Časná růstová retardace plodu – kdy porodit?

Karel Maršál
IUGR

- Neurocognitive impairment
- Metabolic and endocrine changes
- Cardiovascular remodelling

Risk of IUD
Early-onset IUGR

Easy to diagnose

Difficult to manage

Late-onset IUGR

Difficult to diagnose

Easy to manage

≈ 32 weeks
Very preterm birth

Hypoxia

Fetal death
Definition of IUGR

*SGA fetus with abnormal umbilical artery blood flow velocity*

The majority of IUGR cases is due to placental pathology
Timing of delivery in IUGR according Doppler
(questionnaire among 15 experts)

<table>
<thead>
<tr>
<th>FGR</th>
<th>Mean GA</th>
<th>SD</th>
<th>Median GA</th>
<th>Range</th>
<th>Recommended way of delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFW &lt;10th centile, normal Doppler</td>
<td>39.3</td>
<td>1</td>
<td>40</td>
<td>37–41</td>
<td>induction 100%</td>
</tr>
<tr>
<td>EFW &lt;3rd centile, normal Doppler</td>
<td>37.8</td>
<td>0.9</td>
<td>38</td>
<td>36–41</td>
<td>induction 100%</td>
</tr>
<tr>
<td>Abnormal UtA Doppler</td>
<td>38.2</td>
<td>1.21</td>
<td>38</td>
<td>37–40</td>
<td>induction 100%</td>
</tr>
<tr>
<td>Abnormal MCA PI</td>
<td>36.9</td>
<td>1.66</td>
<td>37</td>
<td>34–40</td>
<td>induction 100%</td>
</tr>
<tr>
<td>Abnormal CPR</td>
<td>37.4</td>
<td>1.26</td>
<td>37</td>
<td>35–40</td>
<td>induction 100%</td>
</tr>
<tr>
<td>UA PI &gt;95th centile</td>
<td>36.36</td>
<td>1.72</td>
<td>37</td>
<td>32–40</td>
<td>induction 100%</td>
</tr>
<tr>
<td>UA AEDV</td>
<td>34.64</td>
<td>1.82</td>
<td>34</td>
<td>32–37</td>
<td>induction 50%, elective CS 50%</td>
</tr>
<tr>
<td>UA REDV</td>
<td>30.55</td>
<td>3.17</td>
<td>30</td>
<td>25–37</td>
<td>elective CS 100%</td>
</tr>
<tr>
<td>UA REDV, DV PI &gt;95th centile</td>
<td>29.82</td>
<td>3.49</td>
<td>28</td>
<td>26–38</td>
<td>elective CS 100%</td>
</tr>
<tr>
<td>UA REDV, DV REDV</td>
<td>28.91</td>
<td>3.45</td>
<td>28</td>
<td>25–37</td>
<td>elective CS 100%</td>
</tr>
<tr>
<td>UA REDV, BPP &lt;6</td>
<td>26.27</td>
<td>1.6</td>
<td>26</td>
<td>25–34</td>
<td>elective CS 100%</td>
</tr>
<tr>
<td>UA REDV, abnormal CTG</td>
<td>29.09</td>
<td>3.4</td>
<td>28</td>
<td>25–38</td>
<td>elective CS 100%</td>
</tr>
</tbody>
</table>

CS = Cesarean Section.
RCT, 69 hospitals, 13 countries – 548 pregnancies
randomize when uncertain about the timing of delivery
”immediate delivery” vs. ”delay until no uncertainty”
gest. age at entry (wks) 32 (30-33) vs. 32 (29-34)
time-to-delivery 0.9 days vs. 4.9 days
mortality 10 % vs. 9 %
OR 1.1 (95%CI 0.6-1.8)
death/severe disability at 2 y 19 % vs. 16 %
OR 1.1 (95%CI 0.7-1.8)
Infant wellbeing at 2 years of age in the Growth Restriction Intervention Trial (GRIT): multicentred randomised controlled trial

The GRIT study group*

Criticism

- no defined entry criteria
- no management protocol
- unknown number of eligible pregnancies

- no conclusive and generalizable results!
Predictors of Neonatal Outcome in Early-Onset Placental Dysfunction

