Preeclampsia through the Gestational Ages

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Historical Perspective

- References to convulsive disorders of pregnancy in ancient Egyptian and Chinese writing
- Greeks named it *eklampsis*
  - “Shining forth”

Disclosures

None

- Eclampsia not recognized as an exclusively obstetric complication due to similarity with epilepsy
- 7th century Greek Physician Paulus Aegineta
  - Review of Greek, Roman and Arab knowledge
  - “Epilepsy has also been seen to proceed from the uterus in females at the time they were pregnant, for after delivery it ceased.”
Preeclampsia - Eclampsia

Observation of an organism found in patients with gestational trophoblastic disease and in patients with toxemia of pregnancy

Hydatoxi lualba


- Francois Mauriceau 1637 – 1709
  - *Traite des maladies des femmes grosses et accouchees*
  - The mortal danger to mother and fetus is greater when the mother does not recover consciousness between convulsions
  - Primigravidas are at far greater risk of convulsions than are multiparas
  - Convulsions during pregnancy are more dangerous than those beginning after delivery
  - Convulsions are more dangerous when the fetus is dead than when it is alive

- 1840 – Pierre Francois Rayer
  - Proteinuria in 3 edematous pregnant women

- 1843 – John Charles Lever and Sir James Young Simpson
  - Albuminuria preceded convulsions in eclamptic women; cleared after delivery
  - Link to preeclampsia was made
  - Blood pressure measurements began in 1910 when preelampsia became distinguished from eclampsia

- 1840 – John Charles Lever and Sir James Young Simpson
  - Only way to save the patient was to deliver the baby

- Treatment
  - Over the years many treatments advocated
    - Craniotomy
    - Excision of renal capsule
    - Mastectomy
    - Bleeding
  - Madame Le Boursier du Coudray - Chief Midwife in Paris in 2nd half of 18th century
    - *Only way to save the patient was to deliver the baby*
Medical management in 19th century combined with timely delivery reduced maternal mortality rates from 20% to 5%

- Abandonment of bleeding
- Sedation with morphine, chloroform and chloral hydrate
- Quiet environment
- Magnesium sulfate (1925, EM Lazard)
- Antihypertensive therapy

World-wide 150,000 women die each year

- Mortality rate from Preeclampsia-Eclampsia
  - poorer nations – up to 20%

A preliminary report on the use of magnesium sulfate in puerperal eclampsia

“In May 1924 one of the Internes. . . suggested the use of magnesium sulphate intravenously for the control of eclamptic convulsions. Having in mind the sedative action of magnesium sulphate on the nerve cells. . . as well as the intraspinal use of magnesium sulphate for control of tetanic convulsions, we thought it worth while to give it a trial. Our experience in the few cases reported here has been so uniformly successful . . . these are all cases of the profoundly toxic type, having convulsions, and in coma when first seen, and most of whom have had little or no antepartal care.”

E. M. Lazard, read at meeting of LA Obstetric Society, October 14, 1924

Pathophysiology of Preeclampsia

- Normal Placentation
  - Spiral arteries increase greatly in diameter
  - Endothelium invaded by trophoblast
  - Internal elastic lamina and smooth muscle of the media replaced by trophoblast and fibrin
  - Extend from spiral to distal portion of radial arteries
  - Basal arteries not affected

- Endothelial cell disorder
  - Incomplete trophoblast invasion
  - Absence of appropriate adrenergic denervation
  - Placental ischemia
    - Alteration in thromboxane/prostacyclin ratio
    - Endothelins
    - Nitric oxide
    - Soluble fms-like tyrosine kinase 1 (sFlt-1)

- Systemic Endothelial Dysfunction
  - Disturbed control of vascular tone
  - Increased vascular permeability
  - Abnormal expression of procoagulants
- **Renal Changes**
  - Reduced GFR and renal blood flow
  - Rarely ATN
  - Glomerular endotheliosis

- **Hepatic Changes**
  - Periportal hemorrhagic necrosis
  - Bleeding from these lesions:
    - Subcapsular hematoma, Hepatic rupture

