MECHANISMS OF MULTIFETAL GESTATION

Dizygotic or fraternal twin - twin fetuses result from fertilization of two separate ova

Monozygotic or identical twin - twins arise from a single fertilized ovum

Genesis of Monozygotic Twins

First 72 hours→ **diamnionic, dichorionic**

4th-8th day → **diamnionic, monochorionic**

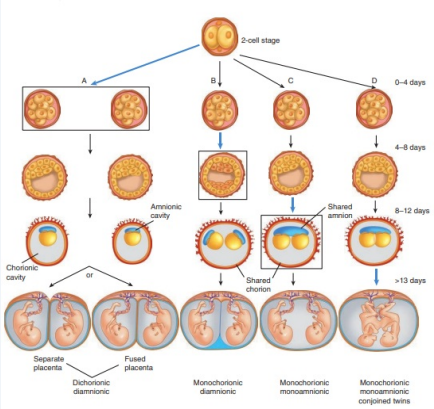
8th-12th day → **monoamnionic, monochorionic**

>13 day→ **conjoined twin**

Superfetation - requires ovulation and fertilization during the course of an established pregnancy

Superfecundation - refers to fertilization of two ova within the same menstrual cycle but not at the same coitus, nor necessarily by sperm from the same male

Mechanism of monozygotic twinning



RISK FACTORS

ART (2-5 fold increase) - Monozygotic twins

Different races and ethnic groups

Maternal age

Increasing parity

Family history - maternal < paternal

Greater nutritional status reflected by maternal size

Pituitary gonadotropin in amount greater than usual

Ovulation induction with FSH plus hCG or clomiphene citrate

In vitro fertilization (IVF)

MATERNAL PHYSIOLOGICAL ADAPTATIONS

Higher serum B-hCG levels → nausea and vomiting

Blood volume expansion is greater (50-60%)

Greater blood loss with vaginal delivery

Greater iron and folate requirements

Augmented cardiac output

Lower vascular resistance

Uterine growth is greater

DIAGNOSIS OF MULTIFETAL GESTATION

Clinical evaluation

- Uterine size is larger during the second trimester

- Palpating two fetal heads in different uterine quadrants

- Palpating two fetal heads in different uterine quadrants

Sonography

- Used to determine fetal number, estimated gestational age, chorionicity, and amnionicity

- Separate gestational sacs

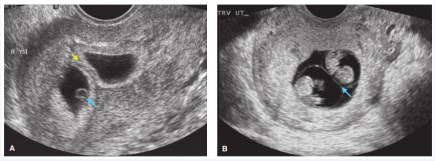
Other diagnostic aids

- Abdominal radiography

- MRI

- Serum and urine B-hCG and maternal serum AFP

SONOGRAPHY



Sonograms of first-trimester twins. A. Dichorionic diamnionic twin pregnancy at 6 weeks' gestation. Note the thick dividing chorion (yellow arrow). One of the yolk sacs is indicated (blue arrow). B. Monochorionic diamnionic twin pregnancy at 8 weeks' gestation. Note the thin amnion encircling each embryo, resulting in a thin dividing membrane (blue arrow).

DIZYGOTIC BOYS - SUPERFECUNDATION

PRENATAL CARE

Prevent preterm delivery of markedly immature neonates

Prenatal visit every 2 weeks beginning at 22 weeks

Diet:

- 37-57 lbs weight gain – normal BMI

- 40-45 kcal/kg/d - daily recommended augmented caloric intake

Sonography

- Serial sonographic examinations

- Oligohydramnios → uteroplacental pathology

- Single deepest vertical pocket is measured

- <2cm = oligohydramnios

- >8 cm hydramnios

Antepartum fetal surveillance

- Biophysical profile

- Nonstress test

- Umbilical artery doppler velocimetry

PRETERM BIRTH

Prediction of preterm birth

- Cervical length

- <20mm most accurate for predicting birth before 34 weeks

- Closed internal os by examination was found to as predictive of postponed delivery

