

## CHAPTER 7

# Genital tract sepsis

ANN HARPER on behalf of the Editorial Board

### Genital tract sepsis: key recommendations

#### Service provision

All units should have an antibiotic policy for cases of sepsis; the aim is to control infection without delay and prevent the development of disseminated intravascular coagulation (DIC) and organ failure.

#### Individual practitioners

When infection develops and the woman is systemically ill, urgent and repeated bacteriological specimens, including blood cultures, should be obtained. Advice from a microbiologist must be sought early to ensure appropriate antibiotic therapy.

When there is strong clinical suspicion of sepsis doctors should commence parenteral broad-spectrum antibiotics immediately, without waiting for microbiology results, even if the presence of diarrhoea suggests gastroenteritis as a possible diagnosis.

Fluid resuscitation and oxygen therapy are also an important part of treatment of the compromised patient.

#### Education and training

The onset of life-threatening sepsis in pregnancy or the puerperium can be insidious, with rapid clinical deterioration. Vomiting, diarrhoea, abdominal pain, tachycardia, tachypnoea and pyrexia greater than 38°C may all be symptoms and signs of pelvic sepsis. Pyrexia may be absent in some cases of severe sepsis. Education of doctors, midwives and medical students about the risk factors, symptoms, signs, investigation and treatment of sepsis and the recognition of critical illness is recommended.

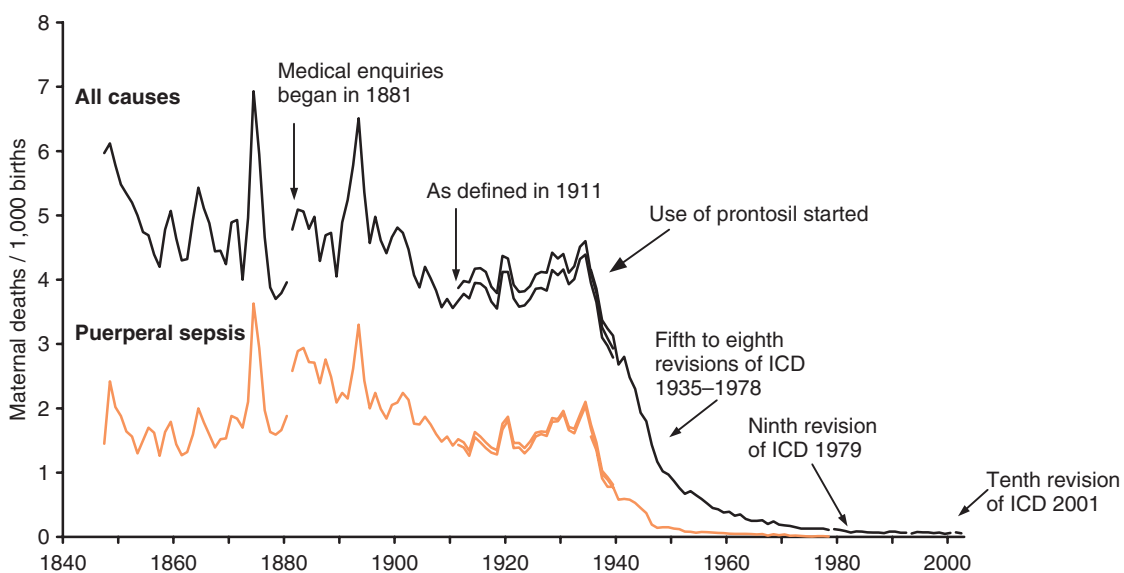
### 50 years ago...