- **Fetal Changes**
  - Impaired uteroplacental blood flow
  - IUGR, Oligohydramnios, Abruption

- **Vascular Changes**
  - Intense vasospasm
  - Hemoconcentration
  - Capillary leak

- **Hematologic Changes**
  - Thrombocytopenia
  - Platelet deposition

- **Hemolysis**
  - Intense vasospasm – endothelial disruption- microangiopathic hemolysis
  - Increased erythrocyte membrane fluidity

- **Neurologic and Cerebral Manifestations**
  - **Cerebral Overperfusion**
    - Initial vasoconstriction to limit overperfusion of brain in tissue distal to MCA
      - Persistent high CPP - MCA and smaller branches damaged by barotrauma
      - Autoregulation overwhelmed- distal overperfusion
      - Vasogenic edema
      - Hypertensive encephalopathy
      - Intracranial hemorrhage
      - Pathologic vasospasm – distal or global ischemia
Criteria for Diagnosis of Preeclampsia

- Blood pressure of 140 mm Hg systolic or higher or 90 mm Hg diastolic or higher that occurs after 20 weeks of gestation in a woman with previously normal blood pressure

- Proteinuria defined as urinary excretion of 0.3 g protein or higher on a 24-hour urine specimen


Diagnosis of Severe Preeclampsia

- Preeclampsia becomes severe if one or more of the following criteria is present:
  - Blood pressure of 160 mm Hg systolic or higher or 110 mm Hg diastolic or higher on two occasions at least 6 hours apart while the patient is on bedrest.
  - Proteinuria of 5 g or higher in a 24 hour urine specimen or 3+ or greater on two random urine samples collected at least 4 hours apart.


Diagnosis of Severe Preeclampsia

- Oliguria of less than 500 ml in 24 hours
- Cerebral or visual disturbances
- Pulmonary edema or cyanosis
- Epigastric or right upper-quadrant pain
- Impaired liver function
- Thrombocytopenia
- Fetal growth restriction


What are the Risks?

- Placental abruption
- Eclampsia
- HELLP Syndrome
- Renal Failure
- Intracerebral Hemorrhage
- Ruptured Hepatic Hematoma
- Maternal Mortality
- Perinatal Mortality
Expectant Management of Mild Preeclampsia

"Expectant management should be considered for women remote from term who have mild preeclampsia."


Expectant Management of Mild Preeclampsia

- "After maternal and fetal conditions are serially assessed, subsequent management may be continued in the hospital, at a day-care unit, or at home. . . ."

- "Observational and randomized studies suggest a place for ambulatory management of selected women. . . it should include frequent maternal and fetal evaluation and access to health care providers."

- "If worsening of preeclampsia is diagnosed, as determined by laboratory findings, symptoms, and clinical signs, hospitalization is indicated."


Expectant Management of Mild Preeclampsia

Maternal Assessment

- Every 1-3 day maternal assessment
- 1-2 times per week laboratory studies
  - CBC, LFTs, Creatinine
- Home blood pressure measurements
  - Hospitalize if ≥ 150/100
- Urine protein dip with each void
- Strict precautions - signs & symptoms severe preeclampsia
- Restful lifestyle

Adapted from Report of National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. AJOG 2000

Expectant Management of Mild Preeclampsia

Fetal Assessment

- Daily fetal movement counts
- Twice weekly Nonstress test and Amniotic fluid index
- Growth scan every 3 weeks

Adapted from Report of National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. AJOG 2000
Mild Gestational Hypertension/Preeclampsia

- **When To Deliver**
  - HYPITAT Study
    - Randomized trial in Netherlands
  - Singleton, 36 - 41 weeks’ gestation
    - Mild GHTN or Pre-E (<170/110)
    - <5 grams proteinuria
  - Induction vs. Expectant monitoring (up to 41 wks)
  - Composite of poor maternal outcome
    - Maternal mortality, eclampsia, HELLP, pulmonary edema, thromboembolism, abruption, major hemorrhage, severe hypertension or proteinuria