- Fetal —bronectin levels also may predict preterm birth

Prevention

- Limited physical activity, early work leave, more frequent health-care visits, serial sonographic examinations, and structured maternal education regarding preterm delivery risks have been advocated to reduce preterm birth rates in women with multiple fetuses

- Prophylactic Tocolysis

treatment did not reduce the rate of twins delivering before 37 or before 34 weeks' gestation

*oral terbutaline**

- Progesterone Therapy

17-alpha-hydroxyprogesterone caproate (17-OHPC) injections are not effective for multifetal gestations

*Vaginal micronized progesterone - ineffective for preterm birth prevention before 34 weeks

- Cervical Cerclage

PRETERM BIRTH (cont)

Prophylactic cerclage - does not improve perinatal outcome in women with twin pregnancies

Physical examination–indicated cerclage in women with a second-trimester twin gestation and a dilated cervix may be beneficial

- Pessary

not recommended

Treatment

- Tocolytic therapy to help halt preterm labor in multifetal pregnancy

does not measurably improve neonatal outcomes

entails higher maternal risk than in singleton pregnancy

augmented pregnancy-induced hypervolemia, which raises cardiac demands and increases the susceptibility to iatrogenic pulmonary edema

nifedipine

- Antenatal corticosteroids

for fetal lung maturation

betamethasone - reduced rates of periventricular hemorrhage

Preterm Prelabor Membrane Rupture

- PPROM after 24 weeks' gestation, the median number of days to subsequent delivery was 4 days for twins compared with 7 days for singletons

Delayed Delivery of Second Twin

- If delayed delivery is attempted, counseling should include the potential for serious maternal complications.

- The range of gestational age for which benefits outweigh the risks for delayed delivery is likely narrow, and gestations of 22 to 24 weeks would seem the most probable to benefit

FETAL DEMISE

At any time during multifetal pregnancy, one or more fetuses may die, either simultaneously or sequentially

Causes and incidence of fetal death are related to

1) fetal anomaly

2) chorionicity - monochorionic twins suffer higher rates of sFGR, TTTS or TAPS from unequal vascular anastomoses; monoamnionic pairs can die from cord entanglement

Early death - **vanishing twin**

Fetus compressus - in a more slightly advanced gestation, the dead fetus may become compressed appreciably

fetus papyraceus - flattened dead fetus through desiccation

FETAL DEMISE (cont)

MANAGEMENT

- decisions should be based on gestational age, the cause of death, and the risk to the surviving fetu

- If the loss occurs after the first trimester, the risk of death or damage to the survivor is largely limited to monochorionic twin gestations. Morbidity in the monochorionic twin survivor is almost always due to vascular anastomoses, which often cause the demise of one twin followed by sudden hypotension in the other.

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

If death of one dichorionic twin is due to a discordant congenital anomaly in the first trimester, it should not affect the surviving twin

If one fetus of a monochorionic twin gestation dies after the first trimester but before viability, pregnancy termination can be considered

Delivery generally occurs within 3 weeks of diagnosis of fetal demise, thus antenatal corticosteroids for survivor lung maturity should be considered. Regardless, unless the intrauterine environment is hostile, the goal is to prolong the preterm pregnancy.

Dichorionic twins can probably be safely delivered at term

Monochorionic twin gestations are more difficult to manage and are often delivered between 34 and 37 weeks' gestation

EVALUATION OF FETAL PRESENTATION

Fetal presentations are best described sonographically

Possible presentation combinations:

-most common: cephalic-cephalic, cephalic-breech, and cephalic-transverse

ROUTE OF DELIVERY

Vaginal vs CS

Cephalic-cephalic - vaginal birth

Cephalic-noncephalic - caesarean section or vaginal

Breech first twin - caesarean section

VAGINAL BIRTH AFTER CESAREAN DELIVERY

No evidence currently suggests an increased risk of uterine rupture, and women with twins and one previous cesarean delivery with a low transverse incision may be considered candidates for trial of labor

