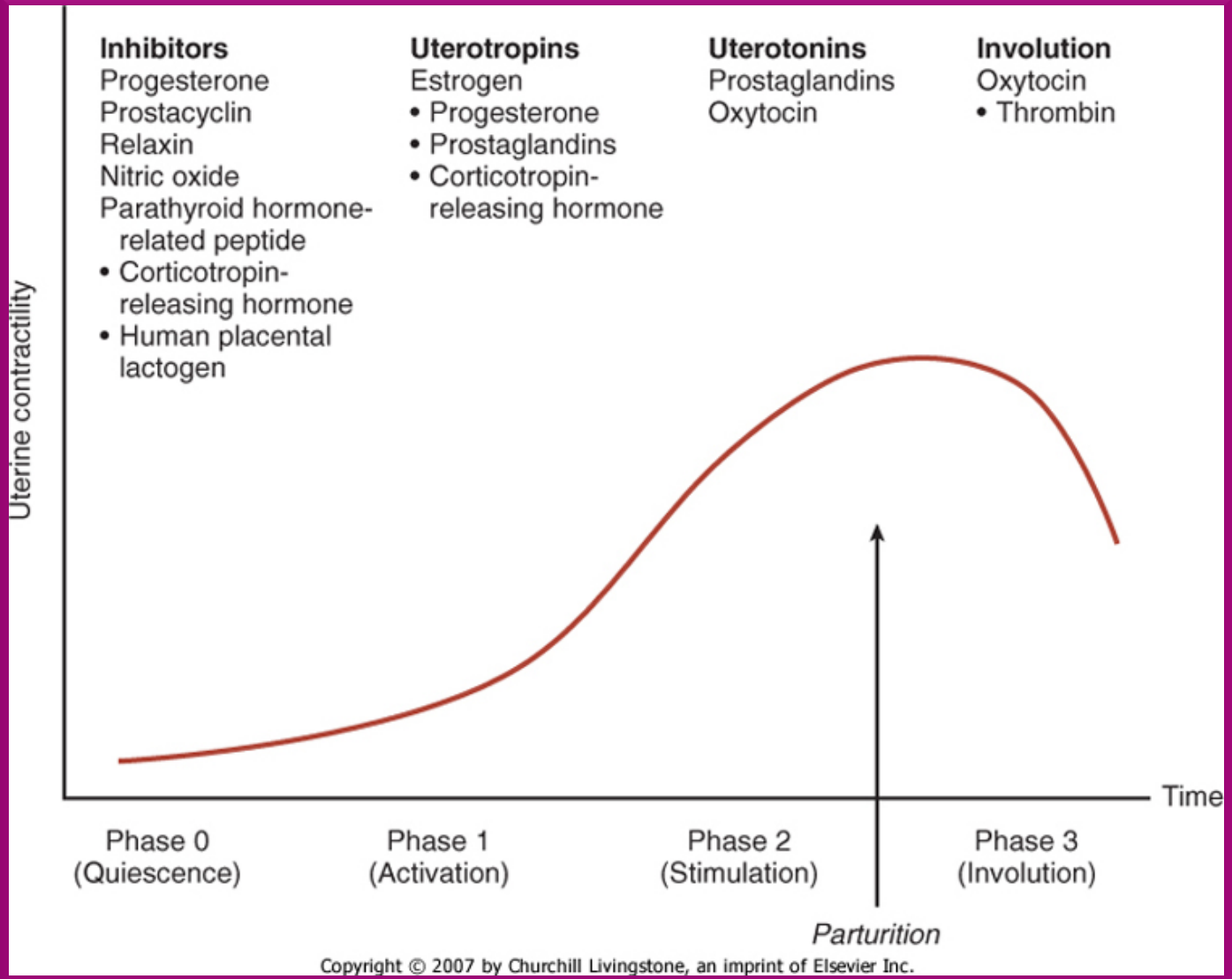
The Basic Mechanisms and Concepts of

LABOR

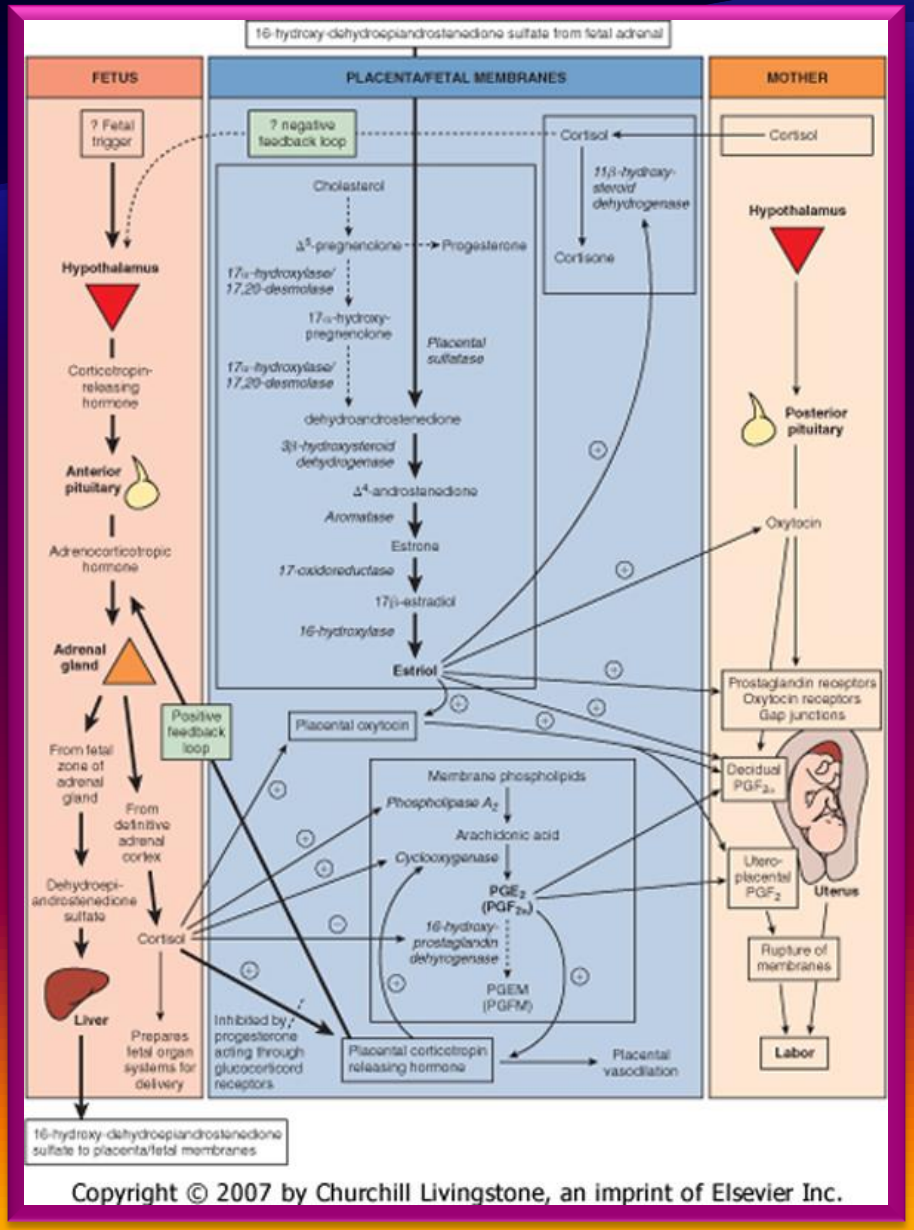
Definition

- The process by which the fetus is expelled from the uterus
- Labor requires regular, effective contractions that lead to dilation and effacement of the cervix

