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OBSTETRIC MEDICINE

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Physiologic Changes in Pregnancy

CLINICAL IMPLICATIONS—to maintain adequate uterine perfusion, fetal oxygenation, and nutrient delivery. May potentially mask serious illness

IMPORTANT CHANGES IN PREGNANCY

	Change	Clinical Implication
Core temperature	Unchanged	Fever should be investigated and treated; maternal fever is teratogenic in T_1, and associated with adverse perinatal outcomes in T_3
Upper airway	↑ edema and friability (hyperemia and glandular function)	Nasal congestion, epistaxis and snoring common. Failed/difficult intubation more common than non-pregnant state
Thorax	↑ circumference, elevated diaphragm (~4 cm) but normal excursion	Anatomical landmarks for thoracentesis shifted. ECG changes: QRS axis deviates to left in late pregnancy ± T-wave inversion ± ST depression in inferior and lateral leads
Tidal volume	↑ early in T_1 at expense of FRC/RV	Expected PaO_2 100–110 mmHg, $PaCO_2$ 28–32 mmHg (mild respiratory alkalosis), HCO_3 18–21 mmol/L (compensatory reduction), arterial pH 7.40–7.45 (normal/slight alkalosis). An elevated RR should be investigated
Respiratory rate	Minimal increase by ~3–4 breaths/min at term	
Minute ventilation (RR × TV)	↑ by 50% at term	
Oxygen consumption	↑ by 15–20%	
Heart rate	↑ by 15–20 beats/min by T_3	Pregnancy may unmask heart disease, especially obstructive lesions. Exacerbation of pre-existing tachyarrhythmias or *de novo* presentations also possible. Compression of IVC by gravid uterus in supine position may ↓ cardiac output by up to 25% left lateral decubitus position recommended Greatest risk of cardiac decompensation between 28 and 32 weeks gestation (maximum increase in maternal blood volume), during labor (hemodynamic changes), and in post-partum period (fluid shifts)
Stroke volume	↑	
Cardiac output (HR × SV)	↑ by 30–50% (peaks ~28 weeks)	
Ejection fraction	Unchanged	

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IMPORTANT CHANGES IN PREGNANCY (CONT'D)

	Change	Clinical Implication
Systemic vascular resistance	↓	
Blood pressure	↓ by 10–15 mmHg (nadir at ~20–24 weeks) with gradual increase back to baseline	↓↓ DBP > ↓ SBP → widened pulse pressure
Renin-angiotensin-aldosterone system	Upregulated	↑↑ renin, ↑ aldosterone, ↓ aldosterone/renin ratio in response to systemic vasodilation and ↓ SVR
Renal blood flow	↑ by 80%	
Glomerular filtration rate	↑ by 40–50%	Hyperfiltration with ↓ in serum Cr to ~35–70 mmol/L [0.4–0.8 mg/dL]; higher levels suggest renal disease. Dose adjustments for renally-cleared drugs may be required
Plasma volume	↑ by 30–50% (1.1–1.6 L) by T_3	JVP height remains normal
RBC mass	↑ by 40%	Iron requirements ↑ by 50%. Disproportionate ↑ in plasma volume results in physiologic anemia (hemoglobin ↓ by ~20 g/L [2 g/dL] by T_3)
Coagulation system	↑ levels of coagulation factors, decreased fibrinolysis	10× ↑ risk for venous thromboembolism during pregnancy and up to 6 weeks postpartum
Gastric pH	↑	Impaired drug absorption, dose adjustments may be required
Lower esophageal sphincter pressure	↓ (progesterone effect)	GERD, nausea and vomiting common. ↑ risk of aspiration with intubation
GI motility	↓	Constipation and abdominal bloating common. Impaired drug absorption, dose adjustments may be required
Hepatic metabolism	Changes in drug metabolism (e.g., cytochrome P450 system enzymes may be ↑ or ↓)	Dose adjustments may be required for hepatically-metabolized medications (e.g., antiepileptics)
Biliary system	↓ motility, ↑ bile cholesterol secretion and saturation	↑ risk for gallstones during pregnancy
Thyroid	↑ thyroid gland size by 18%. ↑ estrogen → ↑ thyroxine-binding globulin → total T4 and ↑ total T3 (but free T4 and free T3 mostly remain normal)	Thyroid function tests should be interpreted using trimester-specific TSH and total T4 reference ranges for pregnant women. For those already on levothyroxine replacement, ~75% of women will require an increased dose during pregnancy. Homology between hCG and TSH can result in hCG mediated hyperthyroidism during pregnancy
Glucose metabolism	↑ insulin resistance (peak ~30 weeks gestation) from human placental lactogen and progesterone	Screen for gestational diabetes by 24–28 weeks gestation

MATERNAL MORTALITY AND RESUSCITATION

MATERNAL MORTALITY—defined as death during pregnancy or up to 1 year postpartum. Most common causes include cardiovascular disease, venous thromboembolism, amniotic fluid embolus, obstetric hemorrhage, infection (sepsis), suicide, and preeclampsia/eclampsia

MATERNAL RESUSCITATION—follow ACLS algorithm for non-pregnant adult population including medications, dosages (for medications, defibrillation, cardioversion, pacing), compressions, and ventilation rate. Special considerations include: (1) obtaining venous access above the diaphragm (potential obstruction from gravid uterus below diaphragm); (2) chest compressions performed higher up on sternum; (3) left uterine displacement (first-line) or left lateral tilt (second-line) to relieve aorto-caval compression by gravid uterus; (4) difficult airway and ventilation requires expertise; (5) perimortem caesarean section if no return of spontaneous circulation within 4 min; (6) remove fetal monitors for defibrillation if possible (theoretical risk to fetus). *Do not delay treatment: healthy baby requires healthy mother!*

Preeclampsia/Eclampsia/HELLP Syndrome

JOGC 2014 36:5
SOGC Hypertensive Disorders of Pregnancy 2014 Guidelines

DIFFERENTIAL DIAGNOSIS OF HYPERTENSION IN PREGNANCY

PREEXISTING (CHRONIC) HYPERTENSION—SBP ≥140 and/or DBP ≥90 mmHg prior to 20th week of gestation, complicates 1% of pregnancies: 20% risk of developing preeclampsia

PREECLAMPSIA SUPERIMPOSED UPON PREEXISTING HYPERTENSION—preexisting (chronic) hypertension with new or worsening proteinuria (≥300 mg/day with 24-h urine collection or ≥30 mg/mmol on spot urine protein/Cr ratio), or resistant hypertension (i.e., resistance to ≥3 antihypertensive drugs), or development of adverse condition (see list below), or development of severe complication (see list below) at ≥20 weeks gestation. *Diagnosis of preeclampsia does not require presence of proteinuria*