Puerperal sepsis (genital tract sepsis) was the leading cause of maternal mortality in the United Kingdom during the 18th, 19th and early part of the 20th centuries.<sup>1</sup> It occurred in epidemics. In 1795, Alexander Gordon described an outbreak of puerperal fever in Aberdeen between 1789 and 1792 and recognised the contagious nature of the disease. In 1847, Ignaz Semmelweiss in Vienna observed that the puerperal sepsis rate

was much higher in the wards attended by doctors and medical students compared with those attended by midwives only. After he introduced hand washing in disinfectant for the medical staff after attending autopsies and before carrying out vaginal examinations in the wards, the rate of sepsis in the wards attended by the medical staff decreased greatly. At that time, the cause of the disease was still unknown. Rokitansky, in 1864, first observed organisms in the vaginal discharge of women with puerperal sepsis and in 1865 these were identified as streptococci. Joseph Lister published his work with surgical antisepsis in 1867 and this was gradually introduced into maternity practice.<sup>1</sup>

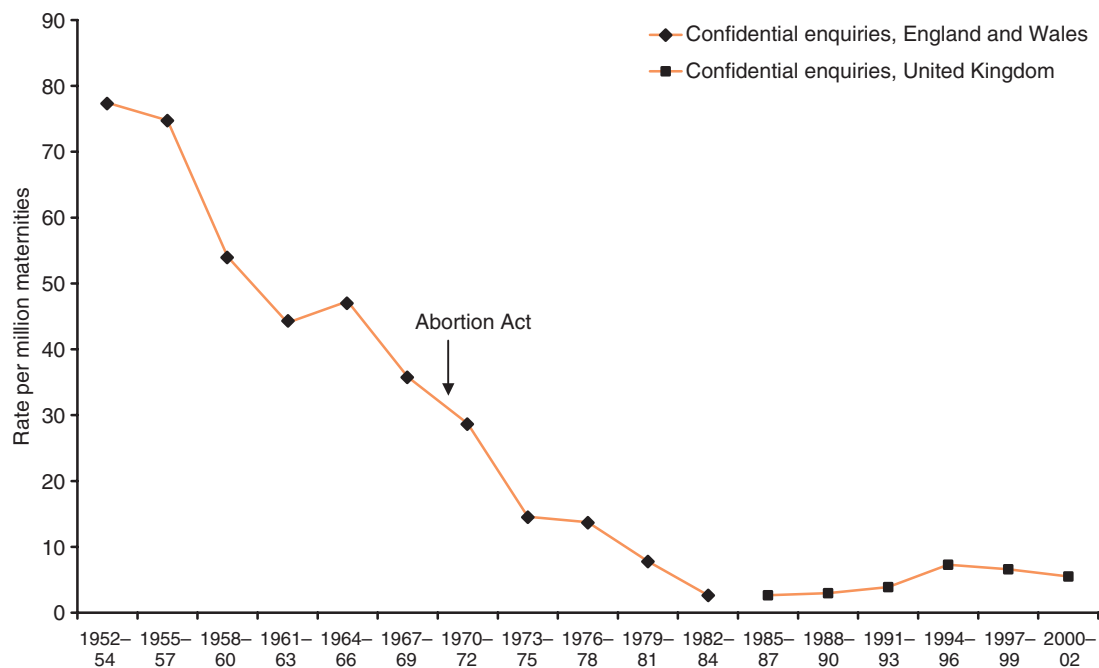
Despite these advances, it was not until the discovery in 1935 of a dramatically effective treatment, Prontosil® (IG Farben), followed by sulphonamides from 1937 and penicillin from 1945, that mortality from puerperal sepsis began to fall in the United Kingdom.<sup>1</sup> By the early 1950s, when the present series of Confidential Enquiries into Maternal Deaths began, sepsis was well down the list of causes. There were only 42 deaths from puerperal sepsis in the first triennial Report (1952–54), which commented: “At the time of the reports of the Departmental Committee in 1930 and 1932, sepsis was the pre-eminent cause of maternal death, accounting for 37% of the deaths directly due to pregnancy and childbirth in that investigation. In the present series, it accounted for only 3.8%. . . . Control of infection has made the major contribution to the reduction of maternal mortality. Deaths from other causes have been reduced but not so markedly”.<sup>2</sup>

