Maternal Sepsis

The Geneva Foundation for Medical Education and Research
### Abbreviations and acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMP</td>
<td>basic metabolic panel</td>
</tr>
<tr>
<td>bpm</td>
<td>beats per minute</td>
</tr>
<tr>
<td>CBC</td>
<td>complete blood count</td>
</tr>
<tr>
<td>C</td>
<td>Celsius</td>
</tr>
<tr>
<td>CRP</td>
<td>C-reactive protein</td>
</tr>
<tr>
<td>CPP</td>
<td>Chronic pelvic pain</td>
</tr>
<tr>
<td>CT</td>
<td>Computed tomography</td>
</tr>
<tr>
<td>e.g.</td>
<td>for example</td>
</tr>
<tr>
<td>IV</td>
<td>intravenous</td>
</tr>
<tr>
<td>IVIG</td>
<td>intravenous immunoglobulin</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
</tr>
<tr>
<td>mg</td>
<td>milligram</td>
</tr>
<tr>
<td>mL</td>
<td>milliliter</td>
</tr>
<tr>
<td>mmol</td>
<td>millimole</td>
</tr>
<tr>
<td>MRSA</td>
<td>methicillin resistant staphylococci aureaus</td>
</tr>
<tr>
<td>PID</td>
<td>Pelvic Inflammatory Disease</td>
</tr>
<tr>
<td>PO</td>
<td>by mouth (per os)</td>
</tr>
<tr>
<td>PPROM</td>
<td>preterm prelabour rupture of membranes</td>
</tr>
<tr>
<td>STI</td>
<td>sexually transmitted infections</td>
</tr>
<tr>
<td>UTI</td>
<td>urinary tract infection</td>
</tr>
</tbody>
</table>
On successful completion of this module you should be able to

- Describe key barriers to the research and data collection on maternal sepsis and why this is important
- List key definitions related to maternal sepsis
- Discuss the epidemiology of maternal sepsis
- Identify common pathogens and infections that lead to sepsis
- Recognize risk factors for infection and sepsis in the antepartum and postpartum periods with specific referral to the postpartum period as a high risk time zone.
- Explain how to best prevent sepsis
- Summarize the methods for diagnosis of sepsis
- Discuss how to manage sepsis, severe sepsis and septic shock in pregnancy
- Identify vulnerable periods for acquiring infections
- Investigate and recognize sepsis in the postpartum period
- Describe which medications to use for different common infections
Research obstacles and data deficiencies

There is an urgent need for further trials and more data in resource-poor countries on the incidence, etiology, risk factors and treatment of maternal and neonatal sepsis in order to decrease maternal and neonatal deaths (Seale 2009).

The following issues are barriers to collecting data and conducting research on the topic:

• Definitions and terms vary from study to study, e.g. sepsis vs. puerperal sepsis vs. metritis vs. maternal infections (Van Dillen 2010)

• Maternal Sepsis is often undiagnosed or misdiagnosed because infection begins after hospital discharge without proper follow-up of cases (Van Dillen 2010).

• Hospital-based studies in low-income countries do not reflect the general population of those countries (Van Dillen 2010).

• Lack of data from low-income countries makes the incidence difficult to determine. The available studies are mostly retrospective and do not include microbiological confirmation (Van Dillen 2010).

Sepsis is thought to be the consequence of the body’s inflammatory response to bacterial endotoxins and exotoxins. Cytokines and immunomodulators are produced by the body to fight infections and in large quantities their release causes a succession of critical events involving multiple organ systems. When an infection is untreated, this response can cause organ dysfunction, septic shock and death. (Karsnitz, 2013).

Common causes of maternal sepsis

Maternal Sepsis

Genital tract infections (eg. endometritis, chorioamnionitis)

Puerperal Sepsis

Mastitis

Incidental infections (eg. Respiratory Infections)

Others: related to labor and birth (eg. UTIs/urinary tract)

Untreated / treated infections

Severe Sepsis

Septic Shock

Definition: Puerperal sepsis

Infection of the genital tract occurring at any time between the rupture of membranes or the onset of labor, and the 42nd day postpartum, in which a fever (oral temperature 38.5°C or higher on any occasion) and 1 or more of the following signs and symptoms are present:

- Pelvic pain
- Abnormal vaginal discharge, e.g. presence of pus, abnormal smell/foul odour of discharge
- Subinvolution, i.e. delay in the rate of reduction of the size of the uterus (<2cm/day during the first 8 days).