GESTATIONAL HYPERTENSION—new-onset hypertension ≥20 weeks gestation, complicates 5–6% of pregnancies. 35% risk of developing preeclampsia

PREECLAMPSIA SUPERIMPOSED UPON GESTATIONAL HYPERTENSION—new-onset proteinuria, or development of adverse condition (see list below), or development of severe complication (see list below) after onset of gestational hypertension

PREECLAMPSIA—occurring *de novo*, defined as gestational hypertension, with either proteinuria, adverse condition, or severe complication

PATHOPHYSIOLOGY

MECHANISMS—multifactorial involving immunologic, genetic and maternal factors that lead to uteroplacental mismatch and endothelial cell dysfunction

ADVERSE CONDITIONS OF PREECLAMPSIA—headaches/visual symptoms, chest pain/dyspnea, oxygen saturation <97%, nausea, vomiting, elevated liver enzymes or creatinine, thrombocytopenia, hyperuricemia, oligohydramnios, IUGR, abnormal uterine artery or umbilical cord Doppler flow. SBP ≥160 mmHg most important predictor of fatal stroke among women with hypertensive disorders in pregnancy

SEVERE COMPLICATIONS OF PREECLAMPSIA—generalized tonic-clonic seizures (eclampsia), PRES (posterior reversible leukoencephalopathy syndrome), cortical blindness/retinal detachment, altered level of consciousness, stroke, pulmonary edema, acute kidney injury, hepatic dysfunction/hematoma/rupture, hemolysis, placental abruption, fetal demise. HELLP (Hemolysis, **E**levated **L**iver **E**nzymes, **L**ow **P**latelets) syndrome = constellation of findings considered variant of severe preeclampsia

RISK FACTORS—extremes of age (<18, >40), nulliparity, multiple gestations, prior preeclampsia, obesity, chronic hypertension, diabetes mellitus, chronic kidney disease, antiphospholipid antibodies, and inter-pregnancy interval ≥10 years

PATHOPHYSIOLOGY (CONT'D)

CAUSES OF DEATH—hemorrhagic stroke from uncontrolled hypertension and eclampsia

CLINICAL FEATURES

HISTORY—inquire about headaches, visual disturbances, epigastric or RUQ pain, nausea, vomiting, swelling, decreased fetal movements

PHYSICAL—check vitals, look for retinal vasospasm, heart failure, edema (facial, limbs), RUQ tenderness, hyperreflexia and clonus

INVESTIGATIONS

BASIC

- **LABS**—CBCD, Cr, spot urine for protein to creatinine ratio, AST, ALT, albumin, uric acid (hyperuricemia associated with preeclampsia)

SPECIAL

- **BLOOD TESTS**—peripheral smear, lytes, urea, bilirubin, INR, LDH if indicated
- **FETAL EFFECTS**—biophysical profile and fetal US

MANAGEMENT

ACUTE—ABC, O_2 to keep sat >95%, IV with judicious fluid

ACUTE LOWERING OF SEVERE HYPERTENSION (SBP ≥160 mmHg or DBP ≥110 mmHg)—*labetalol* (start with 20 mg IV, repeat 20–80 mg IV q10–30 min, or infusion 1–2 mg/min, max 300 mg), *nifedipine short-acting capsule* 5–10 mg PO q30min, or *hydralazine* (start with 5 mg IV, repeat 5–10 mg IV q20–30 min, max 20 mg). Severe cases may require continuous infusion. Consider urgent delivery if not controlled

CHRONIC MANAGEMENT OF NON-SEVERE HYPERTENSION (SBP 140–159 mmHg or DBP 90–109 mmHg)—target BP at 130–140/80–90 mmHg if renal disease, diabetes, cardiovascular disease, or cerebrovascular disease. Otherwise target BP 130–155/80–105 mmHg; tighter control (DBP 85 mmHg [vs. 100 mmHg]) results in less severe hypertension without significant ↑ risk of adverse fetal outcomes. *Labetalol* 100–400 mg PO BID–TID, max 1200 mg/day, *nifedipine XL* 20–60 mg PO daily, max 120 mg/day, or *methyldopa* 250–500 mg PO BID–TID, max 3 g/day are good first-line choices. Avoid ACE inhibitors, ARBs, atenolol and prazosin. Second-line: other β-blockers and hydralazine. Third line: other CCBs, clonidine, and thiazide diuretics

MANAGEMENT (CONT'D)

SEIZURE PREVENTION AND TREATMENT—*MgSO4* 4 g IV bolus, then 1–2 g/h × 24–48 h. Re-bolus for ongoing seizures. Monitor for magnesium toxicity (respiratory depression, hypotension, muscle weakness, hyporeflexia) and give calcium gluconate if toxic. $MgSO_4$ is contraindicated in myasthenia gravis (may precipitate myasthenic crisis). Benzodiazepines, phenytoin and phenobarbital can be considered as adjunctive therapy if ongoing seizures despite $MgSO_4$

DELIVERY—the cure for preeclampsia, eclampsia, and HELLP. Administer steroids to promote fetal lung maturation prior to 34 weeks if early delivery

POSTPARTUM—gestational hypertension, preeclampsia/eclampsia/HELLP syndrome can present *de novo* or worsen in the postpartum period. Blood pressure can increase on days 3–6 postpartum. Monitor and continue antihypertensive therapy. Gestational hypertension/hypertension related to severe preeclampsia expected to resolve within 6–12 weeks. Metabolic abnormalities (e.g., proteinuria) that do not resolve by 3–6 months require further work-up

RECURRENCE—preeclampsia recurrence rate 10–40%. Consider antiphospholipid syndrome screen if preeclampsia or placental insufficiency <34 weeks. *ASA* 81 mg PO daily before 16 weeks gestation during next pregnancy and supplemental calcium 1000 mg/day (in women with dietary calcium intake <600 mg/day) recommended for prevention

LONG-TERM—history of hypertensive disorders in pregnancy increases risk for chronic hypertension, cardiovascular events, cerebrovascular accidents, renal disease, type 2 diabetes, and hypothyroidism. Lifestyle changes and routine vascular risk factor screening essential. Women with history of preeclampsia may experience post-traumatic stress disorder; monitor and provide mental health support

Related Topics
Hypertension (p. 65)
Proteinuria (p. 85)
Seizures (p. 350)

Pulmonary Diseases in Pregnancy

ASTHMA

TREATMENTS—similar to non-pregnant patients. β-agonists, anticholinergics, and glucocorticoids (inhaled, systemic) are safe. Leukotriene antagonists if refractory. Keep O_2 sat >95% to prevent fetal hypoxia. Consider stress dose steroids during delivery if patient required moderate systemic steroids for >3 weeks in the preceding year