<table>
<thead>
<tr>
<th>Induction of labour (n=377)</th>
<th>Expectant monitoring (n=379)</th>
<th>Relative risk (95% CI; p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous</td>
<td></td>
<td>273 (72%)</td>
</tr>
<tr>
<td>Vaginal instrumental delivery</td>
<td></td>
<td>50 (13%)</td>
</tr>
<tr>
<td>Cesarean section</td>
<td></td>
<td>54 (14%)</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Composite adverse maternal outcome</th>
<th>Induction of labour (n=377)</th>
<th>Expectant monitoring (n=379)</th>
<th>Relative risk (95% CI; p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal death</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Severe hypertension (mm Hg)</td>
<td>57 (15%)</td>
<td>88 (23%)</td>
<td>0.68 (0.45-0.96; p=0.003)</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>62 (16%)</td>
<td>103 (27%)</td>
<td>0.68 (0.46-0.92; p&lt;0.0001)</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>26 (7%)</td>
<td>52 (14%)</td>
<td>1.07 (0.43-2.25; p=0.79)</td>
</tr>
<tr>
<td>Severe proteinuria</td>
<td>25 (2%)</td>
<td>44 (12%)</td>
<td>0.60 (0.38-0.95; p=0.03)</td>
</tr>
<tr>
<td>HELLP syndrome</td>
<td>7 (2%)</td>
<td>11 (3%)</td>
<td>0.37 (0.12-1.4; p=0.17)</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Lung edema</td>
<td>0</td>
<td>2 (1%)</td>
<td>NA</td>
</tr>
<tr>
<td>Postpartum hemorrhage</td>
<td>16 (4%)</td>
<td>47 (12%)</td>
<td>0.38 (0.17-0.83; p=0.02)</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>1 (1%)</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Placental abruption</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Severe hypertension measured twice (mm Hg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP</td>
<td>26 (7%)</td>
<td>50 (13%)</td>
<td>0.96 (0.45-2.0; p=0.86)</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>28 (7%)</td>
<td>50 (13%)</td>
<td>0.96 (0.45-2.0; p=0.86)</td>
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<th>Relative risk (95% CI; p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthweight (g)</td>
<td>3220 (2890-3565)</td>
<td>3490 (3080-3910)</td>
</tr>
<tr>
<td>Composite adverse neonatal outcome</td>
<td>24 (5%)</td>
<td>32 (8%)</td>
</tr>
<tr>
<td>Fetal deaths</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Apgar score of&lt;7 after 5 min</td>
<td>7 (2%)</td>
<td>9 (2%)</td>
</tr>
<tr>
<td>Arterial pH of&lt;7.05</td>
<td>9 (3%)</td>
<td>19 (6%)</td>
</tr>
<tr>
<td>Admission to intensive care</td>
<td>10 (3%)</td>
<td>8 (2%)</td>
</tr>
<tr>
<td>Neonatal hospital care</td>
<td>68 (18%)</td>
<td>69 (18%)</td>
</tr>
<tr>
<td>High care</td>
<td>12 (3%)</td>
<td>10 (3%)</td>
</tr>
<tr>
<td>Intensive care</td>
<td>10 (3%)</td>
<td>8 (2%)</td>
</tr>
</tbody>
</table>

“Induction of labor is associated with improved maternal outcome and should be advised for women with mild hypertensive disease beyond 37 weeks’ gestation”

Mild Gestational Hypertension/Preeclampsia 34-37 weeks’ gestation

<table>
<thead>
<tr>
<th>Potential Risks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe hypertension</td>
<td>10-15</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>0.2-0.5</td>
</tr>
<tr>
<td>HELLP</td>
<td>1-2</td>
</tr>
<tr>
<td>Abruptio placentae</td>
<td>0.5-2</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Fetal growth restriction</td>
<td>10-12</td>
</tr>
<tr>
<td>Fetal death</td>
<td>0.2-0.5</td>
</tr>
</tbody>
</table>

Sibai, Seminars in Perinatology, 2011
Severe Preeclampsia

The Dilemma

- Delivery is always appropriate for women with severe preeclampsia
- Delivery not always optimal for the fetus remote from term

Expectant management of Severe Preeclampsia

- Does expectant management improve neonatal outcome versus immediate delivery?
- Does expectant management pose unacceptable maternal risks?
- Management guidelines?