The early Reports had no separate chapter on sepsis. However, as deaths from other *Direct* causes fell, sepsis, in the form of septic abortion, again emerged as a leading cause of maternal mortality (Figure 7.1). The fifth triennial Report (1964–66)<sup>3</sup> was the first to have a chapter devoted to sepsis. It commented that, if deaths from septic abortion were included “. . . sepsis would appear as the second commonest cause of maternal deaths, a fact which is not easy to accept”. In the fifth Report, 123 (21.2%) of the 579 *Direct* deaths were due to sepsis: 66 (11.4%) due to abortion with sepsis, 28 (4.8%) to puerperal sepsis and 29 (5.0%) to sepsis after surgery. The Abortion Act was passed in 1967. Since then, in the period 1967–2002, there have been only 146 *Direct* deaths



**Figure 7.1** Maternal mortality rates from genital tract sepsis and from all causes; England and Wales 1847–2002

Source: General Register Office, OPCS and ONS mortality statistics Birth counts, Tables A10.1.1–A10.1.4



**Figure 7.2** Trends in maternal mortality from genital tract sepsis; England and Wales 1952–84, United Kingdom 1985–2002

associated with septic abortion; the majority of these deaths occurred between 1967 and 1972.

In the triennium 1982–84, there were no deaths directly attributable to puerperal sepsis. Unfortunately, deaths from sepsis have risen in subsequent years and there is no room for complacency, as shown in Figure 7.2. In the current triennium there were 13 deaths due to sepsis, accounting for around 12% of all *Direct* maternal deaths. Eleven of these are counted in this chapter and two, due to sepsis following procedures in early pregnancy are counted in Chapter 6 Early pregnancy deaths. The lessons to be learned from these are described in this chapter; most are not new but repeat the recurring themes from previous Reports.

### Summary of findings for 2000–02

There were 13 deaths in this triennium directly due to genital tract sepsis. Eleven are counted in this chapter and two more are counted in Chapter 6 Early pregnancy deaths.

The ages of the women ranged from 16 years to 41 years (mean age 30 years). Two were primigravida, seven had already had one or more children and two were of very high parity. Eight babies survived, including one set of twins. There were two miscarriages, one stillbirth and one early neonatal death. Two women died before 24 weeks of gestation, one woman died intrapartum, five women died following vaginal delivery and three women died following caesarean section.

Two women delivered at home but all died in hospital. Five women died within 24 hours of hospital admission and only three women survived for more than 2 days following hospital admission. Some were already gravely ill on arrival at hospital and deteriorated rapidly with little opportunity for altering the course of events. Although a variety of

underlying causes and many different organisms were responsible for their sepsis, many presented with abdominal pain, diarrhoea and vomiting; not all had pyrexia. The potential severity of their condition was sometimes unrecognised or underestimated, with resultant delays in referral to hospital, delays in administration of appropriate antibiotic treatment and late involvement of senior medical staff. Awareness of the signs and symptoms of sepsis and recognition of critical illness needs to be raised among staff in maternity units, but also in accident and emergency departments, and among general practitioners, community midwives and health visitors.

The assessors considered that some degree of suboptimal care occurred in 80% of the cases discussed in this chapter, although many of the women were already moribund on admission to hospital. These cases demonstrate that the onset of life-threatening sepsis in pregnancy or the puerperium can be insidious, with extremely rapid clinical deterioration and that rapid referral to consultant care is essential.

The cases discussed in this chapter have been divided into deaths from sepsis in early pregnancy, sepsis before or during labour, puerperal sepsis after vaginal delivery and sepsis after surgery, as shown in Table 7.1. It is important to note that the rates given in Table 7.1 are calculated for all cases in which genital tract sepsis was the *Direct* cause of death, irrespective in which chapter in each Report they were counted, as the allocation of cases by chapter has varied over the years.

### Sepsis before delivery

Four cases of genital tract sepsis occurred before delivery, all before 24 weeks of gestation. Two cases of genital tract sepsis in women who had surgical termination of pregnancy are counted in Chapter 6 Early pregnancy deaths but are included in the overall rates described here, for consistency with previous triennia. Two cases are counted in this chapter; one death was due to fulminating septicaemia in a woman with pelvic sepsis and one death followed amniocentesis.

