Prenatal Care

Objectives

- The sequence of prenatal care
- Dating: Naegele’s rule & Ultrasound
- Consultations / Frequency
- Prenatal screening
  - FTS/IPS/MSS
  - Quad screen
- Diagnostic tests
  - Amniocentesis, CVS

Prenatal Care

Objectives

- Prenatal Investigations
  - Routine test / high risk
- Fetal ultrasound
  - 1st, 2nd and 3rd Trimester
- 3rd TRIM – routine & Special considerations
- Amniotic fluid evaluation
- Fetal well-being

First Prenatal Visit

Dating the pregnancy

- Last menstrual period (LMP)
  - Certain? Regular?
- Naegele’s rule – add 1 week, subtract 3 months
- Average length of gestation ~ 280 days
- Confirm with ultrasound
**Determination of gestational age**

**FIRST TRIMESTER ULTRASOUND SCREENING**
- **CROWN-RUMP-LENGTH (CRL)**

**FIRST TRIMESTER ULTRASOUND**
- **MULTIPLE GESTATIONS**
- **“LAMBDA or TWIN PEAK SIGN”**
  - DICHORIONIC (DC)
  - "T SIGN"
  - MONOCHORIONIC / DIAMNIOTIC (MC/DC)

**MULTIPLE GESTATIONS**
- Triangular peak of villi extending into the intevention membrane
- "Twin peak" sign

**Biparietal Diameter (BPD) & Head Circumference (HC)**

**Measurements**:
- **CRL up to ~14 weeks**: + 5-7 days
- **>14 weeks**: COMBINED BIOMETRY
  - Biparietal diameter (BPD)
  - Head circumference (HC)
  - Abdominal circumference (AC)
  - Femur length (FL)

  **Measurements**: 14-16 weeks → ± 7-10 days
- **2nd TRIM.**: +10 -14 days → + 2 weeks
- **3rd TRIM.**: + 21 days → ± 3 weeks

**Crown sefum pellucidum**
- Thallosus
- Palae cerebri

**BPD**: Measure outer table of the skull to the inner table.
**HC**: Measure around the outer table of the skull.
The Dating Game...

Scenario 1
- 24 yo woman, 1st pregnancy, LMP = Dec 1st, regular cycles q 28 days, Usd Feb 20th, CRL = 12 weeks 2 days.

Her due date is
a) Sept 7th
b) Aug 24th
c) Sept 2nd
d) Whenever the baby decides to come
The Dating Game...

- LMP = Dec 1st
- regular cycles q 28 days
- Usd Feb 20th → CRL = 12 weeks 2 days.

Naegele's rule – add 1 week, subtract 3 months → EDD = Sept 7th

Days:
- 30 days (Dec)
- 31 days (Jan)
- 20 days (Feb)
Total days = 81 / 7 = 11 weeks 4 days → gestational age on Feb 20th

By LMP = 11 weeks 4 days
By US = 12 weeks 4 days → 6 days difference

EDD = By US → Sep 2th

Her due date is
a) Sept 7th
b) Aug 24th
c) Sept 2nd
d) Whenever the baby decides to come

The Dating Game...

- LMP = Dec 1st
- Cycles: ? Irregular pill
- Usd April 5th → Biometry = 20 weeks.

Naegele's rule – add 1 week, subtract 3 months → EDD = Sept 7th

Days:
- 30 days (Dec)
- 31 days (Jan)
- 5 days (Feb)
- 31 days (Mar)
- 5 days (Apr)
Total days = 125 / 7 = 18 weeks → gestational age on April 5th

By LMP = 18 weeks
By US = 20 weeks → 14 days difference (2 weeks)

EDD = By US → Aug 24th

Her due date is
a) Sept 7th
b) Sept 14th
c) Sept 2nd
d) Whenever the baby decides to come

The Dating Game...

- LMP = Dec 1st
- regular cycles q 35 days
- Usd → not done

Naegele's rule – add 1 week, subtract 3 months → EDD = Sept 7th

LONG CYCLE

+ 1 week

EDD → Sep 14th

The Dating Game...

Scenario 2
- 24 yo woman, 1st pregnancy, LMP = Dec 1st, forgot 2 Alesse tablets, Usd April 5th, biometry 20 weeks

Her due date is
a) Sept 7th
b) Aug 24th
c) Sept 2nd
d) Whenever the baby decides to come

The Dating Game...

Scenario 3
- 24 yo woman, 1st pregnancy, LMP = Dec 1st, regular cycles every 35 days, no Usd yet.