Expectant Management of Severe Preeclampsia: Perinatal Outcomes


- Retrospective study of 60 patients with severe preeclampsia: conservative management
  - 18-27 weeks’ gestation
- Maternal results:
  - No maternal deaths
  - Abruption: 21.7%
  - DIC: 8.3%
  - HELLP: 16.7%
  - Eclampsia: 16.7%
  - Renal failure: 5%

**Table 1: Management of severe preeclampsia remote from term**

<table>
<thead>
<tr>
<th>Study</th>
<th>Gestational age (wk)</th>
<th>Women (%)</th>
<th>Average days of prolongation (range)</th>
<th>Relevant aspects of each trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sibai et al. (1990, ISRA)</td>
<td>26-31</td>
<td>46</td>
<td>15 (5-32)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Ounsted et al. (1989, South Africa)</td>
<td>28-34</td>
<td>16</td>
<td>7.1</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sibai et al. (1990, ISRA)</td>
<td>26-34</td>
<td>42</td>
<td>13 (1-28)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Suba et al. (1993, India)</td>
<td>26-34</td>
<td>14</td>
<td>7 (3-9)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Al-Wali et al. (1986, Kuwait)</td>
<td>24-30</td>
<td>25</td>
<td>8 (2-30)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Al-Khawaja et al. (1985, Kuwait)</td>
<td>25-30</td>
<td>34</td>
<td>9.6 (5-12)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Al-Sayed et al. (1984, Kuwait)</td>
<td>26-34</td>
<td>34</td>
<td>10 (3-10)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Al-Fawzani et al. (1983, Kuwait)</td>
<td>24-30</td>
<td>34</td>
<td>9.6 (5-12)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Al-Shamal et al. (1985, Kuwait)</td>
<td>26-34</td>
<td>34</td>
<td>9 (3-10)</td>
<td>MgSO4 + steroids</td>
</tr>
<tr>
<td>Al-Hussainy et al. (1984, Kuwait)</td>
<td>24-34</td>
<td>34</td>
<td>9 (3-10)</td>
<td>MgSO4 + steroids</td>
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<tr>
<td>Al-Sayed et al. (1984, Kuwait)</td>
<td>24-34</td>
<td>34</td>
<td>9 (3-10)</td>
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</tr>
<tr>
<td>Al-Shamal et al. (1985, Kuwait)</td>
<td>26-34</td>
<td>34</td>
<td>10 (3-10)</td>
<td>MgSO4 + steroids, plasma volume expansion</td>
</tr>
</tbody>
</table>

- **Neonatal results**
  - 31 stillbirths
  - 21 neonatal deaths
  - Perinatal mortality rate of 87%

  Sibai et al. AJOG 1985;152:32-7

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### Expectant Management of Severe Preeclampsia: Perinatal Outcomes

**Odendaal et al. Obstet Gynecol 1990**

- Prospective randomized trial
  - 58 women with severe preeclampsia at 28-34 weeks
  - Delivery 48 hours after steroids vs expectant management

<table>
<thead>
<tr>
<th></th>
<th>aggressive</th>
<th>expectant</th>
<th>pvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA del, wks</td>
<td>30.1±2.1</td>
<td>31.9±1.9</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Ventilator</td>
<td>35%</td>
<td>11%</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Neo M&amp;M</td>
<td>75%</td>
<td>33%</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Cesarean</td>
<td>70%</td>
<td>83%</td>
<td>NS</td>
</tr>
</tbody>
</table>

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### Expectant Management of Severe Preeclampsia: Perinatal Outcomes