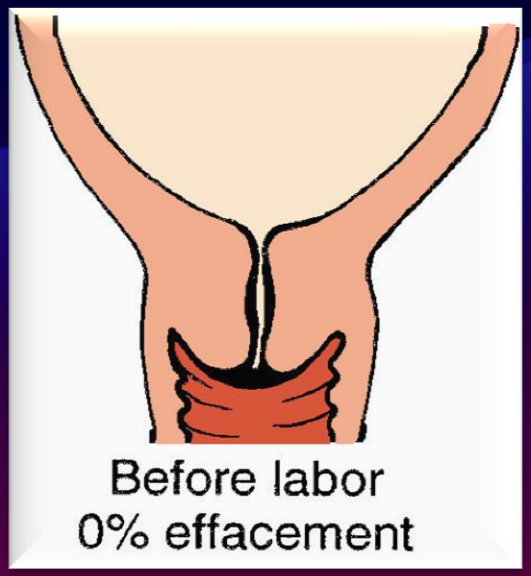
Regulation of Uterine Activity

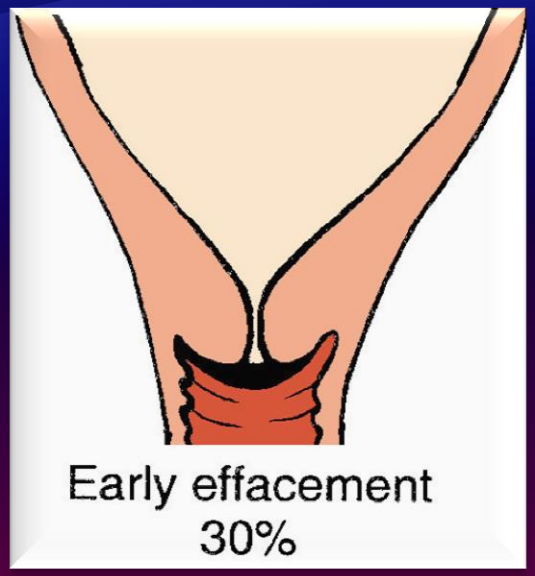


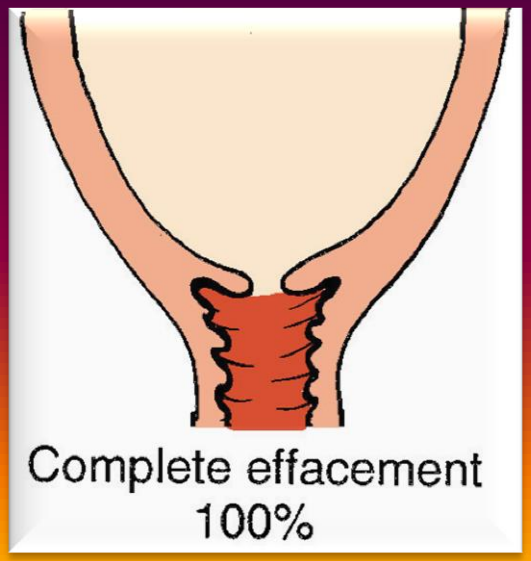
Fetal Contribution to Labor

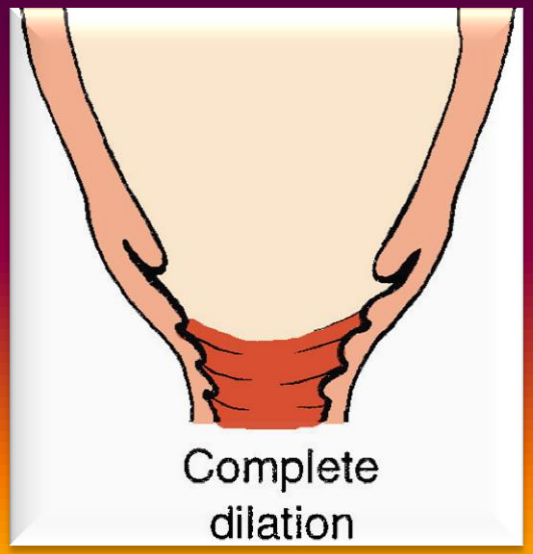


Cervical Changes During Labor









Labor Categorizations

- Phases
  - Latent - The period between the onset of labor and the point when labor becomes active
  - Active - In general, active labor requires ≥80 percent effacement and ≥6 cm dilation of the cervix
- Stages
  - 1st Stage - Labor onset to full dilation
  - 2nd Stage - Full dilation until delivery of the baby
  - 3rd Stage - Delivery of the baby until the delivery of the placenta

The ability of the fetus to negotiate the pelvis during labor and delivery is dependent on the interaction of three variables:

- Uterine activity (Power)
- The fetus (Passenger)
- The maternal pelvis (Passage)

Power

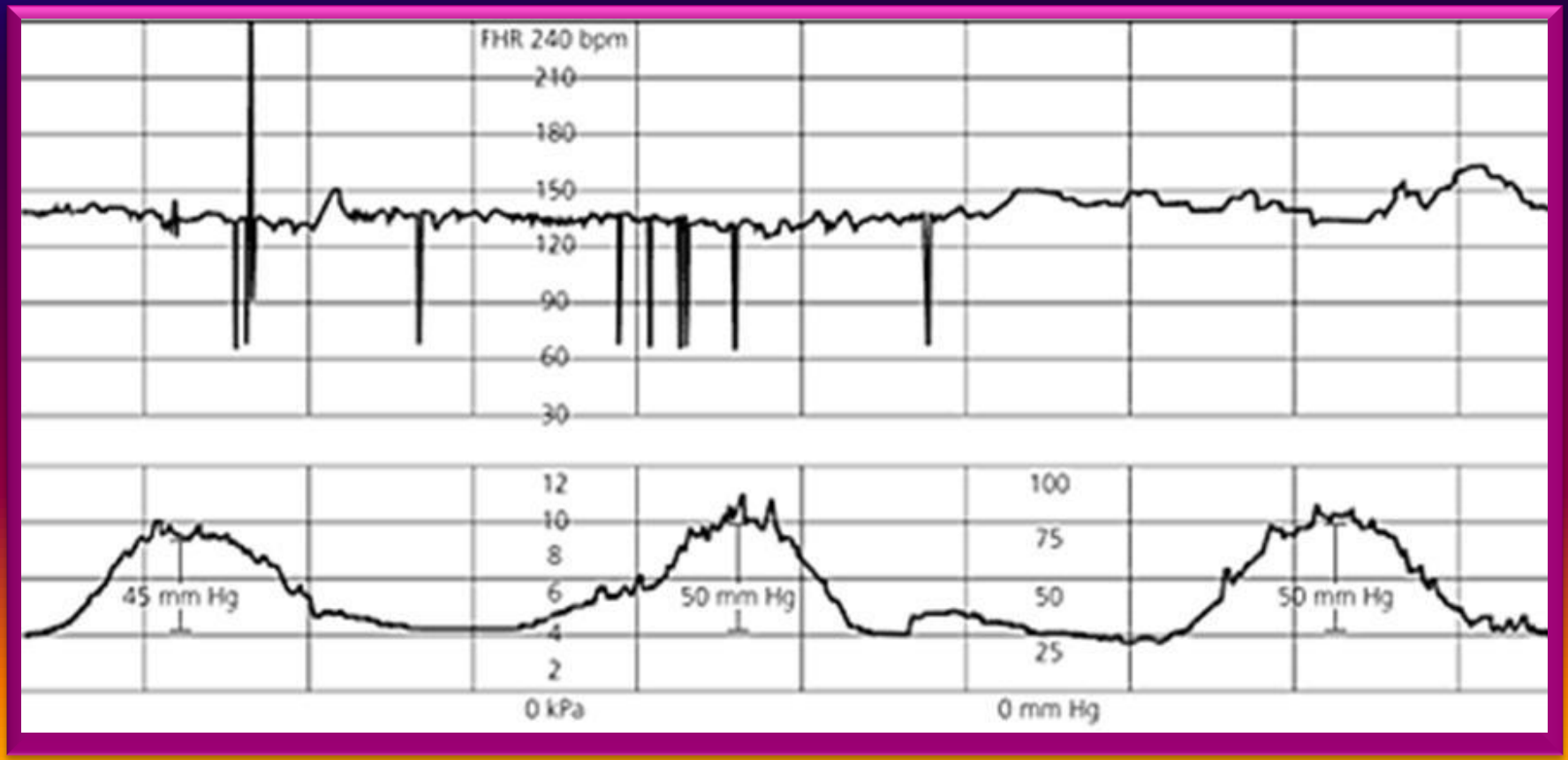
- Uterine activity
  - Frequency
  - Amplitude
  - Duration of contraction
- Assessment of uterine activity
  - Simple observation
  - Manual palpation
  - External objective assessment techniques
  - Direct measurement via intrauterine pressure catheter

Power

Montevideo Units

Calculated by summing the individual contraction intensities in a ten minute period

Generally 200 MVUs are adequate for active phase labor



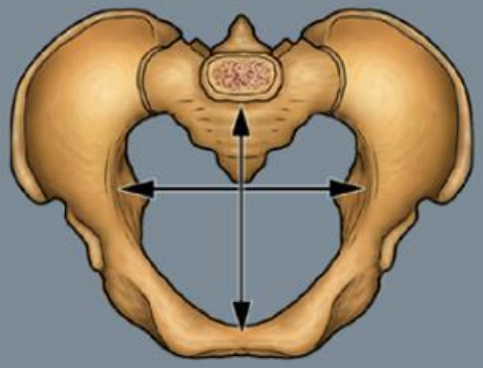
Power

- Normal
  - Five contractions or less in 10 minutes, averaged over a 30-minute window
- Tachysystole
  - More than five contractions in 10 minutes, averaged over a 30-minute window
  - Tachysystole should always be qualified as to the presence or absence of associated FHR decelerations

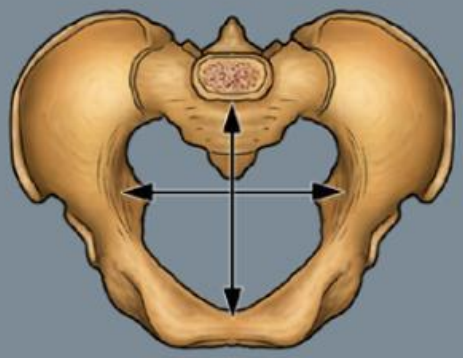
Passage

- The passage consists of the bony pelvis (composed of the sacrum, ileum, ischium, and pubis) and the resistance provided by the soft tissues