VAGINAL DELIVERY OF SECOND TWIN

Following delivery of the first twin, the presenting part of the second twin, its size, and its relationship to the birth canal should be quickly and careully ascertained by combined abdominal, vaginal, and at times, intrauterine examination

- Sonography is a valuable aid

- If the fetal head or the breech is fixed in the birth canal, moderate fundal pressure is applied and membranes are ruptured

- Immediately afterward, digital examination of the cervix is repeated to exclude cord prolapse

- Labor is allowed to resume

- If contractions do not begin within approximately 10 minutes, dilute oxytocin may be used to stimulate contractions

The safest interval between delivery of the first and second twins was frequently cited as <30 minutes

If the occiput or breech presents immediately over the pelvic inlet, but is not fixed in the birth canal, the presenting part can often be guided into the pelvis by one hand in the vagina, while a second hand on the uterine fundus exerts moderate pressure caudally. A presenting shoulder may be gently converted into a cephalic presentation. Alternatively, with abdominal manipulation, an assistant can guide the presenting part into the pelvis

- Sonography can aid guidance and allow heart rate monitoring. Intrapartum external version of a noncephalic second twin has also been described.

If the occiput or breech is not over the pelvic inlet and cannot be so positioned by gentle pressure or if appreciable uterine bleeding develops, delivery of the second twin can be problematic.

To take maximum advantage of the dilated cervix before the uterus contracts and the cervix retracts, delay should be avoided

Prompt cesarean delivery of the second fetus is preferred if no one present is skilled in the performance of internal podalic version or if anesthesia that will provide effective uterine relaxation is not immediately available.

LABOR AUGMENTATION OR INDUCTION

Active labor with twins progresses more slowly in both nulliparas and multiparas compared with that in singleton

Second-stage labor of the first twin also is longer

labor augmentation - *oxytocin* may be used provided that women with twins meet all criteria for its administration

labor induction - *oxytocin alone or in combination with cervical ripening* can safely be used in twin gestations

Augmentation or induction of labor is not recommended in multifetal pregnancy

ANALGESIA AND ANESTHESIA

Epidural anesthesia - ideal because it provides excellent pain relief and can be rapidly extended cephalad if internal podalic version or cesarean delivery is required.

General anesthesia - necessary for intrauterine manipulation during vaginal birth (underliverd twin), uterine relaxation can be accomplished rapidly with halogenated inhalation agent

nitroglycerin (IV/sublingual) or terbutaline (IV) - for uterine relaxation

TRIPLET OR HIGHER-ORDER GESTATION

Fetal heart rate monitoring during labor with triplet pregnancies is challenging

-With vaginal delivery, the first neonate is usually born with little or no manipulation

-Subsequent fetuses, however, are delivered according to the presenting part

--often requires complicated obstetrical maneuvers such as total breech extraction with or without internal podalic version or even cesarean delivery

-Associated with malposition of fetuses is an increased incidence of cord prolapse

--reduced placental perfusion and hemorrhage from separating placentas are more likely during delivery

Pregnancies complicated by three or more fetuses should undergo cesarean delivery

-vaginal delivery was associated with a higher perinatal mortality rate

-recommended prelabor cesarean delivery for triplets

PREGNANCY COMPLICATIONS

Spontaneous Abortion and Vanishing Fetus - monochorionic twins have significantly higher early fetal loss rates than dichorionic pairs

Congenital Malformations - monochorionic twins was almost twice that of dichorionic twin gestations. The occurrence risk and concordance were substantially higher among monochorionic twins

Low Birthweight - Multifetal gestations are more likely to be low birthweight than singleton pregnancies due to restricted fetal growth and preterm delivery. Birthweights in twins closely paralleled those of singletons until 28 to 30 weeks' gestation. Beginning at 35 to 36 weeks' gestation, twin birthweights clearly diverge from those of singletons. Thus, abnormal growth should be diagnosed only when fetal size is less than expected for multifetal gestation. To confirm suitable growth in dichorionic pairs, perform sonography every 4 weeks, starting at 16 to 20 weeks. Monochorionic twins are imaged every 2 weeks for twin-twin transfusion syndrome.

