Maternal sepsis prevention, recognition and management
(GL872)

Approval

<table>
<thead>
<tr>
<th>Approval Group</th>
<th>Job Title, Chair of Committee</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternity &amp; Children’s Services Clinical Governance Committee</td>
<td>Chair, Maternity Clinical Governance Committee</td>
<td>7th October 2016</td>
</tr>
</tbody>
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Change History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author, job title</th>
<th>Reason</th>
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<tbody>
<tr>
<td>1.0</td>
<td>May 2014</td>
<td>Helen Manning, Specialty Trainee Year 7, Samantha Low, Consultant Obstetrician,</td>
<td>Clinical requirement</td>
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<tr>
<td></td>
<td></td>
<td>Guy Jackson, Consultant Anaesthetist</td>
<td></td>
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<tr>
<td>2.0</td>
<td>Sept 2016</td>
<td>Archana Ranganathan ST6, Samantha Low, Consultant Obstetrician, Guy Jackson,</td>
<td>Reviewed and major changes made to incorporate 2 other RBH GL’s</td>
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<td></td>
<td></td>
<td>Consultant Anaesthetist</td>
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Now incorporates the following guidelines which are now obsolete:

- Postpartum infection (GL893) V4.0 written by Miss Siddall
- Pyrexia in labour (GL900) V6.0 written by Miss Jill Ablett & Mr Mark Selinger
- Obstetric sepsis identification tool 7.1
1.0 Background

- Sepsis remains the leading cause of direct maternal death in the UK accounting for almost a quarter of maternal deaths (MMBRACE 2014).
- In a pregnant or postpartum woman, a single abnormal finding can be significant and warrants a thorough clinical assessment looking for signs of an infection. (Saving Lives, Improving Mothers’ Care 2014).
- We should aim to
  1. Prevent sepsis with the appropriate use of prophylactic antibiotics.
  2. Recognise sepsis and treat swiftly following the Sepsis Six pathway.
- New international consensus definitions and diagnostic criteria for sepsis have been published in February 2016.

<table>
<thead>
<tr>
<th>Definitions Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Sepsis</td>
<td>Is life threatening organ dysfunction due to a dysregulated host response secondary due to infection</td>
</tr>
<tr>
<td>Septic Shock</td>
<td>Sepsis with persistent hypotension and or lactate ≥2mmol/L despite adequate fluid resuscitation</td>
</tr>
<tr>
<td>MOWS</td>
<td>Modified Obstetric Warning System</td>
</tr>
</tbody>
</table>

2.0 Risk factors for Maternal Sepsis

<table>
<thead>
<tr>
<th>Non-pregnant Risk Factors</th>
<th>Pregnancy related risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td>Primiparous</td>
</tr>
<tr>
<td>Impaired glucose tolerance/diabetes</td>
<td>Multiple pregnancy</td>
</tr>
<tr>
<td>Anaemia</td>
<td>Cervical cerclage</td>
</tr>
<tr>
<td>Black and other ethnic minority</td>
<td>Amniocentesis and other invasive intrauterine procedures</td>
</tr>
<tr>
<td>Group A Streptococcus (GAS) infection in close contacts or family members</td>
<td>History of Group B Streptococcus (GBS) infection</td>
</tr>
<tr>
<td>History of pyelonephritis/UTI</td>
<td>Prolonged rupture of membranes</td>
</tr>
<tr>
<td>History of pelvic infection/STI</td>
<td>Preterm prelabour rupture of membranes (PPROM)</td>
</tr>
<tr>
<td>Had a febrile illness or were taking antibiotics in the two weeks prior to presentation</td>
<td>Complications of caesarean section (uterine angle tear, difficult delivery of infant, ureter/bladder damage, bowel perforation, multiple adhesions) (10.4% versus 0.7%).</td>
</tr>
<tr>
<td>Immuno-compromised status (e.g., HIV)</td>
<td>Vaginal trauma, wound hematoma</td>
</tr>
<tr>
<td>Pre-existing medical problem (e.g., asthma, haematological, renal disorders, heart failure)</td>
<td>Retained products of conception after miscarriage, termination of pregnancy</td>
</tr>
<tr>
<td></td>
<td>Manual removal of placenta</td>
</tr>
</tbody>
</table>
3.0 Prevention of sepsis

3.1 Antenatal

3.1.1 Influenza vaccination: Department of Health recommends all women who are pregnant during the influenza season, regardless of stage of pregnancy, should be offered the inactivated influenza vaccine. 1 in 11 of maternal deaths (2009-2013) was due to flu. More than half of these deaths could have been prevented by a flu jab. (MMBRACE-UK 2014)