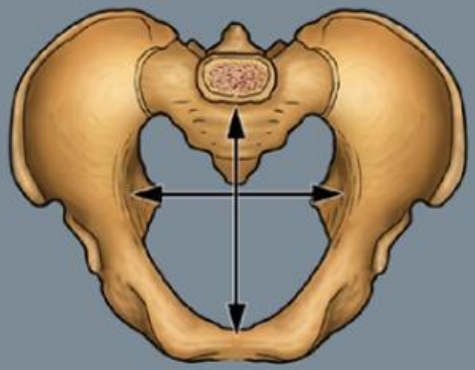
Passage



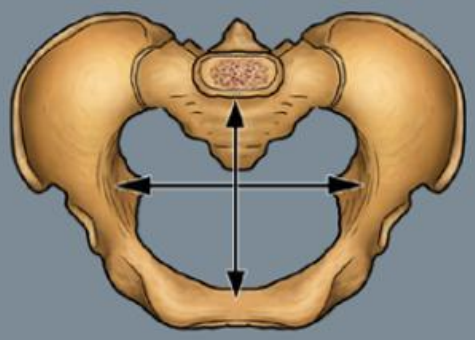
Gynecoid (Typical Female)



Android (Typical Male)

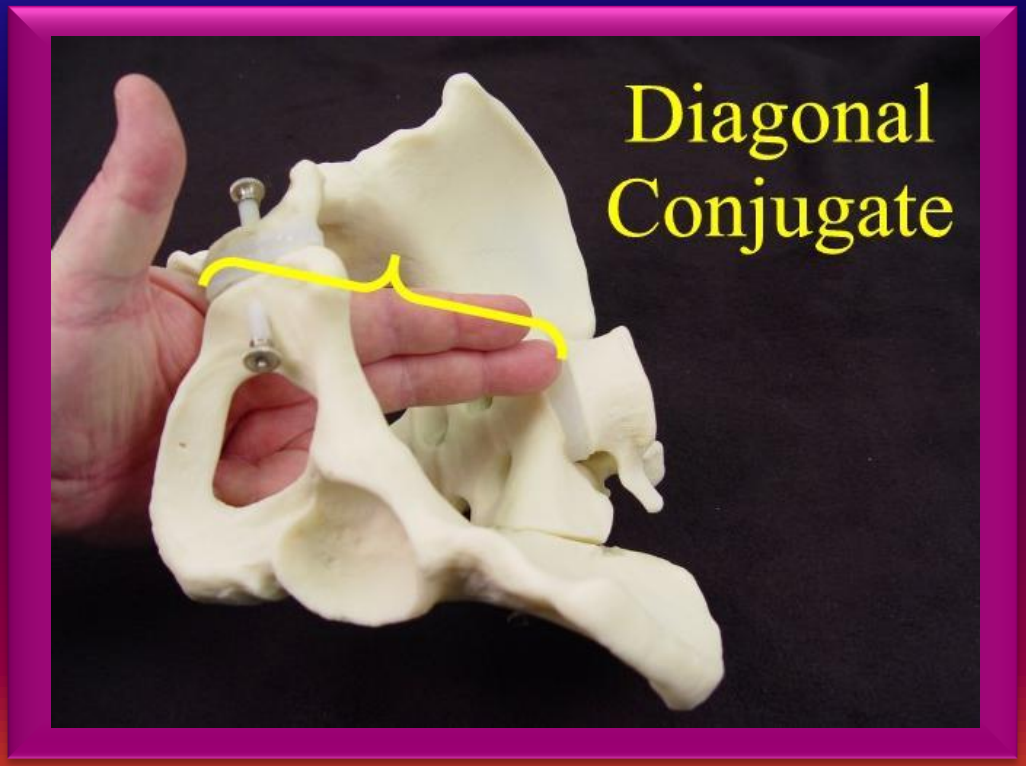


Anthropoid (Narrow)



Platypelloid (Wide)

Passage



Distance from symphysis pubis to the sacral promontory.
Approximate length from fingers to sacrum.
Adequate > 11.5 cm.

Passage

Spines may be prominent or blunt

Passage

Distance between ischial tuberosities
Approximately the width of a fist
Adequate diameter is > 10 cm

Average and Critical Values for X-Ray Pelvimetry

Diameter	Average Value	Critical Limit
Pelvic Inlet		
Anteroposterior (cm)	12.5	10.0
Transverse (cm)	13.0	12.0
Sum (cm)	25.5	22.0
Area (cm^2)	145.0	123.0
Pelvic Midcavity		
Anteroposterior (cm)	11.5	10.0
Transverse (cm)	10.5	9.5
Sum (cm)	22.0	19.5
Area (cm^2)	125.0	106.0

Passenger

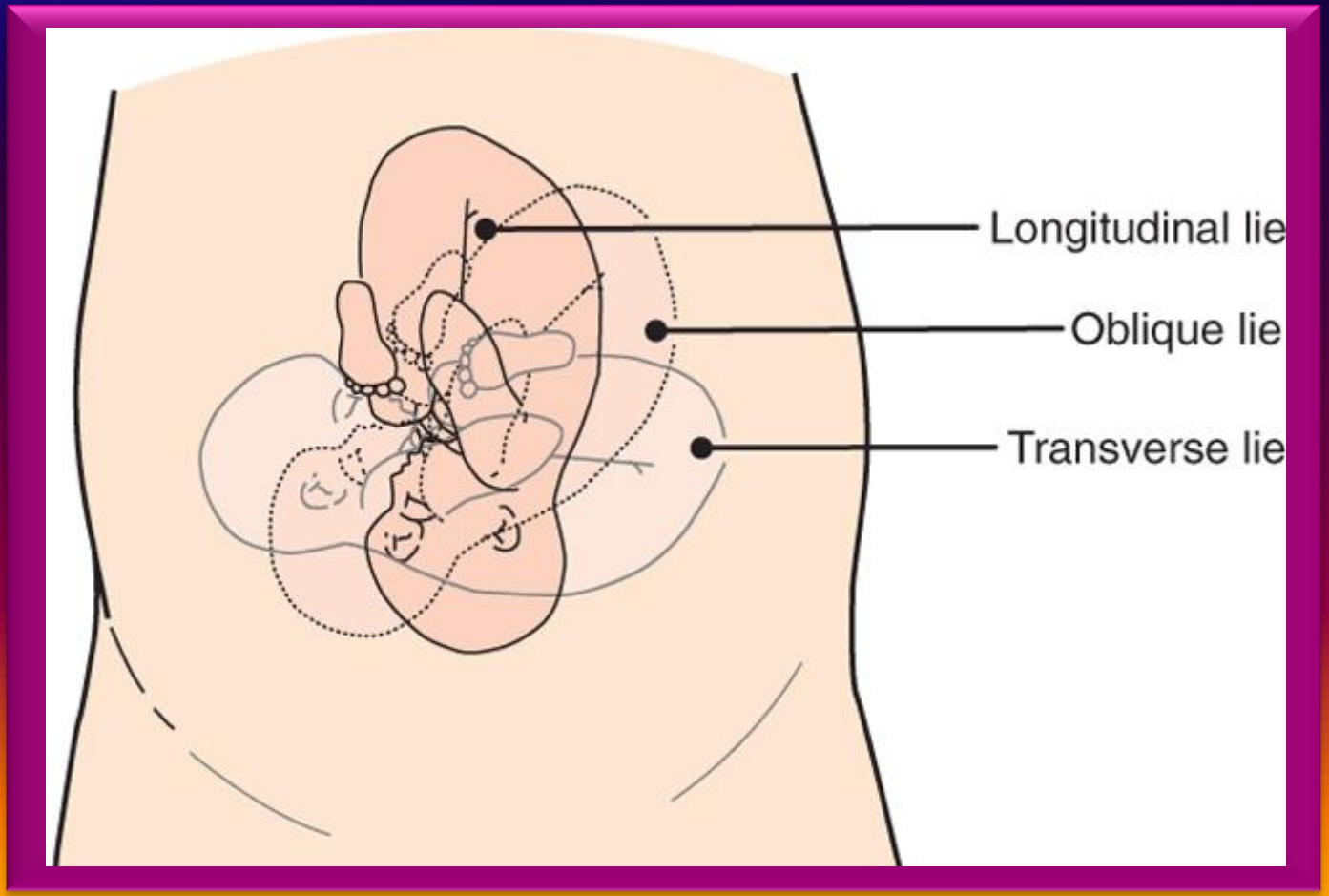
- Fetal size
- Lie
- Presentation
- Attitude
- Position
- Station

Size

- Abdominal palpation
- Ultrasound
  - Subject to large degree of error
  - Macrosomia ≥ 4500 g – associated with increased risk of failure of trial of labor

Lie

- The longitudinal axis of the fetus relative to the longitudinal axis of the uterus



