Assessment of Fetal Well-Being

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- By 1998, electronic fetal monitoring was used in 84% of all U.S. births, regardless of whether the primary caregiver was a physician or a midwife.
- With the advent of these technologies, fetal monitoring is implemented in nearly all pregnancies, either in the antepartum or intrapartum period.

- The goal is to prevent fetal and neonatal morbidity and especially mortality.
- Why Perform Fetal Monitoring?
- Since its inception, the primary objective of FHR monitoring has been to identify the fetus in distress .

- denote disruption of normal fetal oxygenation,
- ranging from mild hypoxia to profound fetal asphyxia.
- The term hypoxia refers to the reduction of tissue oxygen supply below physiologic levels.
- Asphyxia, stopping of the pulse implies a combination of hypoxia and metabolic acidosis.

Indicators of High Risk Pregnancy

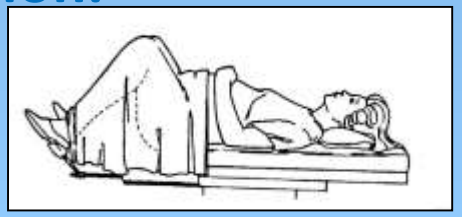
- Maternal age <16 or >35
- Chronic disease – hypertension, diabetes, cardiovascular or renal disease, thyroid disorder
- Preeclampsia- abn hypertension during pregnancy
- Rh isoimmunization-
- History of stillbirth
- IUGR- baby is smaller than needs to be; Growth Retardation
- Postterm pregnancy – 2wks past the due date
- Multiple gestation
- History of preterm labor
- Previous cervical incompetence

Maternal Assessment of Fetal Activity

- **Fetal movement**
  - **Vigorous activity reassuring**
  - **Decreased activity requires immediate follow-up**
  - **Factors affecting activity**
    - **Sound**
    - **Drugs**
    - **Sleep**
    - **Smoking**
    - **Blood glucose level**

Ultrasound

- **High frequency sound waves (3.5-7.0 mega hertz emitted from a transducer)**
- **Advantages** - early detection of fetal anomalies, accurate determination of gestation, noninvasive and painless, no known harmful effects, use at any time during pregnancy
- **Types**
  - **Transabdominal US-** need full bladder, if not full drink 3-4 8oz glasses and rescan
  - **Transvaginal US- probe is inserted into vagina (closer to structures) same preparation. Lithotomy position.**



Clinical Applications

1st trimester

- **Early identification of pregnancy**
- Observation of FHR and breathing movements
- **Measurements – biparietal** "side bones of head" **diameter of fetal head**, crown to rump, fetal femur length, birth weight
- Detection of anomalies
- Identification of amniotic fluid index
- Location of placenta and grading; to check whether there's proper profusion.
- Detection of fetal death
- Determination of fetal position and presentation
- Accompanying procedures (ex: **Amniocentesis)**

Doppler Blood Flow Studies

Not same as Doppler fetal hrt tones

- **Evaluates blood flow in fetus and mother**
- **Assesses placental function**
- **Helpful in managing pregnancies with maternal diabetes**,
- IUGR "term for slowed growth of the fetus during pregnancy", preterm labor, prolonged pregnancies, and multiple gestation

Nonstress Test

Can be done in Dr's office

- Evaluate fetal heart rate with fetal activity
- Reassuring if accelerations occur with fetal movement
- Interpretation
  - **Reactive –** 2 or more FHR accelerations of at least 15 bpm with a duration of at least 15 seconds in a 20 minute interval **(desired)**
  - **Nonreactive – reactive criteria not met within 30 minutes**
  - **If decelerations are noted- phys notified- for further evalutaion**

Baseline Fetal Heart Rate

- Baseline Fetal Heart Rate
- The normal FHR baseline ranges from 120 to 160 beats per minute.
- Early in pregnancy, it is closer to 160 beats per minute,
- declining as gestational age advances.

Bradycardia

- Bradycardia is defined as an abnormally low baseline FHR (<120 beats per minute) and
- bradycardia may be seen in association with maternal blocker therapy, hypothermia, hypoglycemia, hypothyroidism, or
- fetal cardiac conduction defects (congenital atrioventricular block).

Tachycardia

- Fetal tachycardia has many possible etiologies.
- Most often, it is the result of decreased vagal or increased sympathetic outflow,
- associated with fever, infection, fetal anemia, or fetal hypoxia. fetal tachyarrhythmias
- maternal hyperthyroidism
- medications including sympathomimetics (e.g., ritodrine, terbutaline) and parasympatholytics (e.g., atropine,).

Fetal Heart Rate Variability

- Variability in the FHR results from constant interplay between the sympathetic and parasympathetic arms of the fetal autonomic nervous system .
- FHR variability is considered normal or average when both short-term and long-term variability are present, and the difference between the peaks and troughs of the long-term fluctuations is 6 to 25 beats per minute

Fetal Heart Rate Variability

- Persistently decreased variability, however, may signal fetal acidosis.
- Decreased (three to five beats per minute) or absent (zero to two beats per minute) FHR variability reflects diminished fetal CNS activity, usually attributable to fetal sleep cycles or
- to medications administered to the mother (e.g., analgesics, magnesium sulfate, benzodiazepines, phenothiazines, atropine).

Accelerations

- Accelerations in the FHR occur with 90% of fetal movements as early as the second trimester, probably as a result of increased catecholamine release and decreased vagal stimulation of the heart
- By 32 weeks gestation, nearly all normal fetuses will have 15 to 40 spontaneous accelerations per hour, reflecting normal oxygenation of the CNS cardiac axis

Decelerations

- Decelerations in the FHR are most commonly encountered during the intrapartum period.
- They are divided into three categories: early, variable, and late decelerations . Classification is based on the characteristic appearance of the deceleration and its temporal relationship to the onset of a uterine contraction.

