Standardisation of multidisciplinary obstetric emergency training nationally.
Maternal sepsis

Professor Michael Turner
UCD Centre for Human Reproduction
Coombe Women and Infants University Hospital
Maternal sepsis in the UK

- Mortality late 1980s: 0.4/100,000 maternities
- Mortality 2006-8: 1.13/100,000 maternities
- Leading cause of direct death
- Increase mainly community – acquired Group A streptococcus postpartum

(CMACE, 2011)
Challenges of maternal “sepsis”

- Terminology and classification
- Incidence
- Early diagnosis
- Effective management
- Pregnancy considerations
Terminology

- Maternal sepsis?
- Obstetric sepsis?
- Puerperal sepsis?
- Maternal septicaemia?
- Maternal infection?
Incidence of infection

- Success of prevention/vaccinations?
- Population served?
- Diagnostic criteria?
- Healthcare resources?
- Incidence of obstetric interventions?
- Coding/IT systems?
- Hospital or community?
Sepsis (ICD-10 8th Edition)

- Clinical syndrome
- Infection and systemic inflammatory response (SIRS)
- Blood culture may not be helpful

(DOH, 2015)
Maternal infection

• Infections specific to pregnancy
• Infections aggravated by pregnancy
• Infections incidental to pregnancy
Pregnancy-specific infections

1. Chorioamnionitis
2. Endometritis ± retained products
3. Perineal infections
4. CS wound infections
5. Lactational mastitis

• May progress to bacteraemia or sepsis
Chorioamnionitis/Endometritis

- Clinically subtle or florid
- Site of infection not visible
- Microbiological access difficult
- Microbiology may be unhelpful
- Placental bed vulnerable to bacteraemia
- Associated with cervical dilatation and PSROM
- Oligo-hydramnios decreases antibiotic tissue levels
- Timing of delivery (or ERPC) challenging
Wound, perineal, breast infections

- Associated with pain, discharge
- Erythema, swelling visible
- Diagnosis can be made early
- Microbiological cultures feasible
- Sepsis is rare
- Physiological changes resolving
- Choice of antibiotics easier
- Often present in community setting
Pregnancy non-specific infections

• Increased susceptibility e.g. urinary tract toxoplasmosis listeria

• Increased severity e.g. influenza, varicella

• Hesitancy e.g. prophylaxis, treatment

• Emerging organisms

(Jamieson et al, 2006)
Challenges in pregnancy

- Physiological changes may alter recognition
- Changes alter diagnostic criteria
- Modulation of immune system
- Altered pharmacokinetics
- Risks to the fetus
- Aorto-caval compression
- Vulnerability of uterine cavity
Maternal Cardiovascular Changes

[Graph showing percentage change over weeks of gestation for cardiac output, stroke volume, and heart rate]
Vital signs in pregnancy

- HR: ↑ by 15 – 20 /min by T3
- Temperature: no change
- BP: diastolic decreases up to 28 weeks
- RR: increased 1 – 2/min

(Tan and Tan, 2013)
White cell count
Immune modulation
C-reactive protein

Fig. 1. Distribution of C-reactive protein (CRP) in non-pregnant controls and normal pregnant women in the first, second and third trimesters of gestation. The boxes represent the interquartile range (IQR), with the upper and lower edges of the boxes representing the 75th and 25th percentiles, respectively. The central horizontal lines within the boxes represent median levels for each group. The vertical whiskers above and below the boxes represent the range of outlying data points up to 1.5 times the IQR, (a) P < 0.001 vs. non-pregnant controls.
Renal changes
Antibiotic pharmacokinetics
Two patients
Uterine infection
Maternal vital signs

- Recordings dispersed throughout records
- No trending of vital signs
- Measurements not simultaneous
- Potential for omissions
- RR not recorded
- Lack of standardisation of EWS
- No audit or validation
Maternal vital signs post-IMEWS

- Recording consolidated
- Trends obvious
- Measurements contemporaneous
- Omissions obvious
- Recordings improved especially RR
- Charts, escalation standardised
- National audits

(Maguire et al, in press)
Surviving Sepsis Campaign (SSC)

- First guideline published 2004
- Literature updated autumn 2012
- Critical Care Medicine 2013;41:580
- NCEC guideline for adult sepsis Nov. 2014
Definition of Sepsis

Sepsis is a systemic inflammatory response (SIRS) due to confirmed or suspected infection

(SSC, 2013)
Surviving Sepsis Campaign

- Definitions were agreed for the non-pregnant adult patient
- Special considerations for paediatric patients
- No considerations for pregnancy
- No agreed criteria for SIRS in pregnancy!

(SSC, 2004)
## Sepsis Six Box

<table>
<thead>
<tr>
<th></th>
<th>NEWS</th>
<th>IMEWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>&gt; 38.3°</td>
<td>&gt; 37.9°</td>
</tr>
<tr>
<td>RR/min</td>
<td>&gt; 20</td>
<td>&gt; 19</td>
</tr>
<tr>
<td>HR/min</td>
<td>&gt; 90</td>
<td>&gt; 99</td>
</tr>
<tr>
<td>WCC (x 10⁹/L)</td>
<td>&gt; 12.0</td>
<td>&gt; 16.9</td>
</tr>
<tr>
<td>Hyperglycaemia (not DM)</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Altered mental state</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

(HSE/RCPI, 2014)
CONSIDER MATERNAL SEPSIS

Are 2 or more of the following SIRS criteria present?