3.1.2 Advice to at risk women: Appropriate and clear advice on infection prevention and symptom identification in situations where women were prone to sepsis such as premature rupture of membranes. (MMBRACE-UK 2014)

3.1.3 Prophylactic antibiotics: This may be indicated for at-risk women. For prophylactic antibiotics with PPROM, cervical cerclage, caesarean section, recurrent urinary tract infections in pregnancy, Group A streptococcal infection see Antibiotic Treatment and Prophylaxis Guideline for Obstetrics (GL787). For Intrauterine Fetal Death >16 weeks, see Intrauterine Death Guideline (GL862). For Termination of Pregnancy >16 Weeks see Midtrimester Termination of Pregnancy Guideline (GL878).

3.1.4 Group A streptococcus (GAS): Any GAS identified during pregnancy should be treated to avoid invasive GAS infection. The presence of three or four of the following signs suggests that a woman may have a bacterial infection and would benefit from antibiotics: tonsillar exudate, tender anterior cervical lymphadenopathy or lymphadenitis, fever, an absence of cough.

Healthcare workers exposed to respiratory or infected wound secretions of women with confirmed GAS infection during or in the 7 days prior to an infection should be referred to occupational health and considered for antibiotic prophylaxis. Close household contacts should be warned of the symptoms and signs of GAS infection and seek medical care should signs develop within 30 days of the index case. Routine antibiotic prophylaxis of close contacts is not recommended.

3.1.5 Urethral catheterisation: If the patient is not allergic, external genitalia should be cleansed aseptically with Octenalin (aqueous octenidine HCl solution) prior to urethral catheterisation under any circumstance.

3.2 Intrapartum

3.2.1 Prophylactic antibiotics: See antibiotic guideline for GBS prophylaxis, Intrauterine fetal death, termination of pregnancy >16 weeks.
3.2.2 **Group A streptococcus (GAS):** See antibiotic guideline for treatment of GAS. This will decrease the risk of invasive GAS infection. Neonatologists should be informed of any gas finding in mother as it may have a significant impact on the neonate. Also see point 4 in Antenatal prevention of sepsis.

3.2.3 **Caesarean section:** All patients should receive intra-vaginal aseptic preparation with Octenalin solution prior to commencing the procedure. Intravenous antibiotic (see antibiotic guideline) should be administered to all patients, ideally 30 minutes prior to commencing, if possible. The abdomen should be prepared using the ChloraPrep. All surgeons need to be assessed as competent in application by a senior member of the scrub team (e.g. nurse first assistant) before use. Use of PICO dressing must be considered for all women with BMI>35 undergoing caesarean section.

3.2.4 **Vaginal delivery:** Aseptic precautions should be observed for all operative vaginal deliveries. If perineal suturing is required, the operator needs to rescrub and use sterile suture pack. Repair perineal trauma under aseptic precautions.

3.3 **Postpartum**

3.3.1 **Good personal hygiene:** This includes avoiding contamination of the perineum by washing hands before and after using the lavatory or changing sanitary towels. It is especially necessary when the woman or her family or close contacts have a sore throat or upper respiratory tract infection.

3.3.2 **Group A streptococcus:** See point 2 in intrapartum prevention of sepsis.

3.3.3 **Communication amongst health care teams:** Upon discharge, direct handover to the community carers (GP, midwives and health visitors) of women requiring antibiotics during hospital stay is essential, so that appropriate follow-up visits may be arranged and the significance of developing symptoms recognised.

3.3.4 **Prophylactic antibiotics:** For prophylactic antibiotics for third/fourth degree tears, manual removal of placenta, intrauterine balloon insertion, see Antibiotic Treatment and Prophylaxis Guideline for Obstetrics.
4.0 Sepsis Recognition

MOWS ≥3 = SPOT SEPSIS
STOP SEPSIS = SEPSIS 6

5.0 Screening

- All obstetric women should be screened for sepsis on admission to hospital using the MOWS / MEOWS scoring system.
- If MOWS triggers (≥3) at any point during admission, the Inpatient Maternity Sepsis Tool should be used to identify the appropriate management.
- Any obstetric patient who has undergone an invasive procedure and are now feeling / looking unwell should be screened for sepsis.
- Any obstetric patient who is causing clinical concern (regardless of their MOWS) should be screened for sepsis.
- Sepsis 6 pathway should be initiated and completed within one hour of recognising sepsis.