Decelerations

- early
- variable
- late

Early Decelerations

- Early Decelerations beginning at the onset of the contraction and ending when the contraction ends.
- They are thought to result from fetal head compression, transient elevation of intracranial pressure,

Variable Decelerations

- Variable Decelerations and Prolonged Decelerations .
- Variable decelerations result from umbilical cord compression. compression of the umbilical cord leads to occlusion of the umbilical arteries .

Late Decelerations

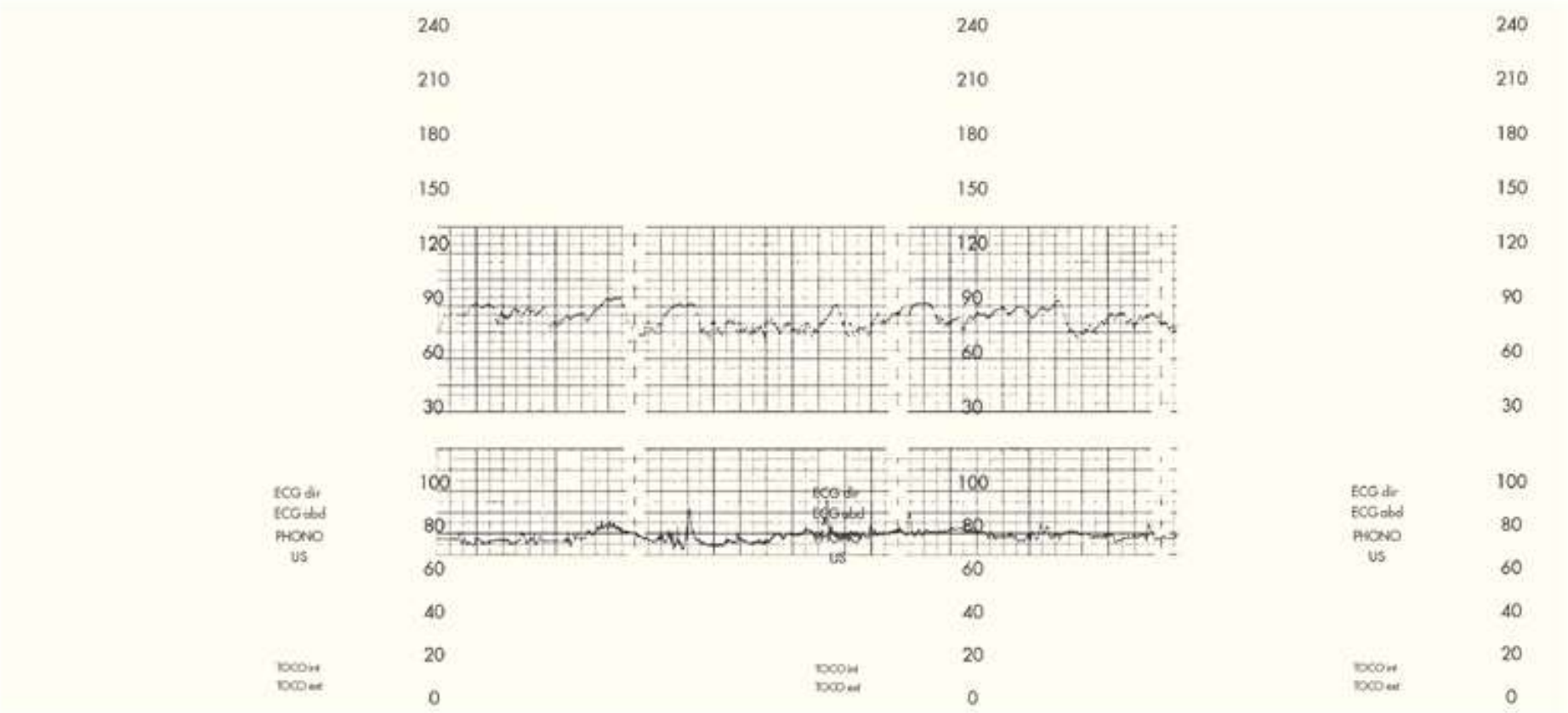
- Late decelerations reflect inadequate uteroplacental transfer of oxygen during contractions.
- Typically, that begin after the onset of a contraction and end after the contraction stops.
- During uterine contractions, decreased maternal perfusion of the uteroplacental unit causes a decline in fetal Po2 .

Late Decelerations

- Late decelerations may be caused by any factor that
- (a) reduces the normal placental transfer of oxygen or
- (b) increases the fetal oxygen demand beyond the available supply. Such factors include uterine hypertonus or tachysystole (oxytocin, prostaglandins, uterine rupture, placental abruption .

Late Decelerations

- maternal hypertension , preeclampsia, collagen vascular disease, renal disease, diabetes cardiac disease, hypovolemia, supine hypotension, sympathetic blockade from regional anesthesia, sepsis maternal hypoxia (apnea, cardiac disease, pulmonary disease) .



Reactive NST. FHR accelerates with fetal movement.