VENOUS THROMBOEMBOLISM

PATHOPHYSIOLOGY—increased risk of DVT/PE due to ↑ factors I, VII, VIII, IX, X, von-Willebrand factor, and fibrin, ↓ protein S and fibrinolytic activity, and increased resistance to activated protein C, especially during T3. Also stasis due to ↓ venous tone and flow. Similar risk of DVT/PE in each trimester but highest postpartum; 90% of DVT in pregnancies are left sided and majority are pelvic

DIAGNOSIS—if suspect venous thromboembolism, consider initiation of LMWH while waiting for investigations. For DVT workup, perform compression US; if pelvic vein DVT suspected, consider MRV pelvis, Doppler study, or (postpartum) CT of pelvic veins. Otherwise, repeat compression US in 5–7 days if still symptomatic. For PE workup, perform V/Q scan if CXR normal (note: if Q normal, can skip V portion of scan). If CXR abnormal and/or V/Q scan nondiagnostic, proceed with CT chest. CT chest is associated with lower fetal radiation exposure than V/Q scan in T_1–T_2, but higher risk of maternal breast cancer (14% increased lifetime risk)

RADIATION RISKS—fetal exposure of <5 cGy [5 rad] accumulatively in each pregnancy is acceptable, but oncologic effects controversial (e.g., childhood leukemia). Consider proximity of fetus to radiations site (i.e., radiation from CT chest > V/Q scan in T_3) and limit where possible (i.e., abdominal shields)

FETAL RADIATION EXPOSURE FOR COMMON IMAGING MODALITIES

Imaging	Estimated fetal radiation exposure (rad)
Ultrasound	None
CXR	<0.001
CT head	<0.001
V/Q scan	0.01–0.02 ventilation (V) 0.01–0.03 perfusion (Q)

VENOUS THROMBOEMBOLISM (CONT'D)

Imaging	Estimated fetal radiation exposure (rad)
CT chest (PE protocol)	0.0003–0.002 (T_1) 0.0008–0.0077 (T_2) 0.005–0.013 (T_3)
Pulmonary angiogram	<0.05 via brachial route 0.2–0.3 via femoral route
Cardiac angiogram	<1
AXR	0.2–0.3
IVP	0.8 (complete series) 0.2 (limited series)
MRI/MRV/MRA	None

Related Topics
Asthma (p. 1)
Pulmonary Embolism (p. 10)

TREATMENT—LMWH dosed using current weight (not pre-pregnancy or ideal body weight). Consider monitoring of anti-Xa level (4–6 h after last dose, target 0.6–1.2 IU/mL). Duration of therapeutic anticoagulation 3–6 months, then transition to prophylactic dose of LMWH until end of 6 weeks postpartum. If neuraxial analgesia, hold therapeutic LMWH × 24 h and prophylactic LMWH × 12 h beforehand. If unable to hold anticoagulation (e.g., acute clot <4 weeks), consider bridging with IV unfractionated heparin (and hold when in active labor or 2 h prior to cesarean section), and/or consider IVC filter. Systemic thrombolysis generally contraindicated (risk of fetal demise). Warfarin not recommended during pregnancy (teratogenic in T_1; associated with fetal CNS hemorrhage/malformations, miscarriage, stillbirth, neonatal demise). May consider warfarin as an alternative to LMWH in the postpartum period while breastfeeding

FUTURE PREGNANCIES—provide antepartum and postpartum thromboprophylaxis to women with significantly increased risk (>1% absolute risk) of venous thromboembolism. Therapeutic-dose anticoagulation if already on long-term anticoagulation for established indication. Intermediate or therapeutic-dose if prior history of venous thromboembolism and high-risk thrombophilia (e.g., APLA, antithrombin defiency), but not previously on anticoagulation. Prophylactic dose if prior history of venous

VENOUS THROMBOEMBOLISM (CONT'D)

thromboembolism (unprovoked, related to oral contraceptive pill, related to pregnancy, or in setting of low-risk thrombophilia), or for asymptomatic thrombophilia (e.g., homozygote with factor V Leiden mutation, homozygote prothrombin gene mutation, antithrombin deficiency)

OTHER CONSIDERATIONS—compression stockings for symptom management. Caution against use of combined oral contraceptive pills. Consider thrombophilia work-up, if appropriate, according to clinical scenario and patient preference

NEJM 2008 359:19
JOGC 2014 36:6

AMNIOTIC FLUID EMBOLISM

PATHOPHYSIOLOGY—can occur during labor and delivery or with uterine manipulation. Risk factors include older age and multiparity. Amniotic fluid enters maternal circulation → inflammation, vasospasm, and venous occlusion → cardiogenic shock and respiratory failure

DIAGNOSIS—clinical diagnosis with classic triad of sudden-onset dyspnea and hypoxia, hypotension, and coagulopathy. Differential diagnosis includes septic shock, pulmonary embolism, aspiration pneumonia, uterine rupture, abruptio placentae, and venous air embolism

TREATMENTS—supportive, supplemental O_2, hemodynamic support (vasopressors ± IV fluids), ICU admission. Rapid delivery of the fetus (beware of risk of rapid blood loss with coagulopathy; may potentially require PRBC, FFP, platelet, and/or cryoprecipitate transfusion)

COMPLICATIONS—at least 20% maternal mortality, 25–50% of which die within the first hours of onset of the disease. Patients who survive are at high risk for ARDS, acute renal injury, and neurological complications due to cerebral hypoxia (up to 85%)

Cardiac Diseases in Pregnancy

PATHOPHYSIOLOGY

HIGH-RISK CARDIOPULMONARY CONDITIONS—generally advise against getting pregnant if any of the following conditions: tetralogy of Fallot with severe cyanosis, Eisenmenger's syndrome, severe pulmonary hypertension, functional limitation NYHA 3 or 4, recent cardiac transplantation with high-dose immunosuppression, Marfan's syndrome with aortic root >40 mm [1.6 in.], interstitial pulmonary fibrosis, lymphangioleiomyomatosis, and active lung cancer

Related Topics
Endocarditis (p. 60)
Heart Failure (p. 37)
Valvular Disorders (p. 59)

VALVULAR DISORDERS

REGURGITANT VALVULAR HEART DISEASE—may improve during pregnancy due to ↓ systemic vascular resistance

STENOTIC VALVULAR HEART DISEASE—may worsen during pregnancy. Symptomatic or severe stenosis should be evaluated for correction prior to pregnancy. Valvuloplasty during pregnancy may be considered for worsening symptoms. β-blockers to decrease HR in mitral stenosis.

