Multifetal Pregnancy

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Mechanism of multifetal gestation

- **Dizygotic / Fraternal twins** - result from fertilization of two separate ova

- **Monozygotic / Identical twins** - arise from a single fertilized ovum that divides

Either or both processes may be involved in the formation of higher numbers.

- Quadruplets may arise from as few as one to as many as four ova.
The outcome of the **monozygotic twinning** process depends on when division occurs...

- **Diamnionic, dichorionic:** If zygotes divide within the **first 72 hours** after fertilization, 2 embryos, 2 amnions, and 2 chorions develop.

- **Diamnionic, monochorionic:** If division occurs between the fourth and eighth day.

- **Monoamnionic, monochorionic:** approximately **8 days** after fertilization, when the chorion and the amnion have already differentiated, and division results in two embryos within a common amnionic sac.
Factors that influence twinning

- Race
- Maternal age
- Parity
- Heredity
- Nutrition
- Infertility treatment
- Pituitary gonadotropins
Sonographic Determination of Chorionicity

- Two separate placentas suggest dizygosity.
- Dichorionic:
  - thick dividing membrane (≥ 2 mm).
  - **Twin peak sign/lambda sign:** triangular projection of placental tissue between the layers of the dividing membrane
- Monochorionic:
  - dividing membrane less than 2-mm thick
- **T-sign:** right-angle relationship between the membranes and placenta; No extension of placenta between the dividing membranes
Diagnosis of Multiple fetuses:

1. Clinical Evaluation

- Uterine size is typically larger during the second trimester than expected.
  - Between 20 and 30 weeks, fundic heights averaged approximately **5 cm greater than expected** for singletons of the same fetal age.

- Palpating two fetal heads, often in different uterine quadrants

- > 1 fetal heart beats noted
Diagnosis of Multiple fetuses:

2. Sonography

- Separate gestational sacs can be identified early in twin pregnancy
- Two fetal heads or two abdomens should be seen in the same image plane
Diagnosis of Multiple fetuses:

3. Radiography and MRI

- Abdominal radiography can be used if fetal number in a higher-order multifetal gestation is uncertain.

- Fetal skeletons before 18 weeks’ gestation are insufficiently radio-opaque and may be poorly seen.

- Magnetic resonance imaging (MRI) provides a more detailed assessment of pathology in twins and is particularly helpful in cases of conjoined twins.
4. Biochemical Tests

- There is **no biochemical test** that reliably identifies multiple fetuses.
- Serum and urine levels of $\beta$-hCG and maternal serum alpha-fetoprotein (MSAFP) are **generally higher** with twins compared with singletons.
- However, levels may vary considerably
Maternal Adaptation to Multifetal Pregnancy

- Physiological burdens of pregnancy and the likelihood of serious maternal complications are typically greater with multiple fetuses than with a singleton.
- Hyperemesis (excessive nausea and vomiting)
- Higher blood volume expansion/hypervolemia → anemia
Cardiac output was increased another 20 percent above that in women with a singleton pregnancy.

Vascular resistance was significantly lower in twin gestations throughout pregnancy compared with singleton gestations.

Uterine growth in a multifetal gestation is substantively greater than in a singleton pregnancy. Maternal abdominal organs and lungs can be compressed and displaced by the expanding uterus.
Pregnancy complications

1. Spontaneous abortion

- Miscarriage is **more likely** with multiple fetuses.
  - spontaneous abortion rates:
    - singleton pregnancies: 0.9%
    - multiple pregnancies: 7.3%

- **Monochorionic** placentation was more common in multiple gestations ending in miscarriage
Pregnancy complications

2. Congenital Malformations

- **Increased incidence** of congenital malformations: 406 per 10,000 twins versus 238 per 10,000 singletons.

- **Malformation rate in monochorionic twins is twice** that of dichorionic twin gestations (high incidence of structural defects in monozygotic twins)
Pregnancy complications

3. Low Birth Weight

- Multifetal gestations are more likely to have low birthweight than singleton pregnancies due to restricted fetal growth and preterm delivery.