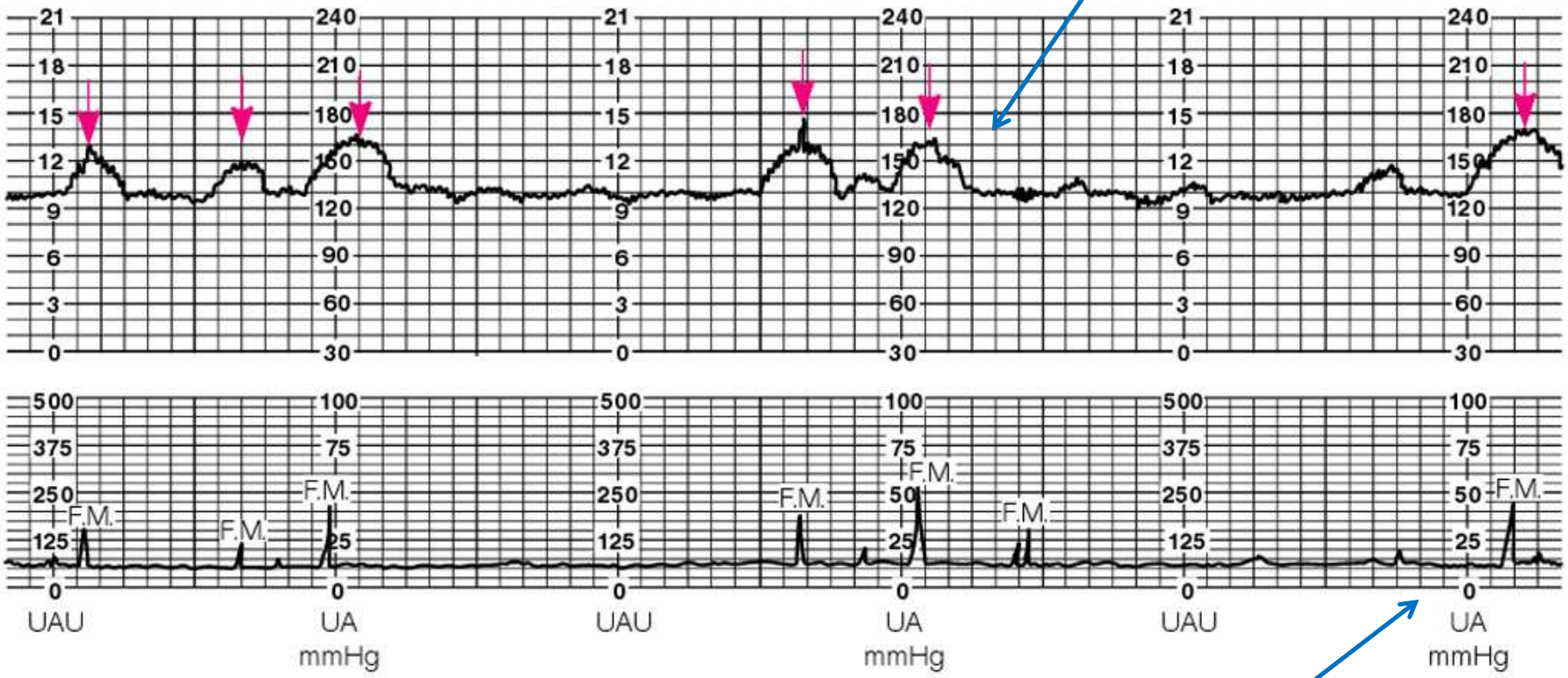
Better example on next slide.

NST

Define:

NST- A test to assess the health of the fetus by monitoring the fetal heart rate in response to fetal movement

incr of about 15 bmp lasting 15 sec desired



Fetal Movement

Figure 14–5 Example of a reactive nonstress test (NST). Accelerations of 15 bpm lasting 15 seconds with each fetal movement (FM). Top of strip shows FHR; bottom of strip shows uterine activity tracing. Note that FHR increases (above the baseline) at least 15 beats and remains at that rate for at least 15 seconds before returning to the former baseline.

Ex: Nonreactive NST. Poss sleep or hypoglycemic. Poss treat w/ juice.