Definition: Puerperal infection

Puerperal infection is a more general term that includes sepsis, but also all extra-genital infections and incidental infections during the period around childbirth:

1. Infections of the genito-urinary (GU) system related to labour, delivery and the puerperium.
   - Infections related to the uterus and surrounding structures (endometritis)
   - Infections related to the urinary tract
2. Infections related to the birth process but not the GU system, e.g. breast abscess.
3. Incidental infections e.g. malaria, respiratory tract infections, which occur during the puerperium.

Why is preventing maternal sepsis is a priority?

Prevention as well as early home visits and postnatal care of the newborn are key to preventing maternal and neonatal sepsis (Miller 2013).

Maternal perspective:
• To reduce maternal morbidity and mortality.

Neonatal perspective:
• Millennium Development Goal 4.2 aims to reduce the infant mortality rate and attention must be made to preventing maternal infection for this rate to decrease (Seale 2010).
• Intra-amniotic infections cause neonatal sepsis, pneumonia and respiratory distress. It is also linked to long-term neurologic impairment in infants (Seale 2010).

Epidemiology

- New cases: Over 5 million/year of maternal sepsis occur globally with an estimated 75,000 maternal deaths (Van Dillen 2013).
- Risk of maternal mortality:
  - In high-income countries: 2.1% of all maternal deaths.
  - In low-income countries: 11.6% of maternal deaths. e.g. 2–2.7-fold higher in Africa, Asia, Latin America and the Caribbean than in developed countries (Van Dillen 2013)
- Risk of long-term morbidity is reported to be 0.1–0.6 per 1000 deliveries. It includes chronic PID, CPP, bilateral tubal occlusion and infertility (Arulkumaran 2013).
- Sepsis is one of the leading causes of preventable maternal mortality in both high-income and low-income countries (Van Dillen 2013).
- Especially in low-income countries, prevention of puerperal infection is the priority (Arulkumaran 2013)
- Though there is an interplay of factors leading to puerperal sepsis, the single most important risk factor for postpartum infection seems to be caesarean section. Trends in puerperal sepsis are likely to increase in future years as a result of increasing trends in caesarean section rates combined with rising incidences of nosocomial infections and antibiotic resistance (Dolea 2003).

Newborn complications from maternal sepsis

Maternal sepsis has a significant impact on neonatal mortality, via vertical transmission of infection, with over one million infection-related neonatal deaths every year (Arulkumaran 2013).

Intra-amniotic infections cause neonatal sepsis, pneumonia and respiratory distress. They are also linked to long-term neurologic impairment in infants (Seale 2010).

Neonatal sepsis causes 26% of neonatal deaths, with an additional 10% of neonatal death arising from other preventable infections including diarrhea and tetanus (Miller 2013).

Millennium Development Goal 4.2 aims to reduce the infant mortality rate and attention must be made to preventing maternal infection for this rate to decrease (Seale 2010).

Why are pregnant women more vulnerable to sepsis and its sequelae?

Normal physiological changes in pregnancy (hyperdynamic circulation, tachycardia, diminished oxygen reserve, hypercoagulability) exacerbate the physiological changes brought on during sepsis to make sepsis life-threatening in pregnancy (Van Dillen 2010).

The most common causes of septic shock in pregnancy and postpartum include: **pyelonephritis, chorioamnionitis, and endometritis** (RCOG 2012).

These will be discussed in detail.


Why are pregnant women more vulnerable to sepsis and its sequelae?

