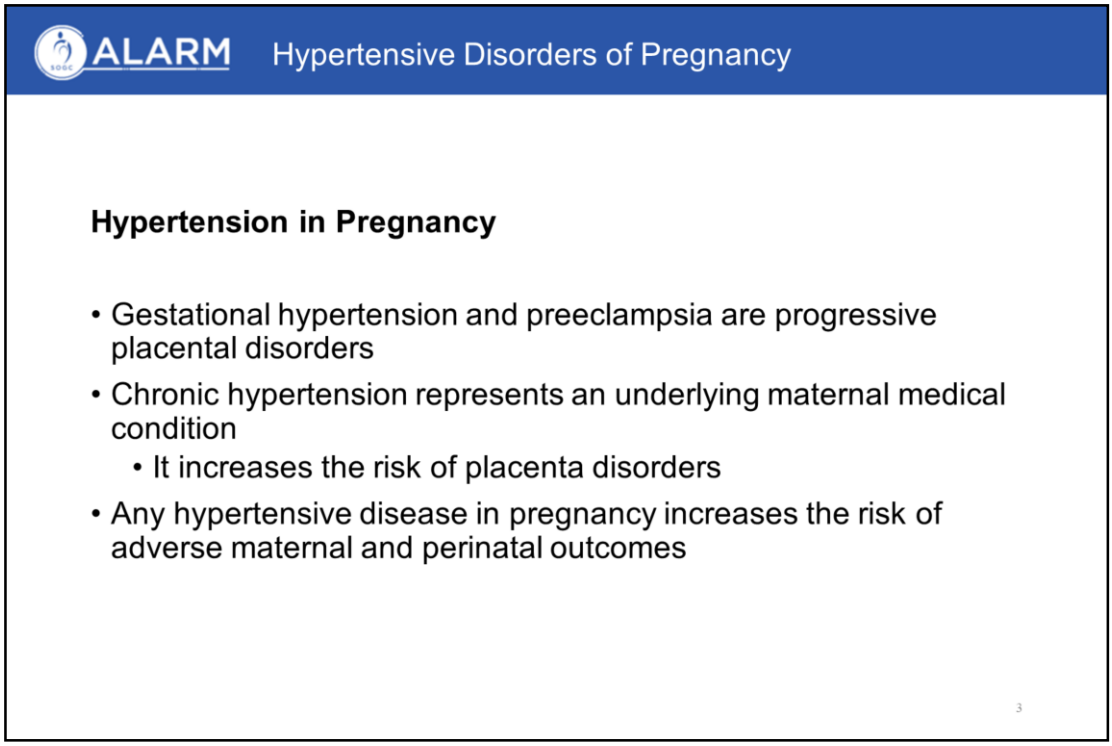
ALARM

Hypertensive Disorders of Pregnancy

Objectives

Participants will be able to:

- Describe the diagnosis and classification of hypertension
- Describe the management of hypertension in pregnancy and labour
- Describe the potential maternal and fetal complications of hypertension



This presentation is based on the 2014 SOGC Guidelines on hypertensive disorders in pregnancy and was updated in 2019.

The new classification system is simpler.

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DIAGNOSIS ASSOCIATED WITH MATERNAL DEATHS

Perinatal Health Indicators for Canada 2017, PHAC

Diagnosis	# of maternal deaths	# deaths per 100,000 hospital deliveries (95% CI)
Diseases of the circulatory system	89	2.5 (2.0–3.1)
Other indirect causes	81	2.2 (1.7–2.7)
Postpartum hemorrhage	49	1.4 (1.0–1.8)
Hypertension	**42**	**1.2 (0.8–1.6)**
Obstetric embolism	39	1.1 (0.8–1.5)
Major puerperal infection	27	0.8 (0.5–1.1)
Ectopic, molar, abortion	26	0.7 (0.5–1.1)
APH, Abruption, previa	21	0.6 (0.3–0.9)

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This table shows why this is an important topic.

Hypertension also contributes to morbidity and mortality of other causes (including bleeding).

Hypertension

Diastolic BP ≥ 90 mmHg
- At least 2 measurements
- Same arm
- > 15 min apart
- > 10 min rest

Systolic BP ≥ 140 mmHg

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- Hypertension is defined at this cut-off, and is associated with increased risk of adverse maternal or fetal outcomes, however the goal of treatment of maternal hypertension is to reduce the risk of maternal stroke, and therefore the targets to initial treatment are often higher.
- Make sure you are taking the blood pressure correctly at rest with correct cuff – review procedure in manual
- dBP > 90 mm Hg is level associated with increased perinatal morbidity/mortality
- Gold standard for BP measurement is with a mercury sphygmomanometer, if an automated BP cuff is used it should be calibrated against either a mercury or aneroid sphygmomanometer. You can switch to an automated cuff once the diagnosis is made.

