AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
SCIENTIFIC ASSEMBLY
1999

Obstetric Emergencies and Emergency Delivery

This course will focus on the major complications of each trimester of pregnancy and the emergency approach to their evaluation and management. Trauma in pregnancy will be discussed. The techniques, advantages, and limitations of ultrasound in the assessment of an obstetric patient will be discussed. Normal labor and delivery will be reviewed, followed by a discussion of the management of emergency deliveries and the principles of neonatal resuscitation.

- Review the normal process of labor and delivery.
- Discuss the diagnostic workup, including the use of ultrasound and fetal monitoring, in the assessment of obstetric patients.
- Describe the complications and management associated with each trimester of pregnancy.
- Discuss the diagnostic evaluation that must be performed when caring for the gravid trauma patient.
- Discuss the management of an emergency delivery and the principles of neonatal resuscitation.

TH-209
Thursday, October 14, 1999
9:00 AM - 10:55 AM
Room # N251
Las Vegas Convention Center

FACULTY

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OBSTETRIC EMERGENCIES

Jay Kaplan, M.D., F.A.C.E.P.
ACEP Scientific Assembly
San Diego, California
October 1999

COURSE TOPICS

Physiology of Pregnancy
- Normal
- Complications (What): Vaginal Bleeding
  Pelvic Pain
  Medical Illness/Trauma
- Complications (When): Early Pregnancy
  Late Pregnancy

Physiology of Labor and Delivery
- Normal
- Complications: Intra-partum
  Post-partum
- Procedures: Emergency Delivery
  Neonatal Resuscitation

PHYSIOLOGY OF PREGNANCY

A. General - important to understand what is "normal" in order to define "abnormal" or "complication"
- may affect response to illness (and trauma)
- maternal response = maintain survival even if adverse effect on fetus

B. Cardiovascular - Beware the Supine Hypotensive Syndrome
- heart rate - increased 15-20 beats/min to an average pulse of 80-95 by third trimester
- blood pressure
  - 2nd trimester --> decreases to an average of 102/55
  - 3rd trimester--> increases to an average of 108/67

B. Cardiovascular (cont.)
- cardiac output - increases 40% reaching max at 20-24 weeks
- stroke volume - increases 25-30%
- plasma volume - increases 45-50% by the 30th week

C. Hematologic -
- RBC mass - increases 33% but not as fast as plasma volume
  ----> Physiologic anemia
- WBC - leukocytosis
- Platelets - increased/number consumption
- clotting factors - marked increase in fibrinogen/factor VIII

D. Gastrointestinal -
- reduced GI motility
- delayed gastric emptying
- increased stomach acidity
- increased gastroesophageal reflux
- GB - slowed and incomplete emptying
- displacement of normal anatomic positions of organs
- abdominal wall less sensitive to peritoneal irritatio
- LFTs – alk phos increases 2-4x, cholesterol increases 2x, AST/ALT/BILI levels no change

E. Pulmonary -
- diaphragm elevated as much as 4 cm
- tidal volume increased 35-50%
- total lung capacity reduced 4-5%
- minute ventilation increased 50%
- O2 consumption up 15-20%, matches increased maternal/fetal needs
- "Hyperventilation of Pregnancy"

F. Genitourinary-
- bladder pushed into abdomen after 12 weeks
- smooth muscle relaxation --> ureteral dilation --> hydroureter/nephrosis -->urinary stasis
- GFR increases 50% --> decreases BUN/Creatinine
- Glucosuria > 50% of women at some point in pregnancy
- uterus grows from 60-80 grams --> 900-1200 grams
- uterine blood flow grows from 60 cc/min --> 600 cc/min
- entire blood volume circulates every 8 minutes

VAGINAL BLEEDING / PELVIC PAIN IN EARLY PREGNANCY

■ ECTOPIC PREGNANCY

- General Principles

EPIDEMIOLOGY

- incidence is rising, variably reported 1/28-1/240 pregnancies
- increased 5x 1970-1987
- leading cause of first trimester mortality
- rate highest among older females/blacks
- concomitant EP / IUP was 1/30,000 now up to 1/4,000
- 99% "tubal" (2% interstitial); cornual, ovarian, intraabdominal uncommon
- PREDISPOSING FACTOR
- prior EP
- prior pelvic inflammatory disease
- prior tubal surgery including tubal ligation
- prior non gynecologic pelvic infection/surgery
- intrauterine device
- history of infertility
- hormonal factors
- embryonic abnormalities
- congenital abnormalities of the fallopian tube
- recent elective abortion

- Clinical Findings

» SYMPTOMS "classic triad - abdominal pain, delayed menses, vaginal bleeding not very sensitive

- abdominal pain 80-85%
  - early nonspecific pelvic pain due to fallopian distension, with leakage/rupture more severe, constant peritoneal pain
  - radiation to shoulder may occur, more sensitive
- delayed menses 75-90%
  - uterine decidua spotting may be mistaken as period
- vaginal bleeding 50-80%
  - usually not heavy
- lightheadedness / syncope 20-30%
  - due to hypovolemia, pain

» SIGNS ON PHYSICAL EXAM

- abdominal tenderness 80-90%
  - may not be present in unruptured
  - if intraperitoneal bleeding - rebound, guarding, diminished bowel sounds
- adnexal tenderness 75-90%
- adnexal mass 50% (20% on the side opposite the ectopic pregnancy)

- uterine enlargement 25%
- cul-de-sac fullness 50%
- orthostatic hypotension 10%-15%
  - occasionally see paradoxical bradycardia (vagally mediated) with rupture

- Diagnostic Adjuncts

» URINE HCG

- current ELISA based tests 99% sensitive/specific
- (+) approx 2 weeks after ovulation
- beware false (-) with low urine specific gravity

» QUANTITATIVE SERUM B-HCG

- note different units used-10mlU International Reference Preparation (IRP) = 5.8 mlU of second international standard (SIS) = 1 ng human chorionic gonadotropin - (+) about 9-10 days after ovulation

B-HCG most useful in conjunction with ultrasound findings - see below

- "serial" B-HCG in selected patients
  - normal HCG levels double every 1.4-2.2 days first 8 weeks
  - abnormal pregnancy (i.e. ectopic) more likely to have abnormal (low) rate of rise
  - indications: patients in the 2 week "window" between when HCG (+) but IUP not yet detectable on TVS/HCG <1000
  - 15% normals fail to show rise
  - 13% ectopics normal rate of increase