Leopold's Maneuvers

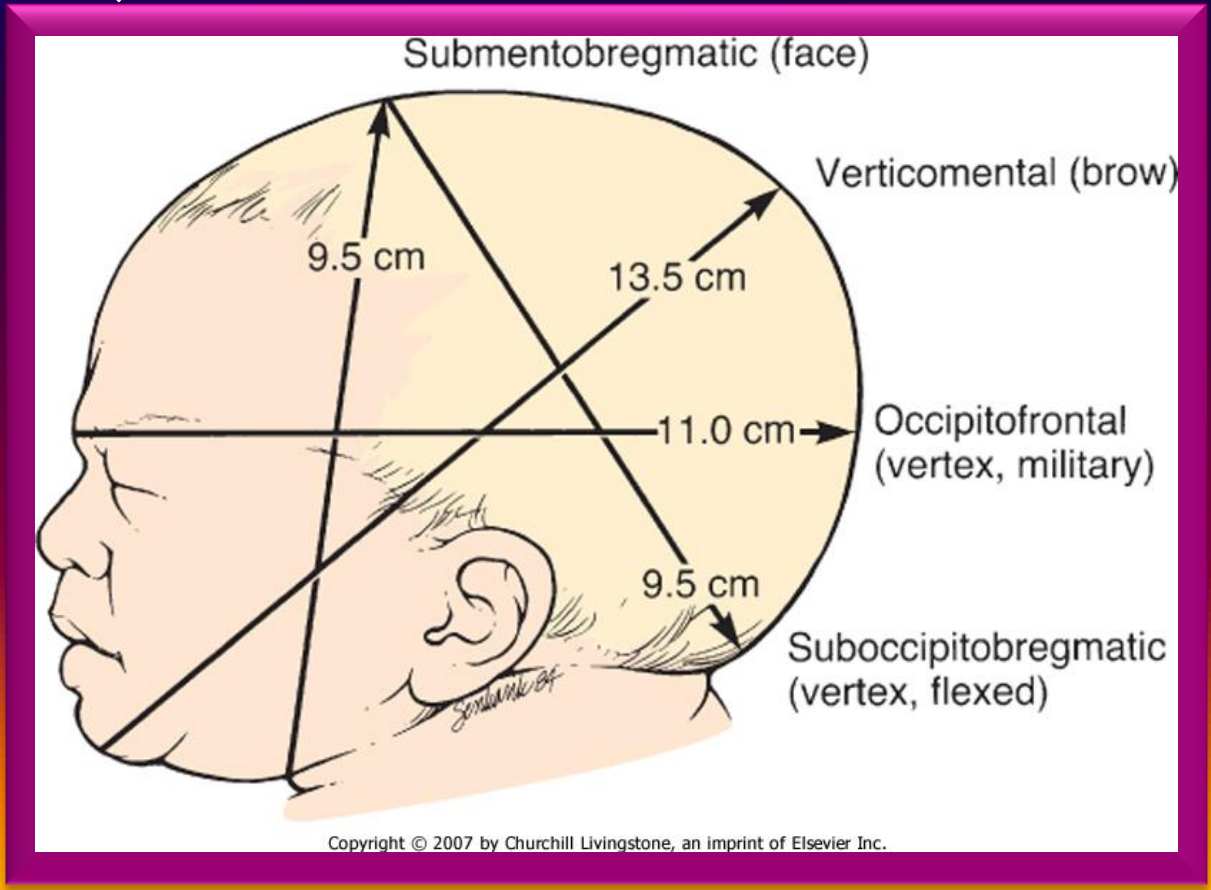
1. Fundal grip - determine the size, consistency, shape, and mobility of the form that is felt
2. Umbilical Grip -attempts to determine the location of the fetal back. The fetal back will feel firm and smooth while fetal extremities (arms, legs, etc.) should feel like small irregularities and protrusions
3. Pawlick's Grip - determine what fetal part is lying above the inlet, or lower abdomen
4. Pelvis grip - attempt to locate the fetus' brow. The side where there is resistance to the descent of the fingers toward the pubis is greatest is where the brow is located

Presentation

- The fetal part that directly overlies the pelvic inlet:
  - Cephalic/Vertex
    - Occiput (vertex)
    - Chin (mentum)
    - Brow
  - Breech
    - Frank
    - Complete
    - Incomplete
  - Funic

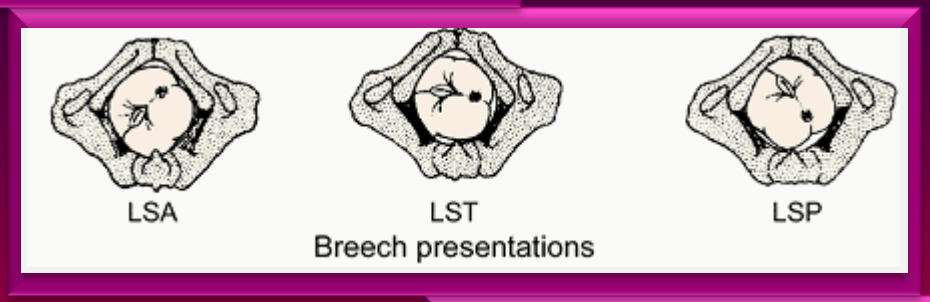
Attitude

- The position of the head with regard to the fetal spine (the degree of flexion and/or extension of the fetal head)



