HYPERTENSION IN PREGNANCY: PREVENTING SEVERE MATERNAL MORBIDITY & MORTALITY THROUGH THE IMPLEMENTATION OF EVIDENCED BASED PROTOCOLS

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LEARNING OBJECTIVES

• Report the incidence of maternal morbidity due to hypertension in pregnancy,
  • and the evidence that these problems are amenable to change
• Compare the different medications used to manage hypertension in pregnancy,
  • including a hypertensive crisis
• Examine the factors that supported Conquering Change in the Healthcare Environment

MATERNAL MORTALITY RATE: USA
MATERNAL MORTALITY RATE: CA

Ratio: 1 to 100
mortality to morbidity

Tip of the
Iceberg

CAUSES OF MATERNAL MORTALITY
OVER TIME - 1987 TO 2009

CAUSES OF MATERNAL MORTALITY
2011 TO 2013:
HYPERTENSION 7.4% / CVA 6.6%

Morbidity-
- MI; Stroke;
- Heart Failure; Renal Impairment
- Bleeding; Eclampsia; Abruption
AMENABLE TO CHANGE?
MISSED TRIGGERS: DELAYS IN DIAGNOSIS; DELAYS IN TREATMENT

PATIENT SAFETY BUNDLE:
READINESS, RECOGNITION, RESPONSE, REPORT

HYPERTENSION IN PREGNANCY

**Etiology**
- BP = Flow X Resistance
- Causes of HTN
  - 1 FLOW
    - Hypervolemia
    - Cardiac Output
    - Contractility
  - 1 RESISTANCE
    - Vasoconstriction

**Critical Parameters**
- SBP > 160
- SV + Vasoconstriction
- DBP > 105
- Vasoconstriction
- Acute rise in MAP > 30

Pulse Pressure =

\[
SBP - DBP = \frac{1}{2} SV \\
2 \times \text{Pulse Pressure} = SV
\]
HTN TREATMENT: DEPENDENT ON CAUSE

**Increased Flow**
- Hypervolemia
  - Decrease fluids and sodium
  - Loop diuretic
  - Vasodilator
- β1 Stimulation
  - Beta Blocker
  - Vasodilator

**Increased Resistance**
- ↑ Catechols
  - Control pain
  - Correct O2 & CO2
  - Control ↑ ICP
  - Vasodilator
- ↑ Endocrine
  - Preeclampsia- Delivery Placenta
  - Vasodilator & Beta Blocker

TREATMENT CHOICES

**Vasodilators**
- Hydralazine (Apresoline)
- Nitroprusside (Nipride)
- Nitroglycerine (Tridil)
- Nifedipine (Procardia)

**Beta Blockers**
- Propranolol (Inderal)
- Esmolol (Brevibloc)
- Atenolol (Tenormin)
- Labetalol (Normodyne)

**ACE Inhibitors**
- Enalapril

**Adrenergic Agonist**
- Clonidine (Catapres)

TOP 3 HTN MEDICATIONS USED IN PREGNANCY

- **Lower – Labetalol**
  - Labetalol 20, 40, 80 mg IVP
  - Repeat every 10 minutes

- **Hypertension – Hydralazine**
  - Hydralazine 5 or 10 mg IVP
  - Repeat every 20 minutes

- **Now – Nifedipine**
  - Nifedipine 60 mg PO
  - Repeat every 30 minutes
CASE STUDY #1

- 24 yo G1P0
- 36 weeks
- BP = 165/108
- Active labor
- Preeclampsia
  - Elevated AST/ALT
  - Proteinuria 2+
  - Platelets 105K
- Headache

TREATMENT - VASODILATOR +/- BETA BLOCKER

- 165 - Mildly hyperdynamic
- 110 - Significant vasoconstriction
- Pulse pressure - 55 mild increase of flow/volume

- Problem - Increased resistance
  - Vasoconstriction due to Pain & Preeclampsia
    (Increased Catechol, Endocrine)
- Plan - Pain Management & Deliver -
  - Eliminates sources of hormones

