Diabetes Mellitus – Pregnancy
Fetal Monitoring- Delivery Time

Özlem Pata
TAJEV 2014
Pregestational DM approximately %1 of all pregnancies

Rapidly increasing incidence of type 2 pregestational DM

%90 of diabetes in pregnancy is gestational DM
Glucose Control

**First Trimester:** Prevention hypoglycemia, congenital malformation

**Second-Third Trimester:** Detailed Ultrasound and Fetal assessment

**Delivery Time**
Glycemic control preconceptional and early gestational days with $< \text{HbA1C}$

- Congenital anomalies $< 4\%$
- Spontaneous abortus ( $13.3\% - 10.4\%$)
- Preterm labor

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Diabetes and Pregnancy Group
France 2003
**Associated with increased fetal and neonatal risks**

<table>
<thead>
<tr>
<th>Associated risks</th>
<th></th>
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<tbody>
<tr>
<td>Spontaneous abortion</td>
<td>As high as %17</td>
</tr>
<tr>
<td>Congenital malformation-</td>
<td>X 4-10</td>
</tr>
<tr>
<td>Stillbirth-P. Mortality</td>
<td>X 5</td>
</tr>
<tr>
<td>Neonatal Mortality</td>
<td>x15</td>
</tr>
<tr>
<td>Infant Mortality</td>
<td>X 3</td>
</tr>
<tr>
<td>Macrosomnia</td>
<td></td>
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<tr>
<td>Gestational DM</td>
<td>% 20</td>
</tr>
<tr>
<td>Pre-existing DM</td>
<td>% 35</td>
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</tbody>
</table>
Fetal Monitoring?
Ultrasound

Determine accurate gestational age

Identified fetal anomalies

To rule out fetal growth abnormalities
Being avoidance of fetal deaths

Early detection of fetal compromise

Prevention of unnecessary premature birth
Fetal limb, body and breathing movements correlate to maternal glucose concentration.

Low or failing levels of fetal movements are associated with abnormal CTGs and fetal distress similar to hypoxic fetus of non diabetic women.

Roberts et al 1980
Inexpensive easy to perform

- Poorly define
- No agreement as to instruction given to women
- 10 movements /2 h

Stillbirth rate drop from 8.2 to 2.1 /1000 live births

Moore et al AJOG 1989
Which Tests To Use?

NST

- A reactive NST reassuring 99% survive for 7 days
- High false positive rate
- %50 reactive < 28wks, 85% beyond 28-32wks
- In DM 2 times/wks

Kersen et al
There was no significant difference identified in potentially preventable deaths
(RR 0.23, 95% CI 0.04 to 1.29, two studies, N = 469)

There is no clear evidence that antenatal CTG improves perinatal outcome

Cochrane Database 2012

Fetal demise and poor outcome have been reported hours after a normal trace
False negative CTG findings are more commonly reported in diabetic than in nondiabetic pregnancies

Shaxted EJ Obstet Gynecol 1981
26 women with type 1 DM in third trimester compared with uncomplicated pregnancies

- 28-39 weeks cCTGs weekly
- 11.3% showed absent episodes with the expected value of 0.8%
- Differences in the short term variation, basal heart rate, frequency of fetal movement, heart rate acceleration.

Correlation between FHR pattern and maternal glycemic control

Relevance of this to the risk of fetal demise has not been determined

Tincello et al J. Perinat Med. 1998
Which Tests To Use?

BPP

- **BPP (Fetal breathing, movement, tone, AFI) /30 minute**
  - 8–10 reassuring
  - 6–7 reevalulation with in day
  - 0–4 suggest hypoxemia

- **Modified BPP (NST+AFI)**
Twice weekly modified BPP was an effective method of fetal assessment to prevent stillbirth with a rate of 1.4/1000.

Kjos et al. AJOG 1995

Good ppv (%95) at determining an APGAR score of >7 at 1 and 5 min. However poor predictive value and sensitivity for adverse fetal outcome.

Dicker et al. AJOG 1988

Diabetic Pregnancies have a higher false negative rates than other high risk pregnancies.
Which Tests To Use?

Doppler Studies

- **Umbilical artery Doppler** will be normal
- **MCA Doppler** redistribution
- **Ductus Venosus** hypertrophic cardiomyopathy

With BPP there may be lowered high incidence false negative tests
Limitation in predictive power of many fetal monitoring methods and lack of RCT

Indivulized according to clinics and patients in various combinations

The frequency of iu deaths excluding congenital malformations 3.0/1000
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**Preexisting Diabetes-Stillbirth (3%)**

- Approximately 50% after 36 weeks
- Usually after 32 weeks

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<table>
<thead>
<tr>
<th></th>
<th>Type 1 diabetes ($n = 1706$)</th>
<th>Type 2 diabetes ($n = 650$)</th>
<th>National rate ($n = 620,841$)</th>
<th>Rate ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency ($n$)</td>
<td>Rate (95% CI)</td>
<td>Frequency ($n$)</td>
<td>Rate (95% CI)</td>
</tr>
<tr>
<td>Stillbirth$^a$</td>
<td>44</td>
<td>25.8 (18.3–33.3)</td>
<td>19</td>
<td>29.2 (16.3–42.2)</td>
</tr>
<tr>
<td>Perinatal death$^b$</td>
<td>54</td>
<td>31.7 (23.3–40.0)</td>
<td>21</td>
<td>32.3 (18.7–45.9)</td>
</tr>
<tr>
<td>Neonatal death$^c$</td>
<td>16</td>
<td>9.6 (4.9–14.3)</td>
<td>6</td>
<td>9.5 (1.9–17.1)</td>
</tr>
</tbody>
</table>

$^a$Source for national data: CEMACH, 2002.