Ahmet A. Baschat, MD, Erich Cosmi, MD, Catarina M. Bilardo, MD, Hans Wolf, MD, Christoph Berg, MD, Serena Rigano, MD, Ute Germer, MD, Dolores Moyano, MD, Sifa Turan, MD, John Hartung, MD, Amarnath Bhide, MD, Thomas Müller, MD, Sarah Bower, MD, Kypros H. Nicolaides, MD, Baskaran Thilaganathan, MD, Ulrich Gembruch, MD, Enrico Ferrazzi, MD, Kurt Hecher, MD, Henry L. Galan, MD, and Chris R. Harman, MD


- multicenter observational study
- 604 liveborn newborns with prenatally diagnosed IUGR
- < 33 gestational weeks (median 29 wks)

- major morbidity 36 %
- IVH 15 %
- NEC 12 %

- mortality 21 %

- intact survival 58 %
Predictors of Neonatal Outcome in Early-Onset Placental Dysfunction

OBSTETRICS & GYNECOLOGY VOL. 109, NO. 2, PART 1, FEBRUARY 2007

Neonatal survival (black diamonds) and intact survival rates (black bars) per gestational week with advancing gestational week.

**Conclusion**

Gestational age and the birth weight are the primary quantifying parameters. Beyond these thresholds, ductus venosus Doppler parameters emerge as the primary cardiovascular factor in predicting neonatal outcome.
Baschat A et al.
Infant neurodevelopment following fetal growth restriction: relationship with antepartum surveillance parameters.
*Ultrasound Obstet Gynecol* 2009; 33: 44–50

**Conclusion**
UA-REDV is an independent contributor to poor neurodevelopment. Gestational age and birth weight remain the predominant factors for poor neurodevelopment in IUGR.

**Criticism**
Patients were delivered for maternal indications or an abnormal biophysical profile

- 20 % acidemia
- 26 % perinatal mortality
- 39 % major neonatal morbidity
Follow-up studies of growth restricted fetuses

Consequences for the obstetric management based on Doppler velocimetry?

More active obstetric management!
IUGR fetus

Good prognosis

Bad prognosis
BLOOD FLOW CLASSES (BFC)

BFC normal

BFC I

BFC II

BFC III A

BFC III B
IUGR fetus < 30 gest. weeks

- delivery at the occurrence of reverse diastolic flow in the umb. artery or if rapid progress in the ductus venosus Doppler

- before the occurrence of FHR pathology!
Early intervention in management of very preterm growth-restricted fetuses: 2-year outcome of infants delivered on fetal indication before 30 gestational weeks

I. BRODSZKI*, E. MORSING†, P. MALCUS*, A. THURING*, D. LEY† and K. MARŠÁL*

Ultrasound Obstet Gynecol 2009; 34: 288–296

- single center observational study
- 46 IUGR fetuses with umb. artery ARED flow
- delivered < 30 gestational weeks

- IUD 9 %
- survival 2 years 90 %

Conclusions  Very preterm growth-restricted fetuses with umbilical artery ARED delivered on fetal indication, in most cases before the occurrence of severe changes in the ductus venosus velocity waveforms and/or fetal heart rate tracings, showed high 2-year survival and low morbidity.
Birthweight (g)

Gestational age (days)

24 wks  26 wks  30 wks

mean-2SD of the standard

(n=106)
### Perinatal outcome

<table>
<thead>
<tr>
<th>N (%)</th>
<th>ARED n=106</th>
<th>Controls n=830</th>
<th>p=0.04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perinatal mortality</td>
<td>7 (6.6 %)</td>
<td>114 (13.7 %)</td>
<td></td>
</tr>
<tr>
<td>Stillbirths</td>
<td>4 (3.8 %)</td>
<td>57 (6.85 %)</td>
<td></td>
</tr>
<tr>
<td>Deaths &lt;7 days</td>
<td>3 (2.8 %)</td>
<td>57 (6.85 %)</td>
<td></td>
</tr>
<tr>
<td>Liveborn</td>
<td>102</td>
<td>773</td>
<td></td>
</tr>
</tbody>
</table>
Very preterm IUGR

