Infant of a Diabetic Mother

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Introduction

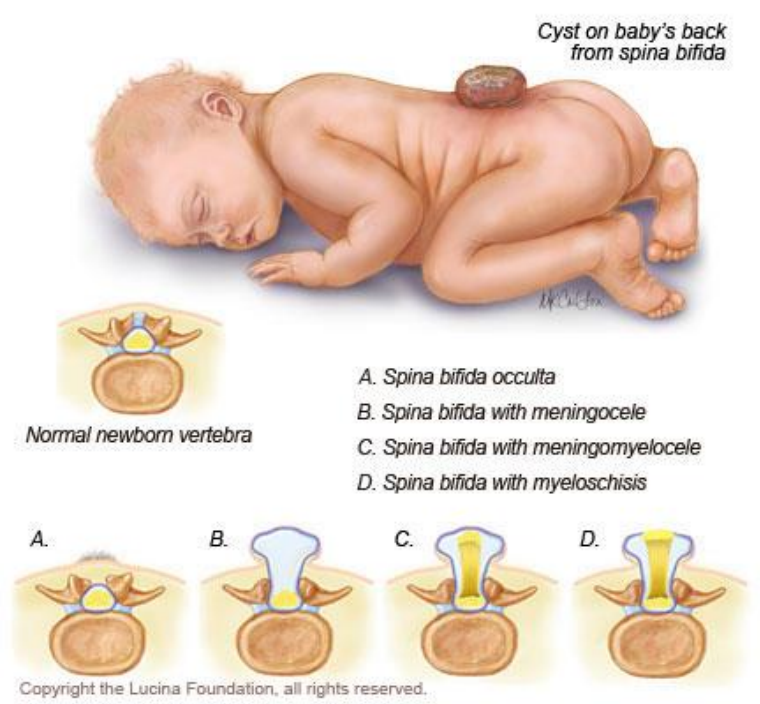
- Frequency: 3-10% of pregnant women have diabetes
  - 88% have gestational diabetes
  - 12% have known diabetes
    - 35% with Type I diabetes
    - 65% with Type II diabetes

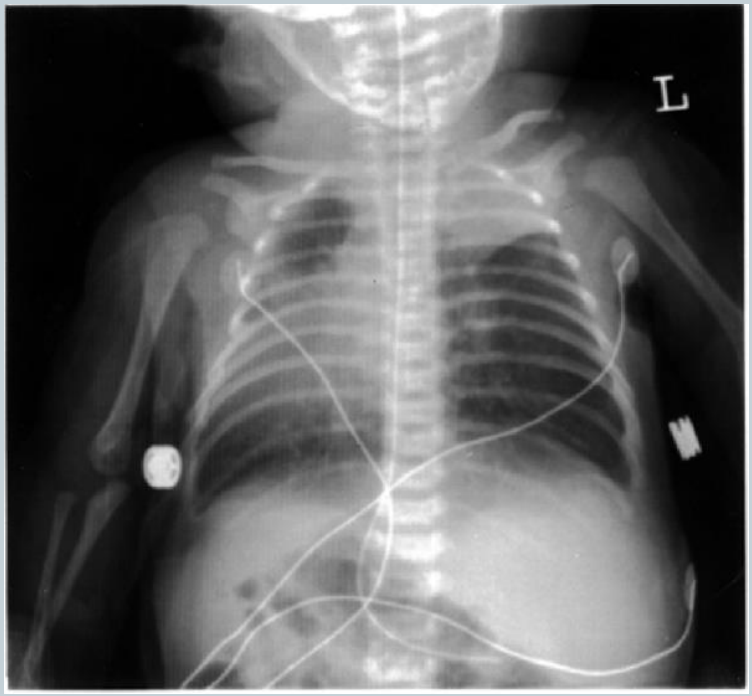
Risk of Complications

- Depends on degree of glucose control
- Higher risk for complications to the fetus in moms with pre-gestational diabetes than with gestational diabetes
  - i.e. increased risk for congenital anomalies, future obesity, and diabetes
- Higher risk of complications during pregnancy when diabetic
  - i.e. preeclampsia 2x more common in diabetic pregnancies vs. normal pregnancies