Hypertension - those with multifetal gestations are more likely to develop a pregnancy-associated hypertensive disorder, and the incidence further rises with advancing fetal number

UNIQUE FETAL COMPLICATIONS

Monoamnionic Twins

Fetal loss - fetuses alive before 16 weeks' gestation, less than half survive to the neonatal period. Fetal abnormalities and spontaneous miscarriage contribute to most loss. High perinatal death is attributable to preterm birth, twin-twin transfusion syndrome, cord entanglement, birth weight discordance, and congenital anomalies.

Congenital anomaly - concordance anomalies - fetal echocardiography is indicated

Twin-twin transfusion syndrome - lower in monoamnionic twins than in monochorionic diamnionic pregnancies

Umbilical cord entanglement - a frequent event. Mothers with monoamnionic twins are often admitted at 24-28 weeks gestation to begin 1 hour of daily fetal heart rate monitoring. Betamethasone is given to promote pulmonary lung maturation. If fetal testing remains reassuring and no other intervening indications arise, CS is performed at 32-34 weeks gestation.

Unique and Aberrant Twinning

UNIQUE FETAL COMPLICATIONS (cont)

Conjoined Twins - referred to as Siamese twins, joining of the twins may begin at either pole and produce characteristic forms depending on which body parts are joined or shared, **thoracopagus** is the most common. Frequently identified using sonography (fetal poles are seen to be closely associated and do not change relative position from one another, more than 1 three vessels in the umbilical cord, fewer limbs than expected, spine hyperflexion, bifid fetal pole, and increased nuchal thickness) at midpregSurgical separation of an almost completely joined twin pair may be successful if essential organs are not shared. Viable conjoined twins should be delivered by cesareannancy.

External Parasitic Twins and Fetus-in-fetu - attached to a relatively normal twin, an external parasitic twin is grossly defective fetus or merely fetal parts. Usually consists of supernumerary limbs, often with some viscera. A functional heart or brain is absent. Parasitic twins are believed to derived from a dead defective twin, whose surviving tissue attached to and receives vascular support from the normal co-twin.

Fetus-in-fetu - one embryo may enfold early within its co- twin and mainly intraabdominally. Vertebral or axial bones are found in the fetiform mass, whereas a heart and brain are absent.

Monochorionic Twins and Vascular Anastomoses - All monochorionic placentas likely share some anastomotic connections (exceptions: anastomoses between twins are unique to monochorionic twin placentas, number, size, and direction of these seemingly haphazard connections vary markedly.
Artery-to-artery anastomoses are most frequent.
Deep artery-to-vein communications can extend through the capillary bed of a given villus -> create a common villous compartment or "-third circulation" that has been identified in approximately half of monochorionic twin placentas
This chronic fetofetal transfusion may result in several clinical syndromes that include twin-twin transfusion syndrome (TTTS), twin anemia poycythemia sequence (TAPS), and acardiac twinning

UNIQUE FETAL COMPLICATIONS (cont)

Twin-Twin Transfusion Syndrome
- blood is transfused from a donor twin to its recipient sibling such that the donor may eventually become anemic and its growth may be restricted.
The recipient becomes polycythemic may develop circulatory overload with heart failure manisfest as hydrops.
- donor twin is smaller and pale, recipient twin is larger and has volume excess.
- recipient may suffer from hyperviscosity and occlusive complicat-ions, polycythemia may lead to hyperviscosity and occlusive compli-cations.
- Chronic TTS: unidirectional arteriovenous anastomoses.
-TTTS typically presents in midpregnancy when the donor fetus becomes oliguric from hypovolemia and decreased renal perfusion.
- Donor develops oligohydramnios; recipient develops severe hydramnios (due to inc. urine production)
- absent amnionic fluid in the donor sac = prevents fetal movement refereed to as *"stuck twin or polyhydramnios-oligohydramnios syndrome - poly-oli"*

