Conception
Fetal Development

LVN-RN Track Instructional Module

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Preconception: Health Care Overview

Defined as a set of interventions aiming to identify

- Risks to a woman's health
  - Medical
  - Behavioral
  - Social

Components of preconception health care

- Routine physical examination
- Health screening
- Education

Preconception: Healthy Diet / Supplements

Good nutrition

- Overweight
- Underweight

Limit caffeine

Avoid fish high in mercury

Folic acid

- 0.4 mg daily
- **Extremely important before conception as well as afterward**

Avoid excessive doses of vitamins

- **Toxic to fetus**

Medications: Discuss with PCP

- Anticonvulsants
- Opioids
- Antidepressants
- Other prescribed medications

Avoid these over-the-counter medications

- Decongestants
- NSAIDs
  - Aspirin
  - Ibuprofen
  - Naproxen

Preconception: Self-Care

Avoid risky behaviors

- Alcohol
- Illicit drugs
- Tobacco/Nicotine
  - Cigarettes
  - E-cigarettes
- Second-hand smoke
- Environmental toxins

Practice safe behaviors

- Exercise / adequate rest/relaxation
- Safe sex
- Seatbelt usage
- Smoke and carbon monoxide detectors
- Dental health
- Sunscreen

Contraception Cessation

Fertility awareness and barrier methods

- Stop utilizing

Monthly hormonal contraception

- Stop: utilize a barrier method for 2-3 months before attempting conception

Depo provera

- Stop and track cycles
- Conception may take several months up to a year

IUD

- Must be removed
- Utilize barrier method for 2-3 months before attempting conception

Ovulation:
Signs and Symptoms

- Increased sensitivity to odors
- Cervical mucus changes – thin, clear
- Change in basal body temperature
  - Slight decrease before ovulation
  - Marked increase after ovulation
- Libido increases
- Breast tenderness

Elements

Ovum and Sperm Lifespan

- Ovum
  - 12 to 24 hours after ovulation
- Sperm
  - 3 days
  - Rarely up to 5 days

Optimal Intercourse Timing

- Daily for the 6 days prior to ovulation
- Day of ovulation

Fertilization (Conception)

A sperm enters the nucleus of an oocyte

Fertilized oocyte – zygote

Zygote contains diploid number of chromosomes

Chromosomes: 22 pairs + 1 pair sex chromosomes: XX or XY–23 pairs

Fertilization normally takes place in the fallopian tube

Early Cell Division

Around day 5 post conception: blastocyst

- Two components
  - Embryoblast
    - Develops into the embryo
  - Trophoblast (outer surface)
    - Assists implantation
    - Develops into part of the placenta

Multiples: More than one developing embryo

- Monozygotic
  - Results from one fertilized ovum that divides into two or more embryos
    - Identical
- Dizygotic
  - Results from fertilization of more than one ova
    - Fraternal

Implantation:
8-10 days after ovulation

Progesterone from the corpus luteum

- Stimulates the endometrium
- Thickens and increases vascularization

Enzymes secreted by the trophoblast

- Digest the endometrial surface to enable implantation

Pregnancy Signs

Presumptive: Mom	Probable (Likely but not definite): Provider
Amenorrhea	Cervical and genital changes: Chadwick's sign / Goodell's sign
Nausea/vomiting	Softening of the lower uterine segment: Hegar's sign
Breast changes	Skin hyperpigmentation (nipples, areolae, face)
Fatigue / frequent urination	Uterine and abdominal growth
Sensitivity to odors / cravings / moodiness	Positive pregnancy test

Positive Signs – Pregnancy Definitive

Auscultation of fetal heart beat

- 10 to 12 weeks' gestation

Fetal movement – palpated/observed

Transvaginal ultrasound visualization

- Detect sac at 4-4.5 weeks
- Cardiac movement at 5.5-6 weeks

Pregnancy Tests

hCG (human chorionic gonadotropin) production begins at implantation

Assessment: the presence / level of hCG

- Urine: tests for presence
- Serum: tests for quantitative level

Detected 7-8 days after conception

hCG Levels

Higher

Higher hCG levels

- Multiples
- Ectopic
- Molar pregnancy
  - The embryo does not develop or is abnormal with a placenta that grows into grape-like cysts
- Genetic abnormality
  - Ex: Trisomy 21 – Down syndrome

Lower

Miscarriage

Ectopic

False positive or false negative

- Anticonvulsants
- Diuretics
- Tranquilizers
- Various conditions

Embryo: 2-8 weeks' gestation

Organs and body structures form and develop

Heart

- 5th gestational week
  - Forms
- 6th gestational week
  - Begins to beat
  - Circulates blood