» OTHER LABORATORY

- not routinely available STAT

- serum progesterone level
  - preliminary cut-off value of 15 ng/ml (Yeko et al, 1987; Matthews et al, 1986)
  - 81% sensitivity/89% specificity (Stovall et al, 1989)

Recommend: < 5 ng/ml = ectopic
> 25 ng/ml = normal
> 5 <25 ng/ml = indeterminate

- serum estradiol (E2)
  - abnormally low in ectopic pregnancies
  - cutoff around 500-650 pg/mL
- maternal serum alpha-fetoprotein
  - elevated in EP
- active renin assay
  - low in nonviable gestations

» ULTRASONOGRAPHY

- "discriminatory level"
  - level of HCG at which intrauterine pregnancy (IUP) should be evident sonographically ("double" gestational sac) - if not present, viable IUP virtually ruled out
  - transabdominal sono (TAS) level 6,000-6,500 IRP (around 40 days from LMP)
  - transvaginal sono (TVS) level 1,000-1,800 IRP (around 35 days from LMP)

- more definitive findings of intrauterine pregnancy (IUP) are intrauterine yolk sac, fetal pole, cardiac activity
- findings suggestive of EP include absent intrauterine pregnancy, cul-de-sac fluid, adnexal mass
- TVS landmarks are seen about one week earlier than TAS
  - decreases number of indeterminate scans (no intrauterine findings, single sac, multiple intrauterine echoes)
  - visualized ectopic fetal pole / fetal cardiac activity is uncommon (10%), but diagnostic of EP
  - addition of pulsed doppler and color flow imaging can improve sensitivity - identifies typical trophoblastic flow pattern

» CULDOCENTESIS

- aspiration of cul-de-sac through posterior fornix of vagina
- interpretation in setting of "r/o ectopic"
  - "positive" = nonclotted blood >0.5cc
  - "negative = serous fluid 0.5 - 10cc
  - "indeterminate" = dry tap, clotted blood in a stable patient
- sensitivity around 85-90% in ruptured ectopic, 65-75% in unruptured
- indications for culdocentesis
  - when ultrasonography unavailable
  - may be useful for stable patients with indeterminate ultrasound results
  - patients of intermediate stability in which sonography not immediately available (stabilized vital signs/peritoneal findings)

» LAPAROSCOPY

- less invasive than laparotomy
- diagnostic modality of choice in the ill but stable patient with inconclusive sonography, negative or indeterminate culdocentesis
- in stable patients with documented ectopic (rupture unlikely) may be used for definitive therapy

» COMMONLY MISSED DIAGNOSIS (>40% delayed diagnosis and treatment despite modern modalities) - factors for delayed recognition include:

- atypical pain (92%)
- absence of adnexal mass on pelvic examination (89%)
- dry tap or serous fluid on culdocentesis (57%)
- nondiagnostic transabdominal sonography (46%)
- misinterpretation of sonography (27%)
- failure to recognize signs of blood loss (32%)
- failure to recognize risk factors (25%)
- inaccurate interpretation of quantitative HCG levels (20%)
- reported passage of tissue (14%)
- failure to recognize the significance of high B-HCG level in combination with empty uterus on sonography (7%)

» CAVEAT - consider pregnancy in all female patients with an ovary from ages 10-55

- Management of Suspected Ectopic Pregnancy
  - » Expectant
  - » Surgical - salpingectomy-->salpingotomy-->salpingostomy
  - » Medical - chemotherapy, e.g. methotrexate
  - » resuscitation (O2, IVs, etc.)
    diagnostic modalities above as indicated additional labs - type and screen/cross, CBC
  - » OB/GYN consultation
    see diagram
- Medical Rx for Ectopic Pregnancy
  - » Methotrexate criteria
  - - hemodynamically stable patient
  - - tubal diameter <3-4 cm
  - - unruptured fallopian tube
  - - no significant intra-abdominal hemorrhage
  - - no fetal activity on sonogram, 50 mg/sq.m.IM
  - »Efficacy 64-78%
  - »Complications - pneumonia, neutropenia, hematosalpinx, hemoperitoneium
  - »up to 1/4 may make ED visit after treatment
  - -look for peritoneal signs, decreased Hgb, hemodynamic instability
  - -dx studies: U/S, quantitative HCG, ?CXR, CBC
  - » Contraindication - sensitivity, hepatic/renal failure, bone marrow suppression
  - »Other prescriptions - prostaglandins, glucose, KCI
- Differential diagnosis = other conditions with + pregnancy test, bleeding, pain includes:
  - » spontaneous abortion
  - » IUP with corpus luteum cyst rupture or adnexal torsion
  - » appendicitis
  - » PID

■ SPONTANEOUS MISCARRIAGE ("spontaneous abortion")

- Definition
  - » fetal loss < 20 weeks gestation
- Epidemiology
  - » bleeding in first weeks of pregnancy occurs in 20% of pregnancies, 50% of these proceed to spontaneous abortion (10-15% of all recognized pregnancies result in spontaneous abortion, peaks at 10 weeks, rarely past 13 weeks)
- Categories
  - » threatened miscarriage
    - vaginal bleeding in first half of pregnancy, cervical os is closed
    - differential diagnosis includes ectopic pregnancy, cervical polyps/erosions/cancer/decidual reactions, vaginal ulcers, trophoblastic disease
    - small amount of bleeding may occur at time of blastocyst implantation or at time of misses menses

» inevitable miscarriage
- bleeding, cervical os is open, no tissue passed

» incomplete miscarriage
- tissue passed or present within os/vaginal canal
- retained products of conception present within uterine cavity

» complete miscarriage
- products of conception have entirely passed and os again closed
- difficult to differentiate clinically from threatened, incomplete, ectopic

»"missed" miscarriage
- prolonged retention of dead products of conception in utero for 4 weeks or more
- uterine size decreases and symptoms of pregnancy regress
- most usually abort spontaneously

» septic miscarriage
- any spontaneous or therapeutic abortion resulting in infection (endometritis, parametritis, peritonitis)

- Etiologies/Predisposing factors

» fetal chromosomal anomalies - 50 %, inadequate placentation - 30%
» autoimmune mechanisms
» maternal systemic disease
» drugs
» increased age/parity
» conception within 3 months postpartum
» abdominal/pelvic surgery during pregnancy