Severe Hypertension

- Systolic BP ≥ 160 mmHg
- Or Diastolic BP ≥ 110 mmHg
- Systolic BP > 160 mmHg is associated with an increased risk of stroke

- Severity is defined by the BP numbers alone, due in part to the increased risk of maternal stroke
- This level of hypertension requires immediate evaluation and management, including anti-hypertensive therapy

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Classification of Hypertension

Chronic
Onset before pregnancy or < 20 weeks

Gestational
Onset ≥ 20 weeks
No maternal organ dysfunction

Preeclampsia: gestational or chronic with new onset:
- Proteinuria
- Maternal organ dysfunction
- Uteroplacental dysfunction (fetal growth restriction or oligohydramnios)

White coat
SBP > 140 mm Hg or DBP > 90 mmHg in the office but is consistently normal outside the office

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- In order to diagnose white coat hypertension, additional information is required (such as ambulatory or home monitoring) 1/3 will go on to meet criteria for preeclampsia or gestational hypertension
- 1/4 of women with either chronic or gestational hypertension will develop preeclampsia.
- Preeclampsia is defined by new onset proteinuria, symptoms/signs of end organ dysfunction or abnormal fetal evaluation

Definitions

Eclampsia

- New seizure activity in a pregnant/postpartum patient without other attributable cause

HELLP syndrome is defined as preeclampsia complicated by:

- Hemolysis
- Elevated liver enzymes
- Low platelets

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- HELLP syndrome can occur in the absence of hypertension and/or proteinuria
- Eclampsia is often, but not always preceded by preeclampsia

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Case #1 – Anika

- Healthy G1P0 at 34 weeks gestation for routine prenatal care.
- BP 140/95
- SFH 34cm, palpates cephalic

What further questions would you ask?
What further examination would you perform?

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History of any symptoms

- New or unusual headache, visual symptoms (blurring, scotomata, somnolence, tremulousness, irritability, seizures)
- Chest pain, shortness of breath, dyspnea
- Bleeding, bruising, petechiae
- Right upper quadrant pain, nausea and vomiting
- Urinary output

OB history

- Review antenatal record
- Confirm dates, previous ultrasounds and previous BP
- PMH

Risk factors – diabetes, renal disease, chronic HTN?

Examination

Ensure BP is being taken properly each time

- Rest for a minimum of 10 minutes, sitting
- Use manual sphygmomanometer
- Appropriate size cuff
- Never place cuff over clothing
- Use a mercury or aneroid sphygmomanometer to make the diagnosis
- Korotkoff sounds I and V (disappearance)

Fetal evaluation

- Establish fetal well-being – start with NST versus ultrasound, what is the urgency for an asymptomatic patient in your office?
- Hyperreflexia
- Abdominal exam – SFH and abdominal tenderness, contractions, presentation
- Chest examination, pulmonary edema (not dx criteria but may be present)
- Pelvic assessment

Signs and Symptoms of Severe Disease

- More urgent assessment needed
  - Severe hypertension → risk of stroke
  - Right upper quadrant pain → risk of HELLP
  - Headache, vomiting and visual disturbances → may predict eclampsia
- For women with established preeclampsia, predictors of adverse maternal outcomes are:
  - Epigastric pain
  - Chest pain
  - Low O2 saturation less than 93%

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Early onset (<34 weeks) of preeclampsia or severe hypertension warrant consideration of further investigations looking for underlying conditions or alternate diagnoses ie Antiphospholipid antibodies, collagen vascular disease, underlying kidney disease

Studies show that preeclampsia is not one disease but may have several subtypes. Various presentations, at various gestational ages, can make prevention, diagnosis and management challenging

Case #1 – Anika

Anika has no symptoms, baby is moving regularly.

What investigations would you order?

Why?