Pathophysiology of Fetal Effects

- Maternal hyperglycemia acts like a teratogen -> spontaneous abortions and malformations





Situs Inversus

Pathophysiology of Fetal Effects

- Intermittent maternal hyperglycemia causes fetal hyperglycemia -> premature maturation of fetal pancreatic islet cells -> hyperinsulinemia in the fetus
- Increased insulin -> macrosomia -> increased metabolic rate -> increased O2 consumption -> relative hypoxia in the fetus ->
  - Stimulates erythropoietin -> polycythemia
  - May be contributing factor to 20-30% stillbirth rate in poorly controlled diabetics

Complications At Delivery

- Premature delivery
- Perinatal asphyxia
- Birth injury

Neonatal Effects

Seen in 0.6% to 4% of diabetic pregnancies

Metabolic

- IUGR or macrosomia:
  - Moms with poorly controlled diabetes and renal, cardiovascular, retinal disease are more likely to have a premature and/or IUGR baby
  - Macrosomia is due to the direct effects of hyperinsulinemia
    - Babies are >90th% in weight or >4000g, with excess fat accumulation in abdominal and scapular regions, along with visceromegaly.

LGA and SGA babies

Metabolic

- Hypoglycemia: glucose <40 mg/dl
  - 27% of IDMs have hypoglycemia
  - Usually occurs in first few hours of life
  - Secondary to persistent hyperinsulinemia while transplacental glucose supply has stopped
  - S/S: lethargy, hypotonia, tremors, seizures, diaphoresis

Metabolic

- Hypocalcemia: Ca <7 mg/dl
  - Usually occurs in first 24-72 hours of life
  - Thought to be due to low PTH in infant, which may be related to high maternal Ca during pregnancy
  - S/S: asymptomatic with self resolution or jitteriness, tachypnea, seizures/tetany, lethargy, apnea

Metabolic

- Hypomagnesemia: Mg <1.5 mg/dl
  - Occurs in 40% of IDMs
  - Thought to be from increased renal losses in diabetic mom
  - Usually transient and asymptomatic
  - May need to treat if also hypocalcemic

Respiratory

- Respiratory Distress Syndrome (RDS)
  - Occurs more frequently in IDMs
  - Hyperinsulinemia causes delayed maturation of surfactant synthesis
  - Diabetic moms are more likely to go into premature labor and delivery, which puts infants at an even greater risk of having immature lungs at birth

RDS

Respiratory

- Transient Tachypnea of the Newborn (TTN)
  - Occurs more frequently in IDMs because of risk factors associated with having diabetes:

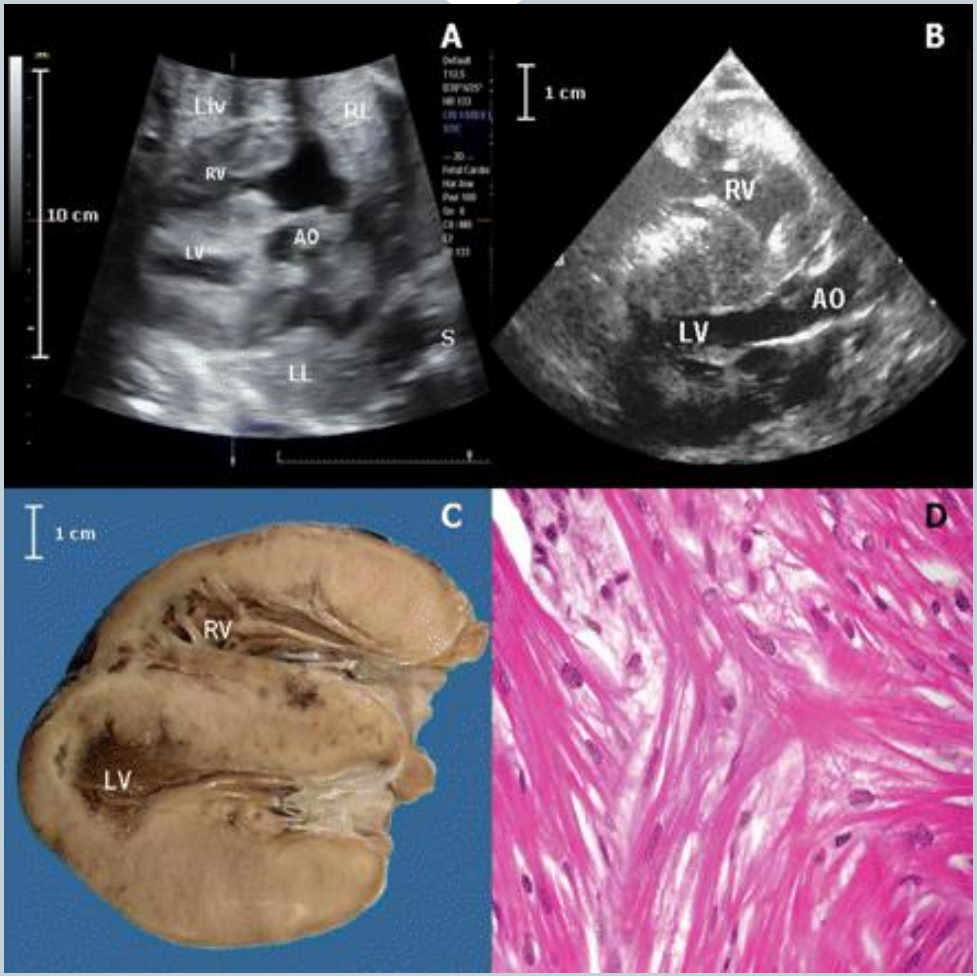
    Prematurity
    Birth asphyxia
    Increased likelihood of c-section
    Macrosomia
    Polycythemia
  - Caused by delayed resorption of fetal lung fluid, mild pulmonary immaturity, and mild surfactant deficiency
  - Usually resolves by 72 hours of life

TTN

Cardiac

- Hypertrophic cardiomyopathy
  - Most infants are asymptomatic, but 5-10% have respiratory distress, other signs of poor cardiac output, or heart failure
  - Usually resolves by 6 months of age
  - Thought to be caused by hyperinsulinemia, which increases fat and glycogen deposition into myocardial cells, causes thickening of interventricular septum &/or ventricular walls