Her due date is
a) Sept 7th
b) Sept 14th
c) Sept 2nd
d) Whenever the baby decides to come

The Dating Game...

Antenatal Visits

- Frequency
  - Initial assessment < 12 wks
  - Q 4-6 wks to 28 wks
  - Q 2 wks to 36 wks
  - Weekly to delivery

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Initial assessment &lt; 12 wks</th>
<th>Q 4-6 wks to 28 wks</th>
<th>Q 2 wks to 36 wks</th>
<th>Weekly to delivery</th>
</tr>
</thead>
</table>

Prenatal Timeline
First and Second Trimester

- Prenatal screening
- Prenatal investigations
- Fetal Ultrasound

Prenatal screening for aneuploidy and Neural tube defect (NTD) and congenital cardiac defect.

- First trimester screening (FTS)
- Integrated prenatal screening (IPS)
- Multiple serum markers (MSS)

Risk for chromosomal abnormalities

<table>
<thead>
<tr>
<th>Maternal age (yrs)</th>
<th>Trisomy 21 Gestation (wks)</th>
<th>Trisomy 18 Gestation (wks)</th>
<th>Trisomy 13 Gestation (wks)</th>
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<tbody>
<tr>
<td>20</td>
<td>1068</td>
<td>1200</td>
<td>1255</td>
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<tr>
<td>25</td>
<td>646</td>
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<td>703</td>
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<td>100</td>
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<td>42</td>
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<td>46</td>
</tr>
</tbody>
</table>
FIRST TRIMESTER ULTRASOUND

11 to 13 + 6 weeks gestation

MARKERS

- CRL
- NT

FMF Algorithm

FETAL MEDICINE FOUNDATION
Nuchal Translucency

www.fetalmedicine.com

NUCHAL TRANSLUCENCY
- Magnification – head and thorax only
- True mid-sagittal section
- Neutral fetal position
- Calipers “on-to-on”
- Maximum lucency
- Thin nuchal membrane

FIRST TRIMESTER ULTRASOUND
NT (mm) x CRL (mm)

T18
Triploidy

T13
Monosomy

NT (mm) x CRL (mm)

Associate with a variety of genetic and nongenetic syndromes
Screening methods for chromosomal abnormalities

<table>
<thead>
<tr>
<th>Method of screening</th>
<th>DR (%)</th>
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</thead>
<tbody>
<tr>
<td>Maternal age (MA)</td>
<td>90</td>
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<tr>
<td>MA and maternal serum biochemistry at 15-18 weeks</td>
<td>50-70</td>
</tr>
<tr>
<td>MA and fetal nuchal translucency (NT) at 11-13+ wks</td>
<td>70-80</td>
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<tr>
<td>MA and total NT and maternal serum free β-hCG and PAPP-A at 11-13+ wks</td>
<td>85-90</td>
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<tr>
<td>MA and fetal NT and fetal nasal bone (NB) at 11-13+ wks</td>
<td>90</td>
</tr>
<tr>
<td>MA and total NT and NB and maternal serum free β-hCG and PAPP-A at 11-13+ wks</td>
<td>95</td>
</tr>
</tbody>
</table>

1st trimester serum screening

Nuchal translucency

Detection rate for 5% false positive rate
Integrated Prenatal Screening - summary

✓ Screening test, NOT a diagnostic test
✓ Offered to all pregnant women

Maternal serum PAPP-A and βHCG
Ultrasound markers: Nuchal translucency

→ 11 - 13 + 6 week’s gestation

• uEstradiol, αFP and βHCG at 15-16 weeks
Detection of ~90-95% of T21

Diagnostic Procedures when risk > 1:200

<table>
<thead>
<tr>
<th>Abnormalities</th>
<th>AFP</th>
<th>Estrol</th>
<th>HCG</th>
<th>Inhibin A</th>
<th>Moesin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down’s syndrome</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Turner’s syndrome</td>
<td>Decreased</td>
<td>Decreased</td>
<td>Very high</td>
<td>Very high</td>
<td>High</td>
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<tr>
<td>Edwards’s syndrome</td>
<td>Unchanged</td>
<td>Low</td>
<td>Very low</td>
<td>Unchanged</td>
<td>HE is low</td>
</tr>
<tr>
<td>Patau’s syndrome</td>
<td>Increased</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>AF Patau is High</td>
</tr>
</tbody>
</table>
First and Second Trimester INVASE PROCEDURES (DIAGNOSTIC)