- In general, the degree of growth restriction increases with fetal number.

- The degree of growth restriction in monozygotic twins is likely to be greater than that in dizygotic pairs.
  - With monochorionic embryos, allocation of blastomeres may not be equal, vascular anastomoses within the placenta may cause unequal distribution of nutrients and oxygen, and discordant structural anomalies resulting from the twinning event.
Pregnancy complications

4. Hypertension

- **Increased** tendency for hypertensive disorders

- Pre-pregnancy BMI $\geq 30$ kg/m² is an independent risk factor for preeclampsia.

- Increased fetal number and placental mass are involved in preeclampsia pathogenesis.

- With multifetal gestation, hypertension not only develops more often but also tends to develop earlier and be more severe.
5. Preterm birth

- Increased incidence of preterm births.
  - Prematurity is increased sixfold in twins and tenfold in triplets, respectively

6. Long term infant development

- Cognitive outcomes between twins and singletons are similar
- Among normal-birthweight infants, the cerebral palsy risk is higher among twins and higher-order multiples
Aberrant twinning mechanisms
Possible outcomes of monozygotic twinning

- Symmetrical
  - Separate
  - Conjoined
- Asymmetrical
  - External Acardiac (TRAP)
  - External Parasitic
  - Internal Fetus in fetu
Aberrant Twinning Mechanisms

1. Conjoined Twins

- Conjoined twins have been referred to as *Siamese twins*—after Chang and Eng Bunker of Siam
- *Thoracopagus* is the most common
- A targeted examination, including a careful evaluation of the connection and the organs involved
Types of conjoined twins
Aberrant Twinning Mechanisms

1. Conjoined Twins

- **MRI** play an important adjunctive role in clarifying shared organs.
- Surgical separation of an almost completely joined twin pair may be successful if essential organs are not shared
- Consultation with a pediatric surgeon often assists parental decision making.
- Viable conjoined twins should be delivered by cesarean.
Aberrant Twinning Mechanisms

2. External Parasitic Twins

- grossly defective fetus or merely fetal parts, attached externally to a relatively normal twin.

- A parasitic twin usually consists of externally attached supernumerary limbs

- A functional heart or brain is absent.

- Parasites are believed to result from demise of the defective twin
Aberrant Twinning Mechanisms

3. Fetus in fetu (internal parasitic twin)

- Early in development, one embryo may be enfolded within its twin.
- As a result, normal spatial arrangement of and presence of many organs is lost.
- These masses are typically supported by their host by a few large parasitic vessels.
Monochorionic Twins and Vascular Anastomoses

1. TTTS
2. TAPS
3. TRAP
4. Complete Hmole with coexisting normal fetus (fetus with mole in situ)
Monochorionic twins and vascular anastomoses

1. Twin-Twin Transfusion Syndrome (TTTS)

- Blood is transfused from a donor twin to its recipient sibling such that the donor may eventually become anemic (pale) and its growth may be restricted.

- Recipient becomes polycythemic (plethoric) and may develop circulatory overload manifest as hydrops.
  - circulatory overload from heart failure and severe hypervolemia and hyperviscosity.

- Polycythemia in the recipient twin may lead to severe hyperbilirubinemia and kernicterus
Monochorionic twins and vascular anastomoses

1. Twin-Twin Transfusion Syndrome (TTTS)

Pathophysiology

- Detected in midpregnancy when the donor fetus becomes oliguric from decreased renal perfusion → oligohydramnios

- Recipient fetus develops severe polyhydramnios, presumably due to increased urine production.

- Low/absent amnionic fluid in the donor sac prevents fetal motion → stuck twin or polyhydramnios-oligohydramnios-syndrome—“poly-oli.”