- Clinical Presentation

» variable

- Evaluation

» HISTORY
- LMP, PNMP
- gravity / parity
- onset, degree, duration of bleeding, passage of tissue
- associated cramps, pain, fever, orthostasis
- PHX gyn disease, procedures

» PHYSICAL EXAM
- vital signs, orthostatics
- abdominal exam - assess uterine size, tenderness/presence of peritoneal signs, presence of fetal heart tones by doppler (>10-12 weeks gestation)
- pelvic exam
    - condition of cervix/os
    - presence of clots/tissue
    - uterine size and tenderness
    - presence of adnexal mass/tenderness
    - fullness of cul-de-sac

» LABORATORY
- CBC
- type and Rh/screen/cross depending on amount of bleeding/hemodynamic status
- coagulation/DIC profile as indicated (late missed/septic abortions)
- ? quantitative serum B-HCG
- examine tissue passed in saline suspension or low power microscopy for chorionic villi, send for pathology evaluation

» ULTRASOUND
- useful to evaluate location/viability of pregnancy/retained POC
- psychological benefit to early diagnosis
- see ectopic pregnancy section

- Management and Disposition

» hemodynamic resuscitation as indicated
» Rh prophylaxis in Rh negative mothers
» at > 12 weeks if risk for large feto-maternal transfusion, Kleihauer-Betke test
» viable on sono
- reassurance
- arrange OB/GYN follow-up
- pelvic rest - no douche, tampon, sex (risk infection)
- body rest - won't alter course but decreases guilt

» nonviable on sono (incomplete/inevitable Ab, blighted ovum/missed Ab)
- conservative Rx/elective D&C vs emergent D&C based on hemodynamic status/OB and patient preferences
- OB/GYN consultation for follow-up
- after D&C
  - methergine 0.2 mg po q 4-6 hours x 8 doses
  - consider prophylactic doxycycline
- patient counseling

» presumed complete Ab or no sac/B-HCG <1000
- send passed tissue to pathology
- D/C with "ectopic / hemorrhage/infection precautions"
- OB/GYN consultation/arrange follow-up
  - possible D&C
  - serial HCG

■ GESTATIONAL TROPHOBLASTIC DISEASE ("Molar pregnancy")

- Pathophysiology

» disordered proliferation of trophoblastic tissue, spectrum of disease from degenerative to neoplastic
» 3 entities
- hydatidiform mole - most common (1/1800 pregnancies in US)
  - hyperplasia and hydropic degeneration of trophoblast
- "invasive" mole - occurs in 10-15% of hydatidiform moles
  - invades the myometrium or adjacent tissues

- Choriocarcinoma
  - malignant form of GTD- in 2-5% of moles

- Clinical Presentation - incidence 1/1500 pregnancies in U.S., 1/125 in Mexico and Taiwan
  - » bleeding in first or second trimester 90% (profuse in 33%)
  - » spontaneous passage of tissue (looks like clusters of little grapes) - in 80% cases is first evidence of molar pregnancy
  - » uterine size larger than expected by dates (in 50%)
  - » absent FHTs in second trimester
  - » extremely high HCG levels
  - » multiple theca lutein cysts causing ovarian enlargement/possible source of pain (20%)
  - » preeclampsia before 24 weeks gestation (10-12%)
  - » hyperemesis (14-32%)
  - » hyperthyroid symptoms (10%)
    - production of thyrotropin by molar tissue
- Diagnosis
  - » symptoms / signs above
  - » HCG value > 100,000 mIu/ml
  - » ultrasonography - classic "snowstorm" appearance of hydropic vesicles within uterus / absence of fetus
- Management
  - » hemodynamic stabilization in ED
  - » OB/GYN consultation - for evacuation in OR / admission / prophylactic chemotherapy (metrotrexate, dactinomycin)
  - » surveillance post op per GYN - watch for persistent GTD
    - effective contraception / serial HCGs / chemo for chorio
  - » incidence of malignant disease 15-30%, 1/3 choriocarcinoma

VAGINAL BLEEDING / ABDOMINAL PAIN IN LATE PREGNANCY

■ PLACENTA PREVIA

- Pathophysiology
  - » implantation of the placenta in the lower uterine segment within the zone of effacement and dilation of the cervix
    - bleeding occurs when placental vessels are torn as lower uterine segment elongates or cervix dilates
  - » occurs in 0.5% pregnancies (responsible for 20% of bleeding in late pregnancy)
  - » CLASSIFICATION
    - complete placenta previa (20%)
      - placenta completely covers internal cervical os
    - partial placenta previa
      - placenta partially covers os

- marginal placenta previa
  - edge of placenta extends to margin of internal os but does not occlude

» predisposing factors
- advanced maternal age, previous c-section, multiparity

- Clinical Presentation

» classically, painless bright red bleeding in third trimester
- antecedent spotting may have occurred earlier in pregnancy
- initial episode usually self limited
- occasionally some initial discomfort
- uterus soft, relaxed, nontender

- ED Management

» maternal resuscitation / stabilization
- O2, 2 large bore IVs, fluid / blood products as indicated

» fetal monitoring

» emergent OB/GYN consultation

» do **not** perform speculum / bimanual pelvic exam in ED

» transfer to obstetric suite

- Diagnosis

» Ultrasonography for placental localization in stable patient (95-97% sensitivity)

» defer if immediate delivery necessary (hemorrhage, labor, fetal distress)

■ ABRUPTIO PLACENTA (Placenta Abruption)

- Pathophysiology

» partial or complete premature separation of the placenta from its site of uterine implantation before delivery of the fetus

» occurs in 1/85 - 1/750 pregnancies
- responsible for 30% of bleeding in late pregnancy

» CLASSIFICATIONS

concealed-(20%) no external vaginal bleeding central placental detachment with
- hemorrhage confined beneath placenta (or relatively concealed by intact membranes)
- external-(apparent) blood drains through cervix after dissection along uterine wall (80%)
- Grading system (I-III) based on clinical features (bleeding/uterine irritability)/coagulation parameters/signs of fetal distress
- based on degree (%) of placental separation (not clinically useful)

» predisposing factors
- placental separation in prior pregnancy (10-20% risk recurrence)
- hypertension
- advanced maternal age / multiparity
- uterine distension (multiple pregnancy/polyhydramnios)
- abnormally short cord/rapid amniotic fluid loss
- smoking/alcohol/cocaine
- trauma - blunt abdominal/deceleration