The risk of uterine infection following amniocentesis is estimated to be very low (1/1000)<sup>4</sup> and maternal death is extremely rare. Nevertheless, one case occurred during this triennium and a similar death due to sepsis following amniocentesis was reported in the last triennial Report.<sup>5</sup> Both demonstrate that overwhelming infection can develop in a

**Table 7.1** Numbers of *Direct* deaths associated with genital tract sepsis and mortality rate per million maternities; United Kingdom 1985–2002

Triennium	Sepsis in early pregnancy*	Puerperal sepsis	Sepsis after surgical procedures	Sepsis before or during labour	Total	Rate per million maternities	
						Rate	95% CI
1985–87	3	2	2	2	9	4.0	1.8–7.5
1988–90	8	4	5	0	17	7.2	4.2–11.5
1991–93	4	4	5	2	15	6.5	3.6–10.7
1994–96	2**	11	3	1	16	7.3	4.2–11.8
1997–99	6	4***	1	7	18	8.5	5.0–13.4
2000–02	4****	5	3	1	13	6.5	3.5–11.1

\* Early pregnancy includes deaths following miscarriage, ectopic and other causes  
 \*\* In 1994–96, these deaths were included in Chapter 6 Early pregnancy deaths  
 \*\*\* Including two *Late Direct* deaths  
 \*\*\*\* Including two cases counted in Chapter 6 Early pregnancy deaths

matter of hours in previously healthy women. A literature search revealed only one other maternal death related to amniocentesis, probably due to amniotic fluid embolism.<sup>6</sup> The Royal College of Obstetricians and Gynaecologists has recently issued updated guidelines for training and performing amniocentesis, which should be followed in all cases.<sup>7</sup>

### Intrapartum deaths

A woman who died during a perimortem caesarean section had overwhelming sepsis due to group A haemolytic streptococcal septicaemia. She had a short history of diarrhoea, vomiting and abdominal pain and although she was breathless she was afebrile on admission to hospital. She suffered a cardiac arrest shortly after admission from which she could not be resuscitated.

This case illustrates the deceptive and fulminating nature of streptococcal infection and the challenges facing staff presented with an afebrile patient who deteriorates so rapidly that there is little time for investigation or treatment. Increasing shortness of breath may predict impending cardiac arrest; regular resuscitation drills may help staff provide rapid and effective resuscitation when such situations arise unexpectedly in clinical practice.

### Sepsis after vaginal delivery

Five women died from sepsis after vaginal delivery and are counted in this chapter. Two had had home deliveries. One case also contributes to the general lessons discussed in Chapter 10 Cardiac disease and Chapter 11 Psychiatric causes of death.

Four of the five of these women became ill in the community after discharge home. Attention is drawn to the need for good communication between hospital and community carers and the need for early referral of recently delivered women who feel unwell and have pyrexia. In one case, the woman had declined postnatal visits.

Two women had risk factors for infection. One woman who had delivered in water with some faecal contamination became unwell with a temperature of 40°C, pain and infection in her buttock and leg. She developed overwhelming sepsis and died, despite intensive medical and surgical treatment. This case highlights the potential dangers of delivering in contaminated water. In another case, community carers were unaware of a history of ragged membranes at delivery and did not immediately suspect sepsis in a recently delivered ill woman.

A woman with a history of 'panic attacks' developed a persistent tachycardia (130–170 bpm) after delivery and her increasingly bizarre behaviour was repeatedly attributed to a psychiatric cause without further investigation or seeking consultant advice. She was admitted to a psychiatric hospital but quickly transferred to the local general hospital where she died shortly after arrival. Autopsy revealed an infected necrotic uterus and several different organisms (*Streptococcus* groups B and D, *Staphylococcus aureus*, *Bacteroides*, *Escherichia coli*, Gram positive rods) were identified in the uterus, blood and gastrointestinal tract. There was also marked left ventricular hypertrophy, which probably accounted for some of her symptoms and was possibly due to peripartum cardiomyopathy, although histological examination was not done to confirm this diagnosis.