- CBC (hemoglobin and platelets, creatinine, electrolytes, AST and/or ALT
- Urine assessment for protein
    - Quantitative until diagnosis is made, spot diagnosis is adequate
    - Serial evaluation or increase in proteinuria is not an indicator of severity of disease, nor does it guide the management
- Uric acid has no prognostic significance and should not be used to determine the severity of the disease or helpful in the management
- LDH (lactate dehydrogenase) is commonly ordered, although it may confirm the presence of hemolysis
- Other tests can be used if other clinical diagnosis are considered – PTT, INR, fibrinogen, albumin, ammonia and glucose (glucose is the most rapid and appropriate test for acute fatty liver)
- Fetal assessment (NST, +/- ultrasound)
    - Evidence for prognostic benefit of biophysical profile in this setting is lacking
    - Doppler studies as indicated (umbilical artery Dopplers in hypertensive patients, ductus venosus and MCA when umbilical artery studies are abnormal)

A table is available in **ALARM manual** as to why each test is done.

Evaluation of Mother – Laboratory

- CBC (Hemoglobin, platelets*)
- Creatinine, electrolytes
- Liver enzymes – AST* or ALT
- Urine protein
- Others (as clinically indicated)
  - PTT, INR, Fibrinogen
  - Glucose, bilirubin, ammonia
  - Albumin
  - GBS

*Indicates tests with greatest clinical correlation with adverse outcome.

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Proteinuria

- > 300 mg/d on 24 hour urine collection
- > 2+ on dipstick suggests > 300 mg/d proteinuria but not diagnostic
- Once proteinuria established, degree has no impact on outcome – serial measurements are not indicated
- Urinary Protein/Creatinine Ration (UPCR)
  - a spot urine protein assessment (not first void)
  - UPCR correlates well with 24 hour urine collection
  - > 30 mg/mmol UPCR suggests proteinuria

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- UPCR < 30 mg/mmol can be used reliably in ruling out significant proteinuria
- Do not confuse UPCR with ACR (albumin creatinine ratio)
- It is the presence of proteinuria not the amount that impacts the prognosis

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Evaluation of Fetus

- Maternal perception of fetal movement
- NST
- Ultrasound
  - Fetal size (growth restriction)
  - AFV (oligohydramnios)
  - Umbilical artery Doppler flow studies
- BPP alone is not sufficient

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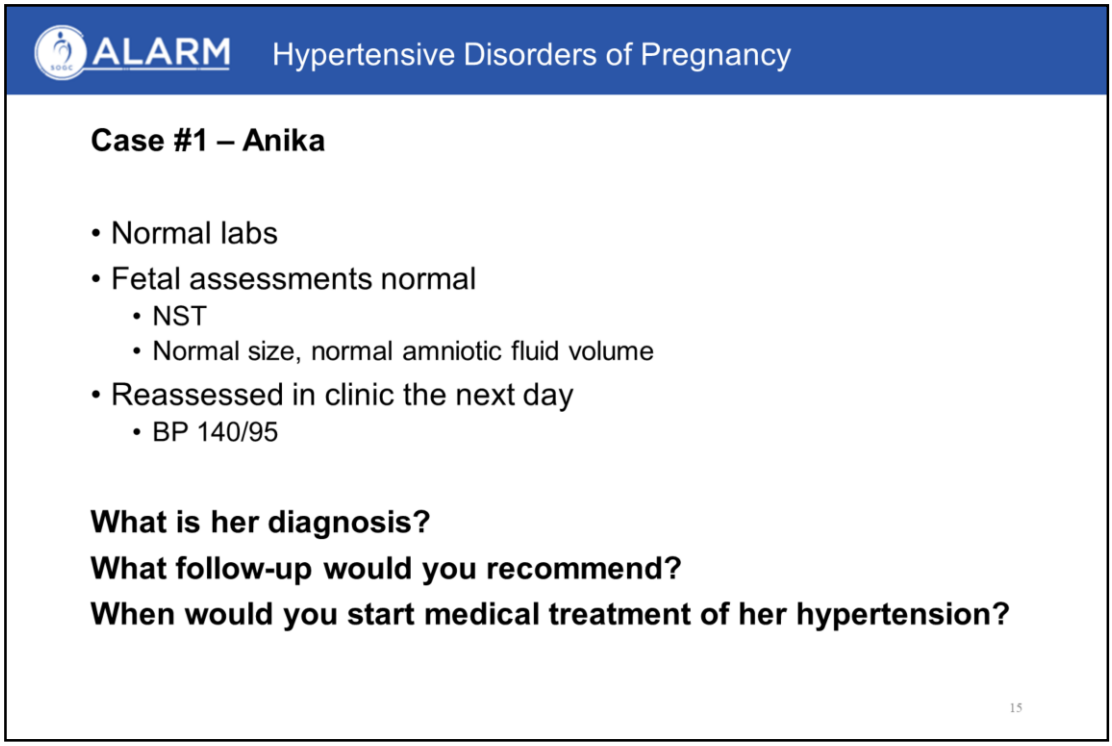
- Doppler flow studies reflect placental microvascular perfusion (umbilical artery) and fetal adaptation (ductus venosus and middle cerebral artery) if the fetus is growth restricted or amniotic fluid volume or NST are abnormal
- Fetuses can be macrosomic or normal in size.