Sibai et al. AJOG 1994; 171:818-822

- Prospective randomized study
  - Severe preeclampsia: 28 to 32 weeks
    - BPs systolic ≥160 mmHg or ≥110 mmHg *and*
    - Proteinuria >500 mg per 24 hours *and*
    - Uric acid >5 mg/dl

---

### Exclusions:

- Renal disease
- IDDM
- Connective tissue disease
- Bleeding
- Platelet count < 100,000
- PROM
- Multifetal gestation
- Preterm labor
- IUGR or abnormal testing

Sibai et al. AJOG 1994; 171:818-822
- **Aggressive management**: n=46
  - Induction or cesarean section 48 hours after first dose of betamethasone

- **Expectant management**: n=49
  - Modified bedrest
  - BP qid – labetolol up to 2400mg/day and nifedipine up to 120 mg/day
  - Daily antenatal testing, biweekly growth scans
  - BMZ weekly
  - Laboratory studies daily


- **Indications for delivery**:
  - Uncontrolled severe hypertension
  - Severe headaches
  - Visual symptoms
  - Epigastric pain
  - Vaginal bleeding
  - PTL, PROM
  - Platelets <100,000
  - Repetitive variable or late decelerations
  - Severe oligohydramnios
  - BPP≤ 4


### Maternal Results

<table>
<thead>
<tr>
<th></th>
<th>aggressive</th>
<th>expectant</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolongation</td>
<td>2.6 days</td>
<td>15.4 days</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Cesarean</td>
<td>85%</td>
<td>73%</td>
<td>NS</td>
</tr>
<tr>
<td>Abruption</td>
<td>4.3%</td>
<td>4.1%</td>
<td>NS</td>
</tr>
<tr>
<td>HELLP</td>
<td>2.1%</td>
<td>4.1%</td>
<td>NS</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Postpartum Days</td>
<td>5.3</td>
<td>5.1</td>
<td>NS</td>
</tr>
</tbody>
</table>


### Neonatal Results

<table>
<thead>
<tr>
<th></th>
<th>aggressive</th>
<th>expectant</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA del, wks</td>
<td>30.8</td>
<td>32.9</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>ICN Admit</td>
<td>100%</td>
<td>76%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>ICN days</td>
<td>36.6</td>
<td>20.2</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>RDS</td>
<td>50%</td>
<td>22.4%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>NEC</td>
<td>10.9%</td>
<td>0%</td>
<td>p=0.02</td>
</tr>
<tr>
<td>SGA</td>
<td>10.9%</td>
<td>30.1%</td>
<td>p=0.04</td>
</tr>
<tr>
<td>IVH</td>
<td>6.5%</td>
<td>2.0%</td>
<td>NS</td>
</tr>
<tr>
<td>BPD</td>
<td>8.7%</td>
<td>4.1%</td>
<td>NS</td>
</tr>
<tr>
<td>Mortality</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

We conclude that the amount of proteinuria, and the rate of increase in proteinuria during conservative management are not important predictors of maternal or perinatal outcome.

We recommend that pregnancies complicated by severe preeclampsia remote from term and managed conservatively not be terminated on the basis of proteinuria.

We do not recommend repeating the 24-hour urine collection for protein determination after the diagnosis of severe preeclampsia has been established.

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### Importance of urinary protein excretion during conservative management of severe preeclampsia

Schiff et al. AJOG 1996;175:1313-1316

- Retrospective review of 66 women with severe preeclampsia under 32 weeks gestation - Quantity of proteinuria not used as an indication for delivery
  - 89% had an increase in proteinuria
  - Compared those with >2 gram increase to those with <2 gram increase
    - No eclampsia or stillbirths
    - No difference in HELLP syndrome, abruption, cesarean for distress or admission to delivery interval

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### Intrauterine growth restriction and the expectant management of severe preeclampsia

Chammas et al. AJOG:2000;183:853-858

- Observational study
  - Singleton pregnancies <34 weeks’ gestation with severe preeclampsia, managed expectantly

- Results:
  - Admission to delivery IUGR vs. Non-IUGR
    - 3.1±2.2 vs 6.6±6.1 days, p<0.05
  - IUGR
    - 85.7% delivered by 4 days
Intrauterine growth restriction and the expectant management of severe preeclampsia

- We are not aware of any published data to support any fetal benefit of an extra 1 or 2 days in utero, beyond the 48 hours needed for the action of betamethasone.