VALVULAR DISORDERS (CONT'D)

Supportive measures with aggressive pain control and early neuraxial analgesia during labor. Assist second stage of labor with vacuum or forceps. Avoid fluid overload

PROSTHETIC HEART VALVE—for mechanical valves, continue oral anticoagulation until conception. During T_1 (within first 6 weeks), switch to therapeutic dose LMWH given BID (target anti-Xa level 0.7–1.2 IU/mL, 4–6 h after last dose), but avoid warfarin (teratogenic, ↑ risk if >5 mg/day). During T_2-T_3 and up until 36 weeks gestation, treatment options include therapeutic LMWH given BID *or* warfarin (target INR 2.5–3.5). Choice of anticoagulation depends on risk of thrombosis (i.e., type of valve) and patient preference. Consider either LMWH *plus* ASA 81 mg PO daily, or warfarin for highly thrombogenic valves (i.e., mitral position, older generation mechanical valve, history of thromboembolism). Warfarin more effective for prevention of valvular thrombosis but associated with higher risk of fetal CNS hemorrhage/malformations, miscarriage, stillbirth, neonatal demise. At 36th week, anticoagulation should be switched to unfractionated heparin in preparation for delivery, and allow at least 10–14 days for (fetal) warfarin washout. Preconception counseling highly recommended

VALVULAR DISORDERS (CONT'D)

ENDOCARDITIS PROPHYLAXIS—not recommended for vaginal delivery and cesarean sections. May consider for select high-risk cardiac conditions (i.e., prosthetic valve, unrepaired cyanotic congenital heart defect, repaired cyanotic congenital heart defect with residual defects, cardiac transplant recipients with valvulopathy, previous endocarditis)

MYOCARDIAL DISORDERS

PERIPARTUM CARDIOMYOPATHY—dilated cardiomyopathy with LVEF <45% during last month of pregnancy or within 5 months postpartum in the absence of previous heart disease. Diagnosis of exclusion. Medical management similar to treatment of HF in non-pregnant individuals with diuretics, β-blockers (except atenolol, risk of fetal growth retardation), nitrates, hydralazine, and digoxin. When pregnant, ACE inhibitors and ARBs are contraindicated, and aldosterone antagonists should be avoided if possible. When breastfeeding, ACE inhibitors (enalapril, captopril) and aldosterone antagonists (spironolactone) may be used. Anticoagulate if LVEF <35% or atrial fibrillation. Overall prognosis variable

MYOCARDIAL DISORDERS (CONT'D)

(mortality in up to 30%, around 25–50% have full recovery of myocardial function within 6 months, and 4–7% have progressive disease eventually requiring cardiac transplant). Recurrence in up to 30% with high risk of mortality in subsequent pregnancy if persistent ↓ LVEF. Preconception counseling highly recommended

ISCHEMIC HEART DISEASE—stress echocardiogram (preferred), exercise stress test, MIBI, and angiograms (beware radiation) can be considered for investigations

RHYTHM DISORDERS

PALPITATIONS—sinus tachycardia and ectopic beats are common. Increased SVT in patients previously diagnosed with SVT. May treat with adenosine, β-blockers (except atenolol), calcium channel blockers, or digoxin. DC cardioversion if unstable (remove fetal monitors if possible [theoretical risk to fetus] but do not delay treatment). Investigate for underlying arrhythmia, structural abnormality (cardiomyopathy, valvular disease), and precipitant (PE, sepsis, thyrotoxicosis) as appropriate

Cleve Clin J Med 2004 71:12

Hepatic Diseases in Pregnancy

DIFFERENTIAL DIAGNOSIS

PREGNANCY-RELATED LIVER DISEASE—hyperemesis gravidarum, preeclampsia/eclampsia/HELLP syndrome, intrahepatic cholestasis of pregnancy, acute fatty liver of pregnancy

- **HYPEREMESIS GRAVIDARUM** (T1–2, incidence 0.3–1%)—**nausea, vomiting**, weight loss, ↑ ALT >AST, N bili
- **PREECLAMPSIA/ECLAMPSIA** (T2–3, incidence 5–10%)—see section under preeclampsia
- **HELLP SYNDROME** (T3, incidence 0.1%)—preeclampsia symptoms. ↑ ALT, ↑ AST, ↑ bilirubin, ↓ platelets, ↑ LDH. May progress to DIC (30%)
- **INTRAHEPATIC CHOLESTASIS OF PREGNANCY** (T2–3, incidence 0.1–0.2%)—functional disorder of bile formation with severe **pruritus**. Jaundice in 20–60%, occurs 1–4 weeks after pruritus starts. ↑ ALT, ↑ AST, ↑ bilirubin (less common), ↑↑ **bile acids**. Associated with prematurity, intrauterine demise, and neonatal respiratory distress syndrome. Cholestasis resolves following delivery without hepatic sequelae
- **ACUTE FATTY LIVER OF PREGNANCY** (T3, incidence ~1 per 20,000 pregnancies)—may be associated with preeclampsia. Characterized by **severe liver dysfunction** (encephalopathy, hypoglycemia, coagulopathy) and commonly jaundice. ↑↑ ALT, ↑↑ AST, ↑ bilirubin, ↑ WBC, ↑ PT, ↑ **uric acid**. US is often normal (microvesicular fat on biopsy) and CT shows a low-density liver. May progress to acute hepatic failure and DIC in >75%. Increased maternal and fetal mortality

DIFFERENTIAL DIAGNOSIS (CONT'D)

PREGNANCY-AGGRAVATED LIVER DISEASE—hepatitis E, hepatitis A, HSV hepatitis, Budd-Chiari, cholelithiasis

- **HEPATITIS E**—may cause fulminant liver failure in pregnancy; mother to child transmission in 1/3 cases
- **HEPATITIS B**—pregnancy does **not** affect natural history of HBV infections (rare cases of fulminant hepatitis among immuncompro-

DIFFERENTIAL DIAGNOSIS (CONT'D)

mised). Routine screening at first prenatal visit (HBsAg). Prophylaxis and immunization for infant if mother HBV positive

- **HEPATITIS C**—pregnancy does **not** affect natural history of HCV infections. Mother to child transmission ~5% (up to 20% if HIV co-infection)
- **CHOLELITHIASIS**—associated with acute cholecystitis, choledocholithiasis, and ascending cholangitis
- **OTHER CONDITIONS**—drug-induced hepatitis, malignancy

CLINICAL FEATURES

HISTORY—jaundice, pruritus, abdominal pain, ascites, swelling, encephalopathy, nausea and vomiting, headache, visual disturbances, fever, obstetrical history (current pregnancy course, previous births, previous preeclampsia), past medical history (hypertension, hepatitis, alcohol, IDU), and medications

PHYSICAL—check vitals (hypertension), edema (facial, limbs), heart (elevated JVP, S3, S4), hepatic tenderness, ascites, jaundice, and hyperreflexia

INVESTIGATIONS

BASIC

- **LABS**—CBCD, peripheral smear, lytes, urea, Cr, spot urine for protein to creatinine ratio, AST, ALT, ALP (mild elevation could be from placenta), GGT, bilirubin, INR, bile acids (intrahepatic cholestasis), uric acid (acute fatty liver), LDH, fibrinogen (DIC), TSH
- **MICROBIOLOGY**—HBV and HCV serology
- **IMAGING**—US abd