**Pregnancy outcome**

<table>
<thead>
<tr>
<th>Liveborn (n=102)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenat. steroids</td>
<td>94</td>
<td>[92 %]</td>
</tr>
<tr>
<td>Cesarean section</td>
<td>102</td>
<td>[100 %]</td>
</tr>
<tr>
<td>Gestational age at birth (wks+days)</td>
<td>26+5</td>
<td>(23+3 – 29+6)</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>610</td>
<td>(340 - 1165)</td>
</tr>
<tr>
<td>Singletons/Twins</td>
<td>78 / 24</td>
<td>[76% / 24%]</td>
</tr>
</tbody>
</table>
## Outcome at 2 years of age

<table>
<thead>
<tr>
<th></th>
<th>IUGR n=102</th>
<th>Control n=773</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>86 %</td>
<td>85 %</td>
<td>( ns )</td>
</tr>
<tr>
<td>Cerebral palsy</td>
<td>9 %</td>
<td>8 %</td>
<td>( ns )</td>
</tr>
</tbody>
</table>
Follow-up at 6 years of age

Neurodevelopment, lung and cardiovascular function, brain MRI (38 preterm IUGR, 38 preterm & 38 term matched controls)

- No increase in CP but more frequent need for habilitation service
- Reduced cognitive function in boys
- Reduced lung function
- Reduced brain volumes – not associated with functional deficits
Nevertheless!

Compared to preterm controls the observed outcomes in preterm IUGR were not sufficiently severe to refrain from delivery.
### Very preterm IUGR fetuses with abnormal flow in the umbilical artery

<table>
<thead>
<tr>
<th>Reference</th>
<th>Liveborn n</th>
<th>Gestational age - inclusion</th>
<th>Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schwarze et al. UOG 2005</td>
<td>53</td>
<td>&lt;32 wks</td>
<td>89 %</td>
</tr>
<tr>
<td>Hartung et al. UOG 2005</td>
<td>11</td>
<td>&lt;29 wks</td>
<td>64 %</td>
</tr>
<tr>
<td>Baschat et al. UOG 2007</td>
<td>326</td>
<td>&lt;30 wks</td>
<td>69 %</td>
</tr>
<tr>
<td>Mari et al. JUM 2007</td>
<td>34</td>
<td>≤32 wks</td>
<td>71 %</td>
</tr>
<tr>
<td>Brodszki et al. UOG 2009</td>
<td>42</td>
<td>24 - 29 wks</td>
<td>90 %</td>
</tr>
<tr>
<td>Lund 1998-2011</td>
<td>102</td>
<td>23 – 29 wks</td>
<td>86 %</td>
</tr>
<tr>
<td>Lees et al. (TRUFFLE) UOG 2013</td>
<td>503</td>
<td>26 - 32 wks</td>
<td>92 %</td>
</tr>
</tbody>
</table>
The European multicentric randomized trial

TRIAL
RANDOMIZING
UMBILICAL and
FETAL
LOW in
EUROPE

Lees et al. 2013
Perinatal morbidity and mortality in early-onset fetal growth restriction: cohort outcomes of the trial of randomized umbilical and fetal flow in Europe (TRUFFLE)


- RCT, 20 hospitals, 5 countries in 2005-2010
- 503 pregnancies
- entry criteria
  - singleton
  - 26 – 32 weeks
  - abd. circumference <10th centile
  - EFW >500 g
  - umb. artery PI<95th centile and normal DV PI
  - normal FHR short-term variability (STV)
Randomized management study in IUGR

**TRUFFLE study**

**Computerized CTG**

**Early ductus changes**

**Late ductus changes**

*All groups as safety net* - computerized CTG (STV)
- umbilical artery Doppler (after 30+0 wks)

Lees et al. 2013
### Short term morbidity & mortality

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>503</td>
</tr>
<tr>
<td>Fetal death</td>
<td>5 (1%)</td>
</tr>
<tr>
<td>No intervention*</td>
<td></td>
</tr>
<tr>
<td>Unexpected#</td>
<td>7 (1%)</td>
</tr>
<tr>
<td>Live birth</td>
<td>491 (97%)</td>
</tr>
<tr>
<td>Neonatal death</td>
<td>27 (6%)</td>
</tr>
<tr>
<td>Death due to congenital abnormality</td>
<td>2</td>
</tr>
<tr>
<td>Overall mortality</td>
<td>39 (8%)</td>
</tr>
<tr>
<td>Neonatal data missing</td>
<td>1 (0%)</td>
</tr>
<tr>
<td>Survival at discharge</td>
<td>463 (92%)</td>
</tr>
</tbody>
</table>