$^b$Rate per 1000 live births plus stillbirths.

$^c$Rate per 1000 live births.

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CEMACH Study 2002
What is the optimum frequency of testing?

- Antenatal surveillance safely achieved with a testing sequence that consists of twice weekly NSTs backed up by BPS, CSTs.
  - Golde et al. AJOG 1984

- 4 deaths in 46 diabetic pregnancies when interval was greater than 4 days
1,206 with type 1 diabetes and 342 with type 2 diabetes

Fetal death 4 times greater (RR 4.56 [95% CI 3.42, 6.07], p < 0.0001)

Infant death nearly doubled (RR 1.86 [95% CI 1.00, 3.46], p = 0.046)
Stillbirth is correlated by glysemic control

Perinatal asphyxia correlated by

- PA HT
- Smoking
- Fetal macrosomia
- Maternal hypoglisemi before delivery

FETAL SURVEILLANCE IS REQUIRED WHEN THESE COMPLICATIONS ARE FOUND IN DIABETIC PREGNANCY
<table>
<thead>
<tr>
<th>Birthweight</th>
<th>Birthweight</th>
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<tbody>
<tr>
<td>Peri-conception HbA1c</td>
<td>Pre-pregnancy care</td>
</tr>
<tr>
<td>Smoking</td>
<td>Third-trimester HbA1c</td>
</tr>
<tr>
<td>Later gestation at first antenatal visit</td>
<td>Increasing maternal BMI</td>
</tr>
<tr>
<td>Prepregnancy nephropathy retinopathy</td>
<td>Longer maternal height</td>
</tr>
</tbody>
</table>

Population based cohort study: n=1505

Glinianaia et al Diabetologia 2012
Histopathological changes
- nRBCs
- Fibrinoid necrosis
- Villous immaturity
- Chorangiosis

Placental weight

AGA-infants of diabetic women may be protected against hypoxemia because of a relative high placental weight

Evers et al 2003
# Type I DM and PAPP-A

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Type I DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>36415</td>
<td>331</td>
</tr>
<tr>
<td>PAPP-A</td>
<td>1.01</td>
<td>0.86</td>
</tr>
<tr>
<td>Free Beta hcg</td>
<td>0.99</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Significant inverse relationship between HbA1C and PAPP-A

Madsen et al Acta Obstet Gynecol 2011
Increase in Fetal Macrosomia

20-50%

- Increase in maternal obesity
- Lower incidence of maternal vascular complications
- Poorer control in advanced pregnancy weeks
Risk of Stillbirth
Risk of shoulder dystocia and intrapartum asphyxia
<table>
<thead>
<tr>
<th>Ratio</th>
<th>Weight</th>
</tr>
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<tbody>
<tr>
<td>5-23.1%</td>
<td>4000-4500</td>
</tr>
<tr>
<td>20-50%</td>
<td>&gt;4500</td>
</tr>
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Wide range of sensitivities and specificities for identifying macrosomia

Serial USG may provide a more accurate estimation


Figure 4 Head circumference/abdominal circumference (HC/AC) ratio in diabetes mellitus Type-1 (DM1), diabetes mellitus Type-2 (DM2) and gestational diabetes mellitus (GDM) pregnancies, subdivided according to non-macrosomia (birth weight < 90th percentile) and macrosomia (birth weight > 90th percentile).

Hammoud- Visser et al UOG 2013
Timing of Delivery

Depends on types of Diabetes - associated risk factors and Glysemic Control
Concerning mode of delivery be initiated when fetal weight >4500

- ACOG

May available >4000g

## Conclusions

<table>
<thead>
<tr>
<th>Gestational Age</th>
<th>Fetal Testing</th>
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<tbody>
<tr>
<td>First Trimester</td>
<td>Dating ultrasound</td>
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<tr>
<td>18-20 wks</td>
<td>Detailed anatomic survey</td>
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<tr>
<td>22 wk</td>
<td>Fetal echocardiography</td>
</tr>
<tr>
<td>Third trimester</td>
<td>Serial Growth US</td>
</tr>
<tr>
<td>32 wk</td>
<td>NST 2 times /wks ins requiring DM</td>
</tr>
<tr>
<td>38 wks</td>
<td>Significant risk factor delivery</td>
</tr>
<tr>
<td>39-40 wk</td>
<td>Deliver ins requiring DM</td>
</tr>
<tr>
<td>40 wk</td>
<td>NST for Diet controlled DM</td>
</tr>
<tr>
<td>41 wk</td>
<td>Deliver diet-controlled DM</td>
</tr>
</tbody>
</table>

Don’t Forget Case by Case Determination
Thank you for your kind attention!