6.0 Recognition

- Urgent Obstetric/ Anaesthetic opinion must be sought when there is a concern.
- An aide memoire of history and clinical examination to help identify sepsis and the source of sepsis is attached in Appendix 3 and 4.
- Severity assessment should be performed using the Inpatient maternity tool. If Red Flag sepsis is identified, Obstetric consultant and Anaesthetist should be involved in management.
7.0 Initial sepsis management

Aim to perform all of the following tasks within 1 hour of recognition of sepsis.

- Full MOWS observations and repeat every ½ hour or earlier if required.
- Administer Paracetamol 1g orally.
- Medical (Obstetric) review.
- Follow the Sepsis 6 pathway (Appendix 1).
- Sepsis 6 pathway only specifies blood lactate and cultures. Where possible, perform all core investigations (Appendix 2) but this should not delay antibiotics.
- If gestation appropriate and not delivered, continuous cardiotocograph (CTG).

8.0 Further management of sepsis

- Continue MOWS assessment every 30 minutes; tailor it according to response to treatment.
- Perform serial lactate to assess response to treatment.
- Every attempt should be made to identify the source of sepsis, (Appendix 5 and 6), to allow additional investigations and treatment (Appendix 2) if necessary.
- Ensure thromboprophylaxis: prescribe TEDS and Tinzaparin. If Tinzaparin is contraindicated apply intermittent compression device (Flowtron).
- If anaemic with Hb < 7 g/dL transfuse blood: aim for target Hb =7 – 9 g/dL
- Alert a consultant to attend in person if the woman fails to respond within 1 hour of initial antibiotic and/or intravenous fluid resuscitation. Failure to respond is indicated by any of:
  1. Systolic blood pressure persistently below 90 mmHg.
  2. Reduced level of consciousness despite resuscitation.
  3. Respiratory rate over 25 breaths per minute or a new need for respiratory support.
  4. Lactate not reduced by more than 20% of initial value within 1 hour of fluid resuscitation.
9.0 Complications
- If woman deteriorates or does not improve, consider additional or alternative IV antibiotics. Seek advice from Consultant Microbiologist.
- Repeat microbiological specimens and mark ‘urgent’.
- Consider additional imaging to aid diagnosis and target treatment.
- If pregnant, consider delivery to assist resuscitation measures.
- Closed-space infections need surgical drainage, including evacuation of retained products of conception.
- In women with Endometritis not responding to antibiotics, consider septic pelvic thrombosis.
- Necrotising fasciitis requires early surgical intervention with fasciotomy and aggressive antibiotic therapy.

10.0 Management of Septic Shock
- Such women should be cared for in Delivery suite or Intensive Care Unit.
- Follow resuscitation measures of airway, breathing and circulation.
- Involve a Consultant Obstetrician as early as possible. The Consultant Obstetrician should seek advice from other specialists e.g. Anaesthetists, Haematologists, Microbiologists, Outreach Team and Intensivists.

11.0 Management of Pyrexia in Labour
If maternal temperature >37.5°C on one occasion:
- Keep woman cool
- Administer Paracetamol 1 g orally, repeated 6-hrly as required
- Avoid dehydration
- Repeat temperature ½ hourly until apyrexial

If maternal temperature >38°C once or >37.5°C on two occasions ≥ ½ hour apart:
- Commence continuous CTG
- Obstetric review
- Initiate Sepsis 6 pathway
- Consider delivery if fetal compromise is suspected
- Inform neonatologist so baby could be assessed for signs of sepsis
12.0 Differential diagnosis

Consider other conditions mimicking sepsis especially when not responding to treatment. This includes occult haemorrhage, myocardial infarction, adrenal insufficiency, venous thrombosis.

Appendix 1 – also available under Stationery/Delivery Suite
Inpatient Maternal Sepsis Tool

To be applied to all women who are pregnant or up to six weeks postpartum (or after the end of pregnancy if pregnancy did not end in a birth) who have a suspected infection or have clinical observations outside the normal limits.