Lees et al. 2013
2 year neurodevelopmental and intermediate perinatal outcomes in infants with very preterm fetal growth restriction (TRUFFLE): a randomised trial

Christoph C Lees, Neil Marlow, Aleid van Wassenaer-Leemhuis, Birgit Arabin, Caterina M Bilardo, Christoph Brezinka, Sandra Calvert, Jan B Derks, Anke Diemert, Johannes J Duvekot, Enrico Ferrazzi, Tiziana Frusca, Wessel Ganzvoort, Kurt Hecher, Pasquale Martinelli, Eva Ostermayer, Aris T Papageorgiou, Dietmar Schlembach, KTM Schneider, Baskaran Thilaganathan, Tullia Todros, Adriana Valcamonico, Gerard HA Visser, Hans Wolf, for the TRUFFLE study group

Lancet 2015; 385: 2162-72

• analysis acc. to randomization
  • STV n=166
  • early DV n=167
  • late DV n=170

• primary outcome – survival without cerebral palsy or neurosensory impairment or a Bayley III developmental score <85, at 2 years of age
## Neonatal morbidity

<table>
<thead>
<tr>
<th>Neonatal morbidity</th>
<th>CTG STV</th>
<th>DV PI 95th</th>
<th>DV no A</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received mechanical ventilation</td>
<td>72 (44%)</td>
<td>63 (39%)</td>
<td>69 (42%)</td>
<td>204 (42%)</td>
</tr>
<tr>
<td>Received supplemental oxygen</td>
<td>98 (60%)</td>
<td>96 (59%)</td>
<td>103 (63%)</td>
<td>297 (61%)</td>
</tr>
<tr>
<td>BPD &gt;28 days</td>
<td>32 (20%)</td>
<td>28 (17%)</td>
<td>31 (19%)</td>
<td>91 (19%)</td>
</tr>
<tr>
<td>BPD &gt;36 weeks †</td>
<td>16 (10%)</td>
<td>17 (10%)</td>
<td>16 (10%)</td>
<td>49 (10%)</td>
</tr>
<tr>
<td>Sepsis (Proven) †</td>
<td>33 (20%)</td>
<td>31 (19%)</td>
<td>23 (14%)</td>
<td>87 (18%)</td>
</tr>
<tr>
<td>NEC Pneumatosis †</td>
<td>3 (2%)</td>
<td>3 (2%)</td>
<td>1 (1%)</td>
<td>7 (1%)</td>
</tr>
<tr>
<td>Perforation †</td>
<td>2 (1%)</td>
<td>2 (1%)</td>
<td>5 (3%)</td>
<td>9 (2%)</td>
</tr>
<tr>
<td>GMH Grade III or IV †</td>
<td>0 (--%)</td>
<td>4 (2%)</td>
<td>8 (5%)</td>
<td>12 (2%)</td>
</tr>
<tr>
<td>PVL Grade II or III †</td>
<td>1 (1%)</td>
<td>2 (1%)</td>
<td>2 (1%)</td>
<td>5 (1%)</td>
</tr>
<tr>
<td>Death following severe morbidity †</td>
<td>10 (6%)</td>
<td>6 (4%)</td>
<td>9 (5%)</td>
<td>25 (5%)</td>
</tr>
<tr>
<td>Adjusted age of survivors at discharge in</td>
<td>-9 (-39 to 170)</td>
<td>-7 (-37 to 99)</td>
<td>-10 (-38 to 169)</td>
<td>−9 (−39 to 170)</td>
</tr>
<tr>
<td>days ‡</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival following severe neonatal</td>
<td>38 (25%)</td>
<td>42 (27%)</td>
<td>38 (25%)</td>
<td>118 (25%)</td>
</tr>
<tr>
<td>morbidity (% of survivors) †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival without severe neonatal morbidity</td>
<td>115 (69%)</td>
<td>115 (69%)</td>
<td>115 (68%)</td>
<td>345 (69%)</td>
</tr>
<tr>
<td>(% of all study entrants)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*No differences between the groups for morbidity*