Beginning development of other structures

- Brain
- Spinal cord
- Gastrointestinal tract

Facts about Embryo and Fetus

Embryo

Exposure to teratogens at this developmental stage can lead to severe consequences

Fetus

A developing human is referred to as a fetus from week 9 to birth

Major structures continue to develop and grow

- Not as sensitive to environmental toxins

Placenta

It becomes fully functional between the 8th and 10th weeks gestation

Fetal side / maternal side

Membrane

- Separates fetal and maternal blood, prevents their mixing

Placental membrane

- Separates fetal and maternal blood, prevents mixing of the two
- Chorionic villi and placental membrane

Placental Facts

Hormones

- Estrogen
- Progesterone
- Human placental lactogen (hPL)
  - Support the pregnancy
  - Promote preparation for delivery

Metabolic functions and gas exchange

- By diffusion
  - Provides nutrients and O2
  - Removes fetal waste products and CO2

Other Placental Facts

Viruses, such as rubella and cytomegalovirus, **can** cross the placental membrane and enter the fetal circulation

Glucose easily passes across the placental membrane

- **Insulin does not**

Drugs **can** cross the placental membrane

- Drugs with an FDA pregnancy category of C, D, or X should be avoided
  - When planning a pregnancy
  - During a pregnancy

Amniotic Sac and Fluid

The amniotic sac

- Two embryonic membranes
  - Amnion: inner membrane
  - Chorion: outer membrane

The embryo and amniotic fluid are contained within the sac

The membranes stretch to accommodate the developing fetus and increasing amount of amniotic fluid

The amniotic fluid

- Acts as a cushion for the fetus
- Allows freedom of fetal movement
- Provides a consistent thermal environment
- Volume
  - 24 to 36 weeks' gestation
    - 500-1000 mL
- **Essential** for fetal lung development

Umbilical Cord / Fetal Circulation

Features

- Connects fetus to placenta
- Insertion: usually the center of the placenta
- Average length: 55 cm
- Wharton's jelly in the cord protects the umbilical vein and arteries

Umbilical Vessels

- Umbilical vein: 1
  - Carries oxygenated blood and nutrients from the placenta to the fetus
- Umbilical arteries: 2
  - Carry blood to be oxygenated and waste products form the fetus to the placenta