Diagnosis is gestational hypertension at 34 weeks gestation

Follow-Up:

- Home or ambulatory blood pressure monitoring (cuff will need to be calibrated) – minimum 2x per week
- Weekly assessments for change in blood pressure, development of proteinuria and fetal assessments
- NST and fluid assessments weekly
- Growth ultrasound q2-4 weeks as indicated
- Patient teaching – signs and symptoms to report for more urgent care
    - Decreased fetal movements
    - Headaches
    - Vision changes, scotoma
    - Epigastric pain, vomiting
    - New bruising

Indications to initiate antihypertensive medications:

- Goal is to reduce maternal risk of stroke, not to improve fetal outcomes
- Target of treatment is 130-155/80-105 mmHg
- Target is not to normalize blood pressure

Blood Pressure Treatment Targets

- BP Goal 130-155/80-105 mmHg
- Treatment is indicated to reduce the maternal risk of stroke
- Treatment will not prevent:
  - Fetal growth restriction
  - Development of preeclampsia or eclampsia
- Increased monitoring to reduce adverse outcomes

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- Treating blood pressure is intended to decrease the risk of maternal stroke
- dBP < 80 may lower placental perfusion
- With other comorbid conditions there may be indications for lower targets (e.g. Renal disease)

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Maintenance Therapy

Agent	Dose	Caution
Labetalol	100 mg po bid; max 400 mg tid (1200 mg/day)	Asthma
Nifedipine Extended release (Adalat XL)	20 mg po od; max 60 mg bid	Aortic stenosis; ensure XL preparation is used
Methyldopa	250 mg po bid; max 500 mg qid (2000 mg/d)	Depression

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- In a case that was earlier gestation and more stable, you might consider maintenance therapy
- There is an increased risk of congenital anomalies and heart defects in women with chronic HTN, independent of the medications they use

NOTE: In Canada, the following doses are available:

- Nifedipine capsule 5 mg and 10 mg (IR)
- Nifedipine Extended Release (Adalat XL) tablet 20 mg, 30 mg, 60 mg (extended release)
- Nifedipine PA is not available

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Ongoing evaluation

	PREECLAMPSIA	GESTATIONAL HTN	CHRONIC HTN
BLOOD PRESSURE	Twice daily	Minimum 2x/week, or home BP monitoring	Each visit
PROTEINURIA SCREEN*	Daily until >300mg/24h, then D/C	1x/week	Each visit
CBC, LIVER ENZYMES	2x/week, or more frequent if unstable	If sharp ↑BP or proteinuria develops	If sharp ↑BP or proteinuria develops
NST, AMNIOTIC FLUID VOLUME	NST daily AFV 2x/week	1x/week	Each visit in 3rd trimester
ULTRASOUND GROWTH/AFV +/- DOPPLER	Weekly; more frequent if abnormal	Every 2-4 weeks; more frequent if abnormal	Start of 3rd trimester; repeat if AFV or SF height low

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*urine dipstick, urinalysis or UPCR or begin 24h urine collection if ≥ 2+

This table provides a guideline for minimum frequency of reassessment. Care must be individualized and the plan of care reassessed at each visit.

Please note the difference between chronic hypertension (a maternal condition) and gestational hypertension and preeclampsia (placental disorders, more likely to be progressive).

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Timing of Delivery

	Recommended GA for delivery
Chronic Hypertension	≥ 38 weeks
Gestational Hypertension	≥ 37 weeks
Preeclampsia without severe features	37 weeks
Preeclampsia with severe features • Inability to control BP • Increasing maternal organ dysfunction • Fetal indication for delivery	Deliver regardless of gestational age

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- Preeclampsia is a progressive disease and expectant management is potentially harmful in severe cases
- Timely delivery minimizes morbidity and mortality
- Stabilize and optimize mother before delivery
- Corticosteroids if < 35^0 weeks
- Magnesium (fetal neuroprotection) if < 32 weeks
    - A 2019 SOGC Guideline was published after the content update recommending up to 33^6 weeks.
- It may be necessary to transport to a center where advanced maternal and neonatal care can be provided
- In exceptional circumstances, may consider prolonging pregnancy to achieve fetal viability in case of early preeclampsia in a setting where urgent intervention can take place

Case #1: Anika

Anika continues to feel well.