MANAGEMENT

HYPEREMESIS GRAVIDARUM—rule out molar pregnancy and hyperthyroidism. Consider alternative cause of N&V if persistent (adrenal insufficiency, eating disorder). Supportive fluids. Diclectin (doxylamine and pyridoxine) is first-line, then consider chlorpromazine, prochlorperazine, promethazine, metoclopramide, and ondansetron (in order of available fetal safety data)

MANAGEMENT (CONT'D)

INTRAHEPATIC CHOLESTASIS OF PREGNANCY—ursodeoxycholic acid 500 mg PO BID or cholestyramine for pruritus, increase fetal monitoring, consider early delivery as risk of fetal demise if high bile acids

ACUTE FATTY LIVER OF PREGNANCY—vitamin K if coagulopathic, early delivery. Can recur in future pregnancies

HELLP—anti-hypertensive, $MgSO_4$, early delivery

HEPATITIS B—provide standard neonatal immunoprophylaxis and consider antiviral treatment (tenofovir) if high maternal HBV DNA levels during pregnancy. Internal fetal monitoring and prolonged rupture of membranes should be avoided

HEPATITIS C—no proven treatment during pregnancy. Internal fetal monitoring and prolonged rupture of membranes should be avoided

SPECIFIC ENTITIES

OTHER GI DISORDERS

- **GERD**—very common during pregnancy. May cause chronic cough and reactive airway disease symptoms. Treatments include lifestyle changes, antacids, ranitidine, PPIs, and metoclopramide
- **CHOLECYSTITIS**—pregnant women are at increased risk due to hormonal changes. Medical management with IV fluids, NG, and opioids. Broad-spectrum antibiotics may be added for severe disease. Cholecystectomy safest during 2nd trimester

Related Topics
Acute Liver Failure (p. 143)
Dyspepsia (p. 125)

Infectious Diseases in Pregnancy

INFECTIONS ASSOCIATED WITH BIRTH DEFECTS

★**TORCHES CLLAP**★—**TO**xoplasma, **R**ubella, **C**MV, **H**SV, **E**nteroviruses, **S**yphilis, **C**hickenpox, **L**yme, **L**CMV, **A**IDS, **P**arvoviruses infections during pregnancy are associated with birth defects. Emerging data on many other potential pathogens that may also be associated with birth defects, such as *Brucella melitensis*, *Coxiella burnetii* (Q fever], *Babesia microti* (babesiosis), human T-cell lymphotropic virus types I and II, hepatitis G, TT viruses, human herpesvirus 6, and dengue

INFECTIONS ASSOCIATED WITH BIRTH DEFECTS (CONT'D)

SEPSIS

Common cause of maternal morbidity in developed and developing world. Assess vital signs (BP, HR, RR [tachypnea never normal], temperature), and for end-organ perfusion (level of consciousness, skin mottling), as well as for potential sources of infection. Medical management similar to treatment of sepsis in non-pregnant individuals with IV fluids and early empiric antibiotic therapy (see below for acceptable antibiotic choices)

INFLUENZA

Increased risk of influenza-related morbidity and mortality (5× higher risk of hospital admission overall, one out of six influenza-related deaths occur in young pregnant women). Influenza associated with adverse pregnancy outcomes (preterm birth, small for gestation age newborns). All pregnant women should receive inactivated influenza vaccine regardless of trimester

URINARY TRACT INFECTIONS

PATHOPHYSIOLOGY—hydronephrosis and hydroureter R > L, urinary stasis, higher protein and amino-acid excretion → UTI

ASYMPTOMATIC BACTERIURIA—defined as 10^5 CFU/mL on a "clean" sample. Occurs in 2–7% of pregnancies, associated with preterm birth, low birth weight, and perinatal mortality. Screen for bacteriuria between 12 and 16 weeks gestation, as 30–40% will develop symptomatic UTI if untreated. Treatment depends on culture and local antibiotic resistance pattern; consider *amoxicillin–clavulanate* 500 mg PO BID × 7 days, *nitrofurantoin* 100 mg PO BID × 7 days (risk of hemolytic anemia). Avoid trimethoprim if alternatives available. Follow-up culture 1 week following treatment completion and then monthly until pregnancy complete

ACUTE CYSTITIS—occurring in 1% of pregnancies, with treatment and follow-up as asymptomatic bacteriuria

PYELONEPHRITIS—occurring in <1% of pregnancies, complicated by septic shock and ARDS in 20%. In-patient treatment with IV antibiotics (cefazolin, ceftriaxone, or ampicillin plus gentamicin) until symptomatic improvement and afebrile for 24–48 h then PO based on drug sensitivities. Low-dose suppressive antibiotics (*nitrofurantoin* 50–100 mg PO qhs [risk of hemolytic anemia] or *cephalexin* 250–500 mg PO qhs) for remainder of pregnancy as recurrent pyelonephritis occurs in 6–8% of women without prophylaxis

HUMAN IMMUNODEFICIENCY VIRUS (HIV)

ANTEPARTUM CARE—determine HIV symptoms, infections, immunization status, and perform ophthalmologic examination if CD4 <50/mm^3. Baseline testing include CBCD, lytes, urea, Cr, AST, ALT, ALP, bilirubin, CD4 count, viral load, genotype resistance assay, HLA-B*5701 (for abacavir), TB skin test, toxoplasma, VDRL, pap smear, cervical swabs for gonorrhea and chlamydia, CMV, HBV, and HCV serologies. All pregnant women with HIV should be treated with combination antiretroviral therapy (regardless of CD4 count or viral load), ideally with a dual nucleoside reverse transcriptase inhibitor (NRTI) backbone that includes one or more NRTIs and a boosted protease inhibitor. If significant nausea, do not begin antiretroviral therapy until nausea is adequately controlled. Counsel regarding risk of perinatal transmission (<1% with consistent use of maternal combination antiretroviral therapy, intrapartum IV AZT, neonatal antiretroviral therapy × 6 weeks and avoiding breastfeeding). Prophylaxis for opportunistic infections same as in non-pregnant patients

INTRAPARTUM CARE—continue combination antiretroviral regimen during labor and delivery. Vaginal delivery recommended for women on antiretroviral therapy with viral load <1000 copies/mL (measured over last 4 weeks prior to delivery) in the absence of another specific obstetrical indication for cesarean section. Upon onset of labour or rupture of membranes, give *zidovudine* 2 mg/kg IV over 1 h, then 1 mg/kg/h until delivery (even if on HAART already). For cesarean section, start infusion at least 3 h before procedure. Consider cesarean delivery if viral load >1000 copies/mL. Avoid invasive monitoring, use of instruments to assist delivery, and prolonged interval between rupture of membranes and delivery

POSTPARTUM CARE—treat newborn with zidovudine for 6 weeks. Determine HIV status at birth, 4 weeks and 3–4 months with HIV RNA PCR. Avoid breast-feeding. Ensure good support system for mother. Counsel regarding contraceptive use

SOGC Guidelines for the Care of Pregnant Women Living With HIV 2014 J Obstet Gynaecol Can 2012;34:6

TUBERCULOSIS

MANAGEMENT—natural history not affected by pregnancy, but delayed recognition is common. Tuberculin skin testing and IFN-gamma release assays require expert interpretation in pregnancy.