Temperature ≥38°C or <36°C
Respiratory rate ≥20 breaths per min
Heart rate ≥100 beats per min
White cell count >16.9 or < 4.0x10⁹/L
Bedside glucose >7.7mmol/L (in the absence of diabetes)
Acutely altered mental status

AND

If infection is suspected after medical review

Intervention: within one hour

COMPLETE SEPSIS SIX

1. Appropriate cultures*
2. FBC +/- lactate
3. Start urine output chart
4. IV antimicrobials
5. Consider IV fluid bolus**
6. Maintain O₂ (94-98%)

*e.g. blood, wound, vaginal swab, urine etc
**exercise caution in presence of pre-edampsia

(HSE, 2014)
Irish Maternity Early Warning System (IMEWS) Escalation Guideline

**ALL IMEWS TRIGGERS**
Consider context and complete full clinical assessment. Implement measures to reduce triggers if appropriate. Complete a full set of observations on IMEWS immediately. Inform the Midwife in charge.

1 **YELLOW**
- Repeat full set of observations on IMEWS after 30 and before 60 minutes.

2 **YELLOW OR 1 PINK**
- Call the obstetrician to review.
- Repeat a full set of observations after 30 minutes.

3 **YELLOW OR 2 PINKS**
- Call the obstetrician and request immediate review.
- Repeat a full set of observations within 15 minutes or monitor continuously.

**ALL IMEWS TRIGGERS**
- Liaise with the Midwife in charge.
- Document all communication including:
  - Redefined plan of care
  - Ongoing frequency of observations

**IMPORTANT:**
1. If concerned about a woman, escalate care regardless of triggers.
2. If action is not carried out as above, CMM/Midwife in charge must contact the senior obstetrician on duty.
3. Document all communication and management plans in notes.

**CONSIDER MATERNAL SEPSIS**
Are 2 or more of the following SIRS criteria present?
- Temperature <35°C or >39°C
- Respiratory rate ≥20 breaths per min
- Heart rate ≥90 beats per min
- White cell count >12.0 or < 4.0 x 10^9/L
- Blood glucose >7.7 mmol/L (in the absence of diabetes)
- Acutely altered mental status

**AND**
If infection is suspected after medical review

**Intervention: within one hour**

<table>
<thead>
<tr>
<th>TAKE 2</th>
<th>COMPREHENSIVE SEPSIS SIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Appropriate antibiotic</td>
</tr>
<tr>
<td>2.</td>
<td>FBC +/− lactate</td>
</tr>
<tr>
<td>3.</td>
<td>Start urine output chart</td>
</tr>
<tr>
<td>4.</td>
<td>Maintain O2 (≥ 98%)</td>
</tr>
<tr>
<td>5.</td>
<td>Consider IV fluid bolus</td>
</tr>
<tr>
<td>6.</td>
<td>IV antibiotics</td>
</tr>
</tbody>
</table>

* e.g.: Bradycardia, altered level, one or more cultures positive in presence of pre-eclampsia
Maternal bacteraemia (Coombe)

- 37584 women (2009-12)
- 58 cases (0.15%)
- No deaths, two septic shock
- Four miscarriages, two stillbirths

(O’Higgins et al, 2014)
Maternal bacteraemia (Coombe)

- Antepartum (n=19): Urinary tract
  *E. coli*
- Intrapartum (n=20): Genital tract
  GBS
- Postpartum (n=19): Genital tract
  *E. coli*

(O’Higgins et al, 2014)
# Maternal bacteraemia (Coombe)

<table>
<thead>
<tr>
<th>Place of birth</th>
<th>Bacteraemia (n=58)</th>
<th>Rest (n=37584)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>47%</td>
<td>69%</td>
</tr>
<tr>
<td>Rest of Europe</td>
<td>12%</td>
<td>17%</td>
</tr>
<tr>
<td>Africa</td>
<td>16%</td>
<td>4%</td>
</tr>
<tr>
<td>Asia</td>
<td>24%</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
<td>4%</td>
</tr>
</tbody>
</table>

(O’Higgins et al, 2014)
Maternal bacteraemia (Coombe)

- Incidence low
- Severe sepsis rare (2/58 cases)
- Clinical outcomes usually good
- Increased risk in non-EU women

(O’Higgins et al, 2014)
Maternal sepsis in the UK

- June 2011 – May 2012
- 365 confirmed cases: 4.6/100,000
- 61% confirmed in laboratory
- Genital tract commonest (31%)
- *E. coli* (20%)
- Group A streptococcus (11%)

(UKOSS Report, 2013)
Severe sepsis (USA): mortality

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rescue cerclage</td>
<td>9.8</td>
</tr>
<tr>
<td>Prophylactic cerclage</td>
<td>3.4</td>
</tr>
<tr>
<td>Retained products</td>
<td>4.5</td>
</tr>
<tr>
<td>PPROM</td>
<td>2.5</td>
</tr>
<tr>
<td>Multiple pregnancy</td>
<td>1.8</td>
</tr>
<tr>
<td>African – American</td>
<td>2.1</td>
</tr>
</tbody>
</table>

(Bauer et al, 2013)
Development of maternal sepsis strongly associated with ascending genital infection
Maternal infection

- Constant vigilance e.g. IMEWS
- Fetal monitoring prenatally
- Caution in ward setting
- Clinical judgement key to Sepsis Six
- Early escalation to medical team
- Implement care decisively
- High-dose appropriate antibiotics quickly
- Pregnancy-specific sepsis preventable
Thank you

- Nursing and Midwifery
- Anaesthetists
- Obstetricians
- NEWS and IMEWS Teams
- Project and Programme Managers
Weblinks


http://www.hse.ie/eng/about/Who/clinical/natclinprog/criticalcareprogramme/standards/


http://www.hse.ie/eng/about/Who/clinical/natclinprog/obsandgynaeprogramme/obstetricsgyneprog.html