- Clinical Presentations
  - » variable from small subclinical separations to maternal and fetal death
  - » vaginal bleeding (80%) - usually dark
  - » abdominal (uterine) or back pain and uterine tenderness (60-70%)
  - » uterine irritability (30%) abnormal frequent contractions to overt tetany
  - » maternal shock from blood loss
  - » DIC coagulopathy
  - » fetal distress (50%)/fetal death (15%)
  - » predisposition to amniotic fluid embolism
- Diagnosis
  - » clinical
  - » ultrasound useful only to assess for placental location (Dx previa)
- ED Management - depends on clinical severity
  - » maternal resuscitation / stabilization #1
    - O2, 2 large bore IVs, fluid / blood products as indicated
    - DIC panel (PTT/PT, platelets, fibrinogen, fibrin degradation products)
    - "the wall clot"
    - Rh evaluation (fetomaternal hemorrhage occurs)
  - » uterine / fetal monitoring
  - » do **not** perform speculum / manual pelvic exam in ED
  - » emergent OB/GYN consultation
- Complications
  - » Defibrination syndrome
  - » acute cor pulmonale
  - » renal cortical and tubular necrosis
  - » transfusion hepatitis
  - » uterine apoplexy

■ UTERINE RUPTURE

Incidence 1/1500 deliveries

- Types
  - » "occult - incomplete
  - » complete - intra-partum/third trimester
  - » spontaneous vs. traumatic
- Etiology risk factors
  - » trauma
  - » prelabor - placenta percreta, invasive mole, cornual pregnancy
  - » labor - oxytocin administration, obstructed labor, prior uterine surgery, multiparity, obstetric trauma - operation vaginal delivery, manual version, fundal pressure

- Clinical Presentation - prior to labor
  - » No reliable signs of impending rupture
  - » Sudden appearance of gross hematuria
  - » local pain and tenderness
  - » uterine irritability/premature labor
  - » vaginal bleeding -little-->massive
- Clinical Presentation - during labor - much like abruption
  - » abdominal pain
  - » vaginal bleeding may be profuse or minimal if hemorrhage concealed within peritoneal cavity or broad ligament
  - » maternal shock (may not be present)
  - » gross hematuria if associated bladder injury
  - » palpation / radiologic exam may confirm abnormal fetal position/extension of fetal extremities
- Treatment
  - » maternal resuscitation
  - » emergent OB consultation for operative management

MEDICAL PROBLEMS IN PREGNANCY

HYPERTENSIVE DISORDERS OF PREGNANCY

■ PREGNANCY INDUCED HYPERTENSION (PREECLAMPSIA ECCLAMPSIA)

- occurs in approximately 7% of all pregnancies typically after 24 weeks gestation

- Pathophysiology
  - » exact etiology unknown (? immune mechanism)
  - » vasospasm and microvascular thrombosis
  - » predisposing factors
    - • multiparity, diabetes mellitus, multiple gestation, molar pregnancy, fetal hydrops, extremes of maternal age, genetic predisposition (familial tendency)
- Definition / Clinical Presentation
  - » VARIABLE PRESENTATION
    - • PIH
      - - may have no signs and symptoms other than elevated BP
      - - easily overlooked when they present to ED for an unrelated problem
      - - best over-diagnosed than missed
      - - do not just attribute to ED or white-coat phenomenon

» CLASSIC TRIAD
- HYPERTENSION
  - blood pressure of 140/90 or higher OR
  - if known, >30 mmHG elevation in systolic pressure or 15 mmHg elevation in diastolic pressure over average baseline (may be less than 140/90)
- PROTEINURIA
  - at least 1 gm/L in random specimen (1+) OR 3 mg/L or 300 mg total in 24 hour collection
- GENERALIZED (nondependent) EDEMA
  - criteria not used by many because may not be present in eclampsia, may be present in normal pregnancy
  - rapid onset more suggestive of PIH

» SPECTRUM
- mild preeclampsia
  - no symptoms / signs of end organ damage other than HTN, proteinuria
  - sBP <160 / dBP <100, proteinuria 1+
- severe preeclampsia
  - BP >160 systolic or >110 diastolic
  - proteinuria 3-4+ (>5 gm/L on 24 hr)
  - evidence of end organ involvement (see complications below)
- eclampsia
  - development of seizures or coma in patient with preeclampsia

» SYSTEMIC COMPLICATIONS OF SEVERE PIH / symptoms and signs
- CNS
  - headache, visual disturbances, hyperactive reflexes
  - cerebral edema / intracranial hemorrhage / infacts
- Hepatic dysfunction
  - RUQ pain/tenderness, nausea/vomiting, elevated transaminases/bilirubin
- Renal
  - oliguria
  - elevated creatinine
- Pulmonary
  - pulmonary edema both cardiogenic and non cardiogenic
- Hematologic
  - thrombocytopenia
  - microangiopathic hemolytic anemia
  - DIC
- "HELLP" syndrome
  - ***H***emolysis (abnormal peripheral blood smear – burr cells and schistocytes), ***E***levated ***L***iver enzymes (bili >1.2mg/dl, LDH >600, SGOT >72), ***L***ow ***P***latelet count (platelets <100,000

- Management

» MATERNAL / FETAL monitoring

» LAB ASSESSMENT FOR ORGAN INJURY

- PIH Diagnostic Tests
  - CBC (HELLP syndrome: drop in HgB, Hct, platelets; peripheral smear for hemolysis)
  - LFTs - LDH, ALT(SGOT), AST(SGPT) elevated in HELLP
  - Uric acid (>4-5 mg/dl in most with pre-eclampsia, correlates with severity)
  - urine dip (proteinuria 1+ or > in pre-eclampsia
  - renal function (BUN >10, Cr >0.8)

» PREVENTION AND TREATMENT OF SEIZURES

- Magnesium Sulfate (MgSO4)
  - load: 4-6 grams in 10% solution over 5-10 minutes
  - maintenance infusion: 1-2 grams/hour IV
  - optimal serum magnesium level 4-8 mEq/L
  - follow for signs magnesium toxicity (depressed DTR's, oliguria, respiratory depression)
- Seizures while on MgSO4
  - additional 2-4 grams MgSO4 load if more than 20 minutes after loading dose
  - consider phenytoin, diazepam
  - consider other causes seizure (CNS bleed, hypoglycemia etc)