Postpartum events:
The postpartum period carries heightened risk for infections that can give rise to sepsis if not identified and treated promptly, due to the following factors:

• The placental site, a common place for infections to occur, is large, warm, dark and moist; the perfect conditions for bacteria to thrive.
• The placental site has a rich blood supply that leads directly to the main venous circulation. This is why septicemia and sepsis can occur quickly.
• Only the vagina (7–10 cm long) separates the entrance to the uterus from the vulva and perineum, making the uterus vulnerable to exogenous and endogenous bacteria.
• Tears to the cervix, vagina or perineum during the birth cause traumatized tissue that is prone to infection. Infection is usually localized initially, but can spread to underlying and surrounding tissues and into the bloodstream, causing septicaemia.
Low-income settings

- Mortality rates attributable to sepsis approach 33% in low-income settings (Arulkumaran 2013).
- Births in resource-constrained environments carry increased risk of exposure to pathogens due to a lack of effective infection prevention and management (Miller 2013).
- Health systems failures including limited access to adequate and timely therapy also contribute to the increase in maternal sepsis (Van Dillen 2010).
- There is little research into common causative microorganisms of puerperal sepsis in the community, making standardization of antibiotic management difficult (Miller 2013).
- Preventative measures as well as early home visits and postnatal care of the newborn are key to preventing maternal and neonatal sepsis (Miller 2013).
- There is no high quality evidence that clean birth kits alone reduce newborn mortality or puerperal sepsis, though a few existing studies of combined interventions that included clean birth kits were associated with reduced puerperal sepsis and neonatal mortality (Hundley 2012).

Risk factors for maternal sepsis

Community risk factors
- Low socioeconomic status
- Lack of adequate healthcare
- Untrained birth attendant

Infection

Birthing condition risk factors
- Cesarean section
- Multiple vaginal exams (>5)
- Unhygienic conditions
- Prolonged rupture of membranes
- Prolonged labor
- Multiple obstetrical maneuvers
- Retained products of conception

Maternal risk factors
- Anemia
- Poor nutrition
- Existing infection (HIV/AIDS, Malaria)
- Primiparity
- Multiple pregnancy
- Obesity

**Common pathogens**

Bacteria causing an infection can be:
- **Endogenous**: organisms that normally exist in the woman’s genital tract, bowel or skin
- **Exogenous**: arising from outside the woman, due to poorly treated existing infections, poor hand washing technique, vaginal exams or other environmental causes

<table>
<thead>
<tr>
<th>Intrapartum</th>
<th>Postpartum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A beta-hemolytic streptococci (GAS)</td>
<td>GAS (symptoms normally present &lt;12 hours postpartum)</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>Escherichia coli</td>
</tr>
<tr>
<td>Group B beta-hemolytic streptococci (GBS)</td>
<td>GBS</td>
</tr>
<tr>
<td>Peptostreptococcus</td>
<td>Staphylococcus aureus</td>
</tr>
<tr>
<td>Bacteroides species.</td>
<td>Chlamydia trachomatis</td>
</tr>
<tr>
<td>Note: most infections are polymicrobial and require multiple drugs</td>
<td>Clostridium</td>
</tr>
</tbody>
</table>

Adapted from:
Royal College of Obstetricians and Gynaecologists. Bacterial sepsis in pregnancy (Green-top Guideline No. 64a).
Royal College of Obstetricians and Gynaecologists. Bacterial sepsis following pregnancy (Green-top Guideline No.64b).
Maternal Sepsis

Specific clinical syndromes associated with maternal sepsis

- Chorioamnionitis In Labor.
- PPROM – Preterm Prelabour rupture of membranes at <37 weeks.
- PROM- Prelabour rupture of membranes.
- Acute Pyelonephritis with pregnancy.
- Endometritis
- Mastitis and Breast Abscess
- Puerperal Wound Infection
Maternal Sepsis

Clinical syndromes: Chorioamnionitis in labor

- Definition: Inflammation of the amnion and/or chorion from ascending pathogens; usually affects the amniotic fluid, fetal membranes, placenta and/or uterus (Fahey 2008).
- Newborn complications of chorioamnionitis include: neonatal sepsis and pneumonia (Czikk 2011) with Neonatal mortality 1-4% for term infants and 10% for preterm infants (Fahey 2008).
- Perinatal complications: Chorioamnionitis presents a significant risk for PPROM, preterm birth, and cesarean section (Fahey 2008)
- Maternal complications: 5-10% of women with chorioamnionitis will develop bacteremia (Fahey, 2008)
- Chorioamnionitis increases maternal risk for postpartum hemorrhage, wound infections, pelvic abscesses and postpartum endometritis (Fahey 2008).