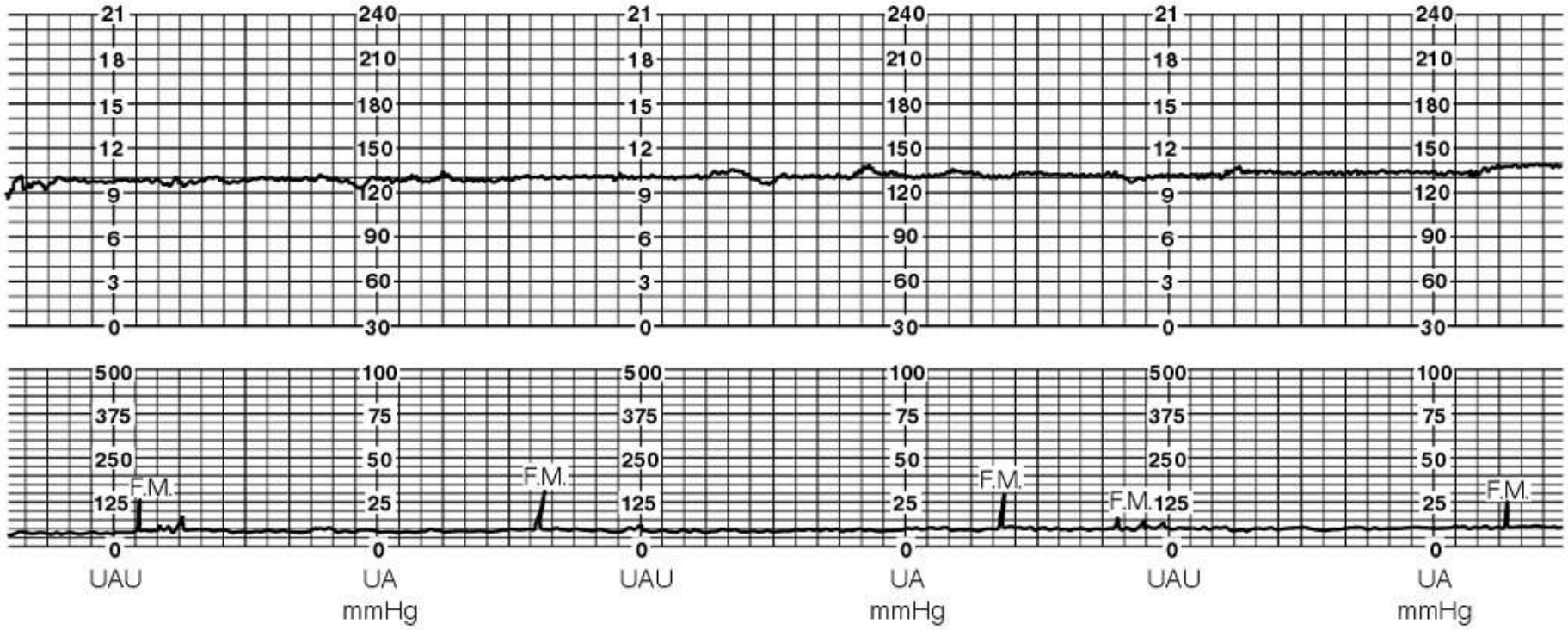


Figure 14–6 Example of a nonreactive NST. There are no accelerations of FHR with FM. Baseline FHR is 130 bpm. The tracing of uterine activity is on the bottom of the strip.

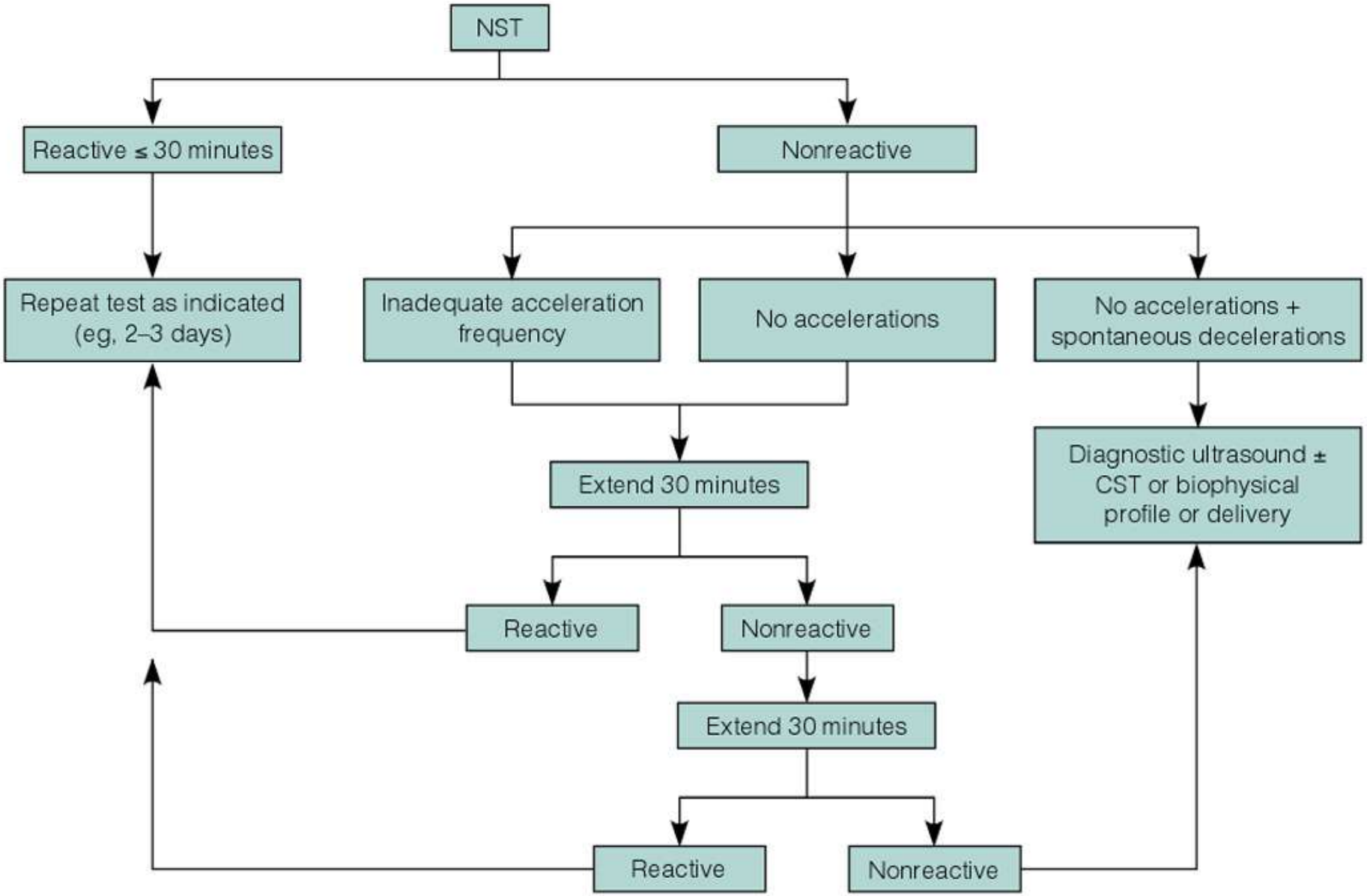


Figure 14–7 NST management scheme. *Source:* Devoe, L. D. (1989). Nonstress and contraction stress testing. In R. Depp, D. A. Eschenbach, & J. J. Sciarri (Eds.), *Gynecology and obstetrics* (Vol. 3, p. 9, Figure 5). Philadelphia: Lippincott.

Fetal Acoustic & Vibroacoustic Stimulation

Used as an adjunct to the NST

"**Define**."

