Standardisation of multidisciplinary obstetric emergency training nationally.
Maternal Collapse

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Outline

• Purpose of the guideline, scope & methods
• Physiological changes of pregnancy
• Maternal cardiac arrest
  ▫ Causes
  ▫ Management
• Areas of implementation & governance
Purpose & scope

• To provide evidence based guidance to healthcare professionals involved in the management of the pregnant woman who has developed a cardiac arrest
Methods

- Review of other published guidelines
- Literature review
- Input from & peer review by interested stakeholders
  - Anaesthesia, midwifery, obstetrics & resuscitation officers.
Maternal Collapse

• Defined as an acute event involving the cardiorespiratory and cerebrovascular systems, resulting in reduced or absent conscious levels at any stage in pregnancy and up to six weeks after delivery.
• Could be sub-divided into:
  ▫ Collapsed but responsive
  ▫ Collapsed but unresponsive
    • With or without a pulse
Incidence of Maternal Cardiac Arrest

• Rare event so true incidence difficult to determine
• UK Confidential Enquiries (2003-2011)
  ▫ 1 in 20-30,000 pregnancies.
• United States (1998-2011) Anesthesiology 2014 Apr;120(4):810-8
  ▫ 4843 cases in 56,900,512 (or 1 in 12,000) hospitalisations for delivery.
  ▫ Database designed to capture a representative sample of approximately 20% of all U.S. hospital admissions.
  ▫ 58.9% survived to discharge.
Physiology of Pregnancy

• Changes to meet needs of growing fetus & placenta.
• Cardiovascular
  ▫ Increase Blood & Red Cell volume +35%
  ▫ Larger increase Plasma volume +45% -dilutional anaemia
  ▫ Increase Stroke volume +30%
  ▫ Increase Heart rate +15 to 30%
  ▫ Increase Cardiac output +40%
  ▫ Decrease SVResistance –15%
    • BP remains at pre-pregnant levels
Physiology of Pregnancy

• Respiratory
  ▫ Increase O2 consumption +20 to 50%
  ▫ Increase MV +50%
  ▫ Increase TV +40%
  ▫ Increase RR +15%
• Increased O2 demand with decreased O2 reserve (FRC)
  ▫ Desaturate very quickly
Causes of Maternal Arrest