» CONTROL OF BLOOD PRESSURE

- MgSO4 as above
- further Rx if dBP remains over 110
- NO diuretics or hyperosmotic agents
- hydralazine (classic)
  - initial bolus of 5 mg IV over 1-2 minutes
  - repeat additional 5-10 mg every 20-30 minutes as needed
  - total dose 20 mg without response, consider another agent
- second-line agents to consider: nifedipine (10mg orally); labetolol 20 mg IV bolus, can double dose every 10 minutes to max of 300 mg; nitroprusside (extreme case)
- also being studied: nimodipine, nicardipine

» OB CONSULTATION / ADMISSION

» TIMELY TERMINATION OF PREGNANCY = definitive Rx

- >28-34 weeks / adequate pulmonary maturity - delivery
- <28 weeks / pulmonary immaturity delivery may be postponed if adequate control BP / no signs of impending eclampsia

» also being studied: low dose ASA in prevention and RX of preeclampsia and IUGR in high risk patients

■ CHRONIC HYPERTENSION

- preexistent before pregnancy or persists greater than 6 weeks postpartum
- usually idiopathic
- most frequently used agents: methyldopa, clonidine, nifedipine
- ACE inhibitors contraindicated

■ CHRONIC HYPERTENSION WITH SUPERIMPOSED PIH

■ TRANSIENT HYPERTENSION

- development of elevated BP during pregnancy or within 24 hours without other signs of PIH

OTHER MEDICAL PROBLEMS

■ CARDIOLOGY

-CPR: displace fundus to the left; if no maternal response in 5 minutes, C/S immed.

-Arrhythmias:

- treatment similar to non-pregnancy
- DC cardioversion OK
- Adenosine/Verapamil OK
- Digoxin, Lidocain, Procainamide OK

-Peripartum cardiomyopathy

- risk factors: older, Black, multiparous, pre-eclampsia; often no history of CV disease
- CHF in last month of pregnancy to first 8 weeks postpartum
- dilatative cardiomyopathy
- Etiology - ? Coxsackie B virus
- Rx: bedrest, NA restriction, Dig, diuretics

■ THROMBOEMBOLIC DISEASE

- Pathophysiology
  - » pregnancy is hypercoagulable state (no "high risk" trimester)
  - » risk 5x greater than nonpregnancy, continues into post-partum period
  - » increased post-partum risk following c-section
- Diagnosis
  - » same as nonpregnant (problematic)
  - » ABG alteration in pregnancy chronic respiratory alkalosis, A-a gradient progressive increase to 15-20
  - » acceptable risk/benefit ratio modalities: impedance plethysmography, doppler ultrasonography, chest x-ray, V/Q scan
  - » labeled fibrinogen studies CONTRAINDICATED
- Treatment
  - » use heparin - doesn't cross placenta
    - after initial inpatient Rx, patient maintained on subQ BID through postpartum period
    - reversal considered during labor
    - low molecular weight heparins are safe in pregnancy
  - » coumadin CONTRAINDICATED - pregnancy category X
    - high rate of fetal malformation/mortality

■ PULMONARY

- Asthma

-1/3 improve/no change/worsen

» recommended therapy:

-inhaled beta agonist ↓ persistent symptoms added inhaled beclomethasone

» recommended therapy (cont.):
consider adding Cromolyn or Ipratropium ↓ persistent symptoms
Prednisone

• URIs
- at risk for more serious disease
- avoid OTC cold meds
- guaifenesin/dextromethorphan OK
- if bacterial superinfection, risk of POL

■ GI

- HYPEREMESIS GRAVIDARUM
  - Diagnosis
    » severe nausea and vomiting associated with dehydration, persistent ketosis, electrolyte imbalance and weight loss
  - Testing
    » urine dip for ketones, serum acetone, LFT's, electrolytes
  - Treatment
    » consider alternative diagnosis
    • UTI, molar pregnancy, liver disease, gastroenteritis, appendicitis, preeclampsia
    • check UA for ketones, bactiuria
    » antiemetics if needed in consultation with patients OB
    • phenothiazines are class C
    » D/C when tolerating PO well
    • OB f/u
    • encourage staff frequent meals, simple carbohydrates, avoid irritant foods, protein at bedtime/crackers before arising
    • outpatient oral pharmacotherapy controversial
- APPENDICITIS IN PREGNANCY
  - Pathophysiology
    » commonest nonobstetric/nontraumatic surgical emergency 1/1600
    » changes of pregnancy obscure findings
    • progressive displacement of appendix from pelvis to deep RUQ near kidney
    • laxity and displacement of abdominal wall - loss of peritoneal signs
    • physiologic increase in WBC
  - Clinical presentation
    » right-sided abdominal pain - location varies, less reliable late pregnancy
    » nausea/vomiting (mimics SX pregnancy when in 1st trimester)
    » anorexia less common
    » pyruria without bacteria in 20%
  - ED Management
    » NPO, IV hydration
    » admit with appropriate OB, SURG consultation

- Differential diagnosis
  - » pyelonephritis (most common mimic), cholecystitis, adnexal events, round ligament pain
- ALL OTHER NONOBSTETRIC CAUSES OF ABDOMINAL PAIN CAN OCCUR DURING PREGNANCY
  - » cholecystitis, intestinal obstruction, pancreatitis, liver disease, urolithiasis, peptic ulcer disease, inflammatory bowel disease, etc.

■ UROLOGY

-RENAL COLIC

- no increased incidence
- atypical presentation – abdominal and visceral pain may predominate over flank pain
- Testing: U/A (10% may lack hematuria);
  Ultrasound → limited IVP (scout, 30 second,, 20 minute film)

URINARY TRACT INFECTION

- Patholgenesis
  - » mechanical pressure on bladder and ureters, progesterone mediated smooth muscle relaxation resulting in increased post void residual, decreased ureter peristalsis
  - » asymptomatic bactiuria occurs in 5% -> these have 20-40% risk of developing upper tract infection
- signs/symptoms
  - » similar to nonpregnant
- differential diagnosis
  - » STD urethritis, cholycystitis, appendicitis
- complications
  - » spread of lower tract disease to kidney parenchyma, permanent renal injury
  - » premature labor
  - » maternal sepsis
  - » pulmonary edema ARDS unusually common (2-8%)
- treatment
  - » outpatient antibiotic for lower UTI/asymptomatic bacteruria 7-10 days
    - cephalosporin, nitrofuramtoin
  - » pyelonephritis
    - admit for IV hydration, IV antibiotics (1st generation or 3rd generation, cephalosporin, ampicillin/gentamycin)
    - outpatient Rx in selected (i.e. stable and able to tolerate P.O.) cases using single dose ceftriaxone followed by 10 days of PO cephalexin

