Postpartum sepsis

Introduction

As early as the 1840s, the Hungarian physician Dr Ignaz Semmelweis achieved a dramatic reduction in the prevalence of sepsis in the puerperium by implementation of hand washing (Nathan and Leveno, 1994). Puerperal sepsis causes at least 75 000 deaths worldwide each year, mostly in low-income countries (Dillen et al, 2010). Despite a decline in maternal mortality in the UK, in 2006–8, there was an increase in deaths related to genital tract sepsis, particularly from community-acquired group A Streptococcus (Centre for Maternal and Child Enquiries, 2011). However, the most recent report from Mothers and Babies: reducing Risk through Audits and Confidential Enquiries UK (MBRRACE-UK) shows that deaths related to genital tract sepsis reduced from 26 per 100 000 maternities in 2006–8 to 12 per 100 000 maternities in 2010–12 (Knight et al, 2014). This highlights the importance of health promotion and prompt recognition of the patient with postpartum or puerperal sepsis.

This article gives a systematic approach to the management of a patient with puerperal sepsis.

What is puerperal sepsis?

Puerperal sepsis is sepsis occurring after childbirth until 6 weeks postnatally. The most common site is genital tract sepsis, in particular endometritis. Other important infections include mastitis, urinary tract infection, pneumonia, skin and soft tissue infection, gastroenteritis, pharyngitis and infections relating to regional anaesthesia. Risk factors for puerperal sepsis include obesity, impaired glucose tolerance or diabetes mellitus, impaired immunity or taking immunosuppressant medication, anaemia, vaginal discharge, history of pelvic infection, amniocentesis and other invasive procedures, cervical cerclage, prolonged spontaneous rupture of membranes, retained products of conception, group A Streptococcus infection in close contacts or family members, black or minority ethnic group origin and carriage of organisms such as group A Streptococcus (Royal College of Obstetricians and Gynaecologists, 2012). *Table 1* lists common microorganisms responsible for puerperal sepsis. If puerperal sepsis is suspected, prompt senior obstetric review is required.

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Group A Streptococcus

This Gram-positive coccus can be carried asymptomatically in the throat and skin (rarely the vagina). It is transmitted through inhalation of large droplets or skin-to-skin contact (Palaniappan et al, 2012). If barrier defences are compromised, such as in breach of mucosa or perineal trauma, these bacteria can invade (Palaniappan et al, 2012).

Clinical syndromes caused by group A Streptococcus infection are outlined in *Table 2*. Onset of this infection is often insidious but can progress to a life-threatening invasive infection, toxin-mediated shock and end-organ failure, even before clinical signs become apparent (Centre for Maternal and Child Enquiries, 2011).

History

Table 3 outlines common symptoms of puerperal sepsis.These will vary according to the source of infection. History should include recent illness or antibiotic therapy, and exposure to those who have been unwell, particularly contact with cases of suspected streptococcal pharyngitis, impetigo or cellulitis. In the Centre for Maternal and Child Enquiries (2011) report five out of six women with group A Streptococcus admitted to hospital

Table 1. Common microorganisms causing puerperal sepsis

Group A streptococcus (*Streptococcus pyogenes*): increasingly causing invasive infections and responsible for 13/29 maternal deaths from infection in UK 2006–8
Escherichia coli and other Gram-negative organisms
Staphylococcus aureus (including meticillin-resistant *S. aureus*; carriage and infection has increased since 2003–5)
Streptococcus pneumoniae
Clostridium septicum

From Royal College of Obstetricians and Gynaecologists (2012)

Table 2. Clinical syndromes caused by group A Streptococcus infection

Diagnosis	Characteristics
Toxic shock syndrome	Differentiated from other types of invasive group A Streptococcus infections by shock and multi-organ system failure early in the course of the infection
Necrotizing fasciitis	Extensive local necrosis of subcutaneous soft tissues and skin
Other invasive disease	Bacteraemia with/without identified focus of infection: the infections are characterized by isolation of bacteria from a sterile body where criteria for streptococcal toxic shock syndrome or necrotizing fasciitis are not met

From Palaniappan et al (2012)

Table 3. Common symptoms of puerperal sepsis

Fever, rigors (persistent spiking temperature suggests abscess). Beware normal temperature may be attributable to antipyretics or non-steroidal anti-inflammatory drugs
Diarrhoea or vomiting – may indicate exotoxin production in early toxic shock
Breast engorgement or redness
Rash (generalized maculopapular rash)
Abdominal or pelvic pain
Wound infection – spreading cellulitis or discharge
Offensive vaginal discharge (smelly suggests anaerobes; serosanguinous suggests streptococcal infection)
Productive cough
Urinary symptoms
Delay in uterine involution, heavy lochia
General – non-specific symptoms such as lethargy, reduced appetite

From Royal College of Obstetricians and Gynaecologists (2012)

with septic shock had a history of recent sore throat or respiratory infection.

