CARDIAC ARREST IN PREGNANCY: 10 THINGS TO KNOW

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1. CV DEATH PREGNANCY EMERGING AS MAJOR PROBLEM

http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html
INCIDENCE

1:12,000 admissions for delivery

Globally 800 maternal deaths daily

1:141 deliveries near misses

Number of high risk women undergoing pregnancy is increasing

Knowledge deficits and poor resuscitation skills may contribute
PREGNANCY RELATED DEATHS: CAUSES

Percentage Pregnancy Related Deaths US 2011

http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html
MATERNAL DEATHS
CVD: UK

Rate: 2.31 per $10^5$

CMACE BJOG 118 (Suppl. 1): 1-203
RATE OF SURVIVAL

Rate of survival to hospital discharge may approach 60%, higher than most populations.

Knowledge deficits and poor resuscitation skills contribute poor outcomes.

Mhyre, JM et al. 2014 Anesthesiology; 120: 810
Einov S et al. 2012 Resuscitation; 83: 1191
LEADING CAUSES

Aesthetic complications
Bleeding/DIC/uterine atony/placenta abruptio/previa
Cardiac disease (MI/dissection/cardiomyopathy)
Drugs
Embolism
Fever/sepsis
General nonobstetric causes (H and T’s)
Hypertension/preeclampsia/eclampsia
### HIGHEST RISK LESIONS

<table>
<thead>
<tr>
<th>Myocardial infarction</th>
<th>NYHA class III or IV symptoms*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical valve</td>
<td>Severe pulmonary hypertension*</td>
</tr>
<tr>
<td>Complex CHD</td>
<td>Significant LV dysfunction*</td>
</tr>
<tr>
<td>- System RV</td>
<td>Severe aortic or mitral stenosis*</td>
</tr>
<tr>
<td>- Fontan circulation</td>
<td>Severe coarctation*</td>
</tr>
<tr>
<td>- Other</td>
<td></td>
</tr>
</tbody>
</table>

#### Aortic Dilatation
- Marfan 40-45 mm
- Bicuspid AV 45-50

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*PREGNANCY CONTRAINDICATED
CONCERNS

The majority of serious cardiac complications of pregnancy occur in women not recognized as having heart disease prior to pregnancy.

In Illinois almost 30% of cardiac deaths felt to be potentially preventable.
2. **HIGH QUALITY CPR/ACLS IS CRITICAL**

More rapid development of hypoxemia  
Reduced functional residual capacity  
O₂ saturation curve shifted to right: higher O₂ partial pressure required for adequate maternal oxygenation  
Starling forces narrow oncotic pressure-wedge pressure gradient increasing risk of pulmonary edema  
Increased aspiration risk
3. MANY CPR RESUSCITATION PARAMETERS ARE THE SAME

Compression rate, depth, hand placement, back board, minimal interruptions in compressions are the same but....

Management decisions depend on gestational age

Aortocaval compression important after 15 weeks

Fundal height approximately

1 hand below umbilicus

Image: NHS clinical guidelines 07043 Essex
BLS CONSIDERATIONS IN PREGNANCY

Aortocaval compression

Lateral Uterine Displacement

Positioning of hands for CPR should be the same

Don’t transport patient: CPR quality diminishes

A. Manual LUD, performed with one-handed technique. B. Two-handed technique during resuscitation.
4. **VFIB = DEFIB**

Staff on obstetrical unit may not have experience in ECG recognition

May wish to consider AED

Anterolateral pad placement with lateral pad under the breast tissue
5. ADDITIONAL ACLS CONSIDERATIONS

Airway management more difficult
More difficult to ventilate: Use capnography if available
IV drugs above diaphragm
Do not delay to assess fetus
6. ACLS: ARRHYTHMIA SPECIFIC RECOMMENDATIONS

For refractory Vfib: Amiodarone 300 mg rapid infusion followed by 150 mg doses as needed
Epinephrine recommended over vasopressin
Atropine only for bradycardia
Calcium for magnesium
No medication should be withheld out of concerns for fetal teratogenicity
Do not alter drug doses
No fetal assessment
Rare case reports of hypothermia use after ROSC. Decide on individual basis
7. TIMELY PERIMORTEM C-SECTION
LIFESAVING: 4 MINUTE RULE