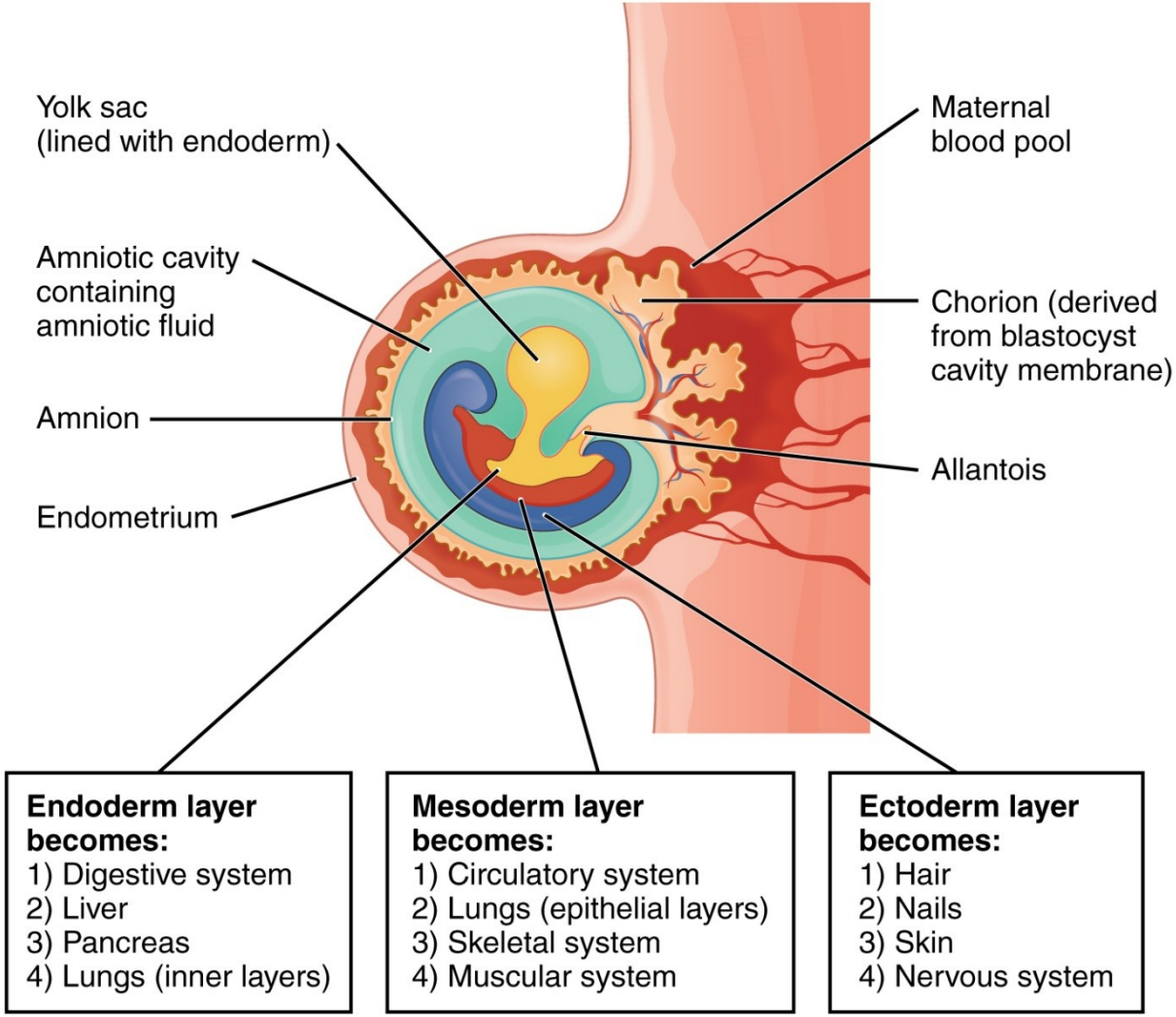
Characteristics of fetal circulation

- The ductus venosis, foramen ovale, and ductus arteriosis direct a large volume of blood flow away from the lungs

Appendices

- See Appendix A for formation of the zygote and its progression into the embryo
- See Appendix B for progression of the fetus
- See Appendix C for more information about fetal circulation

Appendix A
Formation of Structures


Yolk sac
(lined with endoderm)
Amniotic cavity
containing
amniotic fluid
Amnion
Endometrium
Maternal
blood pool
Chorion (derived
from blastocyst
cavity membrane)
Allantois
Endoderm layer
becomes:
1) Digestive system
2) Liver
3) Pancreas
4) Lungs (inner layers)
Mesoderm layer
becomes:
1) Circulatory system
2) Lungs (epithelial layers)
3) Skeletal system
4) Muscular system
Ectoderm layer
becomes:
1) Hair
2) Nails
3) Skin
4) Nervous system

Structures formed from the Primary Germ Layers

Ectoderm	Mesoderm	Endoderm
All nervous tissue	Skeletal, smooth, and cardiac muscle	Epithelium of digestive tract (except that of oral and anal cavities)
Epidermis of skin and epidermal offshoots (hairs, hair follicles, sebaceous and swear glands, nails)	Cartilage, bone, and other connective tissues	Glands of digestive tract (liver, pancreas)
Cornea and lens of eye	Blood, bone marrow, and lymphoid tissues	Epithelium of respiratory tract, auditory tube, and tonsils
Epithelium of oral and nasal cavities, of paranasal sinuses, and of anal canal	Endothelium of blood vessels and lumphatics	Thyroid, parathyroid, and thymus glands
Tooth enamel	Serosa of ventral body cavity	Epithelium of reproductive ducts and glands
Epithelium of pineal and pituitary glands and adrenal medulla	Fibrous and vascular tunics of eyes	
Melanocytes	Synovial membranes of joint cavities	

Appendix B
Fetal Development

Summary of Fetal Development

Gestational Week	Length (crown to rump) and Weight	Fetal Development Characteristics
12	7-9 cm 20-45 gms	Placenta is complete Red blood cells produced in liver Organ systems and fetal circulation are complete Fingers and toes are discernible Fusion of palate and nasal septum are complete Eyelids are closed Fetal heart tones can be heard by Doppler
16	10-17 cm 55-120 gms	Lanugo is present on head Meconium is formed in intestines Teeth begin to form Sucking motions are made with mouth Skin is transparent External genitalia are developed to point that sex can be noted with ultrasound
20	19-25 cm 223-450 gms	Lanugo covers entire body Vernix caseosa covers the body Nails are formed Brown fat begins to develop Fetal movements are felt by the mother (quickening)