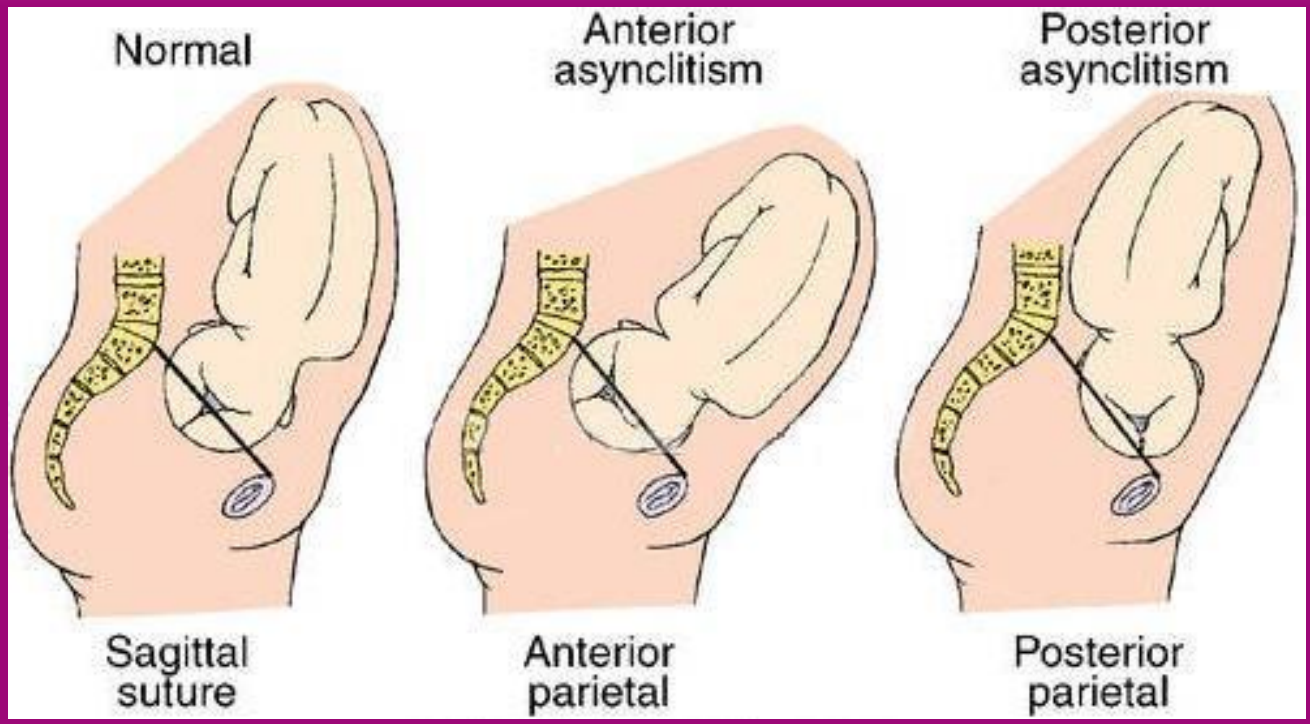
Position

- The relationship of the fetal presenting part to the maternal pelvis

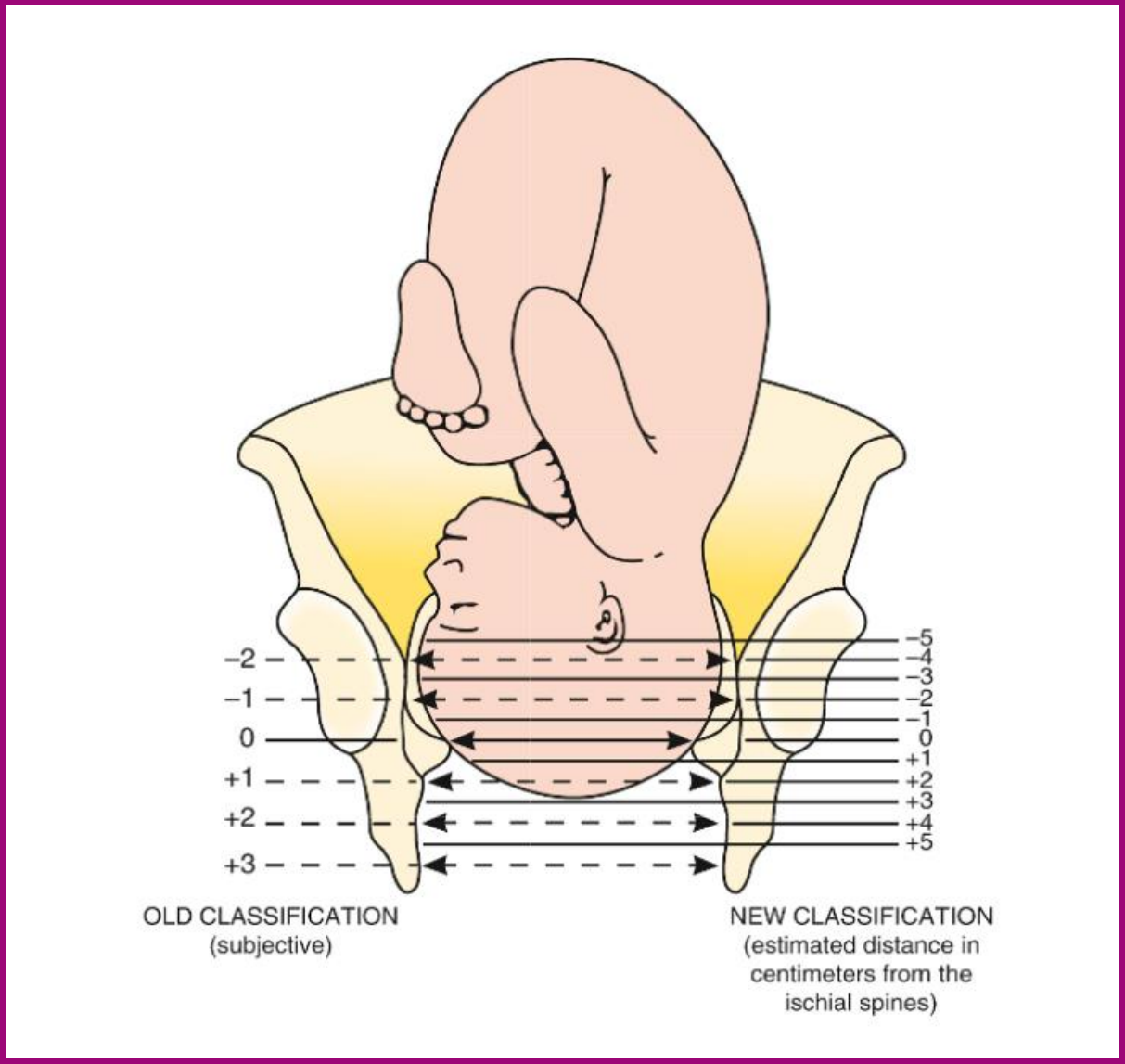


Position

- Asynclitism occurs when the sagittal suture is not directly central relative to the maternal pelvis

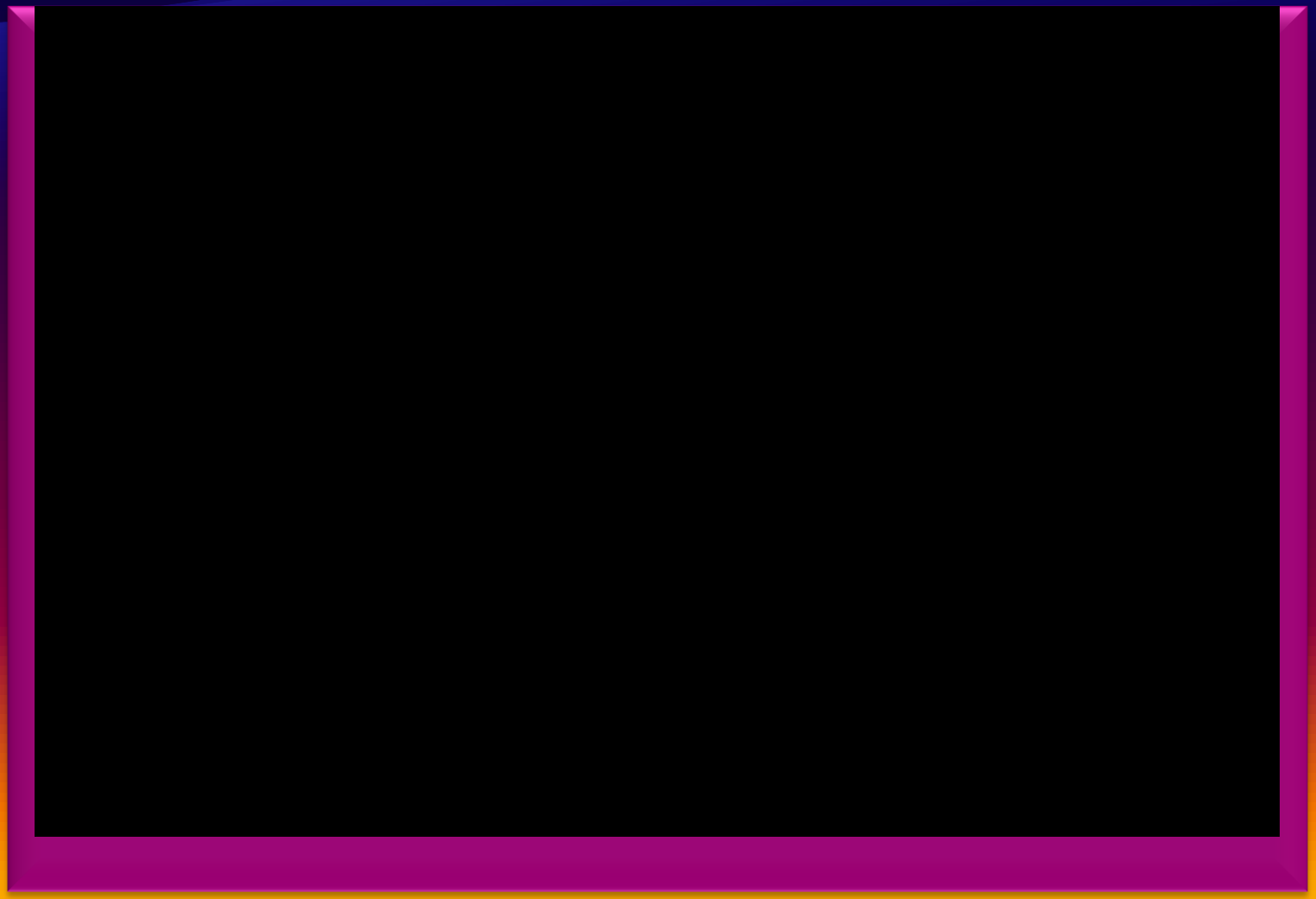


Station


–2
–1
0
+1
+2
+3
–5
–4
–3
–2
–1
0
+1
+2
+3
+4
+5
OLD CLASSIFICATION
(subjective)
NEW CLASSIFICATION
(estimated distance in
centimeters from the
ischial spines)

Station

- A measure of descent of the bony presenting part of the fetus through the birth canal



Cardinal Movements in labor

- Engagement
- Descent
- Flexion
- Internal Rotation
- Extension
- External Rotation
- Expulsion

Engagement

- Passage of the widest diameter of the presenting part to a level below the plane of the pelvic inlet

With a cephalic presentation, engagement is achieved when the presenting part is at o station (at the level of the maternal ischial spines) on vaginal examination

Descent

- The downward passage of the presenting part through the pelvis

Descent of the fetus is not continuous; the greatest rates of descent occur during the deceleration phase of the first stage of labor and during the second stage of labor.