**Patient details (affix label):**

**Staff member completing form:**
- Date:
- Name:
- Designation:
- Signature:

1. **Has MOWS triggered (≥3)?**
   - OR does woman look sick?
   - OR is baby tachycardic (≥160 bpm)?
   - **Tick:**

2. **Could this be an infection?**
   - Yes, but source unclear at present
   - Chorioamnionitis/ endometritis
   - Urinary Tract Infection
   - Infected caesarean or perineal wound
   - Influenza, severe sore throat, or pneumonia
   - Abdominal pain or distension
   - Breast abscess/ mastitis
   - Does newborn baby have infection? Other (specify):
   - **Tick:**

3. **Is ONE of the following maternal Red Flags present?**
   - Responds only to voice or pain/ unresponsive
   - Systolic B.P. < 90 mmHg (or drop > 30 mmHg normal)
   - Heart rate > 130 per minute
   - Respiratory rate ≥ 25 per minute
   - Needs oxygen to keep SpO₂ ≥ 92%
   - Non-blanching rash, mottled/ ashen/ cyanotic
   - Not passed urine in last 18 hours
   - Urine output less than 0.5 ml/kg/hr
   - Lactate ≥ 2 mmol/L
   - **Tick:**

4. **Any Maternal Amber Flag criteria?**
   - Relatives concerned about mental status
   - Acute deterioration in functional ability
   - Respiratory rate 21-24 OR breathing hard
   - Heart rate 100-130 OR new arrhythmia
   - Systolic B.P. 91-100 mmHg
   - Not passed urine in last 12-18 hours
   - Temperature < 36°C
   - Immunosuppressed/ diabetes/ gestational diabetes
   - Has had invasive procedure in last 6 weeks
   - Premature rupture membranes
   - Close contact with GAS
   - Bleeding/ wound infection/ vaginal discharge
   - Non-reassuring CTG/ fetal tachycardia > 160
   - **Tick:**

**Red Flag Sepsis!! Start Sepsis 6 pathway NOW (see overleaf)**

This is time critical, immediate action is required.
# Sepsis Six Pathway

To be applied to all women who are pregnant or up to six weeks postpartum (or after the end of pregnancy if pregnancy did not end in a birth) who have a suspected infection or have clinical observations outside normal limits.

## Action (complete ALL within 1 hour)

### 1. Administer oxygen
- Aim to keep saturations > 94%.
- Give 15L/minute via face mask with reservoir bag

### 2. Take blood cultures
- At least a peripheral set. Consider urine, sputum, vaginal swabs, breast milk culture, throat swabs.
- Think source control & timing of delivery of baby-start CTG!

### 3. Give IV antibiotics
- According to Trust protocol
- Consider allergies prior to administration

### 4. Give IV fluids
- If hypotensive/lactate >2mmol/L, 500ml stat (can repeat up to 30ml/kg). Ask doctor regarding fluids if not hypotensive and lactate normal. Ask Anaesthetist regarding fluids if patient has pre-eclampsia

### 5. Check serial lactates
- Corroborate high VBG lactate with arterial sample
- If lactate >4mmol/L, call Critical Care and recheck after each 10ml/kg challenge

### 6. Measure urine output
- May require urinary catheter
- Ensure fluid balance chart commenced & completed hourly

## Reason not done/variance

<table>
<thead>
<tr>
<th>Time complete</th>
<th>Initials</th>
</tr>
</thead>
</table>

## If after delivering the Sepsis Six, patient still has:
- systolic B.P <90 mmHg
- reduced level of consciousness despite resuscitation
- respiratory rate over 25 breaths per minute
- lactate not reducing
- Or if patient is clearly critically ill at any time

Then call Critical Care Outreach immediately!!

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Appendix 2

Core investigations

- Full blood count (FBC)
- Venous blood gas for Lactate (part of sepsis 6 pathway)
- Biochemical screen: creatinine, urea & electrolytes (U+Es), liver function tests (LFTs), C-reactive protein (CRP), glucose
- Clotting: prothrombin time (PT), activated partial thromboplastin time (APTT)
- Group & Save (G+S)
- Blood cultures – 2 sets (take 3 sets only if infective endocarditis suspected)
- Mid-stream urine (MSU) or catheter-specimen urine (CSU)
- Low vaginal swab (LVS)

Additional investigations

Should only be taken if clinically indicated:

- Endometritis / chorioamnionitis: High vaginal swab (HVS); low vaginal swab (LVS) and rectal swabs for GBS and GAS culture
- Pelvic inflammatory disease: endocervical swabs for chlamydia (use PCR detection kit) and gonorrhoea (swab in charcoal medium)
- Chest infection: sputum cultures, urinary Legionella antigen test
- Tonsillitis/sore throat: throat swab
- Diarrhoeal disease: stool culture
- Wound infection: wound swab
- Headache / photophobia: Lumbar puncture for CSF
- Any injection-site lesions should be swabbed and an MRSA screen performed.