**Chorionic villus sampling (CVS)**
- 11-13 weeks
- Transabdominal or transcervical
- FISH (2-3 days)
- Karyotype (result in 2-3 weeks)
- 0.8% risk pregnancy loss (1:100 – 1:150)

**Amniocentesis**
- Genetic Counseling
- GA 16 weeks
- Ultrasonic visualization
- 20 cc amniotic fluid
- FISH (2-3 days)
- Culture fetal fibroblasts (Result 2-3 weeks)
- 0.5% risk pregnancy loss (1:200)

**NonInvasive Prenatal Testing (NIPT)**
- Cell-free DNA in maternal circulation
Antenatal Visits

First and Second Trimester

- Prenatal screening
- Prenatal investigations
- Fetal Ultrasound

HIGH RISK

Rh disease or Rh (D) disease → Sensitization
HIV (+) → Transmission
Congenital Syphilis
Fetal Rubella Syndrome
Hepatitis B → transmission

Rhesus-immunization

- Rhesus negative pregnant women
- Sensitization either through previous pregnancy or transfusion
- IgG crosses placenta, coated erythrocytes destroyed in fetal Reticulo-Endothelial System (RES)
- Fetal anemia → hydrops
The measurement of the middle cerebral artery peak systolic velocity, a noninvasive technique, has become the standard for the diagnosis of fetal anemia. It's easier to measure High sensitivity in predicting anemia

Rhesus-immunization

- Maternal circulation
- Fetal circulation
- Placenta

Management
- Doppler – MCA - PSV
- Intra-uterine transfusions

Prevention:
- anti-D at 28-32 weeks and after birth

Prevention of HIV transmission
- Transmission of HIV dependent on viral load at delivery:
  - 10% at 1000 copies/mL
  - 17% at 1000-10,000 copies/mL
  - 33% at >10,000 copies/mL
  - 0.6-2% with Highly Active Antiretroviral Therapy – HAART
- Monitoring: Viral load & CD4 count
- Management:
  - HAART if >1000 copies/mL
  - Caesarean section if >1000 copies/mL
  - Intrapartum zidovudine

Hydrops foetalis (30 weeks)
### Congenital Syphilis

- Maternal to fetal transmission 50-80%
- Perinatal mortality 50%
- Non-immune hydrops foetalis:
  - Ascites
  - Scalp edema
  - Hepatosplenomegaly
  - Hyperechogenis or dilated bowel
  - Placentomegaly
  - Polyhydramnios
- Treatment: Penicillin G

### Fetal Rubella Syndrome

- 50% fetal infection among exposed fetuses in 1st trimester, 20% in 2nd trimester
- Fetal Rubella syndrome
  - Deafness
  - Mental retardation
  - Congenital cataracts
  - Heart defects (mainly septal defects)
- **Vaccinate after pregnancy!!!**

### Prevention of Hepatitis B transmission

- Acute Hepatitis: 1-2:1000 pregnancies
- Vertical transmission without prevention:
  - 40% chronic carrier states
  - >1 million deaths per year
- CAVEATS:
  - Only 50% of HBsAg positive women are ‘high-risk’
  - Only 1% of infected women develop fulminant disease
- Management:
  - Post exposure prophylaxis *Hepatitis B Immune Globulin (HBIG)* of the neonate
  - Vaccination
  - Breastfeeding can be considered

### Obstetrics Ultrasound

**1st trimester (0-12 weeks)**
- Diagnosis of pregnancy
- Assessment of viability
- Gestational age
- Uterine and extra-uterine abnormalities
- Trophoblastic disease
- Ectopic pregnancy
- Risk assessment for chromosomal abnormalities
- Multiple pregnancy - chorionicity

### Diagnosis of pregnancy

- **Gestational sac**
  - 4-5 weeks
- **Embryo**
  - Fetal heart rate
  - 6 weeks
Chorionicity in multiple pregnancies

- Lambda-sign (λ)
- Thin membrane
- No membrane
- Monoamniotic
- Monochorionic
- Dichorionic

Obstetrics Ultrasound 2nd trimester (13-24 weeks)

- Diagnosis of fetal life
- Multiple pregnancy
- Gestational age
- Structural defects
- Assisting invasive procedures
- Placental localization
- Assessment of the cervix
- Amniotic fluid volume

Anatomy Scan

- Diagnosis of fetal anomalies
- Assessment of fetal growth, placenta, umbilical cord and amniotic fluid
- Detailed survey of limbs, skeletal structures, brain, face, thorax, heart, diaphragm, abdomen, urogenital system, etc
- Best at 18-20 weeks:
  - Before 18 weeks: some structures not fully developed
  - After 24 weeks: legal termination issues and increased ossification