Diagnosis: commonly based on clinical symptoms: maternal fever (>38°C), maternal tachycardia (≥100-120 bpm), fetal tachycardia (≥160 bpm), uterine tenderness, purulent amniotic fluid and maternal leukocytosis (>15,000-18,000 cells/mm3). However, treating based on these symptoms alone often leads to over-diagnosis (Fahey 2008).

Maternal Sepsis

Clinical syndromes:
PPROM – Preterm Prelabour Rupture of Membranes at <37 weeks

PPROM occurs in approximately 2% of pregnancies but is associated with 40% of preterm births. There is an association between ascending infection from the lower genital tract and PPROM which may lead to preterm births and its sequelae.

Diagnosis is best based on maternal history and a sterile speculum examination. Amniotic fluid pooling in the vagina is visible on speculum exams. Ultrasound examinations (demonstrating oligohydraminos) may be used to confirm the diagnosis.

Management:

<table>
<thead>
<tr>
<th>Do’s</th>
<th>Don’ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Observe the woman for signs and symptoms of chorioamnionitis,</td>
<td>• Perform unnecessary digital examinations.</td>
</tr>
<tr>
<td>• Perform a cardiotocography to diagnose fetal tachycardia</td>
<td>• Perform weekly high vaginal swabs, CBC, or C-reactive protein.</td>
</tr>
<tr>
<td>• Treat group Beta Streptococcus if it is isolated in cases of PPROM</td>
<td>• Carry out Amniocentesis for diagnosis of uterine infection</td>
</tr>
<tr>
<td>• Give antenatal corticosteroids to women between 24-34 weeks gestation</td>
<td>• Give Tocolytic agents</td>
</tr>
<tr>
<td>• Consider delivery from 34 weeks of gestation.</td>
<td>• Prescribe Co-amoxiclav as it increases the risk of neonatal necrotizing enterocolitis.</td>
</tr>
<tr>
<td>• Give Erythromycin for 10 days following diagnosis of PPROM.</td>
<td></td>
</tr>
</tbody>
</table>

Clinical syndromes:
PROM- prelabour rupture of membranes

Antibiotics should not be routinely given to pregnant women with rupture of membranes prior to labour at term (≥36 weeks in this reference) unless they shows signs of infection.

Clinical syndromes: Postpartum maternal sepsis

Postpartum infections account for 46-47% of maternal sepsis and most arise from:
• Endometritis
• Mastitis
• Perineal and abdominal wounds
• Urinary tract infections

Risk factors include: obesity, diabetes, anaemia, invasive procedures during labour and birth, prolonged rupture of membranes, GAS infections, wound hematoma, caesarean section, retained placental pieces, history of pelvic infections, cervical cerclage

Long-term morbidity may include:
• chronic pelvic inflammatory disease
• chronic pelvic pain
• bilateral tubal occlusion
• infertility

## Clinical syndromes: Endometritis

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Risk Factors</th>
<th>Symptoms and signs</th>
<th>Management</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflammation of the uterine lining</td>
<td>• Cesarean birth • Prolonged rupture of membranes • Increased vaginal exams • Retained placental parts • Postpartum hemorrhage • Group B streptococcus colonization • Chorioamnionitis</td>
<td>• Fever • Uterine tenderness • Purulent lochia • Subinvolution • Pelvic pain • Malaise</td>
<td>• History and physical exam • CBC with differential • BMP • Urine culture • Blood culture • Cervical and endometrial cultures should be done if GAS is suspected • Notify pediatric provider if GAS cultures are positive • Antibiotics</td>
<td>• Abscess • Hematoma • Necrotizing fasciitis • Septic pelvic thrombophlebitis • Pelvic infections</td>
</tr>
<tr>
<td>Symptoms present in first 5 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: women who would like an intrauterine device placed must be infection-free for 3 months prior to insertion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Clinical syndromes:
Mastitis

Most cases of mastitis occur in the first 6 weeks postpartum but it can occur at anytime during lactation. It affects anywhere from 3-20% of lactating women.