- Handheld device that generates a low frequency vibration and buzzing sound
- Applied to maternal abdomen for 2-5 seconds up to 3 times
- Stimulates fetal movement - acceleration of FHR

Biophysical Profile

Only in Dr's offc, due chance of induced labor

- **Assessment of 5 biophysical variables**
  1) **Fetal breathing movement (US to determine)**
  2) **Fetal movement of body or limbs**
  3) **Fetal tone (extension and flexion of extremities)**
  4) **Amniotic fluid volume**
  5) **Reactive NST with activity**
- **Scoring (2 or 0, no in-between) Between 8-10 is good/desired**
  - **2 is given for normal**
  - **0 is given for an abnormal finding**

Table 14.3 **Criteria for Biophysical Profile Scoring**

TABLE 14–3 Criteria for Biophysical Profile Scoring

Component	Normal (score = 2)	Abnormal (score = 0)
Fetal breathing movements	⩾ 1 episode of rhythmic breathing lasting ⩾ 30 sec within 30 min	⩽ 30 sec of breathing in 30 min
Gross body movements	⩾ 3 discrete body or limb movements in 30 min (episodes of active continuous movement considered as single movement)	⩽ 2 movements in 30 min
Fetal tone	⩾ 1 episode of extension of a fetal extremity with return to flexion, or opening or closing of hand	No movements or extension/flexion
Amniotic fluid volume	Single vertical pocket > 2 cm	Largest single vertical pocket ≤ 2 cm
	AFI > 5 cm	AFI < 5 cm
Nonstress test	⩾ 2 accelerations of ⩾ 15 beats/min for ⩾ 15 sec in 20–40 min	0 or 1 acceleration in 20–40 min

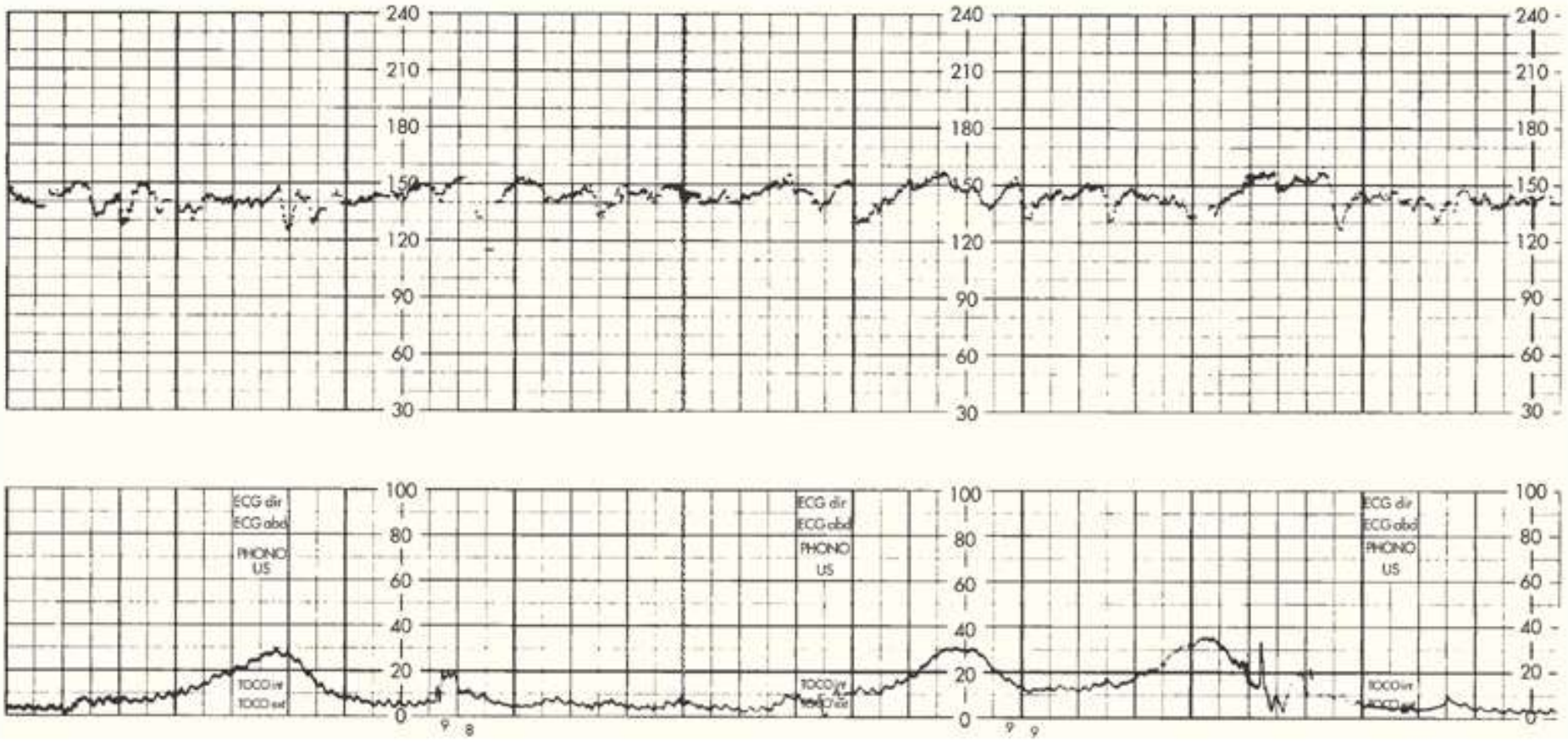
Contraction Stress Test

- **Evaluates the Respiratory function of the placenta**
  - **Does it get O^2 to the baby? Test to check if the placenta has the reserves needed during contractions.**
- **Records FHR response to stress of uterine contractions**
  - **Compress arteries to placenta**

- Uterine Contractions **induced by nipple stimulation** or Oxytocin (Caution: may cause pt to go into labor!)