### Sepsis: Learning points for diagnosis and management in the community

- Sepsis should be considered in recently delivered women who feel unwell and have pyrexia.
- Sepsis can be insidious in onset and have a fulminating course. The severity of illness should not be underestimated; early referral to hospital may be life saving.
- The risk of sepsis is increased after prolonged rupture of membranes, emergency caesarean section and if products of conception are retained after miscarriage, termination of pregnancy or delivery.
- Delivery in water carries a risk of infection for mother and baby due to faecal contamination of the perineum and genital tract.
- Any problems noted during the hospital stay should be reported directly to the community carers (GP, midwives and health visitors) at the time of the woman's discharge so that appropriate follow up visits may be arranged and the significance of developing symptoms recognised. This is particularly important in early postpartum discharge from hospital, which is now an increasingly common practice.

### Sepsis after surgery

Three deaths in women who had a caesarean section and died from genital tract sepsis are counted in this chapter. Two were already ill from sepsis before the emergency caesarean section. Both had chorioamnionitis and developed coagulopathy; one died suddenly a few hours after delivery, the other after a protracted illness in intensive care. The severity of the illness may have been initially underestimated. Starting intravenous antibiotics immediately, involving consultants sooner, continuity of care with a lead consultant and considering ICU admission earlier might have made a difference, although all were extremely ill.

### Comments

The most common pathogen identified among the 11 cases counted in this chapter was the beta-haemolytic *Streptococcus*: Lancefield groups A (3), B (2) and D (1). *S. aureus* (1) and coagulase-negative *Staphylococcus* (1); *E. coli* (2); mixed anaerobes/bacteroides (2) and *Fusobacterium necrophorum* (1) were also identified. More than one organism was identified in three women. No pathogen was identified in one obviously septic patient despite repeated investigation; in two others, results were unavailable or tests were not performed. One case of genital tract sepsis following surgical termination of pregnancy, counted in Chapter 6 Early pregnancy deaths, was due to group A beta-haemolytic streptococcal infection; in the other case, results were unavailable or tests were not done.

One woman who died had a fulminating and overwhelming genital tract sepsis due to an unusual organism, *F. necrophorum*. This is an anaerobic Gram negative bacillus is usually sensitive to penicillin. Death from is rare and usually follows oropharyngeal infection, although death from *F. necrophorum* genital infection has been reported.

### Sepsis learning points: investigating sepsis

Although the number of maternal deaths *Directly* due to genital tract sepsis has decreased from previous triennia, these cases of genital tract sepsis and the cases of overwhelming sepsis counted in other chapters indicate that infection remains a significant cause of maternal death in the United Kingdom.

If sepsis is suspected, vaginal swabs and urine culture should be taken, wound swabs taken, if appropriate, and throat and rectal swabs considered. Blood cultures should always be taken. Blood should also be taken for haemoglobin, white cell count, platelets, C-reactive protein, coagulation screen, group and hold, urea and electrolytes, and liver function tests.

In the event of maternal death due to suspected sepsis where the source of infection and the organisms responsible have not been identified during life, swabs from all possible sites of infection and tissue samples for histology of suspect organs (with informed consent from next-of-kin) should be taken at autopsy.

In many situations, infection may be so rapid and overwhelming that death is unavoidable despite the best efforts of all concerned. Previous Reports have emphasised the often-insidious onset, rapid spread and fulminating course of genital tract sepsis, particularly where it is due to streptococcal infection. This is seen in many of the present cases where the women had a short duration of illness and in some cases were moribund by the time they presented to primary care or hospital.

The importance of prompt aggressive treatment of suspected sepsis with adequate intravenous doses of appropriate broad-spectrum antibiotics must be emphasised, as early intervention may prevent the situation becoming irreversible. In some of the cases reported, there was delay in starting appropriate antibiotic treatment due to imprecise prescribing by medical staff. Doctors prescribing antibiotics and other drugs should ensure that midwives have clear written instructions. Treatment should be started immediately without waiting for results and sensitivities of microbiological investigations, as they may not be available for days. A combination of co-amoxiclav and metronidazole could be used initially. The choice of drug will be influenced by local antibiotic policy and the advice of a consultant microbiologist should be sought. If the woman is already extremely ill, deteriorates or does not improve within 24 hours of treatment, then additional or alternative intravenous antibiotics such as piperacillin/tazobactam or gentamicin and clindamycin should be used. Microbiological specimens should be repeated and urgent results requested.

