

# The critically ill obstetric patient

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# Is this important?

*“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**
  - **CEMACH** 7<sup>th</sup> edition, “saving mothers lives” (2003-5)
  - **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.

Confidential Enquiry into Maternal and Child Health



## Saving Mothers' Lives:

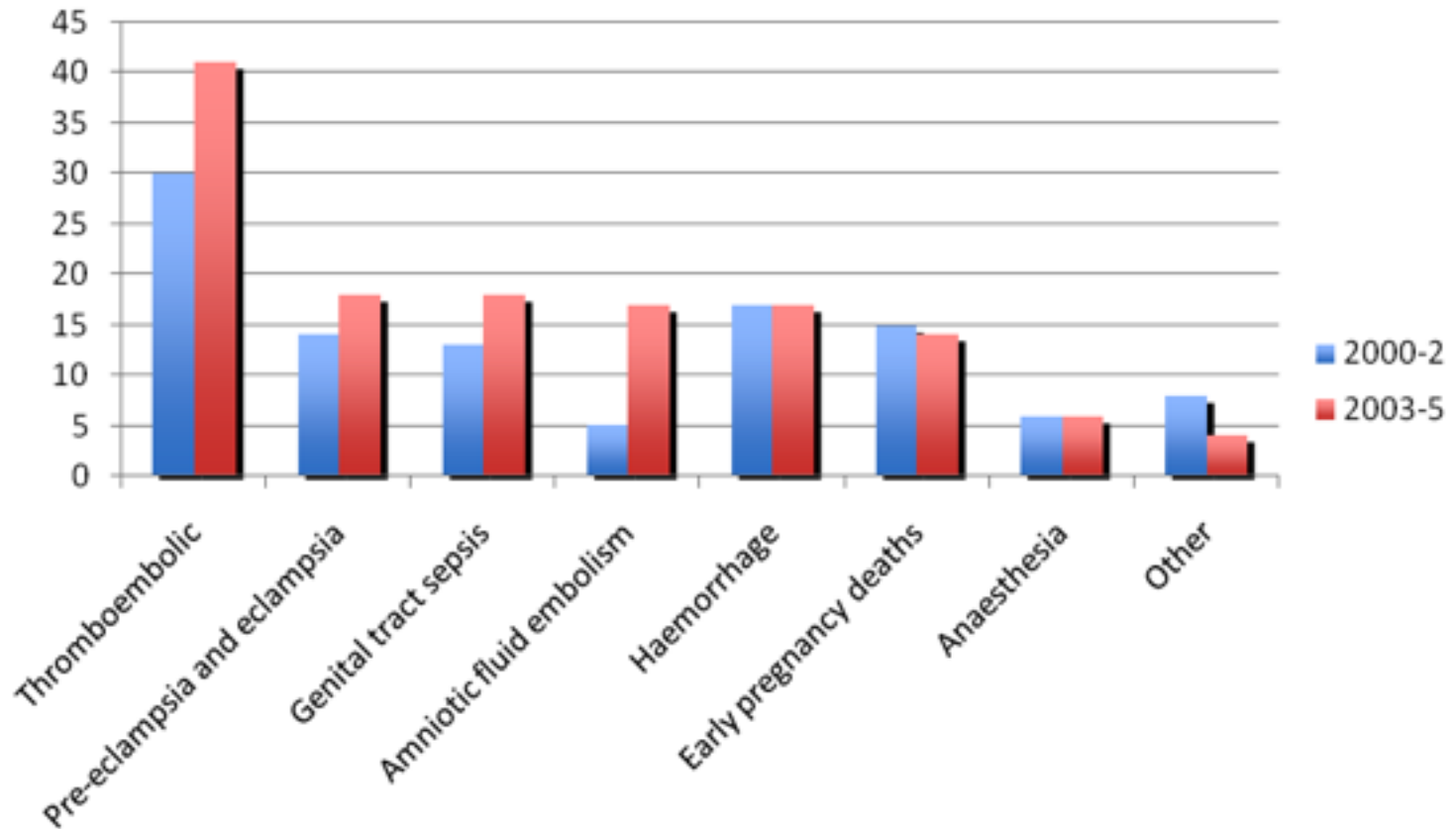
Reviewing maternal deaths to make motherhood safer - 2003-2005