She is scheduled for weekly clinic assessments, including ultrasound for fluid and NST

She measures her BP daily, and will report any changes.

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Case #2 – Maggie

- G1P0 at 37 weeks gestation
- Presented to triage with headache
- BP 150/105
- Recent ultrasound for presentation showed normal fetal growth, normal amniotic fluid
- NST is normal
- Labs pending, urine dip 3+ proteinuria

What is your diagnosis?

What would you like to do?

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- Diagnosis is preeclampsia – HTN, headache, proteinuria
- Admit to hospital, monitor BP, monitor maternal symptoms, monitor fetus
- Consider setting and possible delivery plan depending on how she is doing
- Does she need transfer?
- Resources for mother and baby if delivery is required
- Expectant management could be considered if her blood pressure normalizes and fetal and maternal situation stays stable up to 37 weeks

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Management Goals

- Prevention of severe maternal complications
  - organ damage, seizure, CVA, DVT, death
- Prevention of severe fetal complications
  - abruption, stillbirth, growth restriction
- Symptomatic support

Delivery is the beginning of the cure!

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Balance between stabilizing mother and fetus and gaining maturity.

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Maggie is admitted to hospital.

4 hours later, Maggie's blood pressure is 170/114 mmHg. Her headache is worse. The NST is normal. On vaginal examination, her cervix is soft and mid position, 3 cm dilated, 70-80% effaced (<1 cm), head at -1 station. Her reflexes are increased, with 2 beats of clonus.

What would you do now?

How would you manage her labour differently?

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- Treat blood pressure with medication
- Choices are labetalol, nifedipine
- Hydralazine is not recommended as a first line, especially here as the risk of hypotension is higher
- Labetalol 20 mg IV then 20-80 mg IV q 30 minutes max 300 mg
- OR nifedipine IR 10 mg swallowed then 10-20mg po q 45minutes max 50 mg
- Oxytocin induction of labour
- Initiate magnesium sulfate infusion
- Monitoring - EFM
- Fluid restriction
- Symptomatic support
- Seizure prophylaxis
- Adequate analgesia

Medical Therapy for Severe Hypertension

- Aim sBP to < 160 mmHg, dBP < 110 mmHg over a few hours
- Too rapid BP drop may compromise fetus

- Labetalol – IV
- Nifedipine – Oral
- Hydralazine – IV/IM

- Reduces risk of severe hypertension and maternal CVA
- Does not reduce risk of seizures or adverse fetal outcomes (e.g. IUGR)

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Agent	Dose	Route	Onset	Peak	Caution
Labetalol	20mg; repeat 20-80mg q30 min; max 300 mg	IV	5 min	30 min	Asthma, heart failure, may cause neonatal bradycardia
Nifedipine	10 mg; repeat 10-20mg q45min; max 50mg	Swallowed	30 min	45 min	XL is not for acute therapy
Hydralazine	5mg; repeat 5-10mg q 30 min; max 20mg	IV	5 min	30 min	Not first line; hypotension, abruption, abnormal EFM

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- Ace Inhibitors and ARBs contraindicated because of IUGR, prematurity and oligohydramnios
- Betablockers taken in late pregnancy increase the risk of neonatal hypoglycemia and bradycardia (OR<2 for both)

NOTE: In Canada, the following doses are available:

- Nifedipine capsule 5 mg and 10 mg (IR)
- Nifedipine extended release (Adalat XL) tablet 20 mg, 30 mg, 60 mg (extended release)
- Nifedipine PA is not available

Treatment of Preeclampsia with Acute or Severe Hypertension

- Antihypertensive therapy
- Monitor fetal status while treating BP
- Seizure prophylaxis
- Intravascular volume status
  - Foley catheter and hourly input-output
  - Avoid fluid overload
- Deliver

Symptomatic support

- Manage pain and nausea/vomiting
- Quiet environment
- Presence of supportive family member or professional
- Minimize negative stimuli
- Clear explanation of management
- Consistent, confident team approach

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Fluid Management

- Beware of fluid overload
- At risk for pulmonary edema
- Transient oliguria less concern than fluid overload
- If oliguria persists, beware of magnesium toxicity

No specific intervention except to lower the threshold for early delivery.