TUBERCULOSIS (CONT'D)

Treat TB, if identified, as risk of infection to fetus is greater than risk of medications. Isoniazid, rifampin, and ethambutol safe for use during pregnancy and breastfeeding. *Pyridoxine* 25 mg PO daily is recommended for all pregnant or breastfeeding women taking isoniazid to prevent peripheral neuropathy

ANTIBIOTICS

ACCEPTABLE—penicillins, cephalosporins, azithromycin, vancomycin, metronidazole, clindamycin, erythromycin (except erythromycin estolate), nitrofurantoin (caution as risk of hemolytic anemia), and acyclovir. Consider trimethoprim–sulfamethoxazole (avoid in first trimester but use with folate if no other alternatives) and aminoglycosides (except streptomycin) in some circumstances

ANTIBIOTICS (CONT'D)

AVOID—tetracyclines (infant teeth staining), streptomycin (theoretical concern for fetal ototoxicity), fluoroquinolones (abnormal cartilage development in animals, but not demonstrated in humans)

Related Topics
HIV (p. 291)
Tuberculosis (p. 279)
Urinary Tract Infections (p. 272)

Diabetes in Pregnancy Canadian Diabetes Association 2013 Guidelines

PATHOPHYSIOLOGY

RISK FACTORS FOR GESTATIONAL DIABETES—previous history of gestational diabetes, impaired fasting glucose or impaired glucose intolerance, prior delivery of macrosomic infant or current fetal macrosomia (>4000 g or >90th percentile), polyhydramnios, high-risk ethnic group (Aboriginal, Hispanic, South Asian, Asian, African), maternal age ≥35, obesity (BMI ≥30 kg/m^2), corticosteroid use, PCOS, acanthosis nigricans

PRECONCEPTION CARE FOR PREGESTATIONAL DIABETES—for preexisting diabetes (type 1 or 2), optimize glycemic control prior to pregnancy (HbA1c ≤7%) and suggest weight reduction (if overweight). Screen for retinopathy and nephropathy. Patients on oral agents should switch to insulin for glycemic control. Discontinue ACE inhibitors, ARBs, and statins prior to conception (or immediately upon detection of pregnancy). Supplemental *folic acid* 5 mg PO daily starting at least 3 months preconception until at least 12 weeks gestation, then 0.4–1 mg PO daily

DIAGNOSIS

DIAGNOSIS OF GESTATIONAL DIABETES—screen all pregnant women between 24–28 weeks, or additionally at any stage of pregnancy if at high risk of gestational diabetes (see risk factors above):

- **Step 1: 1-h 50 g oral glucose tolerance test (non-fasting)**
  - If 1 h blood glucose ≥11.1 mmol/L [≥200 mg/dL] → GDM
  - If 1 h blood, glucose 7.8–11.0 mmol/L [140–200 mg/dL] → perform 75 g OGTT
  - If 1 h blood glucose <7.8 mmol/L [<140 mg/dL] → no GDM, but may consider re-testing if ongoing suspicion (e.g., macrosomia, polyhydramnios)
- **Step 2 (if needed): 2-h 75 g oral glucose tolerance test (fasting)**
  - If fasting blood glucose ≥5.3 mmol/L [≥95 mg/dL] → GDM
  - If 1 h blood glucose ≥10.6 mmol/L [≥190 mg/dL] → GDM
  - If 2 h blood glucose ≥9.0 mmol/L [≥160 mg/dL] → GDM

MANAGEMENT

ANTEPARTUM—diabetic diet and exercise. Aim for excellent glycemic control with HbA1C <7% prior to and throughout pregnancy. Monitor blood glucose before and after each meal. Target fasting blood glucose <5.3 mmol/L [<95 mg/dL] and 2 h postprandial blood glucose <6.7 mmol/L [<120 mg/dL] (modify targets if hypoglycemia occurs). Test urine for ketones during illness, or if patient suspected of over-restricting diet (starvation) in order to achieve tight glycemic control. Monitor blood pressure at each visit. In patients with preexisting diabetes (type 1 or 2), screen for retinopathy (ophthalmologist) and nephropathy (serum creatinine and urine albumin/Cr ratio)

- **GESTATIONAL DIABETES**—dietician referral. If glycemic targets not achieved within 1–2 weeks, start insulin (lispo or aspart SC ac meals, and/or NPH

MANAGEMENT (CONT'D)

SC QHS–BID). Adjust dose weekly, as needed. Consider glyburide or metformin for women non-adherent to or who refuse insulin (off-label use in pregnancy, discuss risks with patient)

- **TYPE 1 DIABETES**—basal-bolus insulin therapy or insulin pump
- **TYPE 2 DIABETES**—switch from oral agents to insulin, preferably preconception (lispo or aspart SC ac meals, and/or NPH SC QHS–BID). Adjust dose weekly, as needed. Consider glyburide or metformin for women non-adherent to or who refuse insulin (off-label use in pregnancy, discuss risks with patient)

INTRAPARTUM—target blood glucose 4.0–7.0 mmol/L [72–126 mg/dL] during labor (to minimize risk of neonatal hypoglycemia). NPO, IV fluids, and monitor blood glucose q1h. Consider insulin IV infusion (rarely required for GDM), according to current blood glucose level, time of last meal, and time of last insulin injection

POSTPARTUM—insulin requirements rapidly drop after delivery, especially if breastfeeding (beware of hypoglycemia). Breastfeeding should be encouraged to reduce risk of neonatal hypoglycemia, offspring obesity, and metabolic syndrome in mother

MANAGEMENT (CONT'D)

- **GESTATIONAL DIABETES**—insulin rarely required postpartum. Risk of type 2 diabetes (20% in 10 years); screen from 6 weeks to 6 months postpartum with 2 h 75 g OGTT
- **TYPE 1 DIABETES**—reduce insulin (using preconception dosages as guideline). Screen for postpartum thyroiditis 6–8 weeks postpartum with TSH
- **TYPE 2 DIABETES**—reduce or discontinue insulin (using preconception dosages as guideline). Metformin and glyburide safe while breastfeeding