Flexion

- Occurs passively as the head descends owing to the shape of the bony pelvis and the resistance offered by the soft tissues of the pelvic floor

Complete flexion usually occurs only during the course of labor

Internal Rotation

- Rotation of the presenting part from its original position as it enters the pelvic inlet (usually OT) to the anteroposterior position as it passes through the pelvis

As the head descends, the occiput of the fetus rotates towards the symphysis pubis allowing the widest portion of the fetus to negotiate the pelvis at its widest dimension

Extension

- The fetal head is delivered by extension and rotates around the symphysis pubis

The forces responsible for this motion are the downward force exerted on the fetus by the uterine contractions along with the upward forces exerted by the muscles of the pelvic floor

External Rotation

- The return of the fetal head to the correct anatomic position in relation to the fetal torso

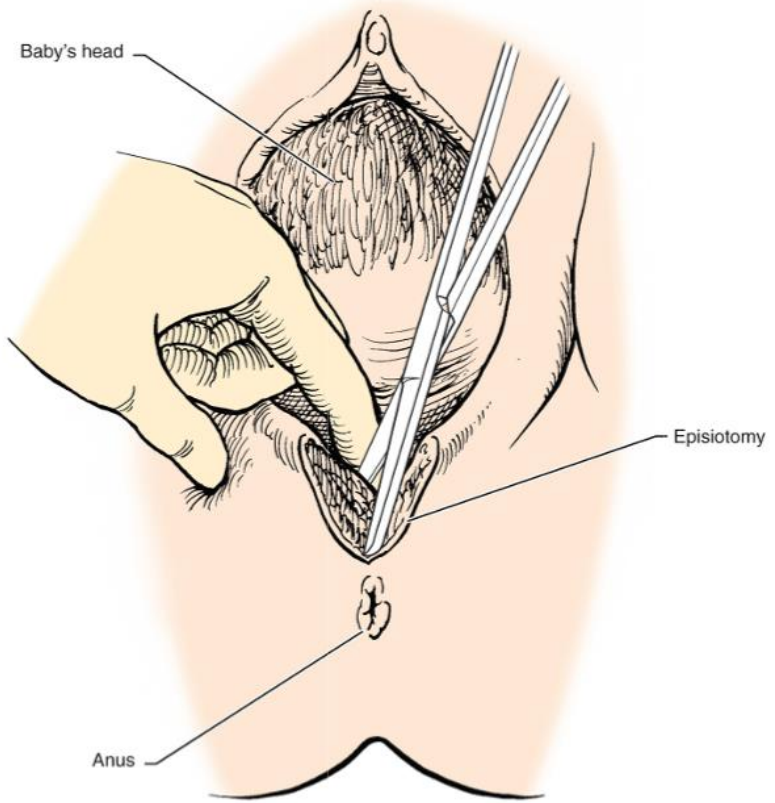
This is a passive movement resulting from a release of the forces exerted on the fetal head by the maternal bony pelvis and its musculature

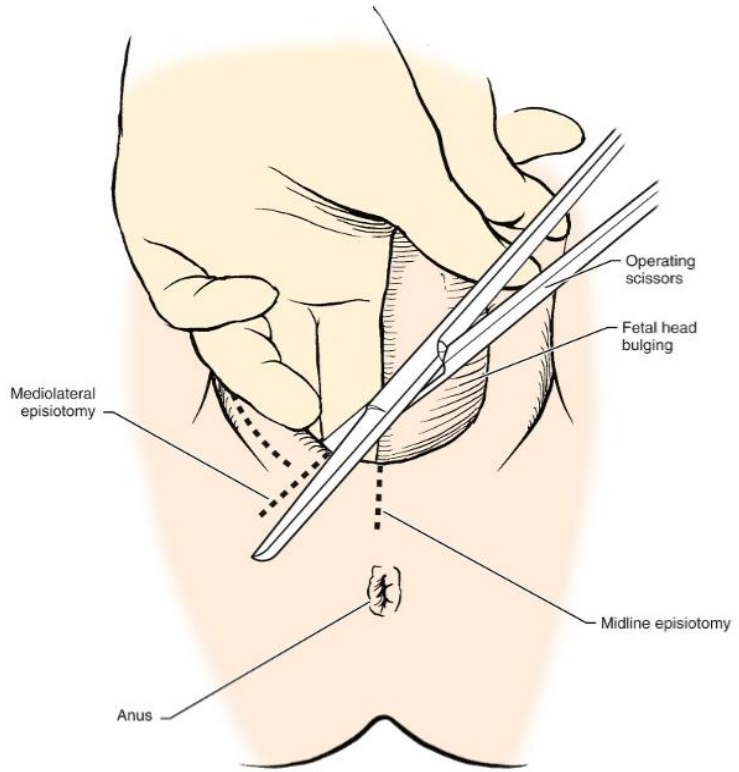
Expulsion

- Delivery of the rest of the fetus

The anterior shoulder is delivered in much the same manner as the head, with rotation of the shoulder under the symphysis pubis. After the shoulder, the rest of the body is usually delivered without difficulty.

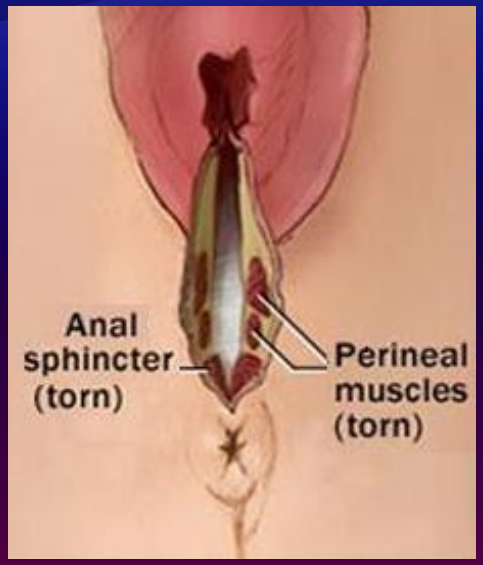
Episiotomy


Baby's head
Episiotomy
Anus

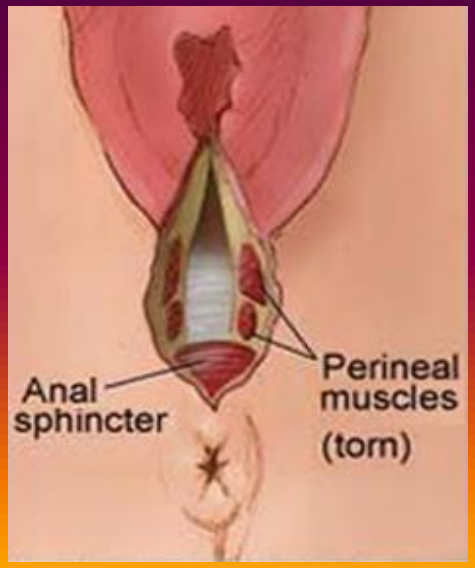

Operating scissors
Fetal head bulging
Mediolateral episiotomy
Midline episiotomy
Anus