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- Fluid bolus may lead to pulmonary edema which is a leading cause of maternal death in preeclampsia
- Fluid bolus pre-epidural is not necessary
- Monitor ins and outs
- Limit fluids by concentrating solutions

Seizure Prophylaxis

- Difficult to predict who will seize
  - Not directly related to degree of hypertension or level of proteinuria
- $MgSO_4$ is agent of choice dosage – 4 g IV followed by 1g/hr IV
  - Consider another 2-4 g bolus if recurrent seizure
  - OK to use cautiously with calcium channel blocker

Do not use phenytoin or diazepam in seizure prophylaxis / treatment in pregnancy unless contraindication to $MgSO_4$, less effective.

Indications for $MgSO_4$ administration

- Severe hypertension
- BP below the severe range associated with symptoms (headache or clonus, visual changes, RUQ pain) or signs (platelets < 100, renal insufficiency, elevated liver enzymes)
- HELLP syndrome
- Secondary prevention of recurrent seizures in eclampsia

Case #2 - Maggie

It is now 6 hours later, and her labour has been progressing well. She has been on $MgSO_4$ 1g/hr infusion since her initial bolus. Epidural is effective. Urine output is 30 cc/hr. Her contractions are moderate, 3 in 10 minutes and she is now 5 cm dilated, 100% effaced and membranes ruptured for clear fluid.

You are called to assess her as she has suddenly had seizure activity.

- **What will your assessment include?**
- **What is your working diagnosis?**
- **What is the management?**

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Magnesium Sulfate (if not already started)

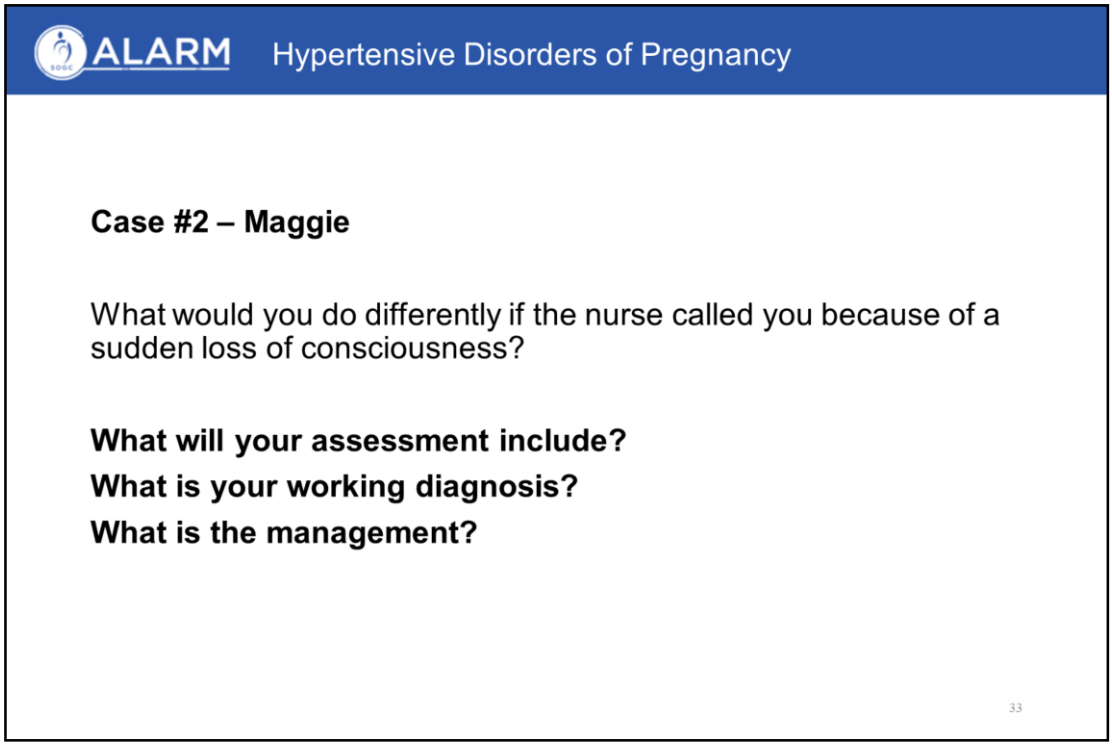
a. Loading dose: 4-6 grams IV over 15-20 minutes
b. Maintenance: 1 gram per hour
c. Consider rebolus of 2-4 grams if Seizure recurs – caution in women with low urinary output due to seizure toxicity
d. Airway and respiratory management
    a. Protect airway from aspiration
        a. Place patient in left lateral decubitus position
        b. Suction oral secretions
    b. Anesthesia or other skilled clinician (e.g. emergency medicine) at bedside for possible intubation
    c. Consider Oral Airway
    d. Supplemental Oxygen
    e. Arterial Blood Gas
        a. Avoid Sodium Bicarbonate unless pH <7.10
e. Prevent injury
    a. Padding on side rails of bed