Intravenous drug misuse carries a high risk of staphylococcal and streptococcal sepsis, as well as immunosuppression of chronic disease, endocarditis and blood-borne viruses (Royal College of Obstetricians and Gynaecologists, 2012).

Travel history may indicate potential contact with multi-resistant organisms.

Previous carriage or infection with resistant organisms should be noted to inform decisions regarding antibiotic therapy.

Specific infections and their clinical manifestation

A systematic examination is necessary. In the general examination look for rashes: a widespread rash with or without conjunctival involvement may be the result of toxic shock syndrome, and a generalized macular rash may be a sign of streptococcal toxic shock syndrome (Royal College of Obstetricians and Gynaecologists, 2012). Early presentation of sepsis (less than 12 hours after birth) is more likely to be caused by streptococcal infection, especially group A Streptococcus. Venous thromboembolism can cause low grade pyrexia so it is important to assess for this (Royal College of Obstetricians and Gynaecologists, 2012). Where intravenous drugs are used it is important to look for features of bacterial endocarditis or abscesses spread via the bloodstream.

Genital tract sepsis

This may be caused by endometritis, where predisposing factors include caesarean section, intrapartum chorioamnionitis, prolonged labour, multiple pelvic examinations or internal fetal monitoring (Collins et al, 2013). There may be fever, foul, profuse and bloody discharge, and subinvolution of the uterus. The uterus may be tender and bulky on examination.

Genital tract sepsis may also be caused by perineal wound infection including infection of episiotomy wounds and repaired lacerations. The perineum may be tender and there may be wound breakdown. It is therefore important to examine the external genitalia after delivery both in hospital and in the community.

Mastitis

This is distinct from breast engorgement (discomfort caused by the synthesis and storage of milk). About 15% of women develop fever from engorgement (Collins et al, 2013).

Symptoms and signs of mastitis include unilateral breast pain, redness, swelling, malaise and flu-like symptoms. Unilateral erythema, oedema and tenderness of the affected breast are usually seen on examination, while engorgement is usually bilateral and uncomfortable rather than acutely painful (Jahanfar et al, 2013). Signs of breast abscesses include a fluctuating, tender or hard breast mass, with overlying erythema.

Urinary tract infection

Up to 4% develop a urinary tract infection postpartum (Collins et al, 2013). Symptoms include increased urinary frequency, dysuria and urgency. If there is ascending infection to the kidneys, there may be loin pain and rigors. The most common organisms are *Escherichia coli*, Proteus and Klebsiella. Increased bladder volume, decreased bladder tone and ureteral tone promoting urinary stasis and ureterovesical reflux, and increased urinary oestrogens and progesterones, as in the puerperium, may lead to increased susceptibility (Maharaj and Teach, 2007).

Pneumonia

Respiratory complications usually occur within the first 24 hours after delivery (Collins et al, 2013). Pneumonia results, at least in part, from aspiration of gastric contents as a consequence of loss of lower oesophageal sphincter tone and diaphragmatic elevation. Patients are also at greater risk of viral and fungal pneumonia as a result of pregnancy-induced immunosuppression (Neligan and Laffey, 2011). Most cases occur in association with caesarean delivery. Clinical features are the same as for non-pregnant women. Pregnant women are particularly susceptible to viral pneumonia commonly caused by influenza and parainfluenza viruses. If they develop primary varicella infection (chicken pox) in pregnancy they are at risk of developing severe varicella pneumonia.

Skin and soft tissue

Skin and soft tissue infections include those secondary to intravenous cannulation and caesarean (*Figure 1*) or episiotomy wounds. They may be associated with toxic shock syndrome. There may be bleeding or discharge from wounds.

The incidence of wound infections after caesarean section is approximately 6% and risk factors include obesity, diabetes mellitus, steroid therapy, and poor haemostasis at surgery with subsequent haematoma formation (Collins et al, 2013).