Should be performed within 5 minutes
Should occur at site of arrest
Facilitates maternal resuscitation
Early delivery decreases risk of neurologic damage to baby
MATERNAL SURVIVAL BY TIME TO C-SECTION

Data extraction of published cases of maternal cardiac arrests 1980-2010

94 cases 51/94 mothers survived to discharge

PMCD beneficial in 31.7% of cases and not harmful in any case

In hospital arrest and PMCD within 10 minutes associated with better maternal outcomes

Einov S et al. 2012 Resuscitation 83: 1191
NEONATAL OUTCOMES BY TIME TO C-SECTION

Mean times to delivery in survivors 14.1±11 minutes
Mean times to delivery in non-survivors 22 ± 13 minutes

Einov S et al. 2012 Resuscitation 83: 1191
### NEONATAL NEUROLOGIC FUNCTION BY TIME TO C-SECTION

**Table 1.** Perimortem cesarean deliveries with surviving infants with reports of time from maternal cardiac arrest to delivery of the infant, 1985-2004.

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Gestational age (wk)</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>25-42</td>
<td>8 (normal infant)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(retinopathy of prematurity and hearing loss)</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td>3 (condition not reported)</td>
</tr>
<tr>
<td>6-10</td>
<td>28-37</td>
<td>1 (normal infant)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 (neurologic sequelae)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 (condition not reported)</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>11-15</td>
<td>38-39</td>
<td>1 (normal infant)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 (neurologic sequelae)</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>&gt; 15</td>
<td>30-38</td>
<td>4 (normal infants)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 (neurologic sequelae)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 (respiratory sequelae)</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

8. **PROTOCOLS IMPERATIVE**

Maternal Cardiac arrest team

- adult resuscitation team
- obstetrics
- anesthesia
- neonatology

Leadership more complicated

Special Equipment

- scalpel
- neonatal resuscitation equipment
9. PRACTICE MAKES PERFECT
10. CENTRAL REGISTRIES NEEDED

A central registry of cases of maternal near miss and cardiac arrest with documentation of both process and outcome should be established (Class I, Level of Evidence C)

A standardized training course in maternal resuscitation should be developed. (Class I; Level of Evidence C

Jeejeebhoy FM et al.: Cardiac Arrest in Pregnancy

Circulation 2015; 132;00-00
DOI:10.1161/CIR.00000000000000300
Pregnant prosecutor, 33, dies suddenly at home 'after going into cardiac arrest'.
THANK YOU!
LEADING CAUSES

Bleeding/DIC
Embolism
Anesthetic complications
Uterine atony
Cardiac disease (MI/dissection/cardio-myopathy)
Hypertension/preeclampsia/eclampsia
Other (standard differential)
Placenta abruptio/previa
Sepsis
CAUSES OF MATERNAL CARDIAC ARREST

- Pulmonary embolism
- Amniotic fluid embolism
- Drugs: magnesium sulphate
- local anaesthetic
- illicit drugs
- Haemorrhage: splenic artery rupture
- hepatic rupture
- uterine (antepartum
- haemorrhage/
- postpartum
- haemorrhage)

- Eclampsia
- Intracranial haemorrhage
- Anaphylaxis
- Aortic dissection
- Cardiac causes: arrhythmias
- myocardial infarction
- cardiomyopathy
- Hypoglycaemia
- Sepsis

Image RCOG Greentop Guideline 2011
MATERNAL SURVIVAL BY RHYTHM

Maternal Presenting Rhythm
N = 83

Einov S et al. 2012 Resuscitation; 83: 1191
NEONATAL SURVIVAL BY MATERNAL RHYTHM

Maternal Presenting Rhythm
N = 92

- "Cardiac Arrest": 15 survived, 4 died
- VT/VF: 18 survived, 3 died
- PEA: 3 survived, 7 died
- Aystole: 15 survived, 8 died
- Bradyarrhythmia: 4 survived, 3 died

Einov S et al. 2012 Resuscitation; 83: 1191
Pregnant prosecutor 'killed' in her home 'after going missing'

- Sarita Wright Lucas, who was six months pregnant, went missing on Sunday and investigations are underway.
- Her unborn daughter, Claire, also passed away.
- Her husband Tony Lucas, a football coach at the University of Delaware, said: 'I don't think I can ever come to terms with it'.
- Wright Lucas had worked as a deputy attorney general in the Delaware Attorney General's Office since 2008 and was considered a rising star.

By Lydia Warren for MailOnline