f. Other post-Seizure measures
    a. Foley Catheter
    b. Consider Internal fetal monitor (Internal Scalp electrode)
    c. Single Seizure does not mandate cesarean delivery – effective intrauterine resuscitation will often be adequate to allow for a trial of labour

Management of Eclamptic Seizure

Anti-seizure medication – Bolus of magnesium sulphate 4g
Supportive care
Continuous fetal monitoring

Seizure is not an indication for CS
- (Unless unresolved fetal compromise, i.e. Abruption)



- Circulation Airway Breathing - CAB
- Vital signs BP 145/92, RR 6, P 60 Saturation 89% on Room air FHR 150
- Reflexes – brisk, 3+ clonus, she is somnolent
- Laboratory assessment: glucose, calcium level, magnesium level, creatinine

Diagnosis – Mg toxicity

- When you use magnesium – observe regularly for signs of toxicity
- Weakness, loss of reflexes, somnolence, decreased respiratory rate
- Renal compromise increases risk of Mg toxicity
- Chart in manual compares Mg levels and clinical signs

Management

- Stop Mg
- Call for help
- Give Oxygen
- Administer 10% calcium gluconate IV over 3 minutes

Magnesium Sulfate Toxicity

Antidote

- Stop magnesium infusion
- Provide respiratory support
- 10% calcium gluconate 10 ml IV over 3 minutes
- Check renal status and Mg infusion rate for safety before resumption

Maggie's respiratory rate is now normal, and she tells you she has a strong urge to push. After a short second stage, she delivers a vigorous female infant weighing 2650 gm. Cord gases were sent.

- **How would you manage her after delivery?**

- Continue Mg for 24 hours
- At risk for continued morbidity (e.g. hypertensive crisis, seizure, stroke, pulmonary edema) – close observation
- Monitor output and reflexes
- Furosemide 20 mg po od while in hospital decreases need for antihypertensive therapy and shortens hospital stay
- Not a candidate for mother/baby early discharge program
- Peak BP postpartum day 3 to 6 – home BP monitoring may be indicated
- As her postpartum BP comes down to normal, she will need less and eventually no medication

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Postpartum Management

- As HTN / symptoms / organ dysfunction / seizures may present or worsen following delivery – monitor closely PP
- If $MgSO_4$ used, continue for 24 hours PP
- Severe PP hypertension and patients with co-morbidities need longer hospitalization
- Goals for blood pressure control similar but may be affected by other conditions
- Consider Furosemide 20mg po daily until discharge for severe hypertension