■ NEUROLOGY

- Headache

- intracranial hemorrhage the cause of 5-12% of all maternal deaths during pregnancy
- consider usual causes - acute v. chronic
- check BP

- Dx: CT, LP safe
- Rx: prochlorperazine, metoclopramide, narcotics (avoid sumatripan, DHE)

• Seizures
  - consider eclampsia if elevated BP/No history
  - gestational epilepsy (13% of patients with epilepsy will have 1st seizure during pregnancy)
  - anti-convulsant levels decrease, esp 3rd trimester
  - acute Rx: lorazepam, diazepam, Mg, phenytoin
  - chronic Rx: all have relative risks

■ INFECTIOUS DISEASE

• Antibiotics
  - clarithromycin, quinolones, tetracyclines contraindicated
  - cephalosporins, PCNs, erythromycin (except estolate), mandelamine safe
  - azithromycin, metronidazole, TMP/SMZ, aminoglycosides use with caution

• Vaginitis
  - trichomonas (metronidazole >2nd trimester, clotrimazole for sx in 1st)
  - bacterial vaginosis (ampicillin, clindamycin, metronidazole--> implicated as contrib. to PROM, POL, postpartum endometritis
  - candidiasis (nystatin: if failure use miconazole or clotrimazole

• Chickenpox (Varicella)
  - incubation 14+/-6 days
  - infectious 1-2 days before rash, 5-6 days after
  - if mother exposed, check for antibody; if (-), recommend VZIG by 72 hours post-exposure (may not prevent intra-uterine infection)
  - if clinical infection, Rx acyclovir
  - fetal risk (1st trimester: 5% teratogenicity; 3rd: if within 5 days before/after delivery, 17% risk of neonatal infection, 31% mortality)

■ WOUND CARE

- local anesthetics safe (lidocaine, bupivicaine
- skin solutions - iodophor, chlorhexidine safe
- all suture materials/staples safe
- Td, TIG safe

■ RADIOLOGY

- x-rays should be ordered for the same general indications as in nonpregnant
- inform tech that patient is pregnant
- avoid skull, LSS, rib, KUB x-rays
- fetal risk - neurologic teratogenicity threshold exposure 10-50 cGy, IUGR at 25 cgY, exposures <5cGy appear safe
- standard doses: PA chest 0.0001cGy, KUB 0.1, limited IVP 0.15, DT brain neglible, V/Q scan <0.04

■ MEDICATIONS DURING PREGNANCY

- FDA use-in-pregnancy categories
  - A: controlled studies show no risk
  - B: no evidence of risk in humans
  - C: risk cannot be ruled out
  - D: positive evidence of risk
  - X: contraindicated in pregnancy

■ TRAUMA

- Types
- Falls
- MVA's (10x the rate of other causes)
- Domestic Violence
- Penetrating injuries
- Burns
- Maternal anatomy and physiology
- affects the type of injury
- affects the mother's response
- generally maternal response is to maintain her own survival even if there are resultant adverse effects on the fetus
- 7-10% incidence
- Cause of 15-22% of non-obstetric deaths
- Diagnostic Tests
- Labs: usual plus Kleihauer-Betke; if suspect abruptio, fibrinogen and FSPs
- Peritoneal lavage the preferred method for evaluating intra-abd trauma
- CT scan the best noninvasive method
- Ultrasound may be helpful
- Trauma-the ABCDE's
- Airway, Breathing: 100% oxygen, aggressive ventilation/intubation, RSI OK; if chest tube, place 1-2 interspaces higher
- Circulation: get uterus off IVC, monitor maternal and fetal VS
- Disability: AVPU - ?event caused trauma
- Expose: check the uterine size, tenderness, contractions, vaginal bleeding, fluid leak
- Primary/Secondary Surveys

Primary:

- consider uterine rupture/abruption
- palpate for abdominal tenderness
- check uterus for tetanic contractions

Secondary:

- vaginal exam to check for bleeding and condition of cervix
- FHTs

Labs: The wall clot, K-B, usual trauma labs

- Trauma - Management

- Oxygen - high concentrations never hurt
- Fluids - pregnant patient may lose 30-35% of blood volume, before hypotension-
  Give RL, avoid D5-containing solutions
- Transfusion - maintain Hct at 25-30% and urine output >30cc/hr
- Fetal monitoring - fetal distress may be the first sign of impending maternal deterioration.
- Rh factor - consider 1 vial RhIG for Rh (-) mothers
- Penetrating trauma - consider lap on all GSWs and stab wounds to upper abd
- Indications for C/S
  -control of maternal hemorrhage
  -viable fetus in distress
  -GSW to abdomen with viable fetus
  -amniocentesis showing bleeding or bacteria

- "Minor" Trauma - Management

Strongly consider immediate OB consult for any of the following:
- vaginal bleeding
- uterine irritability or tenderness
- abnormal fetal heart tones
- abdominal pain
- viability assumed after 24 (?now 20) weeks

Degree of Injury	Mechanism	Monitor
Uninjured or minor	(-)	4 hours
> minor	(+/-)	min 24 hours
uninjured or minor	(+)	min 24 hours

- If not viable fetus, generally treat as if non-pregnant

- Trauma - Risks to Mother

- Vaginal bleeding: "rule out" placenta previa; consider placental abruption, fetal trauma uterine rupture, pre-term labor
- Premature rupture of membranes
- Placental abruption
- Pelvic fractures, with increased hemorrhage

- Trauma - Risks to Fetus

- Fetal death
- Direct tauma --> fractures, intra-cranial hemorrhage
- Indirect injury --> fetal hypoxia due to maternal hypotension, fetal hemorrhage, placental abruption, cord/uterine injury
- Pre-term delivery
- Rh isoimmunization