Summary of Fetal Development

Gestational Week	Length (crown to rump) and Weight	Fetal Development Characteristics
24	28-36 cm 680-820 gms	Eyes are developed. Alveoli form in lungs and begin to produce surfactant Footprints and fingerprints are forming Respiratory movements can be detected
28	35-38 cm 1200-1300 gms	Eyelids open Adipose tissue develops rapidly Respiratory system has developed to point where gas exchange is possible, but lungs are not mature
32	38-43 cm 1500-2500 gms	Bones are fully developed Lungs are maturing Increased amounts of adipose tissue are present

Summary of Fetal Development

Gestational Week	Length (crown to rump) and Weight	Fetal Development Characteristics
36	42-49 cm 1900-2900 gms	Lanugo begins to disappear The face and body have a wrinkled, loose appearance due to subcutaneous fat deposits Labia majora and minora are equally prominent Testes are in upper portion of scrotum Amniotic fluid decreases
40	48-52 cm 3000-3400 gms	Fetus is considered full term at 39 weeks All organs/systems are fully developed Skin is smooth The bones of the skull are ossified and nearly together at the sutures

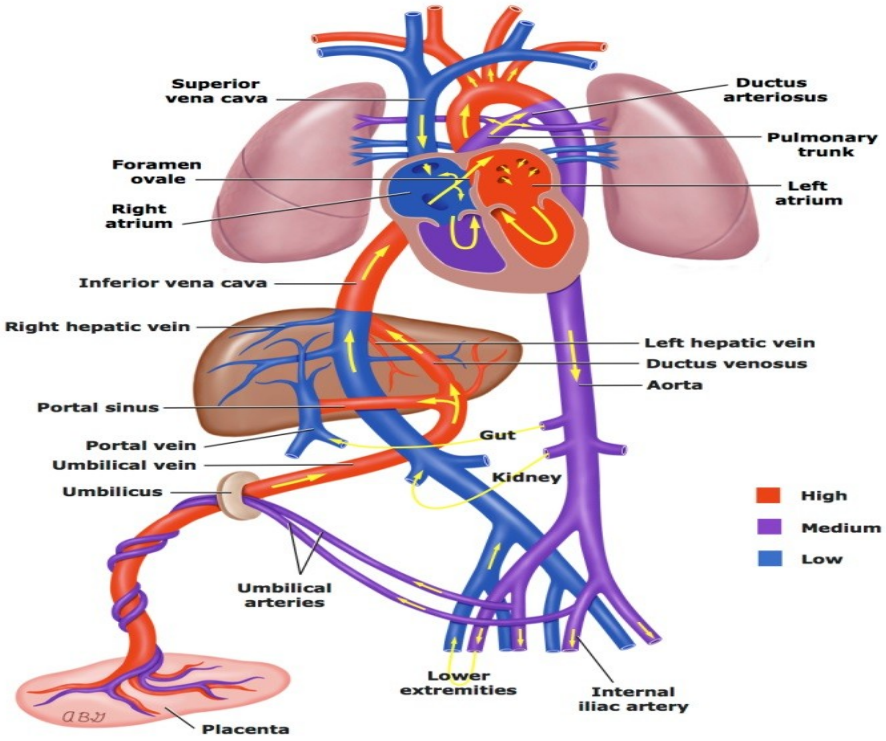
Baby size during pregnancy

fyi

- 4 weeks Poppy Seed
- 5 weeks Apple Seed
- 6 weeks Sweet Pea
- 7 weeks Blueberry
- 8 weeks Raspberry
- 9 weeks Green olive
- 10 weeks Kumquat
- 11 weeks Lime
- 12 weeks Plum
- 13 weeks Lemon
- 14 weeks Nectarine
- 15 weeks Apple
- 16 weeks Avocado
- 17 weeks Pear
- 18 weeks Bell Pepper
- 19 weeks Big Tomato
- 20 weeks Artichoke
- 21 weeks Carrots
- 22 weeks Papaya
- 23 weeks Grapefruit
- 24 weeks Ear of Corn
- 25 weeks Rutabaga
- 26 weeks Lettuce
- 27 weeks Cauliflower
- 28 weeks Eggplant
- 29 weeks Acorn Squash
- 30 weeks Cabbage
- 31 weeks Coconut
- 32 weeks Jicama
- 33 weeks Pineapple
- 34 weeks Butternut Squash
- 35 weeks Honeydew
- 36 weeks Swiss Chard
- 37 weeks SWinter Melon
- 38 weeks Pumpkin
- 39-40 weeks Watermelon

Appendix C
Fetal Circulation Diagram

Fetal Circulation



Chorionic Villi and Placental Membrane