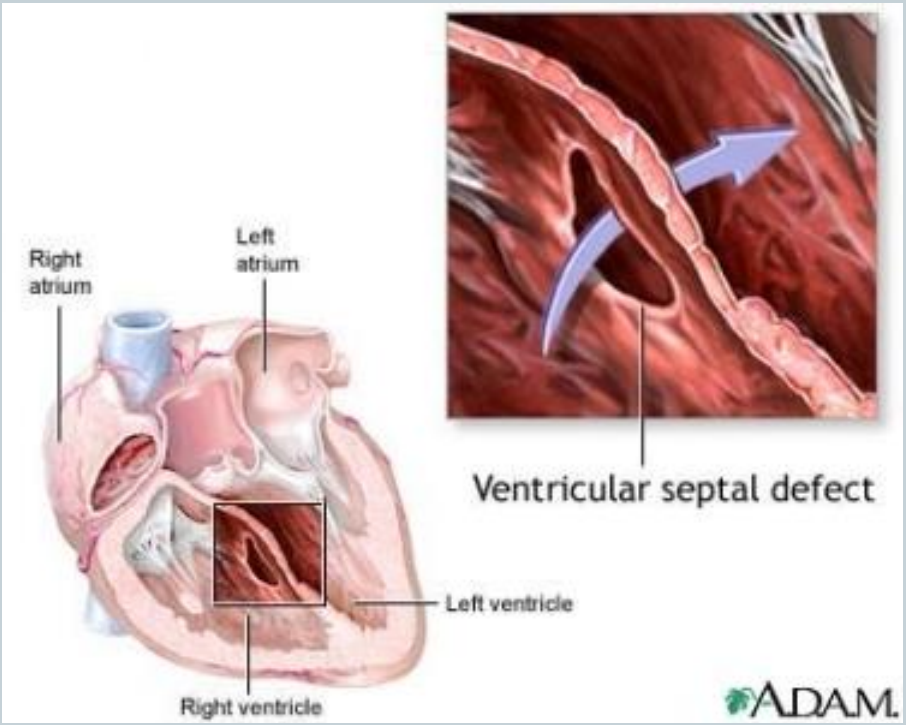
Hypertrophic Cardiomyopathy

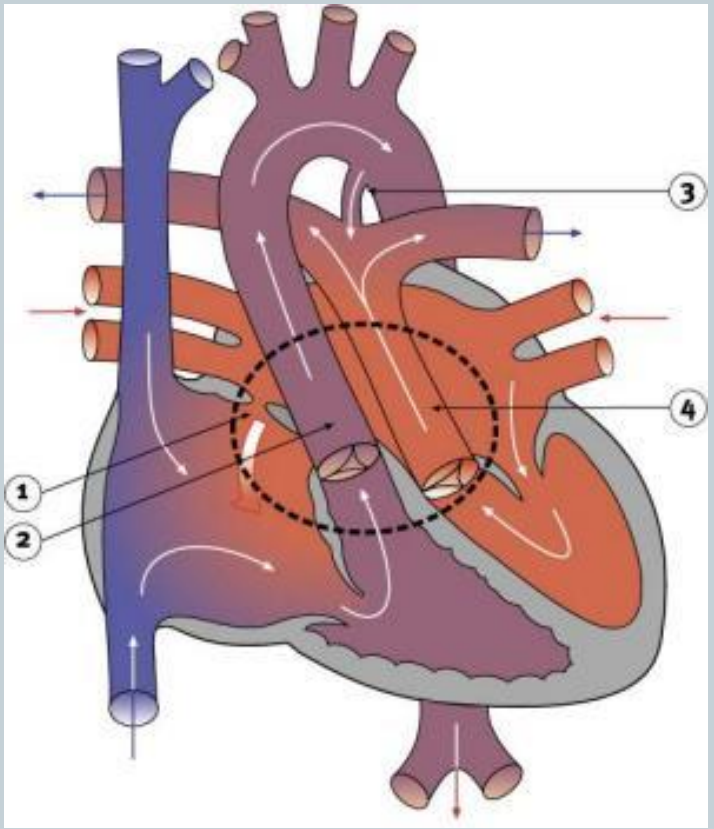


Cardiac

- Cardiac Anomalies
  - Poor diabetic control in the 1st trimester is associated with an increased risk of congenital malformations
  - 2/3 of congenital anomalies are cardiovascular or CNS related.
  - Common cardiac anomalies: Transposition of the great arteries, ASD, VSD, aortic coarctation

Cardiac Anomalies





Transposition of the great arteries

Neurologic

- CNS anomalies
  - Anencephaly and spina bifida occur 12-20x more frequently in IDMs
  - Caudal Regression Syndrome: incomplete development of the lumbar and sacral vertebrae
    - occurs 200x more frequently in IDMs
    - spectrum of structural defects possible
    - associated with neurologic impairment due to involvement of distal spine (i.e. incontinence, decreased growth and movement of legs)

Anencephaly and Caudal Regression Syndrome

GI and GU

- GI anomalies
  - Situs inversus, atresias, small left colon syndrome: presents like Hirschsprung disease, but innervation of the bowel is normal, inability to pass meconium resolves spontaneously
- GU anomalies
  - Renal agenesis and other urinary tract abnormalities