December 2007

The Seventh Report of the Confidential Enquiries  
into Maternal Deaths in the United Kingdom

# 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
  - 3 x 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**



# Scottish Confidential Audit of Severe Maternal Morbidity

**6th Annual Report  
2008**



# 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?

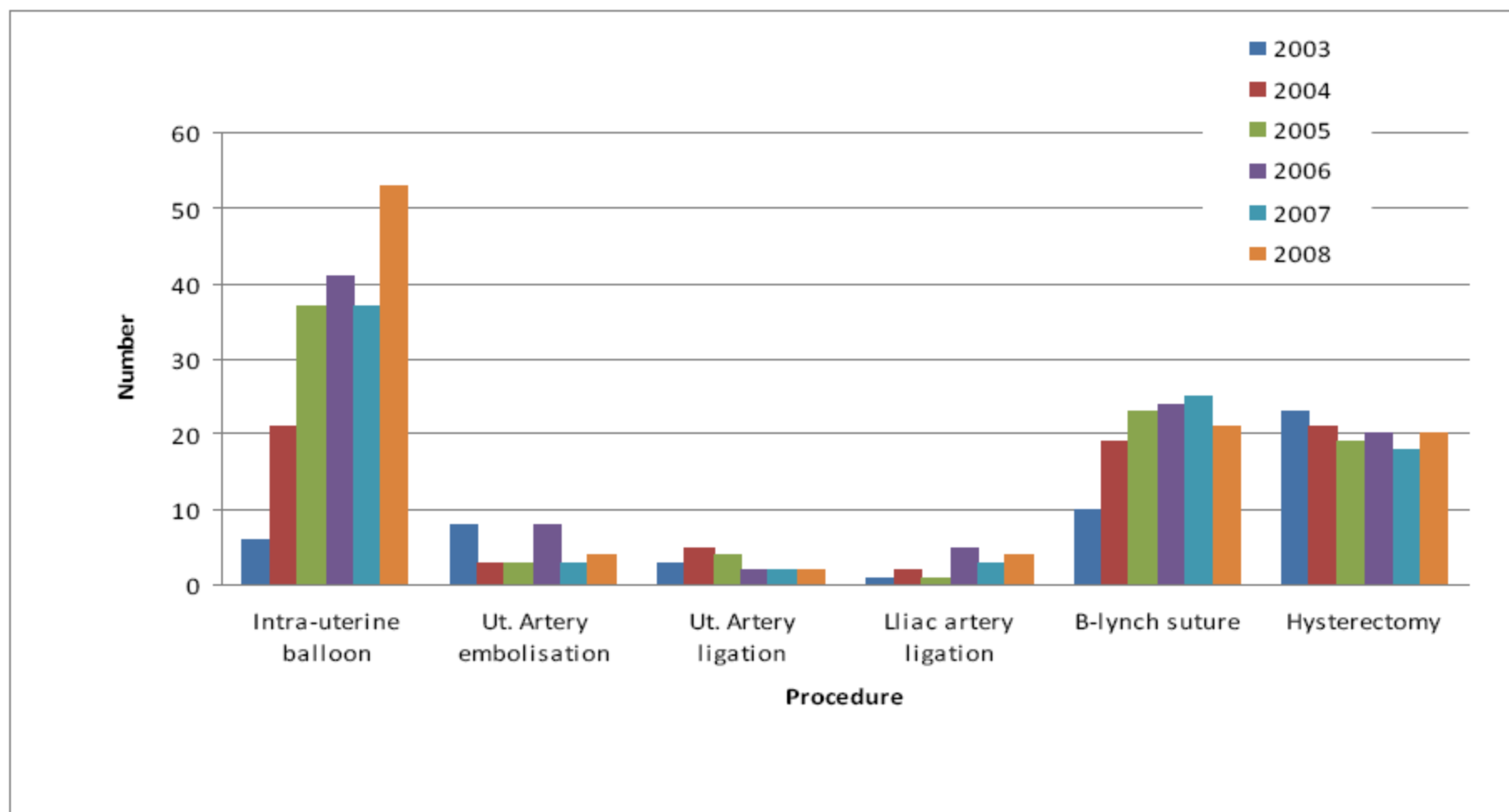
# Pregnancy specific conditions

- 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 (PGF<sub>2</sub>), factor VIIa
- **Cell Salvage**
- **Early aggressive coagulation support**
- **Surgical**
- **Interventional Radiology**

