The critically ill obstetric patient

Dr Judith Joss
Dept of Anaesthesia and Intensive Care
Ninewells Hospital and Medical School
“Admission of the pregnant or post partum women to the Intensive Care Unit is uncommon but may require specialised knowledge for successful management”

Stephen Lapinsky
Crit Care Med 2005;33:1616-1622

Assessment and Management may be affected by

- Physiological change associated with pregnancy
- Pregnancy specific conditions
- Presence of a fetus
- Clinicians lack of familiarity
Objectives

• Epidemiology
  ▪ The Scale of the problem
  ▪ Maternal and Fetal Outcomes in and post ICU

• Specific conditions
  ▪ Obstetric Haemorrhage
  ▪ Sepsis
  ▪ H1N1/Influenza

• Management of the Antenatal patient
  ▪ Ventilation Strategies
  ▪ Decision making around delivery
Epidemiology

• Sources of Information
  ▪ SCASMM (Scottish Confidential Audit of Severe Maternal Morbidity)
  ▪ Published work (case reports, small case series)

• The Scale of the Problem
  ▪ Death and Critical illness
    ▪ 295 UK deaths in last triennial report (13.95/100000 maternities)
    ▪ 15 deaths in Scotland every triennial report (8.6/100000 maternities)
    ▪ Every death there is 70-80 ‘near misses’ or women who become critically ill
    ▪ Approx 80 patients/yr admitted to ICU (Scotland)
CEMACH
comprehensive reporting
of maternal deaths in UK

Maternal deaths are extremely rare in the United Kingdom.

Identifying deaths related to pregnancy through causes stated on death certificates 149 women died between 2003-05; a maternal death rate of 7 per 100,000 maternities.

However more comprehensive data collection methods identified 295 women who died from conditions directly or indirectly related to pregnancy, out of more than two million births.

This gives an Enquiry derived maternal mortality rate of 13.95 per 100,000 maternities.
Causes of Maternal Death
Causes of Death and Critical Illness

- **Indirect** (new or pre-existing conditions aggravated by pregnancy)
- **Direct** (condition that could only exist due to pregnancy)
- **Maternal Mortality rate not falling**
  - 50% Obese
  - 4x ↑ in IHD
  - 3x risk of death if age >40yrs
  - 6x risk of death if black African including asylum seekers and refugees
  - Emergence of new themes (sepsis Grp A strep)
SCASMM identifying maternal morbidity

Annual report from every consultant led obstetric unit in Scotland

• MOH
• Eclampsia
• Renal or Liver dysfunction
• Cardiac arrest
• Pulmonary Oedema
• Acute Respiratory Dysfunction
• Coma
• CVA
• Status Epilepticus
• Anaphylactic Shock
• Septicaemic Shock
• Anaesthetic problem
• Massive Pulmonary Embolus
• Intensive Care Admission or CCU admission

**DEATH : SEVERE MORBIDITY RATIO**

1:60-80
Utilisation of Critical Care resource

- SCASMM identified 81 ICU/CCU admissions in 2007
  - 1.4 ICU admissions / 1000 live births
- Other research suggests that obstetric admissions account for **0.9-1.5% of all ICU admissions**
- 3% obstetric ICU admissions will die
- Ninewells hospital
  - 4500 deliveries (Tayside)
  - Expect 6 obstetric admissions/yr
  - 1.5% of all ICU admissions
  - Maternal death every 5/6 years
ICU Admissions

- Vast majority (80%) admitted Postpartum
- Those admitted antepartum there is a high fetal mortality rate (>20%)
- ICNARC data suggesting significant % of these admissions are HDU/level2 patients
  - 45% IPPV
  - 19% vasopressors
  - 3% RRT
  - 35% had LOS <2days
- 3% mortality
Database issues

• APACHE II, III, SAPS
  – All show significant difference between predicted and observed rates of mortality
    • Are we better than we think?
    • Important differences between population and that used for scoring system development?
    • Lower threshold for ICU admission?
• APACHE II probably best fit
• Difficult to do retrospective analysis
• Should our database ‘flag’ obstetric admissions?
Pregnancy specific conditions