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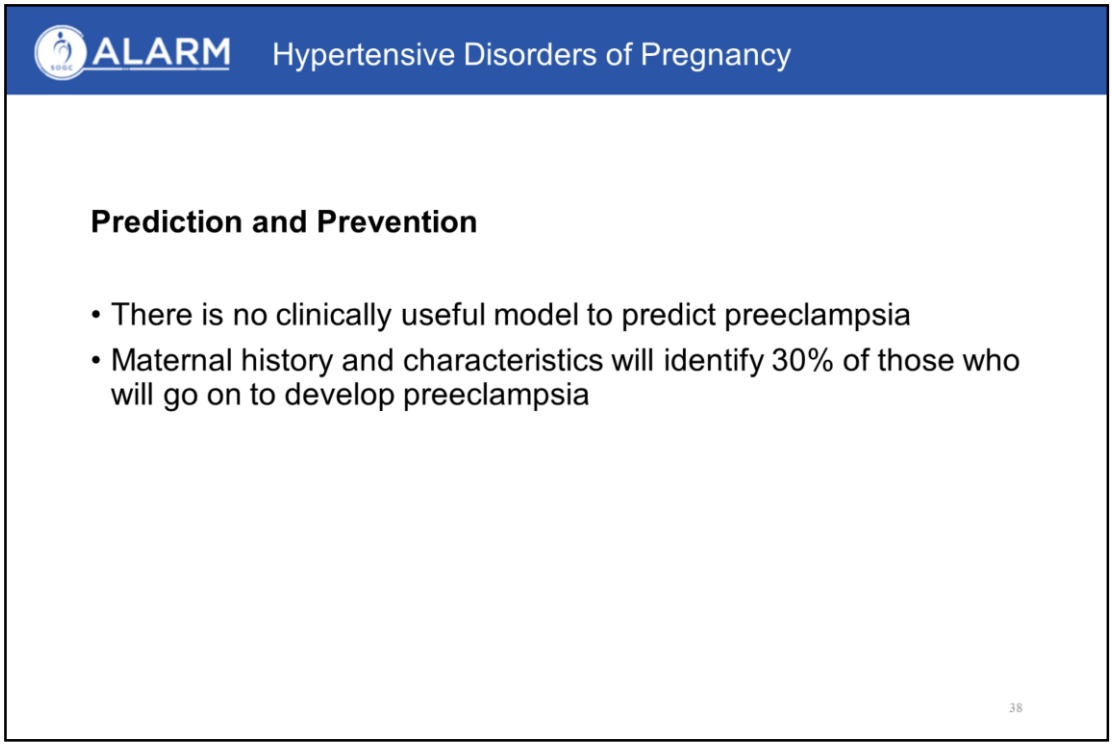
- Measure BP at day 3-6 pp as is time of peak BP due to mobilization of extra cellular fluid
- New onset of late postpartum preeclampsia has been documented up to 3 weeks after pregnancy in an otherwise normal pregnancy
- Furosemide facilitates diuresis, which is the beginning of the cure and thus can be beneficial
- Furosemide is suggested in this case due to the severe course of the disease

How would you counsel Maggie for her next pregnancy?

- Optimize health and BP
- Minimize inter-pregnancy weight gain
- ASA starting before 16 weeks, dose 81-162 mg per day,
- Monitoring maternal BP



Risk factors

- Previous preeclampsia
- Anti-phospholipid antibodies
- Pre-existing medical condition(s)
    - Hypertension or first visit dBP ≥ 90 mm Hg
    - Renal disease or first visit proteinuria
    - Diabetes mellitus
    - Collagen vascular disease
    - Periodontitis
- Multiple pregnancy
- Obesity (BMI ≥ 35)
- Family history of preeclampsia (mother or sister)
- First ongoing pregnancy
- Inter-pregnancy interval ≥ 10 years
- First visit sBP ≥ 130 mm Hg or dBP ≥ 80 mm Hg

Prediction and Prevention

Women at low risk

- Calcium supplementation > 1g/d (if poor calcium intake)
- Low dose ASA is not beneficial

Women at increased risk

- Low dose ASA (81 – 162 mg) started pre-pregnancy or at diagnosis of pregnancy (but before 16 week gestation) until delivery
- 10-17% decrease in risk of preeclampsia

It should be noted that in women with established preeclampsia low dose aspirin, calcium supplementation, anti-hypertensives and $MgSO_4$ failed to show an impact in reducing stillbirth rate.

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Transport

- Consider transporting patient if resources are limited and maternal/fetal condition permits
  - Maternal BP and symptoms stable
  - Fetal status normal
- Discuss with receiving centre and patient/family
- Anti-hypertensive agents if indicated
- $MgSO_4$ if indicated – IM if required
- Accompanied by caregiver who can manage medications and seizure as required
- Plan for urgent communication on route, if required

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- There are issues regarding the administration of magnesium sulfate during transport.
- Check with Provincial Guidelines.
- Consider IM $MgSO_4$ (5 g) with xylocaine in each buttock

Summary

- Severe HTN and preeclampsia are obstetrical emergencies
- Prompt recognition and stabilization required
- In rural communities. transfer of patient may be required
- The cure is delivery
- Antihypertensive therapy is used to prevent CVAs, not seizures
- $MgSO_4$ is the best agent for seizure prophylaxis
- No evidence that antihypertensive therapy for hypertension below 160/110 improves perinatal outcome

Take home message:

- Gestational hypertension and preeclampsia are progressive placental disorders
- Chronic hypertension represents an underlying maternal medical condition
  - It increases the risk of placenta disorders
- Any hypertensive disease in pregnancy increases the risk of adverse maternal and perinatal outcomes
- Women with a history of a hypertensive disorder in pregnancy have an increased risk of cardiovascular disease later in life.