8. Septic Abortion

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The term septic abortion describes the occurrence of infection developing in or around the uterus during or after an abortion. The genital tract is particularly susceptible to infection at this time and sepsis is often, but not always, consequent to attempts to cause abortion by untrained persons using non-sterilised instruments.

The incidence of sepsis complicating an incomplete abortion varies between countries and reported series are given in Table 8.1. Munday et al. (1989) report that there were 3050 women discharged from hospitals in the UK with the diagnosis of septic abortion in 1965 compared to only 390 in 1982. Figures from New Zealand (Shepherd and Benny 1984) show a reduction from 6% of all abortions being septic in 1962 to less than 1% in 1979. The incidence of septic abortion has declined in countries where the operation of termination of pregnancy has been legalised and women have more ready access to these services.

Table 8.1. Incidence of incomplete abortion complicated by sepsis

Author	Country	Incidence (%)
Adetoro (1986)	Nigeria	12
Aggarwal and Mati (1980)	Kenya	16
Barnes and Ulfelder (1964)	USA	14
Botes (1973)	South Africa	5.8–34
Munday et al. (1989)	UK	below 1
Shepherd and Benny (1984)	New Zealand	below 1

Relevance of Septic Abortion to Maternal Mortality Statistics

Deaths from abortion, and particularly septic abortion, contribute significantly to a country's maternal mortality. In England and Wales the most dramatic decline

in maternal mortality followed the introduction of the Abortion Act in 1967. From 1958 to 1972, abortion was the commonest cause of maternal mortality in England and Wales. There was then a steady decline in deaths from abortion and in the triennium from 1982 to 1984, 8% of all maternal deaths were due to abortion, septic complications accounting for 27% of these deaths (DHSS 1989). Abortion as a cause of maternal death has now been regulated to the sixth commonest cause and in the 1982–1984 report (DHSS 1989) there were no deaths from criminal abortion. Epidemiologists in the USA have described a similar reduction of deaths from abortion after the abortion laws were liberalised (Cates et al. 1978; Grimes et al. 1981) and contraception made more freely available.

By contrast, countries where abortion is not legally available have a high death rate from septic abortion leading to calls for liberalisation of abortion laws (Adetoro 1986; Mathai 1986; Unuigbo et al. 1988). In Nigeria, complications of illegal abortion account for up to 50% of maternal mortality in that country (Adetoro 1986). In the Greater Harare Maternity Unit, Zimbabwe, sepsis accounted for 50% of the deaths from abortion and a total of 8% of the maternal deaths. Abortion ranked joint second with puerperal sepsis and haemorrhage as a cause of maternal death (Ashworth 1990). This figure was an improvement on a previous report from the same unit: post-abortal sepsis accounted for 18% of maternal deaths in 1983 (Crowther 1986). Although the abortion laws had not changed during this period, there had been an expansion of available contraceptive services.

Risk Factors

In spite of the presence of profuse bacterial colonisation in the lower genital tract, infection rarely complicates spontaneous abortion. Kowen et al. (1979) studied 100 women and demonstrated 100% bacterial colonisation of products of conception. Of these patients, 10% showed clinical evidence of infection after curettage, although this is an unusually high rate of infection.

Uterine sepsis results from instrumentation of the uterus to remove retained products of conception or to terminate the pregnancy. The use of unsterilised instruments and the astonishing variety of methods used to induce abortion by illegal abortionists leads to incomplete evacuation of uterine contents and the inevitable introduction of infection. Infection may also arise after a spontaneous incomplete abortion, without surgical evacuation, since the remaining products of conception will act as a nidus of infection.

The intrauterine contraceptive device (IUCD) has been implicated in the aetiology of septic abortion, particularly in the second trimester. Williams et al. (1975) showed a higher incidence of septic abortion in IUCD users but no serious consequences were recorded. Tatum et al. (1976) found 2 cases of septic first-trimester abortion out of a total of 113 abortions occurring in women who had a copper T intrauterine contraceptive device. Templeton (1974) reported 4 fatal cases of septic abortion with a Dalkon shield in situ, an observation which subsequently led to the withdrawal of the Dalkon shield.

Chorionic villus sampling may result in septic abortion. Hogge et al. (1986) have reported this complication in 0.6% of their first 1000 cases using the transcervical route. The abortion may be delayed up to 10 weeks following the procedure (Marini et al. 1988). For this reason, many prefer the transabdominal route for this procedure.

Midtrimester rupture of membranes may lead to ascending infection and colonisation of the uterine cavity followed later by septic abortion. Pre-term rupture of membranes may be idiopathic, or related to the insertion of a cervical suture, or to an amniocentesis or cone biopsy.