Assessment of cervix

Placental localization

3rd Trimester (> 25 weeks)

Objectives:
- Determine fetal growth
- Assess maternal health/ wellbeing
- Assess fetal health/wellbeing

- Specific history questions
- Maternal weight, BP, urine dip
- SFH (in cm) should equal GA after 20 wks
- Plot growth on curve on A/N II
- Leopold’s maneuvers to determine lie
Third Trimester

Special Considerations

- 26-28 weeks – GDM screening
- 28 weeks – Rh immunoglobulin if Rh negative → Specific history questions
- 35-37 weeks – Vag/rectal swab for GBS

36 yo woman, first pregnancy, BMI 41. Fasting blood glucose 6.0 at 28 weeks
32 yo woman, first pregnancy, pre pregnancy weight 110 lbs, weight gain 25 lbs
18 yo woman, first pregnancy, smoker, poor nutrition

Match the history to the plot of SF heights

A

B

C

Ultrasound in obstetrics 3rd trimester (25-40 weeks)

- Diagnosis of fetal life
- Placental localization
- Amniotic fluid volume
- Placental abruption
- Fetal well-being

Amniotic fluid production

- <16 weeks: membranes, fetal skin
- > 16 weeks:
  - mainly fetal urine
  - small contribution of fetal lung fluid and membranes
- Consumption by fetal swallowing

Ultrasound and amniotic fluid estimation

Largest vertical pocket >8 cm Polyhydramnios

Largest vertical pocket <2 cm Oligo- or anhydramnios

Amniotic fluid volume

- 12 weeks: 35ml
- 18 weeks: 250ml
- 36 weeks: 1000ml
- 40 weeks: 750ml
Oligohydramnios

- Fetal urinary tract anomalies
  - Renal agenesis anomalies
    - Potter’s sequence
  - Oligohydramnios
  - Musculoskeletal abnormalities
  - Pulmonary hypoplasia
- Obstructive uropathies
- IUGR
- Post dates
- Rupture of membranes

Polyhydramnios

**Maternal causes**

- Diabetes
  → OGTT

- Isoimmunization
  → Blood group/antibody screen

**Fetal causes**

- Neural tube defects
- Disorders of fetal swallowing (e.g. esophageal atresia, musculoskeletal diseases)
- Non-immune hydrops
- Twin-to-twin transfusion
- Infection (e.g. Parvo B19)
  → Level III ultrasound

**Idiopathic**

- At risk for premature labour, abnormal presentations and cord prolapse, abruptio and fetal anomalies

Placental abruption or hemorrhage

**MODELS OF FETAL DISTRESS**

- OBSTRUCTIVE
- ANEMIC
- METABOLIC
- INFECTIOUS
- UMBILICAL
- MEMBRANE
- OTHERS
  - INTRAHEPATIC CHOLESTASIS
  - TWINS
Assessment of fetal well-being

- Biophysical profile
- Non-stress test (Cardiotocography)

Testing for causative factors: i.e. placental function

- Doppler Study
  - UA
  - MCA
  - Ductus Venosus

Assessment of fetal well-being: BIOPHYSICAL PROFILE

<table>
<thead>
<tr>
<th></th>
<th>Normal (2)</th>
<th>Abnormal (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetal breathing</td>
<td>&gt; 30 sec in 30 min</td>
<td>&lt; 30 sec in 30 min</td>
</tr>
<tr>
<td>Fetal movements</td>
<td>≥ 3 gross body</td>
<td>&lt; 3 movements in</td>
</tr>
<tr>
<td></td>
<td>movements in 30 min</td>
<td>30 min</td>
</tr>
<tr>
<td>Fetal tone</td>
<td>Limb movement from</td>
<td></td>
</tr>
<tr>
<td></td>
<td>flexion to extension, return to flexion</td>
<td></td>
</tr>
<tr>
<td>Amniotic fluid</td>
<td>One pocket &gt; 2 cm in two perpendicular planes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Largest pocket &lt; 2 cm</td>
<td></td>
</tr>
<tr>
<td>Non-stress test</td>
<td>≥ 2 accelerations in 40 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; 2 accelerations</td>
<td></td>
</tr>
</tbody>
</table>

Assessment of fetal well-being: DOPPLER STUDY

Doppler assessment of placental function

Neurodevelopment following fetal growth restriction and its relationship with antepartum parameters of placental dysfunction

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