Blisters and necrosis may be present if there is necrotizing fasciitis, and in early infection there may be no visible skin changes (Royal College of Obstetricians and Gynaecologists, 2012). Necrotizing fasciitis is characterized by severe pain out of context with the clinical picture.

Gastroenteritis

This presents with diarrhoea and vomiting. The principal differential diagnosis is toxic shock syndrome where there are also temperature spikes (Royal College of Obstetricians and Gynaecologists, 2012). *Clostridium difficile* infection is rare, but increasingly identified in obstetric patients (Royal College of Obstetricians and Gynaecologists, 2012).

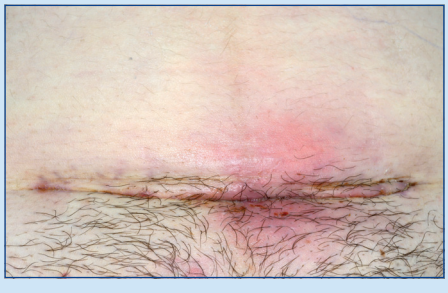
Pharyngitis

Pharyngitis is mostly viral but 10% of cases are caused by group A Streptococcus (Royal College of Obstetricians and Gynaecologists, 2012). If three of four Centor criteria are present (fever, tonsillar exudates, no cough, tender anterior cervical lymphadenopathy) then antibiotic treatment is appropriate, as per local antimicrobial policy after appropriate cultures are taken (Royal College of Obstetricians and Gynaecologists, 2012).

Infection related to regional anaesthesia

Spinal abscess is a very rare complication of regional anaesthesia in obstetric patients and is usually caused by *Staphylococcus aureus* (Royal College of Obstetricians and Gynaecologists, 2012). A meta-analysis from 2006 estimates deep epidural infection

Figure 1. Infected caesarean section wound.



occurs in 1 in 450 000 patients (Rathmell et al, 2006). This must be considered as a differential diagnosis, since permanent spinal cord or cauda equina damage may result if neural compression is prolonged (Rathmell et al, 2006). Superficial infections may present with erythema, tenderness, swelling and purulent discharge at the epidural site. Deeper infections should be suspected if these features are present along the course of the catheter toward the epidural space or in the paraspinous area, often when the catheter is sutured to the subcutaneous fascia (Ruppen et al, 2006).

Investigations

Blood samples should be taken to include full blood count, urea and electrolytes, C-reactive protein and lactate. Before starting antibiotics, blood cultures and other relevant specimens should be taken for diagnostic purposes, including mid-stream urine, stool, sputum, wound swab, throat swab, swabs for meticillin-resistant *Staph. aureus* screening where the status is unknown and swabs of injection sites for intravenous drug users. Antibiotics should be started before awaiting microbiology results. Indwelling catheters or drains should be removed as soon as practicable if infection is suspected (Royal College of Obstetricians and Gynaecologists, 2012). If indicated, imaging should be carried out, such as chest radiograph, pelvic ultrasound or computed tomography of the pelvis.

Management

While patients are still in hospital surgical scars and episiotomy wounds should be inspected regularly for signs of infection as part of the obstetric review.

All patients with puerperal sepsis should have prompt review by a senior obstetrician. As per the Royal College of Obstetricians and Gynaecologists (2012) guideline for bacterial sepsis following pregnancy, abdominal pain and fever over 38°C with tachycardia (more than 90 beats per minute) are indications for intravenous antibiotics and senior clinical review. Patients should be regularly and frequently monitored using locally agreed modified early obstetric warning score (MEOWS) charts, with comprehensive handover while in hospital. *Table 4* indicates when to refer to hospital urgently.

The immediate management of patients with sepsis is the 'sepsis six', as per the Surviving Sepsis campaign (BMJ Best Practice, 2015). Treatment should be directed at the focus of infection, e.g. drainage of a breast abscess. *Table 5* gives a guide for antimicrobial therapy. However, patients who are unwell, have complex underlying conditions, have infections caused by multidrug resistant organisms or are not responding to antimicrobial therapy should be discussed with the on-call microbiologist. Where other therapies have failed intravenous immunoglobulin can be used for severe invasive streptococcal or staphylococcal infection (Royal College of Obstetricians and Gynaecologists, 2012).

Regarding specific considerations for the puerperium, appropriate thromboprophylaxis is especially important because pregnancy confers a higher risk of developing thromboembolism, and non-steroidal anti-inflammatory drugs should be avoided as these reduce the ability of neutrophils to eliminate group A Streptococcus infection (Royal College of Obstetricians and Gynaecologists, 2012).