- In the case of severe preeclampsia complicated by IUGR, the benefit of expectant management beyond 48 hours, with the gain of 1 or 2 more days, needs to be weighed against the continuing risk of deteriorating maternal and fetal conditions.

  Chammas et al. AJOG, 2000;183:853-858.

Severe Preeclampsia

“The management of a woman with severe preeclampsia remote from term is best accomplished in a tertiary care setting or in consultation with an obstetrician-gynecologist with training, experience, and demonstrated competence in the management of high risk pregnancies, such as a maternal-fetal medicine subspecialist.”

ACOG Practice Bulletin, Number 33, January 2002, Level B

Management Protocol for Severe Preeclampsia


- Admit

- Maternal Fetal Evaluation for 24 hours

- Betamethasone

- Magnesium Sulfate for 24 hours

- Anti-hypertensives if systolic BP>160 mmHg, diastolic BP>110 mm Hg (goal 130-150/80-100)

Maternal Guidelines

- Expeditious Delivery (within 72 hrs): 1 or more of following
  - Uncontrolled severe hypertension: ≥160/110 mmHg with maximum doses of 2 anti-hypertensive medications
  - Eclampsia
  - Platelet count <100,000/microL
  - AST or ALT > twice upper limit of normal with epigastric pain or RUQ tenderness.
  - Pulmonary edema
  - Compromised renal function: creatinine 1.5 mg/dl
  - Abruptio placentae
  - Persistent severe headache or visual changes
**Fetal Guidelines**
- Expeditious Delivery (within 72 hours): 1 or more of following
  - Repetitive late or severe variable decelerations
  - Biophysical profile ≤4 on 2 occasions, 4 hours apart
  - Amniotic fluid index ≤2 cm
  - Ultrasound estimated fetal weight ≤5th - 10th percentile?
  - Reverse umbilical artery diastolic flow

**Maternal Guidelines**
- Consider expectant management in setting of:
  - Controlled hypertension
  - Urinary protein of any amount
  - Oliguria (<0.5 ml/kg/hr) that resolves with routine fluid/food intake
  - AST or ALT >2X upper limit of normal without epigastric pain or RUQ tenderness

**Maternal Guidelines**
- Oliguria (<0.5 ml/kg/hr) that resolves with routine fluid/food intake

**Maternal Guidelines**
- Antepartum ward until delivery
- Strict Ins and Outs
- Blood pressure every 4-6 hours
- Daily?
  - CBC
  - Creatinine
  - Uric Acid
  - Aspartate and alanine aminotransferase
  - 24 hour urine collection for CrCl and protein
  - Increasing proteinuria not predictive

**Fetal Surveillance**
- At least daily antepartum testing
  - NST
  - BPP
  - No stillbirths or fetal compromise at birth with daily testing
  - Chari et al. AJOG 1995;173:1207-1210
- Growth scans every 2 weeks
Management protocol for severe preeclampsia

- Delivery
  - Maternal Indications
  - Fetal indications
  - Labor
  - >32-34 weeks’ gestation
- Pregnancy termination if pre-viable

Management of Severe Preeclampsia Remote From Term: Mode of Delivery?

- Retrospective review
  - Severe preeclampsia at < 34 weeks
  - 151 underwent labor induction
  - 46% success overall
    - 24-26 weeks 0%
    - 27-28 weeks 6.6%
    - 29-31 weeks 35.3%
    - 32-34 weeks 68.5%


Summary

- Outpatient management of mild preeclampsia is appropriate provided there is close surveillance and patient compliance
- Severe preeclampsia remote from term can be managed expectantly provided the appropriate resources and experience are available
- Women still die from this disease
- The cure is still delivery