- Diagnostic Testing
  - Karyotype/CMA
- Infectious evaluation
  - 1-5% (CMV/Parvo)
- MRI
- Follow up imaging

Gaglioti PD 2009
Li et al. 2017
**Isolated MVM: Outcome 10-15 mm**

Systematic Review and Meta-analysis

20 studies  
699 fetuses

<table>
<thead>
<tr>
<th></th>
<th>(%)</th>
<th>UOG (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND Delay</td>
<td>7.9</td>
<td>11-12</td>
</tr>
<tr>
<td>P. Finding</td>
<td>7.4</td>
<td>13</td>
</tr>
</tbody>
</table>

Pagani et al. UOG 2014  
Melchiorre et al. UOG 2009  
Devaseelan et al JPM 2010
Fetal Intra-abdominal Umbilical Vein Varix

2:1000 pregnancies

Fusiform dilatation of intra abd. umb. vein

Lee et al. OGS 2014
UVV: > 9mm or > 50% non-dilated portion

Beroud et al. DII 2015
Fetal Umbilical Vein Varix

Case Series and Case Reports

- 10-35% other anomalies
- 4-6% Karyotypic abnl
  - T21, 18, 9, Triploidy
  - Anomalies
- Usually 30+ wks GA Dx
  - 18-41 wks
  - Acquired (nl AS)

Lee et al. OBGynSci 2014
Beroud et al. 2015
Fetal Umbilical Vein Varix

Case Series and Case Reports

- 9-13 mm at 1\textsuperscript{st} Dx
- Most relatively stable size
- Resolution ? False Pos Dx
- 28-50\% Turbulent Flow
- Size/Turbulence not predictive of outcome

Thrombosis, IUFD, SGA

Brookfield et al. JUM 2013
Beroud et al. 2015
### Fetal Umbilical Vein Varix

#### Systematic Review and Meta-analysis - 5 studies (254 fetuses)

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anomalies</td>
<td>19.2</td>
<td>10.9-29.1</td>
</tr>
<tr>
<td>Abnl. K</td>
<td>4.6</td>
<td>0.4-12.9</td>
</tr>
<tr>
<td>IUFD</td>
<td>1.3</td>
<td>0.3-3.1</td>
</tr>
</tbody>
</table>

*Isolated - No karyotypic abnl or IUFD*

DiPasquo et al. UOG 2018 (accepted)
Umbilical Vein Varix

- Detailed anatomic survey
- Possible Fetal Echo
- Karyotype if not isolated and GA appropriate

Mankuta et al. JUM 2011
Isolated FIUVV: ?? Management

- Antepartum monitoring ≥ 32 weeks
  - US: thrombosis, hepatomegaly
  - Adverse outcome despite intensive surveillance
- Delivery at ≥ 37+ wks for uncomplicated

No standard protocol for antepartum monitoring / GA at delivery

Mankuta et al. JUM 2011
Brookfield et al. JUM 2013
Bas-Lando et al AGO 2013
di Pasquo et al. UOG 2018
Fetal Intrahepatic Calcifications

1:1000 - 1:1750 preg - overall

~1/3 isolated
Isolated Hepatic Ca++

- ~95% normal outcome
- Infection
  - ✓ (CMV/ Parvo)
- Aneuploidy

Stein et al. Rad 1995,
Simchen et al. AJOG 2002
Isolated Hepatic Ca++

- Detailed AS
  - Color r/o mass
  - Meconium P
- Correlate with aneup. screening
- Infection
  - (CMV/ Parvo)

Stein et al. Rad 1995, Simchen et al. AJOG 2002
6 weeks - Dating Scan + FH
The chorionic bump is an focal area of convexity in the choriodecidual area that protrudes into the gestational sac.

- Decidualized endometrium with Necrosis/Hemorrhage/hematoma.
- Increased risk of Sab (2-4x)
- Increased risk of aneuploidy in HR pts.

Sana et al. UOG 2013; Baalmann et al. JUM 2017; Wax et al. JCU 2016, Baalman et al JUM 2017
Chorionic Bump: Systematic Review

- Live birth rate 62% (74 of 119)
- 51 pts had embryo with heartbeat- LBR was 83% (42/51)
- No relationship between bleeding, bump volume and live birth

Arleo et al. JUM 2015
Chorionic Bump
Nuchal Cord: 360°

- Single: 20.6%
- Double: 2.5%
- Triple: 0.5%
- Quad: 0.1%

Shui and Eastman 1957; Sherer et al. UOG 1999
Nuchal Cord : Newborn Outcome

Association of CP with conditions which interrupt oxygen supply

Pop. Based CC study

Birth Records

46 children spastic CP

378 Controls

Nelson and Grether AJOG 1998
46 spastic CP

8/46 Tight NC

378 Controls

15/378 Tight NC

OR 18

95% CI 6-48

RECORDING BIAS

20,000 pregnancies to find one tight NC that would potentially have CP

Nelson et al. AJOG 1998, 1999
Greenwood et al EHD 2002
Sherer et al UOG 1999
84 patients
77/336 exams (23%)

% with NC

24-26 30-32 36-38 Delivery

24% on next exam

97% single loop

Clapp JF AJOG 2003
Nuchal Cord

NS: BPP, NST, Decels, Doppler UC

ND: mec, Apgars, UA pH, lactate

↑ abnl FHR pattern

Clapp JF AJOG 2003
Nuchal cord assessment prior to induction

289 patients  18% NC @ delivery

<table>
<thead>
<tr>
<th>Sens.</th>
<th>Spec.</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>37%</td>
<td>80%</td>
<td>29%</td>
<td>85%</td>
</tr>
</tbody>
</table>

NS: C/S, instrumental delivery, FHR, Apgar¹, or pH < 7.1, NICU

Peregrine et al. UOG 2005
Nuchal cord: Perinatal Outcome

166,318 Deliveries

24,392 NC
14.7%

11,748 p VD

4636 NC
39%

NC not associated with adverse perinatal outcome

Sheiner et al. Arch. OG 2005
Shaffer et al. OG 2005
Nuchal Cord

Absent EDF:
Pilu UOG 1998

Abnl notching:
Abuhamad OG 1995
Nuchal Cord at term

- Multiple loops
- Skin indentation
- EFW, BPP and Umb. Art Doppler

Report to OB

Unavoidable

No standard management
Nuchal Cord at term

- Multiple loops
- Skin indentation
- EFW, BPP and Umb. Art Doppler
- Report to OB

Gurau et al. JUM 2016
Thank You