COMPLICATIONS—fetal complications include congenital anomalies (usually with preexisting diabetes), macrosomia (shoulder dystocia, birth trauma) or intrauterine growth restriction (uncommon), neonatal hypoglycemia, respiratory distress syndrome, hypocalcemia, hyperbilirubinemia, and intrauterine death. Offspring at risk for diabetes and obesity in long-term. Maternal complications include gestational hypertension, preeclampsia, polyhydramnios, preterm labor (C-section), and progression of diabetic retinopathy and nephropathy

Can J Diabetes 2013 37:S168-S183

Thyroid Diseases in Pregnancy

HYPOTHYROIDISM IN PREGNANCY

PATHOPHYSIOLOGY—hypothyroidism, when present, usually diagnosed prior to conception (most commonly Hashimoto's). Around 75% of women will require an increase in levothyroxine during pregnancy. ↑ estrogen → ↑ thyroxine-binding globulin → ↓ total T4 and total T3. Estimated required increase in T4 to maintain euthyroidism is 25–50%. Hypothyroidism may also be diagnosed in pregnancy (uncommon). ↑ thyroid hormone synthesis and ↑ renal clearance of iodine → ↑ iodine requirements during pregnancy, but if iodine intake insufficient (endemic) → ↓ T4 and ↑ TSH

MONITORING—screen high risk individuals (history of goiter, thyroid dysfunction, thyroid ablation, thyroidectomy, neck irradiation, autoimmune conditions, family history). Preconception, target TSH 0.2–2.5 mU/L (lower normal range). In T_1, target TSH 0.1–2.5 mU/L (and free T4 in upper normal range); T_2, target TSH 0.2–3 mU/L (and *total* T4 in normal of *pregnancy-adjusted* range); and T_3, target TSH 0.3–3 mU/L

HYPOTHYROIDISM IN PREGNANCY (CONT'D)

(and *total* T4 in normal of *pregnancy-adjusted* range). Use FT4 in first trimester and *total* T4 in second/third trimesters. Monitor TSH and free T4 (or total T4) levels q4weeks during first half of pregnancy and at least once between 26 and 32 weeks' gestation

TREATMENTS—levothyroxine can be safely given during pregnancy. As soon pregnancy is confirmed, ↑ dose by 30% empirically. Levothyroxine should be taken separate from vitamins and ideally on an empty stomach to ensure best absorption

COMPLICATIONS—untreated hypothyroidism associated with neonatal neuropsychological and cognitive impairment, preeclampsia and gestational hypertension, preterm labor, placental abruption, and perinatal morbidity and mortality

HYPERTHYROIDISM IN PREGNANCY

PATHOPHYSIOLOGY—most commonly Graves' disease. TSH receptor stimulating antibody → ↑ thyroid hormone production. Hyperthyroidism

HYPERTHYROIDISM IN PREGNANCY (CONT'D)

may also arise from excess hCG (self-limited surge in T_1 [transient gestational thyrotoxicosis], multiple gestation, hyperemesis gravidarum, or molar pregnancy [hydatidiform mole]) → hCG α-subunit identical to TSH α-subunit → ↑ thyroid hormone production → ↓ TSH

COMPLICATIONS—preeclampsia, premature labor, placental abruption, intrauterine growth restriction, fetal goiter (from excess antithyroid drug treatment), neonatal thyrotoxicosis (typically when TSH receptor antibodies >3–5× upper limit of normal), ↑ mortality (maternal and perinatal), and thyroid storm (rare)

SUBCLINICAL HYPERTHYROIDISM—not associated with adverse outcomes. Supportive care, reassurance, and postpartum follow-up

EXCESS hCG EFFECT—transient gestational thyrotoxicosis may be present in 5–10% of pregnancies during T_1 (↓ TSH, normal/slightly ↑ FT4). Self-limited and typically resolves by T_2. Treatment is supportive with reassurance

GRAVES' DISEASE—most common cause of primary hyperthyroidism in pregnancy (95%). TSH receptor antibodies can cross placenta to cause fetal thyrotoxicosis. Classically improves in pregnancy. Exacerbations may happen in T_1 and postpartum

- **DIAGNOSIS**—presence of symptoms predating pregnancy, eye signs, weight loss despite adequate intake, and pretibial myxedema suggestive of Graves' disease. However, presence of mild–moderately enlarged thyroid gland, hypervascularity, and/or nodularity usually unhelpful in differentiating between Graves' disease vs. normal physiological changes. Presence of ↑ TSH receptor antibodies suggests Graves' disease. Nuclear imaging contraindicated in pregnancy. Postpartum course can also help clarify etiology
- **MONITORING**—in T_1, target TSH 0.1–2.5 mU/L (and free T4 in upper normal range); T_2, target TSH 0.2–3 mU/L (and *total* T4 in normal *pregnancy-adjusted* range); and T_3, target TSH 0.3–3 mU/L (and *total* T4 in normal *pregnancy-adjusted* range). Use FT4 in first trimester and *total* T4 in second/third trimesters. Monitor TSH and free T4 (or total T4) levels q4weeks
- **TREATMENT**—***antithyroid drugs***, preferably *propylthiouracil* during T_1 and methimazole during T_2-T_3 (propylthiouracil associated with idiosyncratic liver injury, methimazole associated with aplasia cutis). Mild under-treatment preferred to hypothyroidism. May require lower dosages of antithyroid medication as pregnancy progresses. Taper or discontinue medication, if possible, towards delivery date to decrease risk of neonatal goiter. ***β-blockers*** (prefer *propranolol*; avoid atenolol) for symptom control, but may lead to fetal bradycardia, fetal hypoglycemia, and intrauterine growth restriction at higher doses. Avoid radioiodine during pregnancy. If surgery required (rare), ideally during T_2. Consult high-risk obstetrician, to monitor maternal and fetal health

POSTPARTUM THYROIDITIS—painless (silent) and affects 10% of postpartum women within first postpartum year (usually first 3–6 months) and may be associated with postpartum depression. Classically begins with a hyperthyroid phase followed by hypothyroid phase. Only 25% have hypothyroid phase. Most cases resolve within 1 year. Risk of recurrence is up to 25% in subsequent pregnancies. Approximately 20–40% go on to develop permanent hypothyroidism

- **TREATMENT**—most patients have mild thyrotoxicosis (×1–2 months) and do not require treatment. For symptomatic thyrotoxicosis give β-blocker. Most eventually return to euthyroid state, but some become hypothyroid. If levothyroxine is needed, start 50–100 μg PO daily, and slowly withdraw after around 6 months as hypothyroidism may have resolved. Monitor TSH q6–8 weeks