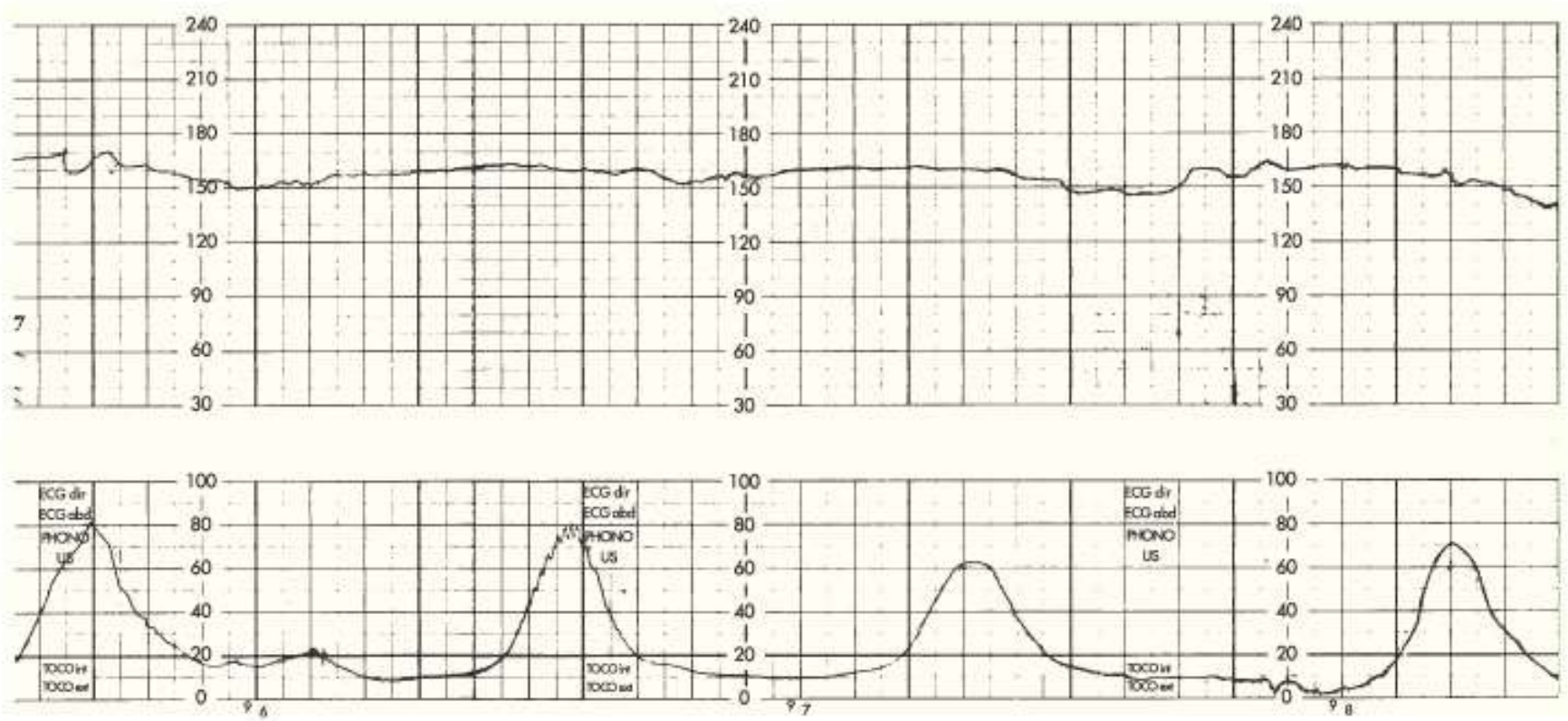
- **Interpretation**
  - **Negative** – 3 good contractions lasting 40 seconds in 10 minute interval with no late decelerations
  - **Positive – persistent late decelerations with more than 50% of the contractions (NOT THE DESIRED RESULTS)**

Ex: CST "Contraction Stress Test"



Negative CST.

Postive CST- baseline about 150, HR drops w/ contractions.



Positive CST, compromised fetus.

Another example of positive CST.