Perineal tears

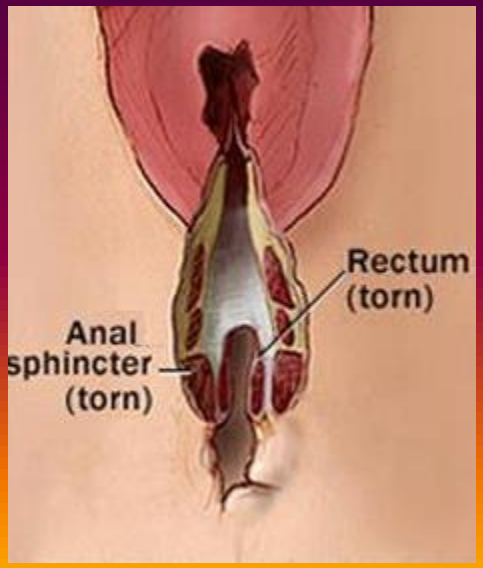
First Degree



Third Degree

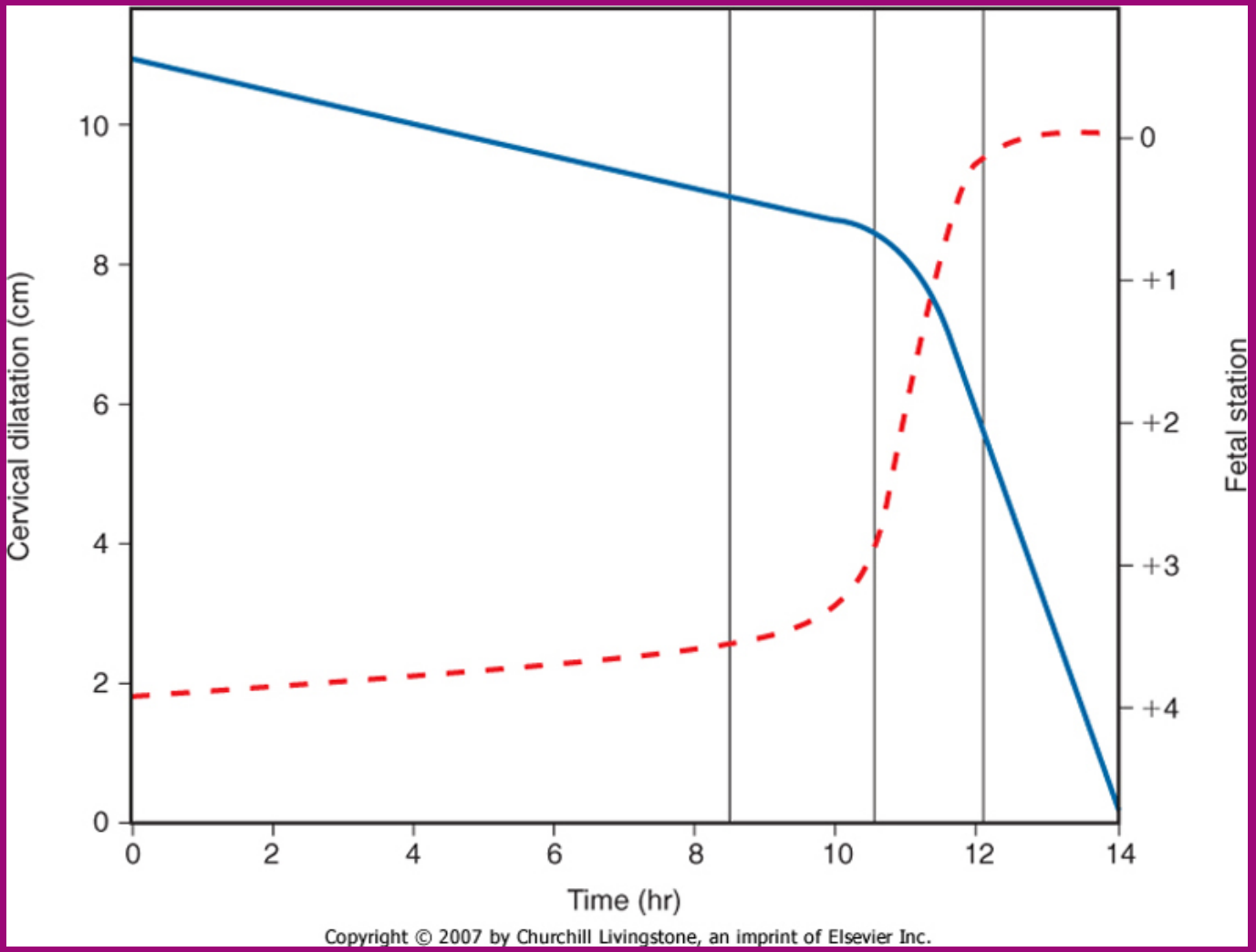


Second Degree

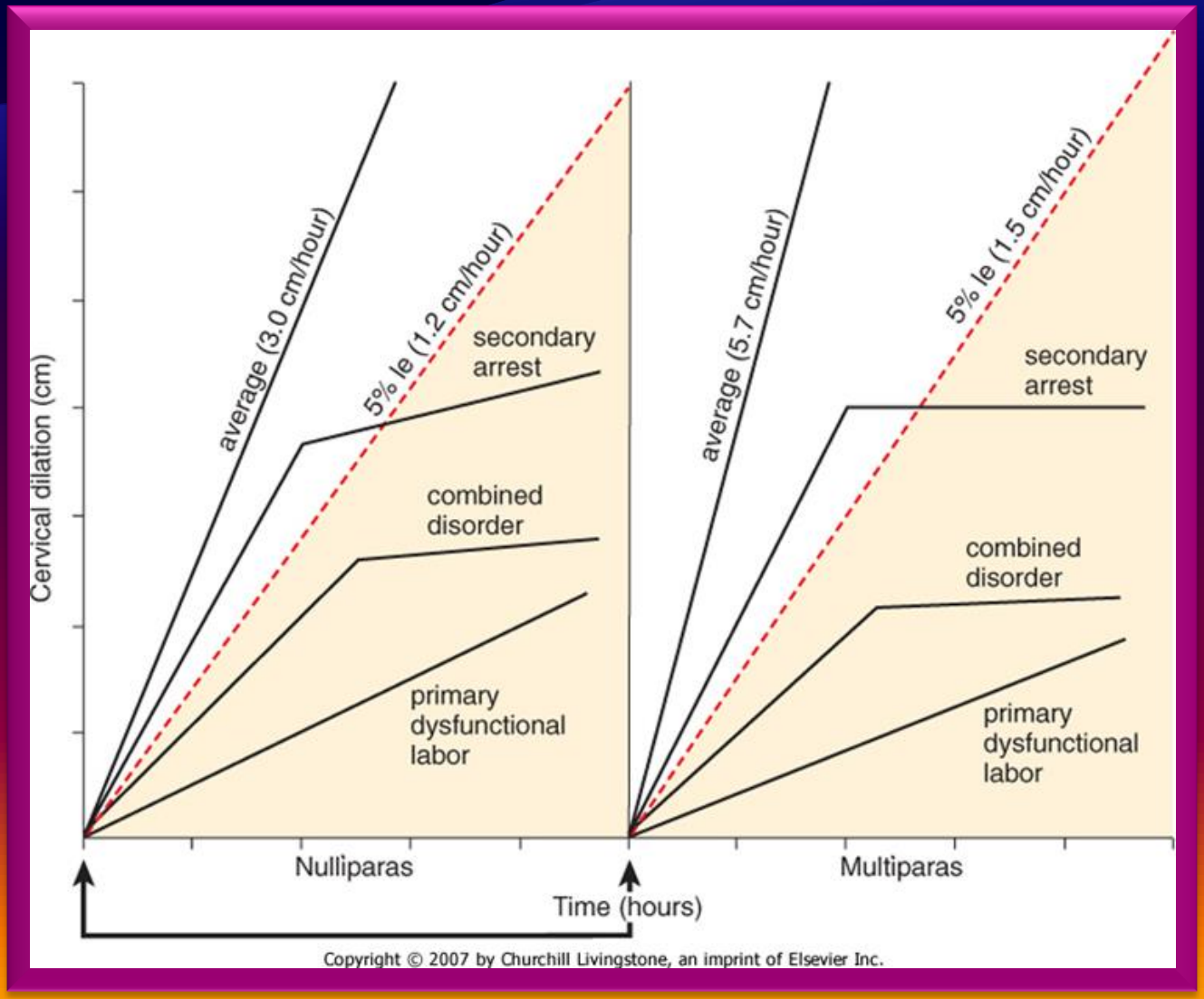


Fourth Degree

Freidman Curve

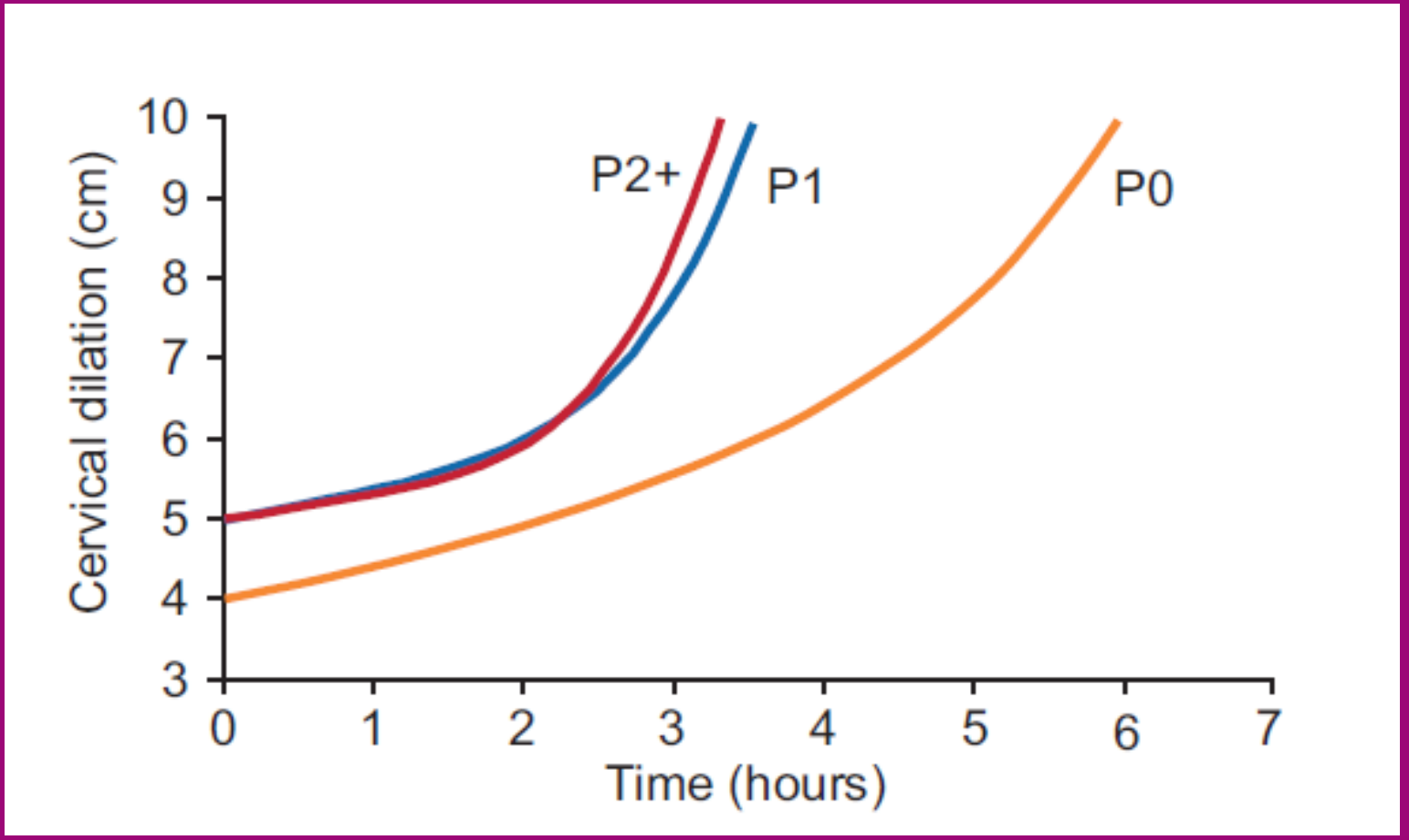


Abnormalities of Labor

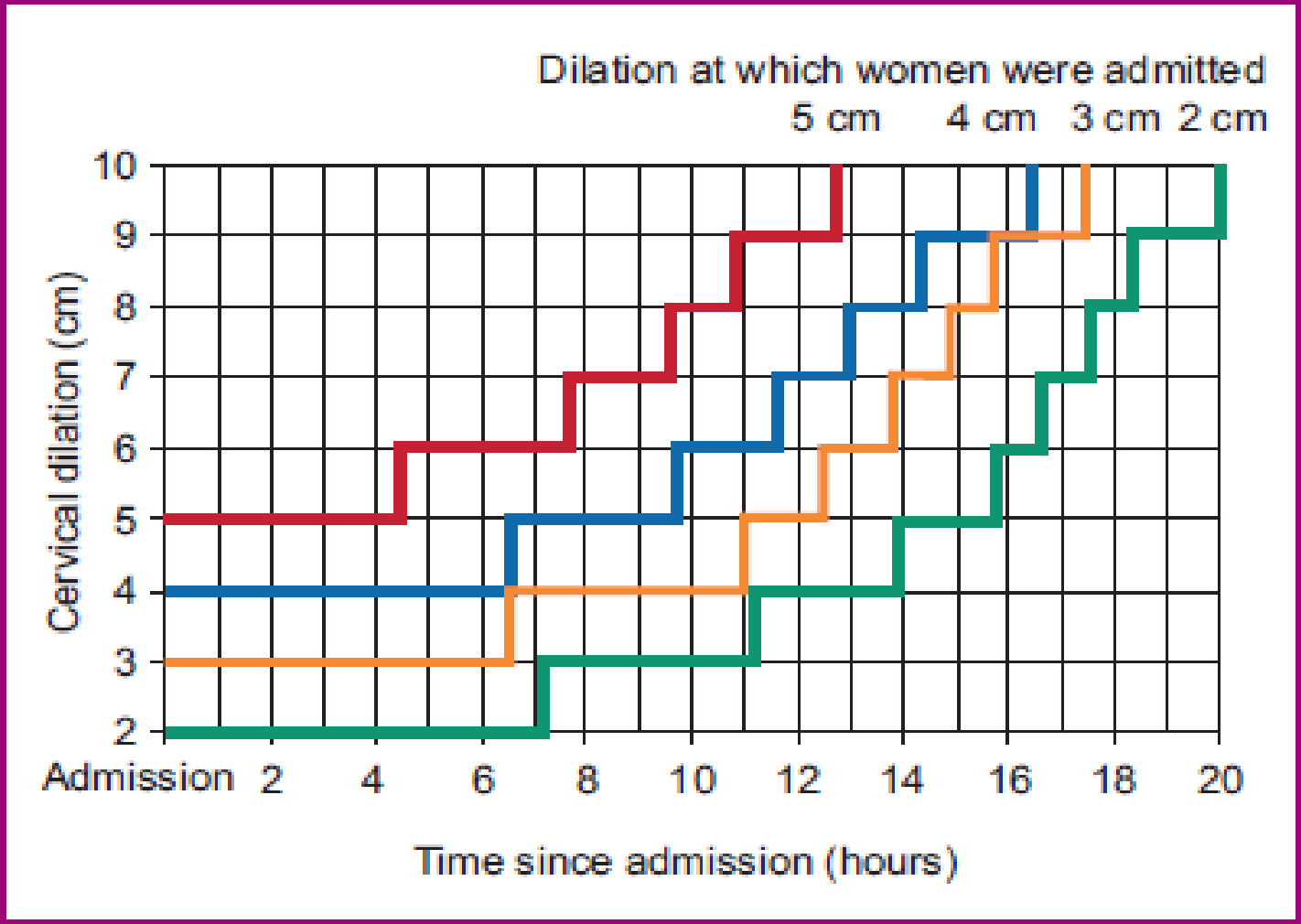


Contemporary Patterns of Spontaneous Labor with Normal Neonatal Outcomes

Consortium on Safe Labor OB/GYN 2010;116:1281-7



Cumulative Duration of Labor Singleton Term Nulliparous Patients 95th Percentiles Consortium on Safe Labor OB/GYN 2010;116:1281-7



SUMMARY OF MEANS AND 95TH PERCENTILES FOR DURATION OF FIRST- AND SECOND-STAGE LABOR

PARAMETER	MEAN	95TH PERCENTILE
Nulliparas		
Latent labor	7.3-8.6 hr	17-21 hr
First stage	6-13.3 hr	16.6-30 hr
Second stage	36-57 min	122-197 min
Second stage, epidural	79 min	336 min
Multiparas		
Latent labor	4.1-5.3 hr	12-14 hr
First stage	5.7-7.5 hr	12.5-13.7 hr
Second stage	17-19 min	57-81 min
Second stage, epidural	45 min	255 min

MEDIAN DURATION OF TIME ELAPSED IN HOURS FOR EACH CENTIMETER OF CHANGE IN CERVICAL DILATION IN SPONTANEOUS LABOR STRATIFIED BY PARITY

Cervical Dilation (cm)	Parity 0	Parity 1	Parity 2
3-4	1.8	-	-
4-5	1.3	1.4	1.4
5-6	0.8	0.8	0.8
6-7	0.6	0.5	0.5
7-8	0.5	0.4	0.4
8-9	0.5	0.3	0.3
9-10	0.5	0.3	0.3

Consortium on safe labor: Contemporary patterns of spontaneous labor with normal neonatal outcomes. *Obstet Gynecol.* 2010;116:1281.

Dystocia refers to a lack of progress of labor for any reason, and it is the most common indication for cesarean delivery (CD) in nulliparous women and the second most common indication for CD in multiparous women