Definition: Mastitis is the inflammation of the breast that may or may not involve a bacterial infection.

There may be a spectrum of mastitis from engorgement to non-infective mastitis to infective mastitis to abscess. The most common pathogen for infective mastitis is S. aureus.

Risk Factors include: (most risk factors are related to milk stasis)
• Damaged nipples (especially if colonized with Staphylococcus aureus)
• Infrequent feedings
• Missed feedings
• Poor attachment of the baby to the nipple leading to inefficient milk removal
• Illness in mother or baby
• Oversupply of milk
• Rapid weaning
• Tight pressure on the breast from tight bras or seatbelts
• Maternal stress and fatigue
• White spot on the nipple or blocked duct

Diagnosis
Signs and symptoms include:
• A tender, hot, swollen, wedge-shaped area on the breast
• Fever of 38.5°C or greater
• Flu-like aches
• Systemic illness

Clinical syndromes:
Mastitis

Diagnosis

Laboratory tests are usually not necessary but WHO suggests breast milk culture and sensitivity if:
• There is no response to antibiotics in 2 days
• The mastitis recurs
• It is hospital acquired mastitis
• The patient is allergic to the usual therapeutic antibiotics
• The case is severe or unusual

Management
• The key is effective and frequent milk removal
• Rest, fluids, good nutrition
• Heat packs before feeding to help with milk flow and cold packs after feeding for pain
• Anti-inflammatory agents
• IV antibiotics for acutely ill women or with no improvement of symptoms after 12-24 hours
• Complications

Breast abscess: a well-defined portion of the breast that remains hard, red and tender despite appropriate interventions. It occurs in about 3% of women with mastitis.
• Breast ultrasound to identify collection of fluid
• Needle aspiration to drain fluid—send for culture
• Continue breast feeding
• Administer antibiotics

Clinical syndromes:
Puerperal wound infection
In resource-poor countries wound infection rates following childbirth can be as high as 20%. These infections usually begin at the site of an episiotomy, perineal laceration or caesarean section.

Risk Factors include:
• prolonged rupture of membranes
• compromised skin integrity
• poor suturing or incision repair techniques
• insufficiently achieving hemostasis during repairs

Signs and symptoms:
• pain or discomfort at a perineal or abdominal wound site
• purulent wound discharge
• wound dehiscence or inflamed wound edges
• edematous perineum
• hip pain
• low-grade fever

Management of perineal wound infections includes
• removal of sutures with wound debridement and cleansing
• sitz baths
• broad-spectrum antibiotics.

Secondary wound repair is necessary in third or fourth degree lacerations.

Abdominal wounds may need to be debrided and reclosure performed in the case of wound dehiscence. Broad spectrum antibiotics should be started.

Complications include abscess, wound extension, septic pelvic thrombophlebitis and necrotizing fasciitis.

### Diagnosis of sepsis: (International surviving sepsis campaign)

<table>
<thead>
<tr>
<th>Item</th>
<th>Diagnostic feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Localizing features</td>
<td>• Fever or rigors</td>
</tr>
<tr>
<td></td>
<td>• Diarrhea or vomiting (may be sign of early TOXIC shock)</td>
</tr>
<tr>
<td></td>
<td>• Abdominal/pelvic pain and tenderness.</td>
</tr>
<tr>
<td></td>
<td>• Offensive vaginal discharge (strong odor suggests anaerobes; serosanguinous suggests streptococcal infection)</td>
</tr>
<tr>
<td></td>
<td>• Subinvolution of the uterus <em>in postpartum period.</em></td>
</tr>
<tr>
<td></td>
<td>• Productive cough</td>
</tr>
<tr>
<td></td>
<td>• Urinary symptoms</td>
</tr>
<tr>
<td>General features</td>
<td>• Fever (&gt;38°C) or Hypothermia (core temp &lt;36°C)</td>
</tr>
<tr>
<td></td>
<td>• Tachycardia (&gt;90 beats/minute)</td>
</tr>
<tr>
<td></td>
<td>• Tachypnoea (&gt;20 breaths/minute)</td>
</tr>
<tr>
<td></td>
<td>• Impaired mental state, altered conscious level</td>
</tr>
<tr>
<td></td>
<td>• Considerable edema or positive fluid balance (&gt; 20ml/kg over 24 hours)</td>
</tr>
<tr>
<td></td>
<td>• Hyperglycaemia in the absence of diabetes (plasma glucose &gt;7.7mmol/l)</td>
</tr>
</tbody>
</table>