Lees C 2015
## Composite primary outcome at 2 years of age

<table>
<thead>
<tr>
<th></th>
<th>CTG STV</th>
<th>DV p95</th>
<th>DV no A</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study group at inclusion</strong></td>
<td>166</td>
<td>167</td>
<td>170</td>
<td>503</td>
</tr>
<tr>
<td><strong>Infants with known outcome</strong>*</td>
<td>144 (87%)</td>
<td>142 (85%)</td>
<td>157 (92%)</td>
<td>443 (88%)</td>
</tr>
<tr>
<td><strong>Survivors evaluated for neuro-development</strong></td>
<td>131 (86%)</td>
<td>131 (84%)</td>
<td>140 (92%)</td>
<td>402 (87%)</td>
</tr>
<tr>
<td><strong>Survival without impairment</strong></td>
<td>111 (85%)</td>
<td>119 (91%)</td>
<td>133 (95%)</td>
<td>363 (90%)</td>
</tr>
<tr>
<td><strong>Percentage of evaluated surviving infants a</strong></td>
<td>111 (85%)</td>
<td>119 (91%)</td>
<td>133 (95%)</td>
<td>363 (90%)</td>
</tr>
<tr>
<td><strong>Percentage of all infants with known outcome b</strong></td>
<td>(77%)</td>
<td>(84%)</td>
<td>(85%)</td>
<td>(82%)</td>
</tr>
</tbody>
</table>

* Includes adjusted Bayley 2 MDI scores (MDI + 5points)

---

Lees C 2015
Risk of neuro-impairment remains the same within randomized group & is unrelated to inclusion gestation
Main findings:

- Lower risk of neuroimpairment
  - if delivery is based on absent or reversed DV ‘a’ wave
  - on CTG STV severely abnormal

Better neurodevelopmental outcome if you wait for late DV changes, but a slightly higher risk of perinatal death.

Lees C 2014
### Differences between Lund and TRUFFLE studies

<table>
<thead>
<tr>
<th></th>
<th>Lund</th>
<th>TRUFFLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pregnancies</strong></td>
<td>singletons and multiples</td>
<td>singletons</td>
</tr>
<tr>
<td><strong>GA at entry (wks + d)</strong></td>
<td>25+3 (23+3 – 29+6)</td>
<td>29+1 (26+0 – 31+6)</td>
</tr>
<tr>
<td><strong>GA at delivery (wks + d)</strong></td>
<td>26+5 (23+4 – 29+6)</td>
<td>30+5 (27+1 – 38+4)</td>
</tr>
<tr>
<td><strong>Birth weight (g)</strong></td>
<td>642 (395 – 1165)</td>
<td>mean 1013 ±321</td>
</tr>
</tbody>
</table>

Median (range)

±SD ±321
Comparative study **Lund vs. TRUFFLE**  
(in progress)

**Selection of comparable sub-cohorts:**
- singletons
- gestational age at entry 26+0-29+6 weeks
- ARED flow in umbilical artery
- birth weight <mean-2SD

**Primary outcome:**
1. survival at 2 years
2. survival without neurodevelopmental impairment

**Hypothesis:**
Umbilical artery Doppler as surveillance tool in very preterm IUGR is as effective as DV Doppler and STV
Comparative study  Lund vs. TRUFFLE
(in progress)

Neurodevelopmental impairment (NDI)

Criteria for NDI as infant and as child

<table>
<thead>
<tr>
<th>Age:</th>
<th>2y</th>
<th>&gt;3y</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMFCS (cerebral palsy)</td>
<td>3-5</td>
<td>2-5</td>
</tr>
<tr>
<td>Bayley/IQ</td>
<td>&lt;85 (B3)</td>
<td>&lt;70 (IQ)</td>
</tr>
<tr>
<td>Hearing</td>
<td>Aids or worse</td>
<td>Aids or worse</td>
</tr>
<tr>
<td>Vision</td>
<td>Blind/sees light only</td>
<td>Blind/sees light only</td>
</tr>
</tbody>
</table>
Comparative study **Lund vs. TRUFFLE**  
(in progress)