There is an increased risk of infection in some clinical situations. Previous Reports have highlighted the importance of continuing close surveillance and assessment of antenatal patients with prolonged rupture of membranes for signs and symptoms of sepsis, avoiding vaginal examinations in these women unless essential, when careful aseptic technique should be observed, and the evidence-based use of routine prophylactic antibiotics for caesarean section. In the postpartum woman with possible sepsis, any history of ragged membranes or possibly incomplete delivery of the placenta should be sought, and the woman examined for the presence of uterine tenderness or enlargement. If retained products of conception are suspected, vaginal swabs and an ultrasound scan

to confirm that the uterine cavity is empty should be done before discharging the woman from hospital. Any relevant information about the woman's hospital stay should be communicated to her GP and community midwife or health visitor at the time of discharge from hospital.

There is evidence from the cases reported that when faced with extremely ill patients, junior doctors sometimes failed to seek timely advice from consultants, perhaps due to a lack of awareness of the possibility of serious infection and its signs and symptoms. In the past, obstetricians were very aware of sepsis and its consequences, but life-threatening sepsis is now rare and many doctors have never seen a case. As general practitioners, junior hospital doctors and nurses or midwives usually have the first contact with these women and it is important to raise their awareness of the possibility of sepsis and their skills in the recognition of developing critical illness. Pregnant women who present to accident and emergency units should be seen and assessed promptly by an experienced doctor. Improved education of 'front-line' staff, emphasising the importance of appropriate timely investigation and treatment and early communication with and involvement of consultants, may help to avoid some future maternal deaths due to sepsis. Obstetricians should seek advice from other specialists, such as anaesthetists, haematologists and microbiologists, at an early stage. All staff should regularly update and practice their resuscitation skills. In pregnant women, correction of aortocaval compression by placing the woman on her left side or using a wedge is important during resuscitation. Maternity units should develop their own guidelines for the management of women with suspected sepsis.

Vomiting, diarrhoea and abdominal pain are all symptoms of underlying genital tract sepsis but are often attributed to gastroenteritis. There may be a rash. Discoloration or mottling of the skin may indicate cellulitis. Significant pyrexia should always be

### Signs of critical illness<sup>8</sup>

#### *Physiological*

- Signs of sympathetic activation: tachycardia, hypertension, pallor, clamminess and peripheral shutdown.
- Signs of systemic inflammation: fever or hypothermia, tachycardia and increased respiratory rate.
- Signs of organ hypoperfusion: cold peripheries, hypoxemia, confusion, hypotension and oliguria.

#### *Biochemical*

- Metabolic acidosis.
- High or low white cell count.
- Low platelet count.
- Raised urea and creatinine concentrations.
- Raised C reactive protein concentration.

investigated and treated but is not always present in cases of severe septicaemia. Elevated C-reactive protein, raised white cell count or neutropenia are important signs that should be investigated. Vital signs should be monitored and fluid balance recorded. Blood gases should be checked at an early stage to detect metabolic acidosis. Persistent tachycardia, peripheral vascular shutdown, oliguria, metabolic acidosis, increased respiratory rate and reduced oxygen saturation indicate critical illness that needs urgent management. Younger women may maintain their blood pressure and conceal serious illness for a long time and appear deceptively well, alert and talking before sudden cardiovascular decompensation occurs.

In some of the cases reported, delays in treatment caused by physical separation of facilities did not facilitate the situation, e.g. transfer to theatre delayed because it was on a different floor, making a lift journey necessary, or transfer to an intensive care unit on a different site, making an ambulance journey necessary. Ideally, there should be an operating theatre on the same floor as the delivery suite and intensive care facilities in the same building as the maternity unit.

### Acknowledgements

This chapter has been read and commented on by Professor W Thompson MD FRCOG, Dr CH Webb, BDS MB FRCPath FFPRCP, Consultant Microbiologist, and Dr JG Barr, PhD CBiol FIBiol FRCPath, Consultant Microbiologist.

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