Adapted from:
Royal College of Obstetricians and Gynaecologists. Bacterial sepsis in pregnancy (Green-top Guideline No. 64a).
## Diagnosis of sepsis: (International surviving sepsis campaign) (cont’d)

<table>
<thead>
<tr>
<th>Item</th>
<th>Diagnostic feature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inflammatory</strong></td>
<td>Leukocytosis (WBC count &gt;12,000/ml). Leukopenia (WBC &lt;4000/mL). Normal WBC count with greater than 10% immature forms. Plasma C-reactive protein &gt;2 SD above the normal value. Plasma procalcitonin &gt;2 SD above the normal value.</td>
</tr>
<tr>
<td><strong>Organ dysfunction</strong></td>
<td>Arterial hypoxaemia (PaO2/FIO2 &lt; 300). Acute oliguria (urine output &lt;0.5 mL/kg/hr for at least 2 hrs despite adequate fluid resuscitation). Creatinine rise &gt;0.5 mg/dL or 44.2micromol/L. Coagulation abnormalities (INR &gt;1.5 or aPTT &gt;60 s) Ileus (absent bowel sounds). Thrombocytopenia (platelet count &lt;100,000/mL), Hyperbilirubinaemia (plasma total bilirubin &gt; 4 mg/dl or 70 mmol/L)</td>
</tr>
</tbody>
</table>

Diagnosis of sepsis: (International surviving sepsis campaign) (cont’d)

<table>
<thead>
<tr>
<th>Item</th>
<th>Diagnostic feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue hypoperfusion</td>
<td>Hyperlactaemia &gt;1 mmol/L. Decreased capillary refill or mottling</td>
</tr>
<tr>
<td>Haemodynamic</td>
<td>Arterial hypotension (SBP &lt;90 mmHg, MAP &lt;70 mmHg, or an SBP decrease &gt;40 mmHg in adults or more than 2 SD below normal for age.</td>
</tr>
</tbody>
</table>

*Note that these features are for diagnosis of sepsis in general and not specific to maternal sepsis*

Key interventions for prevention of maternal sepsis

Early recognition, diagnosis and prompt treatment decreases complications and the risk of sepsis that can arise from genital tract infections (Karsnitz, 2013). The following priority interventions are recommended:

• Treat PPROM (RCOG 2010)
• Maintain asepsis during birth (Karsnitz 2013)
• Perform rigorous hand washing during birth (Karsnitz 2013)
• Make minimal use of invasive procedures (Karsnitz 2013)
• Teach all pregnant and recently postpartum women signs and symptoms of genital tract infections (RCOG 2012).
• Be vigilant for endometritis during the postpartum period (Karsnitz 2013)
• Ensure an early home visit or postnatal care facility for woman and baby (Karsnitz 2013)

Other risk factors for puerperal infections

Given the increased risk of infection associated with the following interventions or conditions, antibiotic prophylaxis is recommended.

1. Manual Removal of the Placenta

There are no RCT to evaluate the effectiveness of prophylactic antibiotics in the management of manual removal of the placenta after a vaginal birth (Chongsomchai 2014). However, the WHO recommends offering a single dose of ampicillin or first-generation cephalosporin after manual removal of the placenta. **Quality of evidence: very low; Strength of recommendation: strong** (WHO 2009)

2. Medical and surgical termination or pregnancy

Healthcare professionals should provide antibiotic prophylaxis against *C. trachomatis* and anaerobes for both medical (Evidence grade C) and surgical abortions (Evidence grade A). A single dose or short course of a tetracycline or nitroimidazole is recommended to prevent upper genital tract infections, however research into the optimal antibiotic is lacking (RCOG 2011).