The question as to whether human immunodeficiency virus (HIV) infection leads to a higher rate of infection after a spontaneous abortion, or worsens the outcome of a septic abortion, needs to be addressed. There are no published data but clinicians working in areas with a high prevalence of HIV believe that the incidence of severe septic abortion has increased in women who are HIV seropositive. The combination carries a high mortality.

Clinical Features

The following features suggest the possibility of septic abortion: illegally procured abortion; continued bleeding after a spontaneous abortion; fevers; chills and rigors; malaise; nausea; an offensive discharge; and lower abdominal pain.

On examination, there may be:

1. Pyrexia: in order for an abortion to be defined as septic, a temperature of at least 38°C should be recorded on any 2 days or a temperature of 38.3°C and above at any time before or after evacuation (Barnes and Ulfelder 1964). The absence of pyrexia can be an ominous sign of septic shock
2. General features: signs of anaemia and dehydration
3. Cardiovascular system: tachycardia will be present; a pulse rate of more than 110 beats per minute suggests more widespread infection. Hypotension may be due to blood loss or circulating endotoxins
4. Abdominal examination: tenderness with guarding and possibly rebound tenderness in the lower abdomen. Spread of infection will lead to signs of ileus with a distended, generally tender abdomen and absent bowel sounds.
5. Vaginal examination: profuse, offensive vaginal discharge and possibly products of conception or evidence of criminal interference such as sticks, leaves, wire etc. Cervical excitation tenderness will be present. The uterus will be tender, soft and enlarged and there will be tenderness in the fornices. An adnexal mass might be present.
6. Rectal examination: this may detect an abscess in the pouch of Douglas.

Many women with septic abortion are never seriously ill. The best indicator of a serious illness is the presence of chills and fever (Barnes and Ulfelder 1964).

Microbiology

Women presenting with suspected septic abortion should have high vaginal and cervical swabs taken. The main organisms isolated are the non-clostridial anaerobic and micro-aerophilic bacteria; anaerobic streptococci and bacteroides (Rotheram and Schick 1969). The normal vaginal flora can make interpretation of these cultures difficult. Table 8.2 lists the organisms which may be found.

Table 8.2. Pathogenic organisms in septic abortion

Anaerobes	Aerobes
<i>Bacteroides fragilis</i>	<i>Escherichia coli</i>
<i>Bacteroides melaninogenicus</i>	<i>Enterobacter</i> species
<i>Peptostreptococcus</i> species	<i>Beta haemolytic streptococci</i>
<i>Peptococcus</i> species	<i>Proteus</i> species
<i>Fusobacterium</i> species	<i>Klebsiella aerogenes</i>
<i>Clostridium perfringens</i>	<i>Pseudomonas aeruginosa</i>
<i>Clostridium tetani</i>	<i>Neisseria gonorrhoeae</i>
	<i>Staphylococcus aureus</i>
	<i>Streptococcus milleri</i>

Of the beta haemolytic streptococci, group A are the most pathogenic and are usually introduced into the vagina by instrumentation since they are not a normal vaginal commensal. Groups B and D are less virulent and are also normal vaginal commensals (Rotheram and Schick 1969).

Clostridium perfringens (welchii) is a gram-positive, anaerobic, spore-forming organism which is often encapsulated. It can be found in up to 29% of cervical cultures in septic abortion (Butler 1945), although only a small percentage of these organisms will be virulent. *Clostridium perfringens* releases many exotoxins, the main ones being an alpha toxin which causes haemolysis, a collagenase, a hyaluronidase, a DNA-ase and a myotoxin. These exotoxins are only produced after 24–48-h incubation in the necrotic host tissue and lead directly to haemolysis, hypotension, jaundice and renal failure. At one time, post-abortion sepsis due to *Clostridium perfringens* was associated with a mortality ranging from 53% to 85% (Decker and Hall 1966). *Clostridium tetani* rarely complicates illegal abortion although it too carries a high mortality (Adadeuoh and Akinla 1970).

Rotheram and Schick (1969) reported positive blood cultures in 60% of patients with septic abortion, anaerobic bacteria predominating. Smith et al. (1970) confirmed *Peptostreptococcus* as the most common organism, found in 41% of positive cultures. Aerobic gram-negative rods are detected in smaller numbers in blood cultures than the anaerobes but they are important since they are the most frequent cause of endotoxic shock (Deane and Russell 1960).

Complications of Septic Abortion

The condition may progress toward shock, with higher fever, tachycardia, tachypnoea, falling blood pressure and diminishing urine output. This is the

“septic syndrome” (Balk and Bone 1989) and it is important that it should be identified before full septic shock ensues.