When to admit to intensive care

The intensive care team should be notified of any patient who has puerperal sepsis, in the event that they may deteriorate and need admission to the intensive care unit and/or anaesthetic team support.

The following are indications for admission to the intensive care unit (Royal College of Obstetricians and Gynaecologists, 2012):

- Cardiovascular – hypotension or raised serum lactate level despite fluid resuscitation
- Respiratory – pulmonary oedema, mechanical ventilation, airway protection
- Renal – declining renal function requiring dialysis
- Neurological – significantly decreased conscious level
- Other – multiorgan failure, uncorrected acidosis, hypothermia.

Postpartum women are more susceptible to pulmonary oedema and therefore careful management of fluid balance is needed where patients are hypotensive and oliguric.

Table 4. When to refer urgently for hospital assessment

'Red flags' which should prompt urgent referral for hospital assessment. Where the woman appears seriously unwell, emergency ambulance is advised	Pyrexia > 38°C
	Sustained tachycardia >100 bpm
	Breathlessness (respiratory rate > 20; a serious symptom)
	Abdominal or chest pain
	Diarrhoea and/or vomiting
	Spontaneous rupture of membranes or significant vaginal discharge
	Urinary symptoms
	Uterine or renal angle pain and tenderness
	The woman is generally unwell or seems unduly anxious, distressed or panicky

From Centre for Maternal and Child Enquiries (2011)

Postnatal/family issues

Some bacteria, such as group A Streptococcus, can be transmitted to babies via breast milk. If mother or baby is infected with invasive group A Streptococcus in the puerperium, both should be treated with antibiotics (Royal College of Obstetricians and Gynaecologists, 2012). If there is puerperal sepsis, the umbilical area should be examined and a paediatric consultant informed.

Prevention of group A Streptococcus infection

Women should be educated about how this infection can be acquired and what symptoms to expect (Royal College of Obstetricians and Gynaecologists, 2012). Stringent hand hygiene should be promoted among mothers and all health-care professionals. Those treating patients with group A Streptococcus infection should wear personal protective equipment. Women with group A Streptococcus should be isolated for a minimum of 24 hours of effective antibiotic therapy. Health-care workers should be asked to present for screening if they develop sore throat, skin infections, lesions or vaginitis, and if they screen positive should commence antibiotic eradication.

Conclusions

Until recently the mortality rate from genital tract sepsis was increasing, making prevention and prompt and appropriate management more important than ever. A thorough history and examination taking appropriate specimens is crucial in diagnosis and to guide targeted antimicrobial therapy, especially for patients who are not responding to empirical treatment. A multidisciplinary team approach is warranted including

liaising with the consultant microbiologist regarding challenging cases. Any evidence of organ failure should prompt discussion with the intensive care team. **BJHM**

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BMJ Best Practice (2015) Sepsis in adults. bestpractice.bmj.com/best-practice/monograph/245.html (accessed 9 July 2015)

Centre for Maternal and Child Enquiries (2011) Saving Mothers' Lives: reviewing maternal deaths to make motherhood safer: 2006–08: The Eighth Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. *BJOG* **118**(Suppl. 1): 1–203

Collins S, Arulkumaran S, Hayes K, Jackson S, Impey L (2013) *Oxford Handbook of Obstetrics and Gynaecology.* Oxford University Press, Oxford

Dillen J, Zwart J, Schutte J, Roosmalen J (2010) Maternal sepsis: epidemiology, etiology and outcome. *Curr Opin Infect Dis* **23**(3): 249–54 (doi: 10.1097/QCO.0b013e328339257c)

Jahanfar S, Ng CJ, Teng CL (2013) Antibiotics for mastitis in breastfeeding women. *Cochrane Database Syst Rev* **2**: CD005458 (doi: 10.1002/14651858.CD005458.pub3)

Joint Formulary Committee (2013) *British National Formulary.* 66th edn. BMJ Group and Pharmaceutical Press, London

Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ, eds (2014) *Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12.* National Perinatal Epidemiology Unit, University of Oxford, Oxford

Maharaj D, Teach DT (2007) CME Review Article: Puerperal Pyrexia: A Review Part II. *Obstetrical and Gynecological Survey* **62**: 6