Additional imaging

Should be arranged if clinically indicated:

In suspected severe sepsis consider imaging to determine focus of infection

- Chest X-ray (CXR)
- Ultrasound (USS) abdomen and pelvis
- Computed tomography (CT) chest (+/- CTPA) or abdomen
- Magnetic resonance (MRI)
Appendix 3
Detailed history

Aim
1. To help identify factors for acquiring infection
2. Clues to identify infection sites which should assist in guiding choice of empirical antimicrobial therapy.
   - Any SROM/PPROM and duration if present
   - Any abdominal pain and nature of this?
   - Any associated offensive discharge?
   - Vomiting/nausea/diarrhoea?
   - Dysuria, haematuria or loin pain?
   - Ear pain, nasal/ear discharge, cough – otitis media?
   - Nasal stuffiness, cough, nasal discharge, frontal headache – sinusitis (Both sinusitis and otitis media can cause invasive CNS infections including meningitis)
   - Shortness of breath, cough with sputum, chest pain?
   - Sore throat, painful swallowing, swelling in neck (Group A strep. Infection), contact history?
   - Any recent antibiotic intake?
   - Any microbiological samples already in lab? e.g. urine sent by GP
   - Has the patient had contact with animals?
   - Has the patient come in contact with another person with similar symptoms?

Full medical history

- What medications does the patient take?
- Has the patient had previous hospitalisation?
- Has the patient had recent surgical procedures?
- Has the patient had indwelling prosthetic devices?
- Has the patient travelled abroad recently?
- Is there underlying immunosuppression?
Appendix 4

Clinical findings in sepsis: General

Central Nervous System
Altered consciousness/confusion

Cardiovascular
Tachycardia
Hypotension
Prolonged capillary refill
Warm or cool peripheries

Respiratory
Tachypnoea
Hypoxaemia

Renal
Oliguria
Anuria
(ensure catheter patent)

Gastro Intestinal
Abnormal LFT’s
Reduced albumin

Metabolic
Lactic acidosis
Hypo/hyperglycaemia
Hypocalcaemia

Haematology
WBC abnormal counts/forms
DIC
↓ Reduced platelets
↑ Increased PT/APTT
↑ Increased D-dimer
↓ Reduced fibrinogen

Skin
Abnormal temperature
Appendix 5

Clinical findings in sepsis: looking for source

Head to toe examination

<table>
<thead>
<tr>
<th>Central Nervous System</th>
<th>Cardiovascular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>New murmur</td>
</tr>
<tr>
<td>Neck stiffness</td>
<td></td>
</tr>
<tr>
<td>Photophobia</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Respiratory</th>
<th>Group A streptococcus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidation</td>
<td>Sore throat, cervical</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>lymphadenopathy, tonsillar exudate</td>
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<table>
<thead>
<tr>
<th>Gastro Intestinal</th>
<th>Renal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain/tenderness</td>
<td>Dysuria</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Loin pain</td>
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</table>

<table>
<thead>
<tr>
<th>Breast changes</th>
<th>Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenderness, engorgement, lump, axillary lymphadenopathy</td>
<td>Swelling/redness/tenderness</td>
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<table>
<thead>
<tr>
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<th>Skin</th>
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<tbody>
<tr>
<td>Neutropenic (primary)</td>
<td>Cellulitis</td>
</tr>
<tr>
<td></td>
<td>Petechial rash</td>
</tr>
<tr>
<td></td>
<td>Splinter haemorrhages</td>
</tr>
<tr>
<td></td>
<td>Wounds</td>
</tr>
<tr>
<td></td>
<td>Cannulae/lines</td>
</tr>
</tbody>
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Obstetric (Antenatal) | Postnatal
---------------------|---------------------
Uterine tenderness   | Uterine tenderness |
Fetal tachycardia    | Uterine Subinvolution |
Offensive liquor      | Offensive lochia |

Perineal/ caesarean wound discharge or breakdown

This document is valid only on date last printed
Appendix 6

Diagnosis in sepsis

Central Nervous System
- Meningitis
- Encephalitis
- Sinusitis
- Cerebral abscess

Cardiovascular
- Endocarditis

Breast
- Mastitis
- Abscess

Respiratory
- Pneumonia
- Empyema
- Bronchiectasis

Renal
- UTI
- Pyelonephritis

Gastro Intestinal
- Peritonitis
  (upper or lower perforation)
- Appendicitis
- Cholecystitis
- Diverticulitis

Joints
- Septic arthritis

Skin
- Cellulitis
- Meningococcal sepsis
- Endocarditis
- Line sepsis
- Wound infection

Haematology
- Neutropenic sepsis

Gynaecological

**Antenatal** – Chorioamnionitis

**Postnatal**
- Endometritis
- Retained products of conception
- Pelvic collection
- Perineal or abdominal wound infection