Other Disorders in Pregnancy

SEIZURES IN PREGNANCY

PATHOPHYSIOLOGY—for women with known epilepsy, 25% will have ↑ frequency (secondary to non-adherence or inappropriately low antiepileptic drug levels), 25% will have ↓ frequency, and 50% will not change in pregnancy. Risk of uncontrolled seizures in pregnancy outweighs risks of antiepileptic drugs. Risk of seizures in offspring is elevated at 5%. Eclampsia, intracerebral bleed, and cerebral vein thrombosis may lead to seizures in pregnancy

TREATMENTS—valproic acid has a relatively high risk of neural tube defects and should be switched to alternate antiepileptic pre-pregnancy

SEIZURES IN PREGNANCY (CONT'D)

if possible. Phenytoin, carbamazepine, and phenobarbital are potentially teratogenic (especially if polytherapy required) but can be used if indicated and after appropriate counseling. Lamotrigine seems to have reasonable data in pregnancy. *Folic acid* 0.4 mg PO daily should be prescribed to all women on antiepileptics in the childbearing age. Those planning a pregnancy should take *folic acid* 5 mg PO daily in the preconception period and in first trimester, then 1 mg PO daily throughout remainder of pregnancy

LUPUS IN PREGNANCY

LUPUS EXACERBATIONS—may have increased flares during pregnancy and postpartum if not in remission for >6 months prior to conception. Plaquenil, azathioprine, and corticosteroids may be used during pregnancy. Avoid NSAIDs in T_3

COMPLICATIONS—increased risk of prematurity and in utero fetal death. Patients with nephritis may have severe exacerbations with acute renal failure, preeclampsia, and maternal death. Test for maternal anti-SSA and anti-SSB antibodies (associated with increased risk of congenital heart block and neonatal lupus) and monitor fetus with fetal heart rate and echocardiogram between 18 and 26 weeks gestation. Patients with antiphospholipid antibodies are at increased risk of preeclampsia, miscarriage, and possibly thrombosis

BREAST CANCER IN PREGNANCY

DIAGNOSIS—often delayed given physiological changes. Staging workup similar to non-pregnant women. Use MRI or US instead of CT if imaging of abdomen required

TREATMENTS—mastectomy preferred over lumpectomy to avoid radiation. If adjuvant radiation indicated, it should be deferred until after delivery. Anthracycline containing adjuvant chemotherapy can usually be safely given during T_2 and T_3, but not in T_1 or within 2 weeks of delivery. Methotrexate is absolutely contraindicated and taxane/dose dense regimens should be avoided. Hormonal therapy is contraindicated during pregnancy. Breast-feeding contraindicated in women on hormonal therapy or chemotherapy. Stage by stage, gestational breast cancer has similar prognosis to non-pregnant counterpart

PAIN CONTROL IN PREGNANCY

ACCEPTABLE—acetaminophen, opioids

WITH CAUTION—NSAIDs in T_1 and T_2

PAIN CONTROL IN PREGNANCY (CONT'D)

CONTRAINDICATED—NSAIDs in T_3 (premature closure of ductus arteriosus, fetal renal insufficiency, and periventricular hemorrhage)

THROMBOCYTOPENIA IN PREGNANCY

PERIPARTUM CONSIDERATIONS—neuraxial anesthesia (epidural) generally safe if platelet $>75\times10^9$/L; Cesarean delivery safe if platelet $>50\times10^9$/L; vaginal delivery safe if platelets $>30\times10^9$/L

GESTATIONAL THROMBOCYTOPENIA (T_3)—asymptomatic and resolves rapidly after pregnancy. May be difficult to distinguish from ITP initially (until postpartum). Platelet count usually higher ($>70\times10^9$/L) in gestational thrombocytopenia. Follow platelet count q4weeks initially then q1week after 36th week

ITP (T_1–T_3)—may use prednisone and IVIG in pregnancy. Platelet transfusion if acute. Monitor closely. Splenectomy is last resort (safest in T_2). 10% of newborns may also develop thrombocytopenia due to placental transfer of maternal antibodies, but intracranial hemorrhage rare (<1%). Maternal platelet count does not predict fetal platelet count. Fetal platelet counts should be tested and monitored, as needed, after birth

PREECLAMPSIA/HELLP (T_2–T_3)—supportive, early delivery, steroids for lung maturity if delivered <34 weeks (see earlier sections)

TTP/HUS—presence of severe thrombocytopenia and microangiopathic hemolytic anemia (↑↑↑ LDH) differentiates TTP/HUS from HELLP. Requires plasma exchange ± dialysis

OTHERS—DIC, nutritional deficiencies (vitamin B12, folic acid), HIV, hepatitis B and C, drugs, autoimmune diseases (APLA), hypersplenism, and primary bone marrow disorders

ANTIPHOSPHOLIPID ANTIBODY SYNDROME IN PREGNANCY

PATHOPHYSIOLOGY—persistent presence of antibody against phospholipids or cell surface proteins bound to anionic phospholipids. These include lupus anticoagulants (associated with thrombotic events), anticardiolipin antibody (associated with thrombotic events and obstetric complications; false-positive VDRL), and anti-β2GP1 antibody → most lead to hypercoagulable state, some may inhibit coagulation. Higher risk associated with higher antibody titer

CLINICAL FEATURES—venous and arterial thrombosis and rarely hemorrhage affecting the lungs, heart, CNS, GI, kidneys, skin, and eyes. Also

ANTIPHOSPHOLIPID ANTIBODY SYNDROME IN PREGNANCY (CONT'D)

thrombocytopenia (via ITP, TTP), Raynaud's phenomenon, ↑ risk of preeclampsia/eclampsia, recurrent fetal losses (see below), and intrauterine growth restriction

CAUSES—primary APS, secondary APS (various rheumatic diseases such as SLE, infections such as HIV and drugs)

DIAGNOSIS—clinical criteria of VTE or arterial thrombosis, or ≥3 unexplained losses <10 weeks, or ≥1 unexplained loss of morphologically normal fetus ≥10 weeks, or ≥1 premature births <34 weeks because of preeclampsia/eclampsia/placental insufficiency; *plus* laboratory criteria of elevated anticardiolipin antibodies, or lupus anticoagulant, or anti-β2GP1 antibodies, confirmed >12 weeks apart. Diagnosis requires at least one clinical and one laboratory criteria

ANTIPHOSPHOLIPID ANTIBODY SYNDROME IN PREGNANCY (CONT'D)

TREATMENTS—for women with APS associated with adverse obstetric outcomes, give prophylactic LMWH and low-dose ASA during pregnancy. For women with APS associated with VTE, same antenatal treatment plus anticoagulation prophylaxis postpartum for 6 weeks (see p. 175 for more details on ANTIPHOSPHOLIPID ANTIBODY SYNDROME)

Related Topics

Antiphospholipid Antibody Syndrome (p. 175)
Breast Cancer (p. 208)
Lupus (p. 316)
Thrombocytopenia (p. 167)
Seizures (p. 350)