Nathan L, Leveno KJ (1994) Group A streptococcal puerperal sepsis: historical review and 1990s resurgence. *Infect Dis Obstet Gynecol* **1**(5): 252–5 (doi: 10.1155/S1064744994000190)

Neligan PJ, Laffey JG (2011) Clinical review: special populations – critical illness and pregnancy. *Crit Care* **15**: 227

Palaniappan N, Menezes M, Wilson P (2012) Group A streptococcal puerperal sepsis: management and prevention. *The Obstetrician and Gynaecologist* **14**: 9–16 (doi: 10.1111/j.1744-4667.2011.00082.x)

Rathmell JP, Lake T, Ramundo MB (2006) Infectious risks of chronic pain treatments: infection therapy, surgical implants and intradiscal techniques. *Reg Anesth Pain Med* **31**(4): 346–52 (doi: 10.1016/j.rapm.2006.03.004)

Royal College of Obstetricians and Gynaecologists (2012) Bacterial sepsis following pregnancy. Green-top guideline No. 64b. www.rcog.org.uk/womens-health/clinical-guidance/sepsis-following-pregnancy-bacterial-green-top-64b (accessed 1 March 2014)

Ruppen W, Derry S, McQuay H, Moore RA (2006) Incidence of epidural hematoma, infection and neurologic injury in obstetric patients with epidural analgesia/anesthesia. *Anesthesiology* **105**: 393–9

KEY POINTS

- Postpartum sepsis is sepsis after childbirth and occurring up to 6 weeks postnatally.
- The most common site is genital tract sepsis, especially endometritis.
- Until recently mortality from genital tract sepsis was increasing, especially from group A Streptococcus.
- A thorough infectious diseases history should be sought.
- Clinically relevant samples should be taken before commencing antibiotic therapy.
- Management as per the 'sepsis six' is needed, with prompt senior obstetric review.
- Regular hand washing should be promoted among mothers and health-care professionals.

Table 5. Antimicrobial therapy for postpartum sepsis

		Postpartum (general)		Postpartum (breastfeeding)	
Infection		**First line antibiotic**	**Penicillin allergic**	**First line antibiotic**	**Penicillin allergic**
Sepsis ? source		Co-amoxiclav or cefuroxime and metronidazole depending on extent of allergy	Clindamycin + ciprofloxacin* or cefuroxime and metronidazole	Co-amoxiclav or cefuroxime and metronidazole depending on extent of allergy	Clindamycin + ciprofloxacin* or cefuroxime and metronidazole
Endometritis		As above	As above	As above	As above
Pneumonia †		Co-amoxiclav + clarithromycin or cefuroxime + clarithromycin‡	Cefuroxime + clarithromycin depending on extent of allergy or only clarithromycin if pneumonia not severe or teicoplanin + clarithromycin in severe pneumonia	Same as column 2	Same as column 3
Urinary tract infection	Lower	Trimethoprim or oral cephalosporin (e.g. cefalexin) or oral co-amoxiclav (if resistance to above is an issue)	Trimethoprim or oral cephalosporin (e.g. cefalexin), the latter depending on extent of allergy	Trimethoprim or oral cephalosporin (e.g. cefalexin), the latter depending on extent of allergy	Trimethoprim or oral cephalosporin (e.g. cefalexin), the latter depending on extent of allergy
	Upper	Co-amoxiclav or cefuroxime	Ciprofloxacin	Ciprofloxacin	Ciprofloxacin
Mastitis ¶		Flucloxacillin	Clindamycin	If breast feeding continues, same as column 2	If breast feeding continues, same as column 3
Skin and soft tissue infection		As for mastitis	As for mastitis	As for mastitis	As for mastitis
Gastroenteritis		Antibiotics not recommended – contact microbiology if systemically unwell for all columns			
Pharyngitis		If thought to be bacterial in origin – oral penicillin	Clarithromycin	Clarithromycin	Clarithromycin
Infection relating to regional anaesthesia – is this relating to spinal or epidural anaesthesia?		If infection suspected to have breached the dura contact microbiologist for advice; if not treat as skin and soft tissue infection above			

* Even though ciprofloxacin is not licensed in pregnancy the benefit outweighs the risk. † Observational studies have indicated benefit of oseltamivir in influenza if given early in the disease – applies to all four columns. ‡ Remember to take viral swabs for respiratory viruses. ¶ NB for all columns: antibiotics will not penetrate large abscesses and surgical drainage is the management of choice with antibiotics as an adjunct. From Joint Formulary Committee (2013)