PERIPARTUM COMPLICATIONS

■ PRETERM LABOR

- Definition
  - » uterine contractions with sufficient intensity, duration, and frequency to produce progressive cervical effacement and dilation before 37 weeks gestation
- Predisposing factors / causes
  - » infection - uterus, cervix, urinary tract
  - » uterine abnormality - eg incompetent cervix
  - » maternal disease - eg diabetes, hypertension
  - » multiple gestation / fetal anomaly
  - » placenta previa / abruptio
  - » premature rupture of membranes
- Clinical presentation
  - » regular uterine contractions (patients may complain of "abdominal tightenings", menstrual-like cramps, back or thigh pain, change in vaginal discharge)
- Management
  - » OB consultation / transfer to tertiary perinatal center
- Evaluation
  - » uterine-fetal monitoring
  - » full vital signs
  - » cervical-vaginal exam
  - » uterine fetal size
  - » cervical cultures (GC, group B strep, chlamydia)
  - » urinalysis with C&S
  - » cardiotocographic fetal monitoring
  - » consider precipitating factors
    - UA/C&S, CBC, coagulation profile, cervical cultures (group B step, E Coli, chlamydia)
    - consider empiric antibiotic therapy – Ampicillin 2g every 6 hours
  - » rest
  - » intravenous hydration 1L NS over 30 minutes
  - » reassess - if contractions persist, cervical changes documented, tocolytic therapy warranted (eg MgSO4, terbutaline 0.25mg SQ every 30-60 minutes up to 3 doses, ritodrine) for patients <34 weeks gestation
- Contraindications to toxolytics
  - » severe PIH
  - » severe vaginal bleeding
  - » infection
  - » severe IUGR

■ PREMATURE RUPTURE OF MEMBRANES (PROM)

- Definition - spontaneous rupture of fetal membranes before the onset of labor

- Clinical presentation
  - » history of trickle or sudden gush of fluid per vagina
- Primary concerns
  - » chorioamnionitis
  - » preterm delivery
- Evaluation
  - » sterile speculum exam - look for pooling in posterior vault, visualize cervix
  - » sterile swab of secretions
    - test with nitrazine paper
    - amniotic fluid is alkaline, normal vaginal secretions acidic, , false positives with blood, semen, urine, certain vaginal infectious especially trichomonas
    - microscopic exam of air dried smear - "ferning" seen with amnionic fluid, 85-98% accuracy, best seen at 5-10x magnification
  - » cervical cultures
  - » no digital exam
  - » if suggested , but above tests equivocal, do ultrasound to assess amniotic fluid volume
- Treatment
  - » OB admission / ? transfer to tertiary perinatal center
  - » depends on gestation age, status of cervix, signs of maternal infection
- Complications
  - » Preterm labor
  - » Chorioamnionitis
    - S/S: fetal/maternal tachycardia, uterine tenderness, contractions, foul vaginal discharge, maternal fever
  - » Prolapsed umbilical cord
    - descent of umbilical cord into lower uterine segment where it is compressed by adjacent presenting part (occult prolapse) or descent below presenting part through cervix (overt prolapse)
    - resultant compromise to umbilical cord circulation->fetal bradycardia, deep variable decelerations
    - Management
      - make arrangements for emergency C-section
      - maternal O2, IV, carditocographic fetal monitoring
      - place patient in knee-chest position, examiner applies continuous upward pressure on presenting part of lift and maintain fetus away from compressing prolapsed cord until delivery accomplished

EMERGENCY DEPARTMENT DELIVERY

■ PLEASE NOTE

- » Neither doctors nor nurses nor emt's nor policemen deliver babies...mothers do.
- » Your primary role will be to help the mother as she delivers her child and to be prepared to intervene if complications arise

- The Quick History & Physical
  - » What you need to know....
  - » What you need to look for ....in order to have some idea of what to expect.
- The History
  - » What number baby is this?
  - » When is the baby due?
  - » Did the bag of waters break? When?
  - » What color was the fluid?
  - » Has there been any bleeding?
  - » How often are the contractions?
  - » Is there the urge to push?
- The Physical
  - » Observe:
    - Perineum for bulge during contractions, bloody show or bleeding, leakage and color of amniotic fluid
    - The woman's emotional state
    - Digital exam: identify the presenting part, dilation, effacement, station re: the ischial spines, membranes ? intact
- The Diagnosis
  - » labor is early, birth in not imminent-->transport to Labor & Delivery
  - » there's a problem - STAT transport
  - » birth is imminent-->prepare for delivery in the Emergency Department

■ "NORMAL" (term, vertex) SPONTANEOUS VAGINAL DELIVERY

- In Emergency Department only if delivery *imminent*: bulging perineum with visible scalp at introitus (normal vertex presentation)
  - » Patients who present to ED in stage 1 of labor without intercurrent emergency illness/injury are best transported directly to labor and delivery suite
    - otherwise, concurrent OB involvement ASAP
    - signs of fetal distress: loss of beat-to-beat variability, persistent fetal tachycardia or bradycardia, variable decelerations not relieved by maternal repositioning/O2 administration, late decelerations, fetal scalp pH<7.20-7.25
- Equipment needed
  - » Basic - sterile gloves, surgical scissors, 3 hemostats, cord clamp, bulb syringe, DeLee suction trap, sterile towels, ring forceps, gauze sponges, baby blanket
  - » Doppler stethoscope
  - » Neonatal resuscitation equipment, radiant warmer
- STEP - BY - STEP STAGE 2: controlled, gradual to minimize morbidity
  - » in left lateral position with right leg held by assistant or lithotomy position with buttocks elevated on rolled blanket or inverted bedpan
  - » control emergence of head
    - ask mother not to push

- gentle pressure with palm on fetal head to prevent sudden "popping out" and control extension
- fingers of second hand draped with sterile towel press upward posterior to maternal anus to gently lift chin

» palpate for nuchal cord and slip gently over baby's head
- if tight, clamp x2 and cut between

» clear upper airway after baby's head rotates laterally
- wipe and suction nose, mouth, and oropharynx with bulb syringe (or DeLee suction if meconium)

» deliver anterior shoulder
- gentle downward traction with hands on either side of baby's head

» controlled delivery of posterior shoulder
- gentle upward traction, do not allow to "pop" across perineum (resulting 3° or 4° laceration)

» rest of body delivers spontaneously
- slippery! - hold infant along length of arm with thumb and index supporting nape of neck, head slightly lower than feet

» vigorous drying, repeat suction, warm (blanket/mom's chest, radiant warmer)

» resuscitate baby if indicated

» apgar

- STAGE 3: delivery of placenta

» signs of placental separation - uterus becomes firm, globular, then rises in the abdomen, sudden gush of blood and increased protusion of cord from introitus

» do not pull on cord

» inspect placenta / membranes passed for completeness

- control bleeding

» facilitate uterine contraction
- gentle fundal massage
- oxytocin 10-20 units in 1L at 250cc/hr