- Amnionic fluid imbalance is associated with growth restriction, contractures, and pulmonary hypoplasia in the donor twin, and premature rupture of the membranes and heart failure in the recipient.
anemia
hypotension
oliguria
oligohydramnios
circulatory insufficient
growth restriction
renal failure
fetal demise

unbalanced shunt flow

polycythemia
hypertension
polyuria
polyhydramnios
circulatory overload
heart failure
hydrops fetalis
fetal demise
Monochorionic twins and vascular anastomoses

1. Twin-Twin Transfusion Syndrome (TTTS)

- Society for Maternal-Fetal Medicine (2013), TTTS is diagnosed based on two criteria:
  
  1. Presence of a monochorionic diamnionic pregnancy
  
  2. Hydramnios defined if the largest vertical pocket is > 8 cm in one twin and oligohydramnios defined if the largest vertical pocket is < 2 cm in the other twin.
Several therapies are currently used for TTTS, including amnioreduction, laser ablation of vascular anastomoses, selective feticide, and septostomy (intentional creation of a communication in the dividing amnionic membrane).
Monochorionic twins and vascular anastomoses

2. Twin Anemia Polycythemia Sequence (TAPS)

- characterized by significant hemoglobin differences between donor and recipient twins without the discrepancies in amniotic fluid volumes typical of twin-twin-transfusion syndrome

- diagnosed antenatally by middle cerebral artery (MCA) peak systolic velocity (PSV) > 1.5 multiples of the median (MoM) in the donor and < 1.0 MoM in the recipient twin
Monochorionic twins and vascular anastomoses

3. Twin-Reversed Arterial Perfusion (TRAP) Sequence

- Also known as an acardiac twin

- There is usually a normally formed donor twin that has features of heart failure and a recipient twin that lacks a heart (acardius) and other structures.

- It has been hypothesized that the TRAP sequence is caused by a large artery-to-artery placental shunt, often also accompanied by a vein-to-vein shunt.

- Within the single, shared placenta, arterial perfusion pressure of the donor twin exceeds that in the recipient twin, who thus receives reverse blood flow of deoxygenated arterial blood from its co-twin.

- This “used” arterial blood reaches the recipient twin through its umbilical arteries and preferentially goes to its iliac vessels → only the lower body is perfused, and disrupted growth and development of the upper body results.
Monochorionic twins and vascular anastomoses
3. Twin-Reversed Arterial Perfusion (TRAP) Sequence

- Failure of head growth is called acardius acephalus
- A partially developed head with identifiable limbs is called acardius myelacephalus
- Failure of any recognizable structure to form is acardius amorphous
- Because of this vascular connection, the normal donor twin must not only support its own circulation but also pump its blood through the underdeveloped acardiac recipient → lead to cardiomegaly and high-output heart failure in the normal twin
Monochorionic twins and vascular anastomoses

4. Complete Hydatidiform Mole with Coexisting Normal Fetus

- Also termed a twin molar pregnancy
- This is due to a complete diploid molar pregnancy comprising one conceptus, whereas the cotwin is a normal fetus.
- Optimal management is not known for this twin gestation.
Monochorionic twins and vascular anastomoses

4. Complete Hydatidiform Mole with Coexisting Normal Fetus

- Pregnancy progression exposes the woman to persistent trophoblastic disease that requires chemotherapy and may be fatal.

- Despite this, pregnancy continuation is recommended in cases with normal twin, no early preeclampsia, and declining hCG levels.

- If observation and pregnancy progression is chosen, preterm delivery is frequently required because of persistent and heavy bleeding or severe preeclampsia.
DISCORDANT GROWTH OF TWIN FETUSES
Twin discordancy

1. Twin discordancy is calculated using the larger twin as the index.

For example: Twin A: 3200g      Twin B: 2500g

- % Weight discordancy: \[
\frac{3200 \text{ g} - 2500 \text{ g}}{3200 \text{ g}}
\]
  = 21.87%

- Significant if > 20%

2. Difference in abdominal circumference (AC) > 20mm
- **Unequal placental sharing** is probably the most important determinant of discordant growth in **monochorionic twins**

- Among **dichorionic twins**:  
  - Dizygotic fetuses may have different genetic growth potential  
  - One placenta might have a suboptimal implantation site.
Twin discordancy:

Management

- **Sonographic monitoring of growth** within a twin pair and calculating discordancy is mainstay in management.