IDENTIFY TRIGGERS
RAPID DIAGNOSIS
TIMELY TREATMENT

- Re-check BP in 15 m
- Dx - Hypertensive Crisis
- Notify Physician -
  - TORB: “Implement Hypertension protocol; Use Labetalol as 1st Priority”
- Treatment started - 30 min of presentation
- Labetalol 1st priority:
  - Give 20 mg IVP; Wait 10 min
    - BP still > 160 or 105
  - Give 40 mg IVP; Wait 10 min
    - BP < 160/105
  - Greater than 34 wks - Pain relief & Deliver
CASE STUDY #2

- 35 yo G3P2
- 29 weeks
- BP = 210/110
- Obese (BMI - 52), Chronic HTN, T2DM
  - ↓ renal function
  - poor compliance - DM
- Normal preeclampsia labs
- Creatinine ↑; Hgb ↓

TREATMENT -
- Beta Blocker; Loop Diuretic; Vasodilator

- 210 - Significant Hyperdynamic
- 110 - Significant Vasoconstriction
- Pulse pressure - significant increased flow

- PROBLEM -
  - Increased flow - renal disease
  - Increased resistance -

- PLAN -
  - Control HTN; Treat anemia
  - Reduce volume; Maintain electrolyte balance
  - Maintain fetal wellbeing

IDENTIFY TRIGGERS
RAPID DIAGNOSIS
TIMELY TREATMENT

- Re-check BP in 15 m
- Dx - Hypertensive Crisis
- Notify Physician -
  - TORB: “Implement Hypertension protocol; Use Hydralazine as 1st Priority”
- Treatment started - 30 min of presentation
- Hydralazine 1st priority:
  - Give 10 mg IVP; Wait 20 min
  - BP still > 160 or 105
  - Give 10 mg IVP; Wait 20 min
  - BP still > 160/105
  - Give Labetalol 20mg IVP; Wait 10 min
• Give Labetalol 40 mg
  • Wait 10 min - BP still >160/105
• ICU Admission for IV Meds-
  • Titrate to effect
  • Rapid onset, Short duration
• Nicardipine drip-
  • Calcium channel blocker
• Esmolol drip-
  • a beta 1-selective (cardio-selective) adrenergic receptor blocking agent

LONG TERM MANAGEMENT

□ Pregnant patients experiencing HTN
  □ Balance- maternal & fetal wellbeing
  □ Antenatal testing: Outpatient vs. Inpatient
  □ Intrauterine blood flow depend on BP
  □ When to deliver-
    □ >34 weeks - Deliver
    □ < 34 weeks- Control BP with PO meds; IVP PRN
  □ Give antenatal steroids & Magnesium Sulfate-
    □ 12 hours for Fetal Neuro-protection

LONG TERM MANAGEMENT

□ Postpartum patients experiencing HTN
  □ F/U- Preeclampsia –
    □ Labetalol PO +/- Nifedipine PO
    □ 3 to 10 days PP; BP check;
    □ Pt Educ-When to return to hospital (HA)
  □ F/U- Chronic HTN-
    □ Beta blocker; Loop diuretic; Vasodilator
    □ Could add- Clonidine or Lisinopril
    □ Address co-morbidities
CONQUERING CHANGE
IN THE HEALTHCARE ENVIRONMENT

• Implementation Science-
• Sustainment-

IMPLEMENTATION METHODS

☐ Staff Education-
  ✓ eLearning
  ✓ In-person
  ✓ Posters

☐ In-Situ Simulations
  ✓ Inter-professional
  ✓ Shared mental model
  ✓ Closed loop communication
  ✓ Situation monitoring
  ✓ Mutual support

SUSTAINMENT- SEVERE MATERNAL MORBIDITY REVIEWS

• SMM Reviews
  • 4 or more blood products
  • Transfer to ICU within 24 hours or birth
  • Anything rises to level of severe morbidity

• Inter-professional Review Process-
  • What went right!!
  • What are our challenges??
  • Systems issues: Communication/Equipment
  • Individual issues: Peer Review/Just Culture
REPORTING

Outcome metrics-
- Chart audits
- Dx in 15 min
- Pyxis reports
- Tx in 30-60 min

Balance Measures-
- Unexpected Newborn Complications
- Emergency Cesarean

CA STATE WIDE REDUCTION IN MATERNAL MORTALITY

REFERENCES


Main, E. et al. Pregnancy-Related Mortality in California: Causes, Characteristics, and Improvement Opportunities. Maternal Gynecol 2015; 125 (3) 938-947