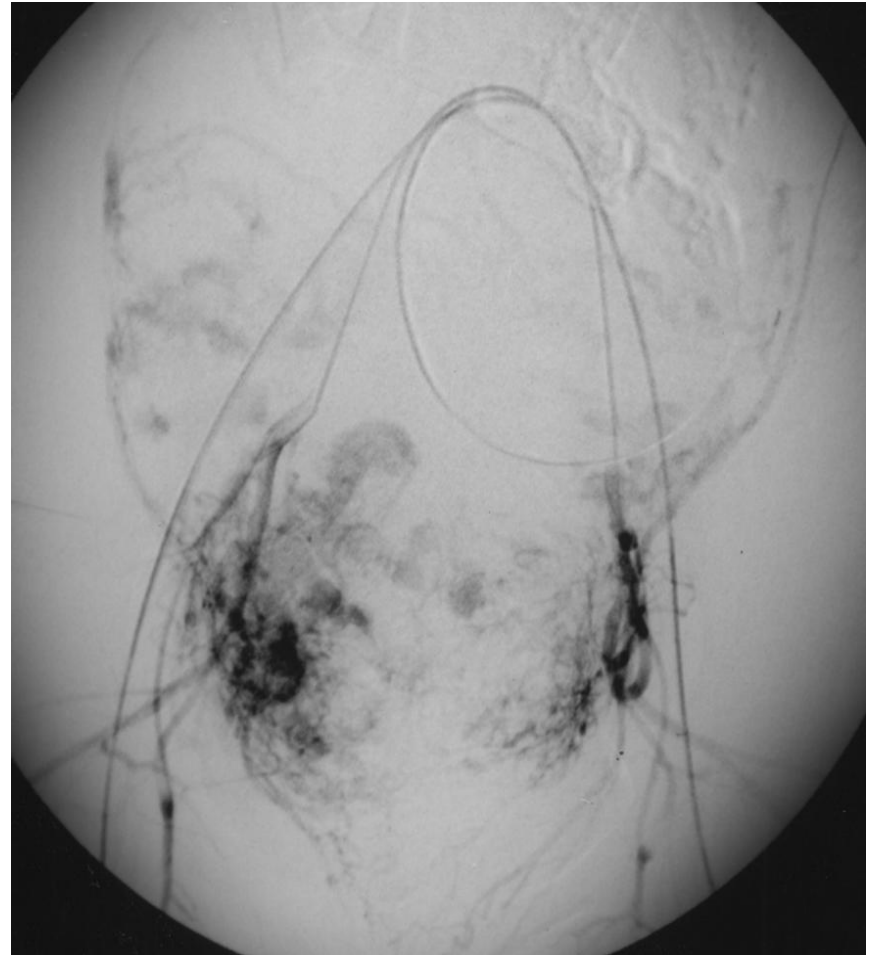
**Figure 4: Numbers of haemostatic surgical procedures undertaken in cases of major obstetric haemorrhage by year (2003-2008)**