The diagnosis of arrest (i.e., no cervical change) in the first stage of labor should be reserved for women at or beyond 6 cm cervical dilation with membrane rupture and one of the following: 4 hours or more of adequate contractions (e.g., more than 200 Montevideo units) or 6 hours or more of inadequate contractions

RECOMMENDATIONS FOR 95TH PERCENTILE DURATION FOR THE SECOND STAGE OF LABOR

	95TH PERCENTILE
Multiparas	
Second stage without an epidural	2 hours
Second stage with an epidural	3 hours
Nulliparas	
Second stage without an epidural	3 hours
Second stage with an epidural	4 hours

Obstet Gynecol. 2012;120(5):1181.

Duration of Pushing and Outcomes

Obstetric Outcome	Duration of Active Pushing (min) — Nulliparous: Less Than 60 (n=15,148)	60–119 (n=6,613)	120–179 (n=2,796)	180–239 (n=1,011)	240 or Greater (n=460)	*P**
Maternal						
Route of delivery						<.001
Cesarean	447 (3.0)	543 (8.2)	499 (17.9)	245 (24.2)	103 (22.4)	
OVD	1,201 (7.9)	881 (13.3)	768 (27.5)	355 (35.1)	151 (32.8)	
SVD	13,500 (89.1)	5,189 (78.5)	1,528 (54.7)	411 (40.7)	206 (44.8)	
PPH	150 (1.0)	87 (1.4)	68 (2.5)	37 (3.7)	15 (3.3)	<.001
3rd- or 4th-degree laceration	752 (5.0)	563 (8.5)	391 (14.0)	154 (15.3)	75 (16.3)	<.001
Neonatal						
CAO	193 (1.3)	97 (1.5)	61 (2.2)	26 (2.6)	11 (2.4)	<.001
Mechanical ventilation 1 d or greater	80 (0.5)	43 (0.7)	21 (0.8)	4 (0.4)	3 (0.7)	.39
Confirmed sepsis	23 (0.2)	7 (0.1)	3 (0.1)	1 (0.1)	0	.25
Brachial plexus palsy	16 (0.1)	9 (0.1)	8 (0.3)	5 (0.5)	0	.009
Fracture						
Clavicular	39 (0.3)	12 (0.2)	10 (0.4)	4 (0.4)	0	.86
Skull	1 (0.0)	2 (0.0)	1 (0.0)	2 (0.2)	0	.009
Other	0	3 (0.1)	2 (0.1)	3 (0.3)	0	<.001
Seizure	18 (0.1)	12 (0.2)	13 (0.5)	3 (0.3)	5 (1.1)	<.001
HIE	51 (0.3)	25 (0.4)	15 (0.6)	8 (0.8)	5 (1.1)	.001
Death	1 (0.0)	0	0	0	0	.49

Grobman et al. OB/GYN 127:4; 667-74.2016