- **BEAU-CHOPS**
- **Bleeding/ DIC**
- **Embolism: pulmonary/coronary/amniotic fluid embolism**
- **Anaesthetic complications**
- **Uterine atony**
- **Cardiac disease: myocardial ischaemia / infarction, aortic dissection, cardiomyopathy**
- **Hypertension, preeclampsia, eclampsia**
- **Other: standard differential diagnosis of 6 Hs & Ts**
  - Hypoxia, Hyper/Hypokalaemia, Hypo/Hyperthermia, Hydrogen ions (acidosis), Hypoglycaemia, and Tension pneumothorax, Tamponade, Toxins, Trauma.
- **Placental abruption/praevia.**
- **Sepsis.**
Management of Maternal Collapse
<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call for help!</td>
<td>□ Call “OB Code”</td>
</tr>
<tr>
<td>Start CPR</td>
<td>□ Call neonatal team</td>
</tr>
<tr>
<td></td>
<td>□ AED/defibrillator</td>
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<tr>
<td></td>
<td>□ IMMEDIATE BLS</td>
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<tr>
<td></td>
<td>□ Adult code cart</td>
</tr>
<tr>
<td></td>
<td>□ Adult airway equipment</td>
</tr>
<tr>
<td></td>
<td>□ Backboard</td>
</tr>
<tr>
<td></td>
<td>□ Scalpel/Cesarean pack</td>
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<tr>
<td></td>
<td>□ Assign timer/documenter</td>
</tr>
<tr>
<td>C Circulation</td>
<td>□ Left uterine displacement (manual)</td>
</tr>
<tr>
<td>Chest compressions</td>
<td>□ Hands mid-sternum</td>
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<tr>
<td></td>
<td>□ 100 compressions/min</td>
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<tr>
<td></td>
<td>□ PUSH HARD! PUSH FAST!</td>
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<tr>
<td></td>
<td>□ Change compressors every 2 min</td>
</tr>
<tr>
<td></td>
<td>□ Obtain IV access above diaphragm</td>
</tr>
<tr>
<td>A Airway</td>
<td>□ Chin lift/jaw thrust</td>
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<tr>
<td></td>
<td>□ 100% O₂ at 10–15 L/min</td>
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<tr>
<td></td>
<td>□ Use self-inflating bag mask</td>
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<tr>
<td></td>
<td>□ Oral airway or</td>
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<tr>
<td></td>
<td>□ Experienced personnel: Intubation with 6–7.0 ETT or</td>
</tr>
<tr>
<td></td>
<td>□ Supraglottic airway (e.g., LMA)</td>
</tr>
<tr>
<td></td>
<td>□ Do not interrupt chest compressions!</td>
</tr>
<tr>
<td>B Breathing</td>
<td>□ If not intubated: 30 compressions to 2 breaths</td>
</tr>
<tr>
<td></td>
<td>□ If intubated: 10 breaths per min</td>
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<tr>
<td></td>
<td>(500–700 mL per breath)</td>
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<tr>
<td></td>
<td>□ Administer each breath over 1 s</td>
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<tr>
<td>D Defibrillate</td>
<td>□ Pads front and back</td>
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<tr>
<td></td>
<td>□ Use AED or Analyze/defibrillate every 2 min</td>
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<tr>
<td></td>
<td>□ Immediately resume CPR for 2 min</td>
</tr>
<tr>
<td></td>
<td>□ Prepare for delivery</td>
</tr>
<tr>
<td>E Extract FETUS</td>
<td>□ Aim for incision by 4 min</td>
</tr>
<tr>
<td></td>
<td>□ Aim for fetal delivery by 5 min</td>
</tr>
</tbody>
</table>
Collapsed & unresponsive

• Pulse present?
  ▫ Yes
    • Place in left lateral position & measure BP.
  ▫ No pulse
    • Activate the emergency response team
    • Commence Basic Life Support
      • Compressions  Airway  Breathing
Resuscitation Team

- Should comprise
  - The locally agreed adult medical emergency team
  - An obstetrician capable of performing Caesarean Delivery.
  - Neonatal team should be called early if delivery is planned.
- Stand alone maternity hospital
- General hospital
  - May require creation of specific code for maternal cardiac arrest so that appropriate personnel arrive.
Chest Compressions

- 100/minute to depth of 5-6 cm
  - 2-3cm higher on sternum in 3\textsuperscript{rd} trimester.
- No interruptions if airway secured with endotrachial tube
- 30 compressions to 2 breaths
  - If trachea not intubated.
- Person doing compressions changes every 2 mins
- ACLS recommends monitoring exhaled CO2 as an indicator of compression effectiveness.
Left Uterine Displacement (LUD)

- Gravid uterus may cause aortocaval compression
  - If uterus palpable at umbilicus
  - > 20/40 gestation
  - Polyhydramnios, multiple pregnancies etc

- Compressions most effective
  - Patient supine on hard surface
  - Manual displacement of uterus to the left.
  - Wedges, pillows etc – compressions not as effective
Manual LUD
Defibrillation

- Treatment of Ventricular fibrillation
- Standard Defibrillator or Automatic External Defibrillators (AEDs)
  - AEDs useful where people may not have rhythm recognition skills.
  - Be familiar with what’s in your own unit.
- Only interrupt compressions to assess rhythm
- 150 joules shock for adult
Airway Management