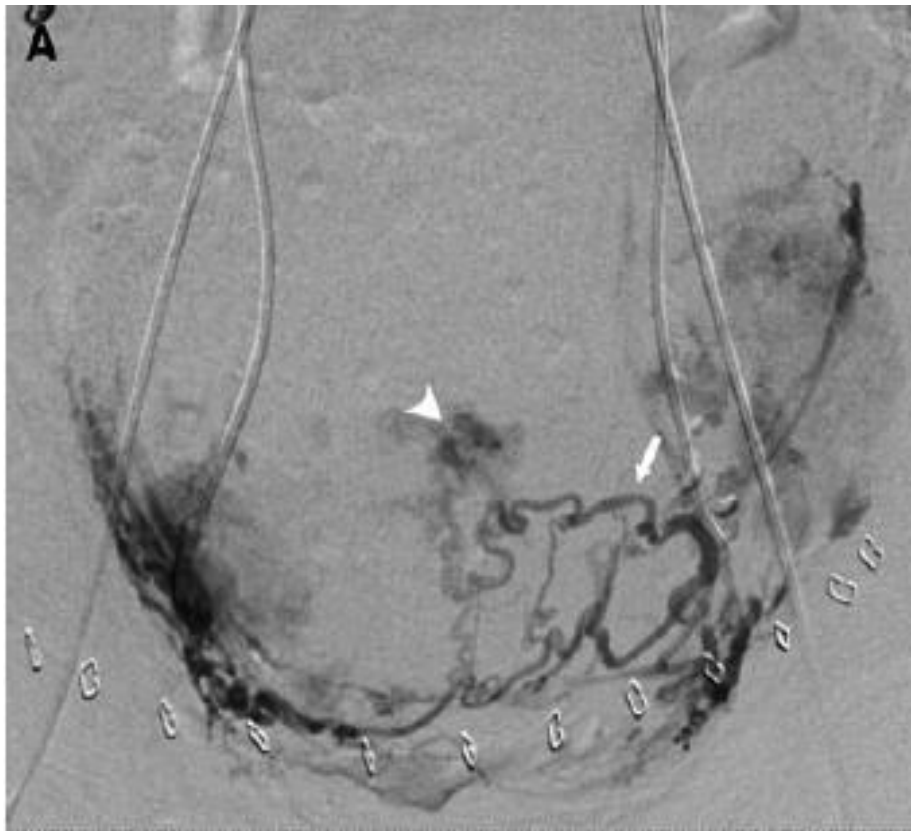


# Interventional Radiology

## 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

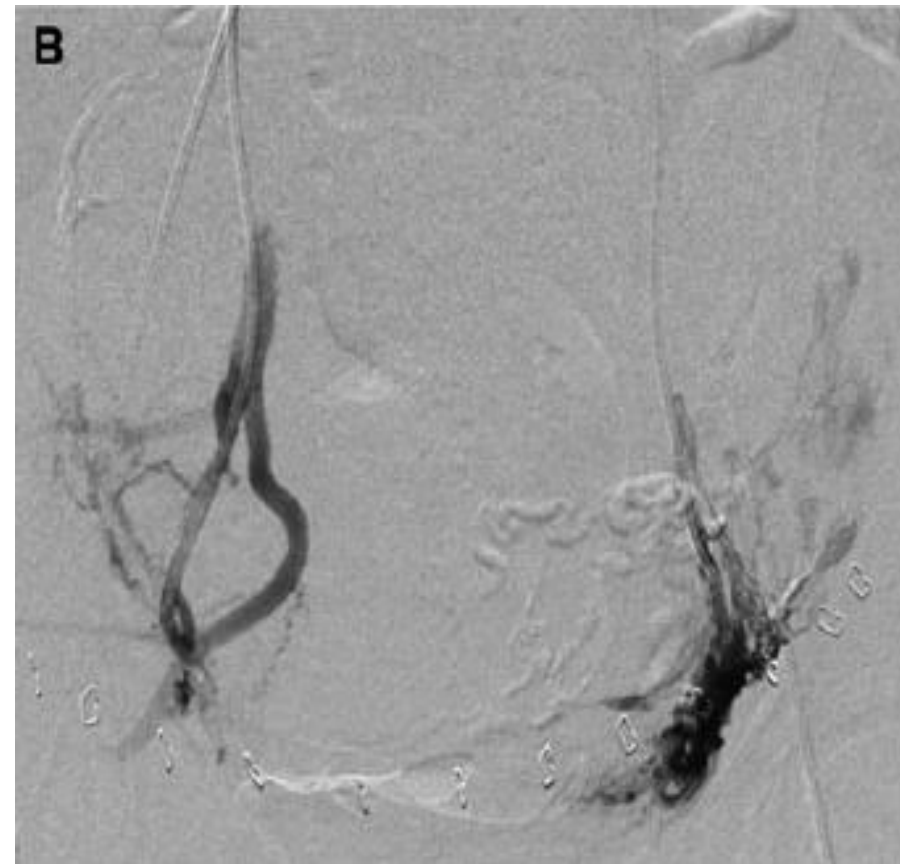




## The role of Interventional Radiology in the management of Obstetric haemorrhage

Elective/prophylactic  
Emergency

Images show selective embolisation of  
the uterine artery with abolition of  
placental 'flare'