• Pre eclampsia
  – ICH, cerebral oedema, ischaemic CVA, HELP syndrome

• Eclampsia
  – 38% antenatal, 18% intrapartum, 44% postpartum, 20% no PET

• Tocolytic pulmonary Oedema (0.3-10% of whom 15% require ventilatory support)
  – Decreased oncotic pressure, increased capillary hydrostatic pressure increases risk
  – Left ventricular dysfunction (catecholamine myocardial necrosis + diastolic dysfunction 2° to tachycardia)

• Peripartum Cardiomyopathy
  – Rare 1: 3500 but associated with 20-50% mortality
  – 36/52 to 5/12 postpartum

• Amniotic Fluid Embolus

• Obstetric Haemorrhage
  – Antepartum, Intrapartum, Postpartum
Management of Obstetric Haemorrhage

• Majority (60%) is Postpartum Haemorrhage
  – (23% vaginal delivery, 63% C-section (50% emergency 13% elective)

• Cause of PPH
  – 45% atony, 20% extension of uterine incision, 19% retained products,
    14% vaginal laceration, 14% placenta praevia

• Management of PPH

• Drugs
  – ergometrine, oxytocin, carboprost (PGF₂), factor VIIa

• Cell Salvage

• Early aggressive coagulation support

• Surgical

• Interventional Radiology
Figure 4: Numbers of haemostatic surgical procedures undertaken in cases of major obstetric haemorrhage by year (2003-2008)
Interventional Radiology

Techniques to control Obstetric Haemorrhage

- Elective or Emergency placement of vascular occlusion balloons
- Aortic occlusion balloons
- Selective Arterial embolisation or stenting
  - Glue
  - Metal Coils
  - Gelfoam / PVA particles
  - Amplatzer plugs
The role of Interventional Radiology in the management of Obstetric haemorrhage

Elective/prophylactic
Emergency

Images show selective embolisation of the uterine artery with abolition of placental ‘flare’
During the 2006 – 2008 triennium, sepsis was the leading cause of direct maternal deaths, accounting for 26 direct deaths and a further 3 deaths classified as ‘Late Direct’

Whilst maternal mortality is declining overall, maternal deaths due to sepsis have risen in recent triennia, particularly those associated with Group A streptococcal infection (GAS)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate per 100000 maternities</td>
<td>0.65</td>
<td>0.85</td>
<td>1.13</td>
</tr>
<tr>
<td>Numbers (all organisms)</td>
<td>13</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>Numbers (GAS)</td>
<td>3</td>
<td>8</td>
<td>13</td>
</tr>
</tbody>
</table>
Sepsis

“diarrhoea is an important sign of pelvic sepsis, the combination of abdominal pain and fetal loss should alert the clinician to the possibility of sepsis as well as consideration of abruption”

• Fetal loss of 45% associated with Group A Streptococcus
• Fatal Streptococcal A infections occurred between December and April
• All fatalities had had contact with young children
• Early recognition and treatment with Penicillin and Clindamycin plus consideration of Immunoglobulin
Sepsis

- Alteration in maternal immune response increases risk of sepsis
- Early warning scores/early detection difficult especially in labour
- Data for APC and EGDT very limited
Influenza A (H1N1)

- Pregnant women disproportionately affected by pandemic strains of Influenza
  - 1919 maternal mortality was 27%
  - 1958 50% female deaths were pregnant
  - 2009/10 4x greater than age matched controls, 7x more likely to go to ICU, & 7x increase in mortality

- 12 maternal deaths UK (8 confirmed H1N1)
- 17 referred to Leicester ECMO (4 deaths, 2 from ICH)
- Australia/NZ 9.1% ICU admissions were pregnant

- Very high rate of fetal loss or poor outcome
Assessment of Fetus

- Fetal viability will depend upon
  - gestational age
    - 24 weeks viability (some survivors at 21 weeks)
    - 30-32 weeks
  - Biophysiological assessment of fetus
    - Doppler assessment of fetal Heart Rate
    - CTG (cardiotocograph) fetal HR variability > 28wks
    - USS (fetal heart rate, movement, breathing,)
    - Fetal pH
Fetal Outcome

Fetal outcomes of critically ill pregnant women admitted to the intensive care unit for non obstetric causes
Rodrigo Cartin-Ceba, Ognjen Gajic, Vivek N. Iyer, Nicholas E. Vlahakis,
(Crit Care Med 2008; 36:2746 –2751)

• Fetal loss independently associated with
  • low gestational age (OR 1.2 for every gestational week below 37 wk (95% CI=1.1–1.3)
  • Shock (no independent association with vasopressor) (OR 6.85 (95% CI=1.16-58)
  • Blood transfusion (OR 7.24 95% CI=1.4–49)

