Obstetrics Content Outline
Second/Third Trimester (Normal Anatomy)
(Effective February 2007)
(8 – 12 %)

Obstetric Parameters

• the average human pregnancy is 40 weeks (280 days)
  – from the first day of the last menstrual period (LMP).
• estimated date of confinement (EDC) or due date is
  – derived by other clinical parameters (uterine size, Doppler [auscultation of fetal heart tones], ultrasound, ovulation indicators).

Trimesters

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Weeks Gestation</th>
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<tbody>
<tr>
<td>First Trimester</td>
<td>0 to 12 weeks</td>
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<tr>
<td>Second Trimester</td>
<td>13 to 26 weeks</td>
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<tr>
<td>Third Trimester</td>
<td>27 to 40 weeks</td>
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<tr>
<td>Post Term Pregnancy</td>
<td>greater than 40 weeks</td>
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Naegele’s rule: Ψ

EDC = LMP – 3 months + 7 days
Menstrual age = date of pregnancy from LMP

Central nervous system
The Cranium

• choroid plexus seem large early in pregnancy, but as the brain grows, these structures appear small in relationship to the entire brain
• cranial bones ossify by the 12th week
• By 18 weeks of gestation,
• brain structure have been determined

Central nervous system
The Cranium

• the dura (pachymeninx) and the pia arachnoid (leptomeninges) are highly echogenic
• check the contour or outline of the skull bones
  – Look for anencephaly or deformity
• assess brain development.
Central nervous system
The Cranium
• transverse plane
  – skull should be round or oval with a smooth surface
• the interhemispheric fissure (IHF) or falx cerebri is observed as a membrane separating the brain into two equal hemispheres
• ventricular system consists of two paired lateral ventricles, a midline third ventricle, and the fourth ventricle.

• CSF travels
  – through the foramen of Monroe to the third ventricle
  – Through the aqueduct of Sylvius to the fourth ventricle
  – Through the foramina of Luschka and Magendie into the cerebral and spinal subarachnoid spaces
  – then enters the venous system (e.g., cranial venous sinuses).

Lateral Ventricles
• CSF is manufactured by the choroid plexuses located within the roofs of each (lateral) ventricle
• one of the most common neural tube defects is ventriculomegaly or hydrocephalus
• body or glomus of the choroid plexus marks the site at which the size of the ventricle may be assessed.

cerebellum
• located in back of the cerebral peduncles within the posterior fossa.
• hemispheres are joined together by the cerebellar vermis
• distortion of cerebellum may represent findings suggestive of an open spina bifida
  – “banana sign”
  – Arnold-Chiari malformation, downward into the foramen magnum

Cerebellum/cisterna magna
• Measurements of width allow assessment of fetal age
• cisterna magna lies directly behind the cerebellum
  – effaced or obliterated in fetuses with the Arnold-Chiari malformation
• cranial findings helpful in screening for spinal defects

cisterna magna
• Enlargement - Dandy-Walker malformation
• normal measures 3 to 11 mm
  – average 5 to 6 mm
• Linear echos in this region represent dural folds that attach the falx cerebelli
orbits

- note presence of orbits (and eyes) and spacing between them
- Measurements aid in GA assignment and detecting abnormalities
  - missing (anophthalmia)
  - fused or closely spaced (hypotelorism)
  - abnormally widened (hypertelorism)

Face

- Facial Profile
  - contour of the frontal bone, nose, upper and lower lips, and chin may be assessed
- relationship of the nose to lips
  - forehead malformations
  - anterior cephaloceles
  - cleft lip and palate
  - frontal bossing - seen in some forms of skeletal dysplasias
  - assessing the formation of the chin - to exclude micognathia
  (an abnormally small chin)

Coronal Facial View

- reveals
  - both orbital rings, parietal bones, ethmoid bones, nasal septum, zygomatic bone, maxillae, and mandible.
- Tangential views of the face differentiate t
  - nostrils, nares, nasal septum, maxillae, and mandible
  - This view is helpful in the diagnosis of craniofacial anomalies, such as cleft lip.

The Vertebral Column

- studied in both coronal and sagittal transverse scanning planes
  - coronal - spine appears as two curvilinear lines extending from the cervical spine to the sacrum

- Normal spine tapers near the sacrum and widens near the base of the skull.
- double line appearance “the railway sign” generated by echoes from the posterior and anterior laminae and spinal cord.
- closed neural tube - spinal column appears as a closed circle in transverse plane

note the integrity of the skin surface
this membrane is absent in fetuses with open spina bifida.
Thorax

- the lungs are important landmarks to visualize within the thoracic cavity.
- serve as lateral borders for the heart
- breathing movements can be observed
- Lung size, texture, and location assessed to exclude a lung mass
- lung tissue appears denser than the liver

Cardiovascular system

- standard antepartum obstetric examination guidelines require the sonographer to image and record a four-chamber view of the fetal heart
- Most major anomalies are excluded when cardiac anatomy appears normal in the four-chamber view of the heart.

assess the following in the four-chamber view:
- Cardiac position, proper situs, and axis.
  – The apex of the heart should point to the fetal left side
- Presence of the right and left ventricle
  – equally sized ventricles
- equal-sized right and left atria
  – foramen ovale opening toward the left atrium

The Diaphragm

- An interventricular septum that appears uninterrupted
- Normal placement of the tricuspid and mitral valves.
- tricuspid valve inserts lower
- valves should open during diastole and close during systole.