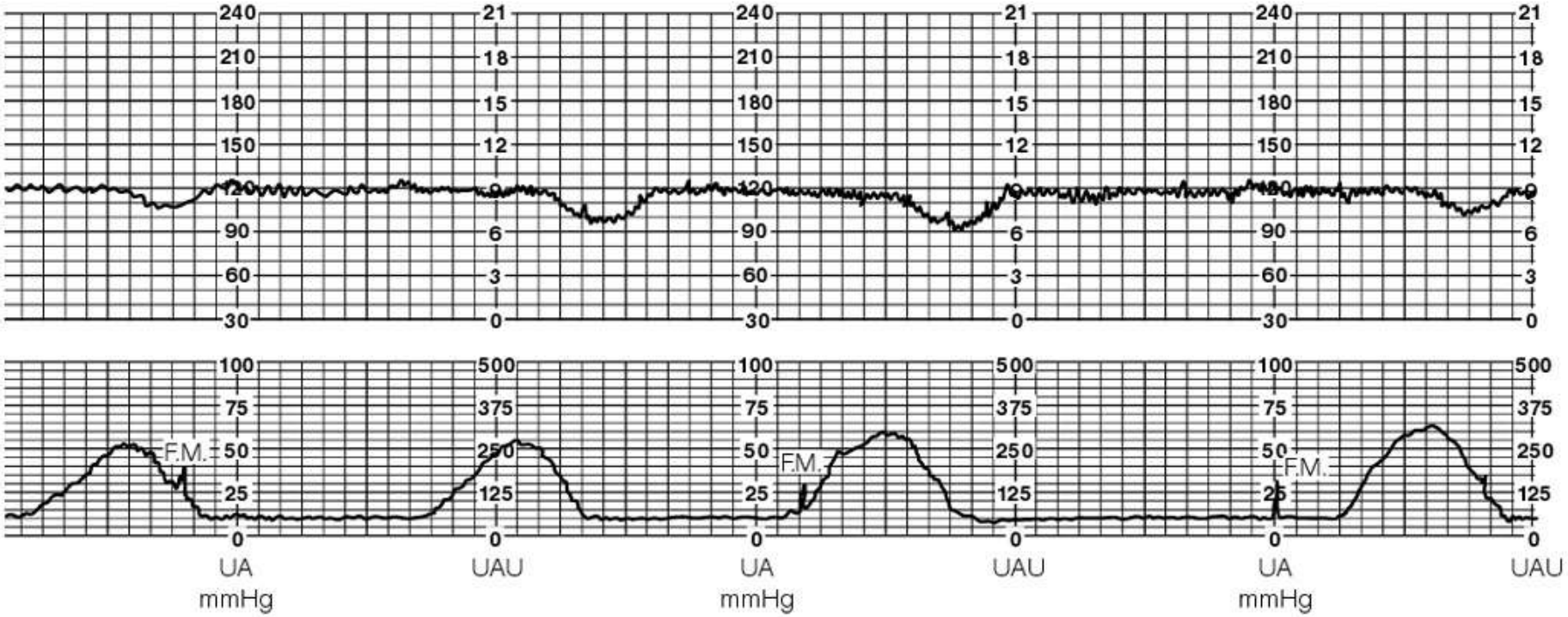


Figure 14–8 Example of a positive contraction stress test (CST). Repetitive late decelerations occur with each contraction. Note that there are no accelerations of FHR with three fetal movements (FM). The baseline FHR is 120 bpm. Uterine contractions (bottom half of strip) occurred four times in 12 minutes.

KEY FACTS TO REMEMBER

Nonstress Test

Diagnostic value: Demonstrates fetus's ability to respond to its environment by acceleration of FHR with movement.

RESULTS

- *Reactive test:* Accelerations (at least 2) of 15 bpm above the baseline, lasting 15 sec or more in a 20-min window, are present, indicating fetal well-being.
- *Nonreactive test:* Accelerations are not present or do not meet the above criteria indicating that the fetus is at risk or asleep.
- *Unsatisfactory test:* Data cannot be interpreted or there was inadequate fetal activity.

HINTS FOR PRACTICE

When offering expectant parents options for fetal evaluation, make sure that the parents understand the differences between *screening* tests, such as the nuchal translucency testing (NTT) and quadruple screen, and *diagnostic* testing, such as the chorionic villus sampling and amniocentesis. Screening tests can be valuable tools to determine if a fetus is at risk; however, a diagnostic test indicates whether or not the fetus actually has the disorder.

TABLE 14–1 Summary of Screening and Diagnostic Tests

Goal	Test	Timing
To validate the pregnancy	Ultrasound: gestational sac volume	5 and 6 weeks after last menstrual period (LMP) by transvaginal ultrasound
To determine how advanced the pregnancy is	Ultrasound: crown–rump length	6 to 10 weeks' gestation
	Ultrasound: biparietal diameter, femur length, abdomen circumference	13 to 40 weeks' gestation
To identify normal growth of the fetus	Ultrasound: biparietal diameter	Most useful from 20 to 30 weeks' gestation
	Ultrasound: head/abdomen ratio	13 to 40 weeks' gestation
	Ultrasound: estimated fetal weight	About 24 to 40 weeks' gestation
To detect congenital anomalies and problems	Nuchal translucency testing	9 to 13 weeks' gestation
	Ultrasound	18 to 40 weeks' gestation
	Chorionic villus sampling	10 to 12 weeks' gestation
	Amniocentesis	15 to 20 weeks' gestation
	Fetoscopy	18 weeks' gestation
	First trimester combination screening test or quadruple test	Generally 15 to 20 weeks' gestation
To localize the placenta	Ultrasound	Usually in third trimester or before amniocentesis
To assess fetal status	Biophysical profile	Approximately 28 weeks to birth
	Maternal assessment of fetal activity	Approximately 28 weeks to birth
	Nonstress test	Approximately 28 weeks to birth
	Contraction stress test	After 28 weeks
To diagnose cardiac problems	Fetal echocardiography	Second and third trimesters
To assess fetal lung maturity	Amniocentesis	33 to 40 weeks
	L/S ratio	33 weeks to birth
	Phosphatidylglycerol	33 weeks to birth
	Phosphatidylcholine	33 weeks to birth
	Lamellar body counts	33 weeks to birth
To obtain more information about breech presentation	Ultrasound	Just before labor is anticipated or during labor

Quiz

1 -The heart rate of a normal fetus at term:
A. 80-100 bpm.
B 100-120 bpm.
C. 120-160 bpm.
D. 160-180 bpm

2 -The following are major indicators of fetal asphyxia:
A. Old meconium at the time of induction of labor.
B. Loss of acceleration.
C. Deep type I deceleration in the 2ND stage of labor.
D. Type II (late) decelerations with tachycardia.
E. Excessive fetal movements

Amniocentesis

- **Amniotic fluid obtained by inserting a needle through the abdominal and uterine walls**
- Purpose
  - Genetics - Abnormal AFP
  - Fetal lung maturity
- **Risks**
  - **Infection** (Sterile tech req'd)
  - **Pregnancy loss**
- Tests
  - Triple tests – AFP, hCG, and UE3 (unconjugated estriol/estrogen)
  - L/S ratio- "Lecithin/Sphingomyelin" test for fetal lung maturation; **2:1**
  - **Fetal maturity index**
  - **Phosphatidylglycerol- another phospholipid surfactant**