• 50% fetal loss (Hazelgrove) 20% fetal loss (ICNARC)
  • 1\textsuperscript{st} trimester 65% loss
  • 2\textsuperscript{nd} trimester 43% loss
  • 3\textsuperscript{rd} trimester 5% loss
Feto-placental physiology

• Oxygen delivery to fetus depends upon
  – Maternal Oxygen delivery
  – Placental/uterine blood flow (position dependent)
  – High O₂ extraction

• Fetal oxygen extraction
  – HbF and high Hct shifts oxyhb curve to left
  – Favours O₂ extraction by fetus

• Fetal CO₂ Clearance
  – Down concentration gradient aided by lower maternal CO₂
Ventilating the Pregnant Patient

• 8x risk of difficult/failed intubation

• Non Invasive Ventilation/CPAP
  – No evidence but assume indications remain same
  – Success will depend upon patient selection

• Lung protective ventilation
  – No evidence, but assume best practice?
  – Are the pressure limits the same?
  – Is permissive hypercapnia safe?
Ventilating the pregnant patient

• What are our gas exchange goals
  – \( \text{PaO}_2 \text{ uncertain?} \ > 9.3 \text{kPa} \)
  – \( \text{PaCO}_2 \text{ do we aim for normal ‘mild hypocapnia’ of pregnancy} \)
  – To low = placental vasoconstriction
  – To high = fetal acidosis (fetal \( \text{CO}_2 \) = 1.3kPa > than maternal)
  – To high = \( R \) shift of oxyhb dissociation curve with decreased extraction of \( \text{O}_2 \)
  – In presence of good oxygenation does fetal acidosis matter?
  – Some anecdote that \( \text{PaCO}_2 \text{ range 6-8kpa is tolerated} \)

• Is there any evidence for using Bicarbonate in maternal acidosis?
Ventilating the pregnant patient

• Rescue Ventilation Strategies
  – Prone Ventilation
  – Nitric Oxide
  – APRV
  – HFOV
  – ECMO
  • Australia 2009, 68 patient received ECMO support for H1N1, 6 pregnant and 4 post partum

• Delivery of Fetus
Decision making around delivery in the critically ill

- Evidence free zone
  - Case reports
  - Largest case series = 10 patient (Tomlinson)
  - Data not captured by ICNARC or Wardwatcher

- Decision making will be influenced by viability of fetus.
- Is there maternal benefit to delivery?
  - 28% reduction in FiO2 (case series)

- What are the risks of delivery to mother and fetus?
- What method of delivery?
- How to manage delivery, IOL in presence of coagulopathy
When to deliver the fetus?

“consideration of delivery to benefit mother if intractable hypoxia or hypercarbia or possibly for fetal benefit if remains viable”

“delivery mode remains guided by obstetric indications”

vaginal vs C-section??
References

Fetal outcomes of critically ill pregnant women admitted to the intensive care unit for nonobstetric causes*

Multicenter study of obstetric admissions to 14 intensive care units in southern England
Jane F. Hazelgrove, Catherine Price, V. John Pappachan, Gary B. Smith, Crit Care Med 2001; 29:770 –775

Sepsis and Acute Renal Failure in Pregnancy

Hemodynamic assessment in a pregnant and peripartum patient
Shigeki Fujitani, Marie R. Baldisseri, Crit Care Med 2005; 33[Suppl.]:S354–S361

Critical illness in pregnancy: An overview

Obstetric Admissions to the Intensive Care Unit: Outcomes and Severity of Illness

Critically Ill Patients With 2009 Influenza A(H1N1) Infection in Canada
Anand Kumar, Ryan Zarychanski, Ruxandra Pinto, Deborah J. Cook, JAMA. 2009;302(17):1872-1879

H1N1 novel influenza A in pregnant and immunocompromised patients
Stephen E. Lapinsky, Crit Care Med 2010; 38[Suppl.]:e52–e57

Clinical review: Ventilatory strategies for obstetric, brain-injured and obese patients

Cardiopulmonary complications of pregnancy

Does delivery improve maternal condition in the respiratory compromised Gravida?


Breathing for Two Ventilating the Pregnant Patient

Obstetric intensive care unit admission: a 2-year nationwide population-based cohort study
Thank you