Small Left Colon Syndrome

Hematologic

- Polycythemia
  - Intervention required when central hematocrit > 65 with symptoms or >70 when asymptomatic
  - Occurs in 13-33% of IDMs
  - Related to hypoxia in utero -> stimulates erythropoietin, which increases RBC production
  - Hyperviscosity in vasculature can cause sludging, ischemia, and infarction of internal organs

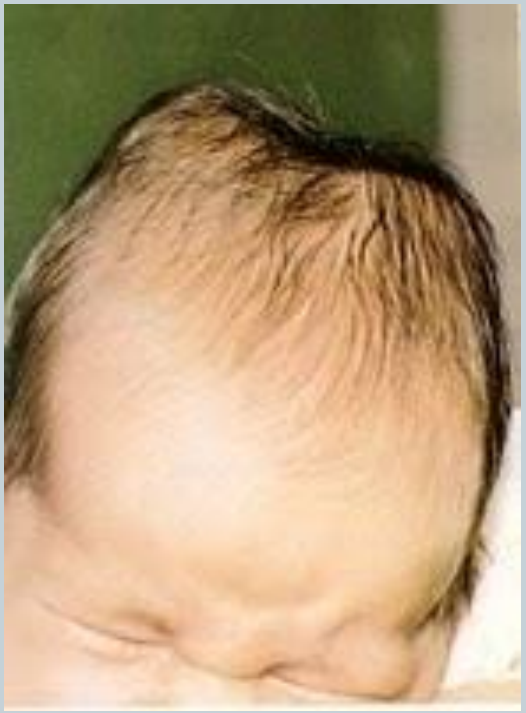
Hematologic

- Hyperbilirubinemia
  - Occurs in 11-29% of IDMs
  - Risk factors include:
    - Prematurity
    - Birth injury resulting in bruising or cephalohematoma
    - Polycythemia causing increased hemolysis and release of bilirubin

Birth Injury

- Macrosomia puts infant at risk for injuries during delivery
  - Shoulder dystocia can lead to:
    - Clavicular and/or humeral fractures
    - Brachial plexus injuries
  - Traumatic delivery or need for vacuum/forceps assistance can lead to:
    - Cephalohematomas
    - Facial bruising
    - Facial nerve injuries

Birth Injuries



Work-Up and Management

- Follow blood sugars
- If SGA or LGA, also check hematocrit
- Further work-up and management depends on patient's clinical presentation and physical exam
  - Hypoglycemia – early feeding or IVFs with dextrose
  - Symptomatic electrolyte abnormalities – replete electrolytes
  - Respiratory distress – Cardiopulmonary support, CXR/echo to search for cause
  - Hyperbilirubinemia – phototherapy
  - Polycythemia – IVF hydration or exchange transfusion
  - Neuro/GI/GU anomalies – imaging studies, specialist consult

Treament of neonatal hypoglycemia

- Start oral or gavage feeding as soon as possible(1-3hr of age)
- If neonate can not tolerate oral feeding,or if asymptomatic transient neonatal hyopoglycemia,give IV glucose infusion (4-8 mg/kg/min)
- In symptomatic hypoglycemia (other than seizures) give IV bolus of 200mg/kg of 10% glucose (2ml/kg),if seizure present give (4ml/kg)
- After initial therapy,give glucose infusion 8mg/kg/min

- If hypoglycemia recures ,infusion rate increase until 15-20% glucose is used.
- If this are inadequate to eliminate symptoms ,hyperinsulinemia is probably present , using of steroid, diazoxide ,octeriotide may be useful
- Subtotal pancreatectomy may be needed in persistent hyperinsulinemia
- Follow up every 2 h after initiating therapy ,subsequently every 4-6 h
- Rx gradually reduced and discontinued when glucose level normal and infant asymptomatic for 24-48 h.

Prognosis

- Morbidity and mortality lessen with adequate diabetes control during pregnancy
- If diabetes is poorly controlled, there is a higher risk of neurodevelopmental deficits
- The risk of CP and epilepsy is increased
- The risk of childhood obesity, diabetes, and metabolic syndrome is increased