## CMACE EMERGENT THEME BRIEFING

### #1: Genital Tract Sepsis

September 2010

#### SAVING MOTHERS' LIVES 2006-08: Briefing on genital tract sepsis

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)

	2000-2002	2003-2005	2006-2008
Rate per 100000 maternities	0.65	0.85	1.13
Numbers (all organisms)	13	21	29
Numbers (GAS)	3	8	13

# 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

OBSTETRIC EARLY WARNING CHART. **FOR MATERNITY USE ONLY**

NHS Forth Valley

NAME: \_\_\_\_\_ DOB: \_\_\_\_\_  
 CHI: \_\_\_\_\_ WARD: \_\_\_\_\_

**CONTACT DOCTOR FOR EARLY INTERVENTION IF PATIENT TRIGGERS ONE RED OR TWO YELLOW SCORES AT ANY ONE TIME**

Date :																								
Time :																								
RESP (write rate in corresp. box)	>30																							>30
	21-30																							21-30
	11-20																							11-20
	0-10																							0-10
Saturations	90-100%																							90-100%
	<90%																							<90%
O2 Conc.	%																							%
Temp	39																							39
	38																							38
	37																							37
	36																							36
	35																							35
HEART RATE	170																							170
	160																							160
	150																							150
	140																							140
	130																							130
	120																							120
	110																							110
	100																							100
	90																							90
	80																							80
	40																							40
Systolic blood pressure	200																							200
	190																							190
	180																							180
	170																							170
	160																							160
	150																							150
	140																							140
	130																							130
	120																							120
	110																							110
	100																							100
90																							90	
80																							80	
70																							70	
60																							60	
50																							50	
Diastolic blood pressure	130																							130
	120																							120
	110																							110
	100																							100
	90																							90
	80																							80
	70																							70
	60																							60
	50																							50
	40																							40
	Passed/Urine	Y or N																						
Lochia	Normal																							Normal
	Heavy / Foul																							Heavy / Foul
Pretainuria	2+																							2+
	> 2+																							> 2+
Liquor	Clear / Pink																							Clear / Pink
	Green																							Green
NEURO RESPONSE (-)	Alert																							Alert
	Voice																							Voice
	Fair / Unresponsive																							Fair / Unresponsive
Pain Score (0-3)	2-3																							2-3
	0-1																							0-1
Nausea (v)	YES (v)																							YES (v)
	NO (v)																							NO (v)
Looks unwell	YES (v)																							YES (v)
	NO (v)																							NO (v)
Total Yellow Scores																								
Total Red Scores																								

CEMACH apologises to Drs Fiona McKelvey, Chris Cairns and their colleagues at Birkenhead Royal Infirmary for not acknowledging their important role in the development of the original report. Requests for copies of the original chart in MS Excel format may be made to Dr Fiona McKelvey at: Fiona.McKelvey@fwh.scot.nhs.uk

# 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<sup>st</sup> trimester 65% loss
  - 2<sup>nd</sup> trimester 43% loss
  - 3<sup>rd</sup> trimester 5% loss

# Feto-placental physiology

- Oxygen delivery to fetus depends upon
  - Maternal Oxygen delivery
  - Placental/uterine blood flow (position dependent)
  - High O<sub>2</sub> extraction
- Fetal oxygen extraction
  - HbF and high Hct shifts oxyhb curve to left
  - Favours O<sub>2</sub> extraction by fetus
- Fetal CO<sub>2</sub> Clearance
  - Down concentration gradient aided by lower maternal CO<sub>2</sub>

# 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
  - **PaO<sub>2</sub> uncertain ? >9.3kPa**
  - PaCO<sub>2</sub> do we aim for normal 'mild hypocapnia' of pregnancy
  - To low = placental vasoconstriction
  - To high = fetal acidosis (fetal CO<sub>2</sub> = 1.3kPa > than maternal)
  - To high = R shift of oxyhb dissociation curve with decreased extraction of O<sub>2</sub>
  - In presence of good oxygenation does fetal acidosis matter?
  - Some anecdote that **PaCO<sub>2</sub> 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 FiO<sub>2</sub> (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??*



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Thank you