Amniocentesis

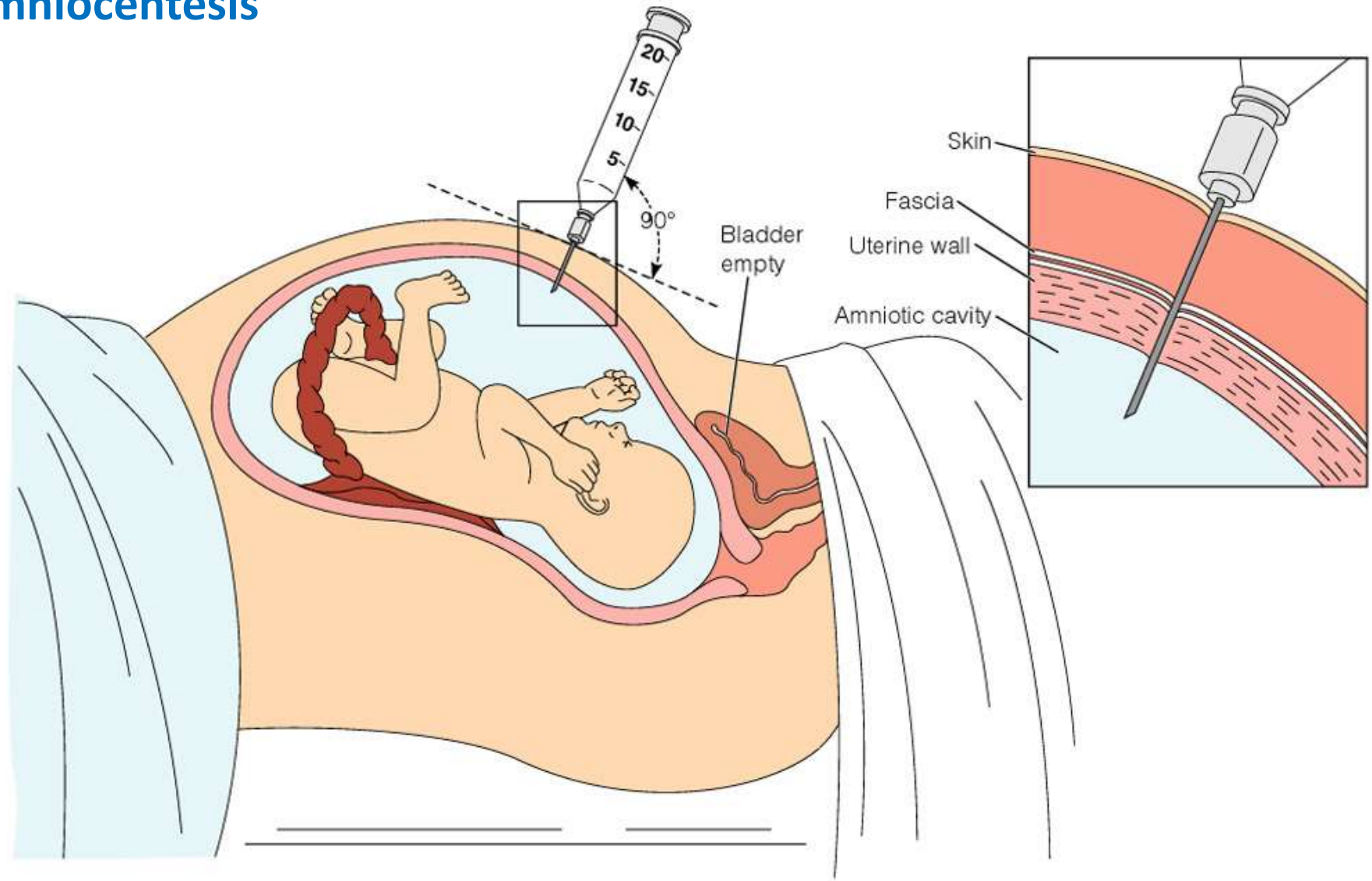


Figure 14–9 Amniocentesis. The woman is scanned by ultrasound to determine the placental site and to locate a pocket of amniotic fluid. Then the needle is inserted into the uterine cavity to withdraw amniotic fluid.

Other Fetal Diagnostic Tests

- **Chorionic Villus Sampling** – performed at 10 – 12 weeks, off the placenta
- **Percutaneous Umbilical Blood Sampling-**
- **Computed Tomography-** obtain maternal pelvic and fetal diameters
- **Magnetic Resonance Imaging-** confirm anamolies, placental assessment for location and size
- **Fetal Echocardiography-** identify cardiac anomalies- during 2nd and 3rd trimester

- Antepartum testing is used primarily in patients who are considered to be at increased risk for fetal hypoxia or asphyxia secondary to suboptimal uteroplacental transfer of oxygen.
- It is expected that the use of antepartum testing in these high-risk patients will reduce their risk of fetal/neonatal morbidity/mortality to the level of the low-risk patient

The goals of antepartum testing

- The goals of antepartum testing are
- (a) to identify fetuses in hazard so that permanent injury or death might be prevented and
- (b) to identify healthy fetuses so that unnecessary intervention might be avoided .

- Reported false-negative rates range from 0.4 to 1.9 per 1,000 with current testing methods. Another important measure is the false-positive rate.

- A false-positive test may be defined as an abnormal test that prompts delivery but is not associated with evidence of acute fetal compromise
- False-positive rates range from 30% to 90% with current testing methods.

Conclusion

- Antepartum testing is used primarily in patients who are considered to be at increased risk for fetal hypoxia or asphyxia secondary to suboptimal uteroplacental transfer of oxygen.
- It is expected that the use of antepartum testing in these high-risk patients will reduce their risk of fetal/neonatal morbidity/mortality to the level of the low-risk patient


THANK YOU