» inspect cervix / fornices, vagina / labia and perineum for lacerations using ring forceps/ gauze-direct pressure/clamp bleeders

■ COMPLICATIONS DURING DELIVERY

- breech presentation
- fetal compromise - the blue baby / the pale baby
- prolapsed cord
- abnormal presentation, shoulder dystocia, placenta accreta, uterine inversion, fetal compromise

■ PERIMORTEM CESAREAN SECTION

- Best chance of fetal survival if done within 5 minutes of maternal cardiac arrest
- Continue ongoing maternal resuscitation, ideally including thoracotomy with open chest cardiac massage
- viable gestational age (around 23 weeks), + FHT

- may improve maternal survival
  - » via relieving vena caval compression
- technique
  - » asepsis, surgical instruments, etc not required
  - » both abdomen and anterior uterus incised vertically (i.e. #10 scalpel)
  - » if anterior placenta encountered, incise it to reach fetus
  - » deliver fetus, promptly clamp and cut cord
  - » THEN may cross-clamp mother's aorta and continue resuscitation of both parties
  - » repair, IV antibiotics for surviving mom

NEONATAL RESUSCITATION

■ Assessment and Resuscitation occur simultaneously

- APGAR scores at "1 and 5" descriptive, prognostic (not used to determine therapy)
- Responses to interventions seen within 15-30 seconds
  - » assess respiratory effort, heart rate, and color

■ STEPS

- Drying, Warming, Positioning, Suctioning, Tactile stimulation
  - » rubbing dry with warm towels, radiant warmer
  - » suction first on perineum before delivery then again after
    - bulb, DeLee
    - avoid pressure on posterior pharynx
    - via ETT if thick meconium
  - » stimulate by rubbing back, gently slapping heels, repeat as needed
- Assess respiratory effort, heart rate, and color
- Oxygen administration
  - » if **central cyanosis or any signs of respiratory distress** *in a spontaneously breathing infant* via face mask or tubing 100% at 5 LPM
- Positive pressure Ventilation
  - » indications: **respirations absent or inadequate to maintain oxygenation, heart rate less than 100, central cyanosis persists despite O2 administration**
  - » bag-valve-mask with popoff set at 35mmHg, 450cc ambu bag for term (250 for neonate)
    - ? laryngeal mask airway alternative
  - » 40 breaths per minute with 100% O2
  - » reposition and suction as necessary, orogastric tube to decompress stomach
  - » continue until adequate ventilation and hear rate >100
- Chest Compressions
  - » indications: a **heart rate less than 80 or that is not rapidly increasing despite adequate ventilation and oxygenation**
  - » hand encircling or 2 finger method, rate 120, depth 1/2-3/4"

- Endotrachael Intubation
  - » indications: **prolonged positive pressure ventilation needed, suctioning of thick meconium, or if bag-valve-mask ineffective**
  - » miller blades 0 and 1
  - » tube size range 2.5 (1kg preemie) - 4.0 (3kg term), uncuffed
  - » distance lip-to-tip 6 + weigh in kg
- Medications
  - » Access:
    - vascular: no. 5F umbilical catheter into umbilical vein until backflow easily identified
    - via ETT with 0.5 cc respiratory saline chaser
  - » Epinephrine
    - indications: heart rate less than 80 despite adequate ventilation with 100% O2 and chest compressions
    - dose: 0.01 mg/kg of 1:10,000 solution (0.1 ml/kg)
  - » Naloxone HCL
    - indications: respiratory depression secondary to maternal narcotic administration
    - dose: 0.01 mg/kg
  - » Glucose
    - indications: hypoglycemia (<30 mg/dL)
    - dose: 2 ml/kg of 10% dextrose (D10W) over 2 minutes followed by maintenance fluids to provide ongoing supply (D5-1/4 NS at 4cc/kg/hr)
  - » Volume expanders
    - indications: any neonate not responding to resuscitation
    - fluids used: O neg blood, fresh frozen plasma, 5% albumin-saline, NS, RL
    - dose: 10 ml/kg over 10 minutes

POST PARTUM COMPLICATIONS

■ POST PARTUM HEMORRHAGE

- Definition / Etiology
  - » blood loss in excess of 1000 cc after vaginal delivery of fetus, 1500 cc after c/s
  - » immediate
    - within 24 hours of delivery
    - uterine atony, genital tract lacerations, retained placental fragments, abnormal placental attachment, uterine inversion, uterine rupture, puerpural hematoma, coagulopathy
  - » late
    - more than 24 hours after delivery
    - retained placenta, subinvolution of implantation site, endometritis, withdrawal bleeding

- Management
  - » usual resuscitation measures - O2, IVs, fluids, CBC, type and cross, coagulation profile including fibrinogen
  - » uterine atony (90%) of PPH
    - Dx - uterus feels soft and boggy on abdominal exam
    - Treatment
      - uterine massage
      - oxytocin (pitocin) 20-40 units in 1 liter saline at 200-500 cc/hr
      - methergine 0.2 mg IM
      - prostagandin F2 alpha 0.25 mg IM q15-90 minutes

■ POST PARTUM INFECTIONS

- endometritis
  - » predisposing factors
    - PROM, prolonged labor, c-section or operative vaginal delivery, preexisting vaginitis/cervicitis, internal fetal monitoring
  - » clinical presentation (variable severity)
    - fever/chills, abdominal pain, uterine tenderness/CMT, malaise, orthostasis, foul lochia
  - » etiology
    - polymicrobial gram-positive aerobes (group B strep, enterococcus), gram negative aerobes (E. coli, enterobacter), anaerobes (bacteroides, peptostreptococcus)
  - » treatment
    - IV fluids
    - IV antibiotics (gentamicin/clindamycin, cefoxitin, ampicillin/sulbactam)
    - admit
  - » complications
    - septic pelvic thrombophlebitis, pelvic abscess, shock wound infection

- mastitis
  - » onset 2-4 days post partum or 5-6 weeks
  - » predisposing factors
    - clogged duct, engorgement, cracked nipple
  - » signs/symptoms
    - fever,, chills, malaise, breast/pain/tenderness/warmth/erythema
  - » etiology
    - staph aureus most common
  - » treatment
    - moist heat
    - keep nursing
    - dicloxacillin, 1st generation cephalosporin, amoxicillin/clavulanate
  - » complications
    - abscess, toxicity
- other - UTI, pneumonia

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