<table>
<thead>
<tr>
<th></th>
<th>Lund</th>
<th>TRUFFLE</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>49</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>GA at delivery, weeks</td>
<td>27+6</td>
<td>28+4</td>
<td>0.0003</td>
</tr>
<tr>
<td>median (range)</td>
<td>(26+0-29+6)</td>
<td>(26+1-29+6)</td>
<td></td>
</tr>
<tr>
<td>Male gender, n (%)</td>
<td>28 (57%)</td>
<td>64 (55%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Birth weight, g, mean ±SD</td>
<td>732 ±187</td>
<td>738 ±149</td>
<td>n.s.</td>
</tr>
<tr>
<td>Apgar score &lt;7 at 5 min, n (%)</td>
<td>10 (20%)</td>
<td>21 (18%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Apgar score &lt;4 at 5 min, n (%)</td>
<td>0</td>
<td>9 (8%)</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Fetal death, n (%)</strong></td>
<td>0</td>
<td>10 (8%)</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Neonatal death, n/N (%)</strong></td>
<td>$1/49$ (2%)</td>
<td>15/117 (13%)</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Survival at 2 years (of all), n (%)</strong></td>
<td>46 (94%)</td>
<td>102 (80%)</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Survival without NDI (of live-born), n/N (%)</strong></td>
<td>37/45 (82%)</td>
<td>78/92 (85%)</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
### Comparative study Lund vs. TRUFFLE
(in progress)

<table>
<thead>
<tr>
<th></th>
<th>Lund</th>
<th>TRUFFLE DV no A-wave</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>49</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>GA at delivery, weeks median (range)</td>
<td>27+6 (26+0-29+6)</td>
<td>28+5 (26+1-29+6)</td>
<td>0.0005</td>
</tr>
<tr>
<td>Fetal death, n (%)</td>
<td>0</td>
<td>4 (9%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Neonatal death, n/N (%)</td>
<td>1/49 (2%)</td>
<td>5/39 (13%)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Survival at 2 years (of all), n (%)</td>
<td>46 (94%)</td>
<td>34 (79%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Survival without NDI (of live-born), n/N (%)</td>
<td>37/45 (82%)</td>
<td>30/33 (91%)</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
Conclusion
The use of umbilical artery Doppler in monitoring very preterm IUGR fetuses (<30 weeks) led to fewer fetal and neonatal deaths and to a higher survival at 2 years of age than did the use of ductus venosus Doppler or CTG short-term variability.
There was no difference in the postnatal neurodevelopment.
Take home messages from the Lund and TRUFFLE studies

• Active management of very preterm IUGR is associated with improved survival

• The long-term outcome is not worse than that in very preterm infants with normal growth (AGA)

• All available information on fetal condition is of importance (Doppler, CTG – preferably computerized, growth etc.)

• Longitudinal development of Doppler findings is important

• The most important fetoplacental Doppler parameters: umbilical artery, umbilical vein, ductus venosus, CTG STV
Absence or reverse EDF at 23-24 wks

- FHR without severe pathology
- Ductus venosus without reverse flow
- Hospitalization
- Doppler daily
- CTG several times a day
- Steroid treatment
Dept. Ob & Gyn, Skåne University Hospital, Lund, Sweden

≥ 25+0 wks

Absent EDF

- hospitalization
- steroid treatment
- CTG several times a day
- Doppler daily

Reverse EDF

- steroids
- delivery most often within 24 hrs

Delivery if abnormal findings in the FHR or DV, or if change to Reverse EDF
SGA fetus

Umbilical artery – the first doppler examination

BFC normal + normal CTG + no clinical compl.

BFC I

BFC II

BFC III A

BFC III B

Fetal weight deviation

-22 - 27%

-28 - 33%

≤ -34%

Control 1-2 times per week:
• clinical evaluation
• doppler
• CTG
• AFI

Admission considered
• doppler CTG, AFI
• steroids (<34+0 wks)

Admission
• individual management acc. to the gestational age*
• doppler daily
• CTG twice daily
• steroids (<34+0 wks)

If expectance:
• CTG 2-4 times a day

Admission
• cesarean section principally on the same day*
• at 24+0 to 26+6 wks individual management
• steroids (<34+0 wks)

Fetal weight deviation

Uterine artery

Bilateral notch no

Bilateral notch yes

Control every second week:
• clinical evaluation
• doppler
• CTG
• AFI
+ every second week:
• fetometry

Control weekly:
• clinical evaluation
• doppler
• CTG
• AFI
+ every second week:
• fetometry

Control weekly:
• clinical evaluation
• doppler
• CTG
• AFI

Control weekly:
• clinical evaluation
• doppler
• CTG
• AFI
+ every second week:
• fetometry

*Pulsations in the umbilical vein and/or abnormal ductus venosus waveform = contributing indication to delivery