Royal College of Obstetricians and Gynaecologists. The Care of Women Requesting an Induced Abortion (Evidence-based Clinical Guideline No. 7). Royal College of Obstetricians and Gynaecologists. 2011.

Other risk factors for puerperal infections (cont’d)

3. Perineal Tears

The use of a broad-spectrum antibiotic is recommended for all obstetric anal sphincter repairs to reduce the incidence of infection and wound dehiscence.

4. Caesarean Sections

Prophylactic antibiotics should be given pre-operatively to women receiving a caesarean section. Ampicillin and first-generation cephalosporins are both effective in decreasing post-partum endometritis.

Severe sepsis and septic shock

The Surviving Sepsis Campaign is a joint collaboration of the Society of Critical Care Medicine and the European Society of Intensive Care Medicine committed to reducing mortality from severe sepsis and septic shock worldwide by changing clinical behaviour: For more information see the surviving sepsis website which gives more specific treatment plans http://www.survivingsepsis.org/

They provide guidance on standard definitions and a multidisciplinary approach to treatment for sepsis based on a 2-phase approach.

1. The resuscitation phase
2. The management phase

Based on review of current best evidence, the Surviving Sepsis Campaign endorses the following “care bundles” for the treatment of severe sepsis and septic shock.

Note: This treatment is not specific to maternal sepsis

Treatment of severe sepsis - Resuscitation bundle

Tasks to Be Performed within 6 Hours of Identifying Severe Sepsis

Obtain blood cultures (PRIOR to antibiotic administration)

Administer broad-spectrum antibiotic within 1 hour of recognition of severe sepsis and narrow therapy when organism is identified

Measure serum lactate (≥ 4mmol/l is indicative of tissue hypoperfusion)

In case of hypotension and/or a serum lactate>4mmol/l;
• Give initial minimum 20ml/kg of crystalloid or an equivalent.
• Give vasopressors for hypotension that is not responding to initial fluid resuscitation to maintain mean arterial pressure (MAP) > 65mmHg

In the event of persistent hypotension despite fluid resuscitation (septic shock) and or lactate >4mmol/l
• Achieve a central venous pressure (CVP) of ≥8mmHg
• Achieve a central venous oxygen saturation (ScvO2) ≥70% or mixed venous oxygen saturation (SvO2)≥65%

IVIG has been used in pregnant women and is effective in treating shock due to streptococci and staphylococci

## Treatment of severe sepsis - Management bundle

<table>
<thead>
<tr>
<th>Tasks to be performed as soon as possible and scored over 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administer low-dose steroids per hospital policy</td>
</tr>
<tr>
<td>Administer drotrecogin alfa (activated) per hospital policy</td>
</tr>
<tr>
<td>Maintain glucose higher than lower limit of normal, but less than 150mg/dl (8.3mmol/l)</td>
</tr>
<tr>
<td>Maintain inspiratory plateau pressures at less than 30cmH\textsubscript{2}O for mechanically ventilate patients</td>
</tr>
</tbody>
</table>

General management of maternal sepsis

- Assess general condition of woman (WHO 2008)
- Administer oxygen and perform resuscitation if necessary (WHO 2008)
- Collect blood cultures (before antibiotics are administered) (RCOG 2012)
- Begin antibiotic treatment (RCOG 2012)
  - High-dose broad-spectrum IV antibiotics initially
  - Narrow therapy when organism is identified
- Test serum lactate (RCOG 2012)
- Test for MRSA status via nose swab if status is unknown (RCOG 2012)
- Identify the source of sepsis and treat it: rule out retained placental fragments (RCOG 2012)
- Consider giving a tetanus toxoid if she was exposed to tetanus or has an unknown vaccination history (WHO 2008)
- While aggressive fluid replacement in septic patients is necessary, postpartum women are more vulnerable to pulmonary oedema with fluid overload than non-postpartum women (RCOG 2012).
- Breast feeding limits the use of certain antibiotics.