- separate the thorax and abdomen and is commonly viewed in the longitudinal plane.
- inferior to the heart and lungs and superior to the liver, stomach, and spleen
- stomach should be viewed inferior to the diaphragm
  – excludes a left-sided diaphragmatic hernia.
Fetal Circulation
• oxygenation occurs in the placenta
• bypasses the lungs – ductus arteriosus
• hepatobiliary system shunts oxygen-rich blood directly to the heart through the ductus venosus

Abdomen
• stomach should be viewed inferior to the diaphragm – excludes a diaphragmatic hernia.
• Differentiate hepatic and portal vessel by evaluating the thickness of the vessel wall. – the walls of the portal vessels are more echogenic than those of hepatic vessels.

Hepatobiliary System and Upper Abdomen
• includes the liver, portal venous system, hepatic veins and arteries, gallbladder, and bile ducts.
• liver shunts oxygen-rich blood from the placenta to the heart, brain, and body organs.
• umbilical vein courses cephalad along the falciform ligament to the liver – connects with the left portal vein.

• ductus venosus blood directly to the IVC, which empties directly into the right atrium.
• left lobe of the liver is larger than the right lobe
• liver is the main storage site for glucose and is very sensitive to disturbances in growth

The Gastrointestinal System
• esophagus may be recognized ingestion of amniotic fluid – traced during swallowing into the oral cavity, through the hypopharynx
• stomach becomes apparent as early as the 11th week of gestation – always beyond the 16th week

• conditions prohibit normal filling of the stomach – ↓ amniotic fluid ex. rupture of the membranes – blockage - esophageal atresia
• Other stomach problems – Enlargement of the stomach non–insulin-dependent diabetic pregnancies – congenital anomaly - duodenal atresia
<table>
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<tr>
<th>The Urinary System</th>
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<tbody>
<tr>
<td>• kidneys, adrenal glands, ureters, and bladder.</td>
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<td>• kidneys are apparent as early as the 15th week</td>
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<td>• normal renal pelvis contain a small amount of fluid</td>
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<td>• pelvis measuring &gt; 10 mm beyond 20 weeks gestation is considered abnormal</td>
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<th>Extremities</th>
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<td>• long-bone measurements help assess fetal age and growth</td>
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<td>• allow detection of skeletal dysplasias and various congenital limb malformations.</td>
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<td>• Individual fingers may be assessed and counted if an anomaly is suspected</td>
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<td>• trisomy 18 - clenching of the hands is common</td>
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| • kidneys appear as elliptic structures in the longitudinal axis |
| • in transverse views appear circular in their retroperitoneal locations adjacent to the spine |
| • adrenal glands frequently observed in a transverse plane just above the kidneys. |

| • urinary bladder is visualized in either transverse or sagittal sections through the anterior lower pelvis |
| • size varies, depending on the amount of urine contained within the bladder cavity |
| • fetus generally voids at least once an hour – Recheck |
| • important indicator of renal function. |

• Beyond 20 weeks small bowel may be differentiated from large bowel.
• SB appears to occupy a central position within the lower abdomen
• Peristalsis and fluid-filled small bowel loops may be observed.
• large intestine are identified by their peripheral locations in the lower pelvis.

• adrenals are seen as early as the twentieth week of pregnancy – by 23 weeks assume a rice grain appearance
• center of the gland appears as a central echogenic line surrounded by less echogenic tissue
• adrenal glands may normally appear large in utero and should not be confused with the kidneys. ψ
Adequate amniotic fluid are essential to evaluate the hands or feet.
- Femur is the most widely measured long bone.
  - Distal femoral epiphysis signifies a gestational age beyond 33 to 35 weeks.
- The fetal feet are prone to malformations, such as extra digits, overlapping, and splaying.

Genitalia
- Clinically important when a fetus is at risk for a gender-linked disorder.
  - Aqueductal stenosis, hemophilia.
- Gender determination as early as 14 to 16 weeks.
  - Clear delineation may not be possible until the 20th to 22nd weeks.
- Fluid around the testicles (hydrocele) is a common benign finding during intrauterine life.

The Umbilical Cord
- Normal cord contains one umbilical vein and two umbilical arteries.
- Vein transports oxygenated blood.
- Arteries return deoxygenated blood from the fetus to the placenta.
- Arteries spiral around umbilical vein, and is surrounded by Wharton’s jelly (material that supports the cord).

The Umbilical Cord
- Identification of the placental insertion important.
  - Choosing a site for amniocentesis.
  - The selection of the appropriate site for cordocentesis.
- Cord insertion should be routinely scrutinized because of anterior abdominal wall defects.

The Placenta
- Major role:
  - To permit the exchange of oxygenated maternal blood (rich in oxygen and nutrients) with deoxygenated fetal blood.
- Thickness of the placenta varies with gestational age.

The Amniotic Fluid
- Several important functions:
  - Allows the fetus to move freely.
  - Maintains intrauterine temperature.
  - Protects the developing fetus from injury.
- Produced by:
  - Umbilical cord and membranes.
  - Lung.
  - Skin.
  - Kidneys.
The Amniotic Fluid

• Fetal urination accounts for nearly the total volume of amniotic fluid by the second half of pregnancy
• amount of amniotic fluid is regulated by
  – the production of amniotic fluid,
  – removal of fluid by swallowing
  – fluid exchange within the lungs,
  – membranes and cord.

The Amniotic Fluid

• lung development is critically dependent on the exchange of amniotic fluid within the lungs
• With severe oligohydramnios Inadequate lung development may occur
• Subjective observation determine the norm and extremes
  – Inexperienced AFI
• polyhydramnios or oligohydramnios
  – targeted studies for the exclusion of fetal anomalies are recommended.