- Monochorionic twins are generally monitored more frequently, because their risk of death is higher.

Fetal Demise
Death of One Fetus

- In some pregnancies, one fetus dies remote from term, but pregnancy continues with one or more live fetuses.

- "Vanishing twin" - When this occurs early in pregnancy

- "Fetus compressus" - dead fetus that is barely identifiable, and compressed appreciably

- "Fetus papyraceous" – dead fetus may be flattened remarkably through desiccation
Death of one fetus:

Management

- Decisions should be based on gestational age, the cause of death, and the risk to the surviving fetus.
- If the loss occurs early in the first trimester, a vanishing twin is considered harmless to the survivor.
- If the loss occurs after the first trimester, the risk of death or damage to the survivor is largely limited to monochorionic twin gestations.
Death of one fetus:

Management

- Single fetal death during late second and early third trimester presents the greatest risk to the surviving monochorionic twin.

- Delivery generally occurs within 3 weeks of diagnosis of fetal demise, thus antenatal corticosteroids for survivor twin’s lung maturity should be considered.

- Dichorionic twins can probably be safely delivered at term.
Death of one fetus:

Management

- **Monochorionic** twin gestations are more difficult to manage and are often delivered between 34 and 37 weeks’ gestation.

- In cases of single fetal death at term, especially when the etiology is unclear, most opt for delivery instead of expectant management.
PRENATAL CARE AND ANTEPARTUM MANAGEMENT
PRENATAL CARE AND ANTEPARTUM MANAGEMENT

1. Diet
2. Fetal surveillance
3. Tests of fetal well being
Diet

- The Institute of Medicine guidelines for twin pregnancy recommend a **37- to 54-lb weight gain** for women with a normal BMI.

- The daily recommended increased caloric intake for women with twins is **40 to 45 kcal/kg/day**
  - 20 percent protein, 40 percent carbohydrate, and 40 percent fat divided into three meals and three snacks daily.
Fetal Surveillance

- cornerstone of fetal assessment in twin pregnancy is **identification of abnormal fetal growth or discordancy**

- serial sonographic examinations are usually performed throughout the third trimester.

- Assessment of amnionic fluid volume is also important.

- Associated oligohydramnios may indicate uteroplacental pathology and should prompt further evaluation of fetal well-being
  - SVP < 2 cm = oligohydramnios
  - SVP ≥ 8 cm polyhydramnios
Tests of fetal well being

- Nonstress test (NST) or biophysical profile (BPP) are commonly used in management of twin or higher-order multifetal gestations.
Pulmonary maturation

- planned delivery of uncomplicated monochorionic twins at 38 weeks
- amniocentesis to verify pulmonary maturity before delivery between 36 and 38 weeks
  - lecithin-sphingomyelain ratio (L/S)
  - pulmonary maturation is usually synchronous in twins
  - Usually exceeds 2.0 by approximately 32 weeks
Delivery Route
Delivery Route

Cephalic-Cephalic

- delivery can usually be accomplished spontaneously or with forceps

Cephalic-Noncephalic

- Optimal delivery route remains controversial
- Options: Cesarean delivery of both twins; vaginal delivery of cephalic first twin, then eternal cephalic version of the 2\textsuperscript{nd} twin (fetal weight > 1500 grams)
Delivery Route

Breech Presentation of First Twin

- Problems with the first twin presenting as breech are similar to those encountered with a singleton breech fetus.

- If for vaginal delivery, major problems may develop if
  1. The fetus is unusually large, and the aftercoming head is larger than the birth canal.
  2. The fetal body is small compared to fetal head. Example: preterm or growth-restricted fetuses or with a macrocephalic fetus due to hydrocephaly.
  3. The umbilical cord prolapses.
Many clinicians believe that pregnancies complicated by three or more fetuses are best delivered by cesarean.

Vaginal delivery is reserved for those circumstances in which survival is not expected

(example: fetuses are markedly immature or maternal complications make cesarean delivery hazardous to the mother)
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