- Head-tilt, chin-lift, jaw-thrust to open airway
- Oropharyngeal (Guedel) airway
- Bag mask ventilation to visible chest rise
- Laryngoscopy & intubation by experienced personnel
- Supraglottic airways e.g. LMA may be used.
- Focus is on oxygenation & ventilation by whatever means
- Pregnant at risk of gastric aspiration
  - Cricoid pressure may reduce risk
  - May also obstruct ventilation
Guidelines support rapid delivery of fetus in setting of aortocaval compression
  ▫ Emptying gravid uterus improves venous return
• No response to advanced life support measures incl adequate LUD
• Aim to deliver fetus at 5 mins
  ▫ Maternal & neonatal survival reported with longer intervals of arrest.
• Perform PMCD at site of maternal arrest
• Resus trolley should have surgical pack for CD

Peri-mortem Caesarean Delivery (PMCD)
PMCD


• Review of 94 published cases
  ▫ Where data was deemed adequate
• 54% survived to hospital discharge
• PMCD beneficial in 32%
• Condition not worsened in any
• Only 4 of 94 delivered within 5 mins
Intravenous Access

- Equipment for rapid delivery of large, warmed fluid volume should be available
  - Give fluids above the diaphragm if possible.
  - Massive haemorrhage protocol
  - Rapid infusors
  - Ultra sound for central venous access
  - Intra-osseous needle on resus trolley
Resuscitation Drugs

- Same drugs & doses used as for non-pregnant patients
- Lipid emulsion on all resus trolleys
  - Treatment of local anaesthetic toxicity
Post Resuscitation

- Treatment for specific causes
  - e.g. pulmonary embolus

- There should be a defined pathway for transfer of a successfully resuscitated patient to the Intensive Care Unit (ICU)
  - Recently published HSE guideline in conjunction with National Clinical Programs in Anaes, Crit Care & Obs.

- Post- resuscitation measures
  - e.g. therapeutic hypothermia
Guidelines for the Critically Ill Woman in Obstetrics

Obstetric & Gynaecology, Anaesthetic and Critical Programmes
Clinical Strategy & Programmes Division
Health Service Executive
Quality Improvement

- Designated lead for resuscitation in each unit
- All clinical staff should have adequate & up to date resuscitation skills
- All cases of maternal collapse should be reviewed through a clinical governance process
- Periodic emergency drills within a hospital
  - Anaesthesia, obstetrics, neonatal, midwifery
How to deliver standard multidisciplinary training?

• BLS locally
• ? UK PROMPT (Practical Obstetrical Multi-Professional Training) style courses
• ? Multidisciplinary simulation laboratory sessions
  ▫ College of Anaesthetists & anaesthetic department of some hospitals
  ▫ “Pregnant” mannequins available to simulate
    • Contractions,
    • CTG monitoring,
    • Breech, instrumental delivery,
    • Shoulder dystocia,
    • Haemorrhage etc
Key Performance Indicators

- Evaluate the multitude of contributing factors and interventions relevant to the scenario.
- Cardiac arrest KPIs
  - early defibrillation, effective chest compressions, and adequate oxygenation.
- Utstein reporting templates
  - Recommended by AHA & European Resus Council etc
  - Collect a multitude of data but most important:
    - Collapse time to 1st CPR attempt
    - Collapse time to 1st defib shock.
    - Collapse time to PMCD (where appropriate)
Take Home Message

- Each obstetric unit should have a designated lead person for resuscitation.
- All healthcare providers within the unit should have adequate & up to date resuscitation skills.
- Standard adult resuscitation protocols (with the addition of left uterine displacement) are applicable to the pregnant woman.
- PMCD in setting of aortocaval compression should be performed as soon as possible (ideally within 5 minutes) if there is no response to adequate resuscitation manoeuvres including LUD.
Guidelines reviewed

- The American Heart Association 2010 ACLS guidelines for cardiopulmonary resuscitation in special situations (pregnancy).
- The Society for Obstetric Anaesthesia and Perinatology 2014 consensus statement on the management of cardiac arrest in pregnancy.
- The Royal College of Obstetrics and Gynaecology 2011 maternal collapse in pregnancy and the puerperium guideline.
- The European Resuscitation Council 2010 guidelines on cardiac arrest in special circumstances (pregnancy).