Fetal Brain Damage
Cerebral palsy, microcephaly, porencephaly, and multicystic enceph-alomalacia are serious complications associated with placental vascular anastomoses in multifetal gestation.
--> likely caused by ischemic necrosis leading to cavitary brain lesions
donor twin (hypotension, anemia, or both --> ischemia) o recipient twin (blood pressure instability and episodes of profound hypote-nsion -->ischemia)

Diagnosis
TTTS is diagnosed based on two sonographic criteria:
1) a monochorionic diamnionic pregnancy is identified
2) hydramnios (defined by a largest vertical pocket >8cm) in one sac and oligohydramnios (defined by a largest vertical pocket <2cm) in the other twin is found
Sonographic surveillance of pregnancies at risk for TTTS is recomm-ended:
-begin at approximately 16 weeks AOG
- subsequent studies are considered every 2 weeks

Quintero (1999) Staging System
Stage I - discordant amnionic fluid volumes as described in the earlier paragraph, but urine is still visible sonographically within the bladder of the donor twin
Stage II - criteria of stage I, but urine is not visible within the donor bladder
Stage III - criteria of stage II and abnormal Doppler studies of the umbilical artery, ductus venosus, or umbilical vein
Stage IV - ascites or frank hydrops in either twin
Stage V - demise of either fetus
-myocardial performance index (MPI) or Tei index --> a Doppler index of ventricular function calculated for each ventricle

Management and Prognosis

Prognosis is related to Quintero stage and gestational age at presentation.

Several therapies are available for TTTS and include amnioreduction, laser ablation of vascular placental anastomoses, selective feticide, and septostomy

- amnioreduction - needle drainage of excess amnionic fluid
- Septostomy - intentionally creating a hole in the dividing amnionic membrane

laser ablation of anastomoses is preferred for severe TTTS (stages II-IV)

- Selective fetal reduction has generally been considered if severe amnionic fluid and growth disturbances develop before 20 weeks --> both fetuses typically will die without intervention
-

UNIQUE FETAL COMPLICATIONS (cont)

Twin Anemia-Polycythemia Sequence

This form of chronic fetofetal transfusion is characterized by significant hemoglobin differences between donor and recipient twins.

It is diagnosed antenatally by MCA peak systolic velocity (PSV) >1.5 multiples of the median (MoM) in the donor and <1.0MoM in the recipient twin.

Spontaneous TAPS usually occurs after 26 weeks' gestation, and iatrogenic TAPS develops within 5 weeks of a procedure.

Twin Reversed-Arterial-Perfusion Sequence aka **acardiac twin**

a rare but serious complication of monochorionic multifetal gestation where there is a normally formed donor twin that shows features of heart failure and a recipient twin that lacks a heart (acardius) and other structures.

- caused by a large artery-to-artery placental shunt, often also accompanied by a vein-to-vein shunt
- failed head growth is called **acardius acephalus**
- failed head growth is called **acardius acephalus**
- failure of any recognizable structure to form is **acardius amorphous**
- Radiofrequency ablation (RFA) of the umbilical cord is the preferred modality of therapy

Median gestational age at delivery was 37 weeks and the average gestational age at the time of the RFA was 20 weeks

- Major complications were prematurely ruptured membranes and preterm birth.

Hydatidiform Mole with Coexisting Normal Fetus

This unique gestation contains one normal fetus, and its cotwin is a complete molar pregnancy

- must be differentiated from a partial molar pregnancy, in which an anomalous singleton fetus (usually triploid) is accompanied by molar tissue

Diagnosis is usually made in the first half of pregnancy

- Sonographically, a normal-appearing twin is accompanied by its cotwin (a large placenta containing multiple small anechoic cysts).

Often, these pregnancies are terminated, but pregnancy continuation is increasingly adopted.

1) the pregnancy prognosis is not as poor as previously thought
2) the risk of persistent trophoblastic disease is similar whether the pregnancy is terminated or not

Complications of expectant management include vaginal bleeding, hyperemesis gravidarum, thyrotoxicosis, and early-onset preeclampsia.