Note: Management is based on expert opinion and case reports (RCOG 2012)

Royal College of Obstetricians and Gynaecologists. Bacterial sepsis following pregnancy (Green-top Guideline No.64b).
General management of maternal sepsis
Management of suspected genital tract sepsis

Neonatal sepsis management

Neonatal sepsis can occur as a result of maternal puerperal infection and should be treated promptly.

Definition:
- Early-Onset Neonatal Sepsis: occurs within 7 days of birth- 75% of neonatal deaths occur in this period. This is usually reflective of vertically acquired infection from the maternal genital tract (Seale 2010).
- Late-Onset Neonatal Sepsis: occurs after 7 days of birth and is usually reflective of environmental microorganisms (Miller 2013).

Risk Factors
- Lack of rigorous hand washing, strict hand washing is important to prevent spread of infection (ReproLine Plus 2014).

Diagnosis/Signs and Symptoms:
- Careful monitoring of the baby for signs and symptoms of sepsis is necessary especially if the mother has an infection (ReproLine Plus 2014).
  - Vital signs
  - Altered feeding patterns
  - Lethargy or poor muscle tone
  - Cry weak or inconsolable

Management/Treatment
- If the baby and mother are well enough, keep them together and the mother may breastfeed (ReproLine Plus 2014).
- If the mother is very ill, contact a newborn care provider. A close relative may care for the baby if the mother and baby must be separated (ReproLine Plus 2014).

## Antibiotic regimens

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chorioamnionitis</strong></td>
<td>IV ampicillin 2 grams every 6 hours AND IV gentamicin 1.5 mg/kg every 8 hours</td>
</tr>
<tr>
<td>Czikk MJ, McCarthy FP, Murphy KE. Chorioamnionitis: From Pathogen to Treatment. Clinical Microbiology and Infection. 2011 Sep;17(9):1304-1311.</td>
<td>(</td>
</tr>
<tr>
<td></td>
<td>IV clindamycin 900 mg every 8 IN case of CS</td>
</tr>
<tr>
<td></td>
<td>Note: one additional dose after delivery</td>
</tr>
<tr>
<td><strong>Group Beta streptococcus</strong></td>
<td>Penicillin G, 5 million units IV initial dose, then 2.5–3.0 million units every 4 hours until delivery (should be started &gt;4 hours before delivery)</td>
</tr>
<tr>
<td><strong>Endometritis</strong></td>
<td>Clindamycin 900mg IV AND Gentamicin 1.5mg/kg IV every 8 hours (moderate to severe cases)</td>
</tr>
<tr>
<td><strong>PPROM</strong></td>
<td>Erythromycin 250mg PO every 6 hours for 10 days</td>
</tr>
<tr>
<td>RCOG.PROM (Green-top Guideline No. 44). Royal College of Obstetricians and Gynaecologists. 2006; amended 2010.</td>
<td></td>
</tr>
<tr>
<td><strong>Bacterial vaginosis</strong></td>
<td>Metronidazole 500mg PO twice a day for 7 days</td>
</tr>
</tbody>
</table>
# Antibiotic regimens (cont’d)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infectious mastitis</strong></td>
<td>Betzold, C. An Update on the Recognition and Management of Lactational Breast Inflammation. Journal of Midwifery &amp; Women’s Health, 2007(updated 2010);52(6): 595-605.</td>
</tr>
<tr>
<td><strong>Breast abscess</strong></td>
<td>Betzold, C. An Update on the Recognition and Management of Lactational Breast Inflammation. Journal of Midwifery &amp; Women’s Health, 2007(updated 2010);52(6): 595-605.</td>
</tr>
<tr>
<td><strong>Severe sepsis (broad spectrum)</strong></td>
<td>WHO. Managing puerperal sepsis. Education material for teachers of midwifery, Midwifery education modules – 2nd edition, 2008, Geneva.</td>
</tr>
</tbody>
</table>

Royal College of Obstetricians and Gynaecologists. Bacterial sepsis following pregnancy (Green-top Guideline No.64b). Royal College of Obstetricians and Gynaecologists. 2012.
References

Maternal Sepsis

References


References

Maternal Sepsis

References