Septicaemia

A systemic response differentiates the septicaemic patient from the bacteraemic one. The dispersion of bacteria into the circulation occurs in approximately 10% of women with septic abortion. Transient bacteraemia is common after uterine curettage, but does not usually lead to septicaemia (Kowen et al. 1979).

The usual organisms found in septicaemia are gram-negatives such as *Escherichia coli*, *Klebsiella*, *Proteus mirabilis* and *Pseudomonas aeruginosa* (Botes 1973). Streptococci and anaerobic organisms are also found.

Endotoxic Shock

Endotoxic shock complicates approximately 0.7% of septic abortions (Botes 1973). The mortality from septic shock is high, ranging from 11% to 82% (Adetoro 1986; Cavanagh et al. 1985; Douglas and Beckman 1966).

The pathophysiology of septic shock involves infection which results in peripheral circulatory failure with inadequate tissue perfusion leading to cellular dysfunction or death. The underlying haemodynamic anomaly is vasoconstriction. Endotoxic shock occurs as a result of the release of a lipopolysaccharide-protein complex from gram-negative bacteria, leading to platelet damage and the activation of the coagulation system. Cytokines, such as tumour necrosis factor and interleukin-1 appear to have an important mediating effect as well as the prostaglandin cascade (Pearlman and Faro 1990). Microemboli are generated which reduce the blood supply to various organs. Pooling of blood in the portal system leads to a relative hypovolaemia with reduced venous return to the heart, resulting in reduced cardiac output to vital organs.

The haemodynamic changes in patients with septic shock commence with “warm” shock when the patient is in a hyperdynamic, vasodilated state and progress to “cold” shock when vasoconstriction occurs with a diminished cardiac output. The clinical manifestations of septic shock are summarised in Table 8.3 (Pearlman and Faro 1990). The organisms which lead to endotoxic shock are the gram-negative bacteria.

Acute Tubular Necrosis

Acute tubular necrosis may result from hypotension and vasoconstriction together with fibrin and immune complex deposition. Clostridia release a nephrotoxic exotoxin, as may certain abortifacient agents such as soap and detergent douches.

Table 8.3. Common clinical manifestations of septic shock

Organ system	Clinical findings	Mechanism
Cardiovascular hypotension	Systolic BP <60 mmHg	Vasodilation Decreased circulating volume due to increased vascular permeability
Cardiac dysfunction	Increase in cardiac index (early) Decrease in CI (late) Decrease in ejection fraction	Myocardial depressant factor Decreased myocardial blood flow
Pulmonary ARDS	Bilateral diffuse infiltrates on CNR Hypoxemia Normal PACWP (<18 mmHg)	Increased vascular permeability Direct endothelial damage
Renal oliguria	Less than 30 ml/h	Hypotension and renal vasoconstriction
ATN		Prolonged cortical hypoxia secondary to decreased renal blood flow
Interstitial nephritis		Immune mechanism
Haematologic DIC	Elevated FDP, PT, PTT Decreased platelets, and fibrinogen Spontaneous bleeding (uncommon)	Endotoxin activation of Hageman factor
Leukocytosis	>20 000 cells/mm ³	Demargination Neutrophil releasing substance
Neurologic mental status changes	Somnolence, coma, combative (uncommon, usually due to hypoxia)	Decreased cerebral blood flow Hypoxia
Fever	Temperature >38°C	Direct endotoxin/TNF effect on hypothalamus

From Pearlman M, Faro S (1990) Clinical Obstetrics and Gynecology 33:482–492. Reproduced with permission.

Management of Septic Abortion

Prevention

The incidence of septic abortion has dramatically declined in countries where abortion laws have been liberalised. If access to legal termination of pregnancy were universally available, there would be a significant improvement in maternal mortality from septic abortion.

Uterine evacuation should be performed following incomplete abortion in order to prevent subsequent infection of retained products of conception. This may be a problem in those countries in which women have limited access to health services. Antibiotics should be given to a woman with an incomplete abortion if there are signs of infection at initial presentation.

Infection may follow elective termination of pregnancy. Women should be screened pre-operatively and treated with a full course of antibiotics if infection is

detected (Mills 1984). Some units use a single prophylactic dose of antibiotics peri-operatively, doxycycline 500 mg orally, but this may be insufficient to treat established infection.

When pregnancy occurs with an IUCD in situ, the coil should be removed during the first trimester in order to reduce the risk of septic abortion (Foreman et al. 1981).

Prophylactic antibiotics do not reduce the risk of intrauterine infection in midtrimester rupture of membranes (Keirse et al. 1989). However, they do reduce the problems of postpartum infection in the mother although it is not yet clear whether giving antibiotics at the time of delivery would be as efficacious.

Antibiotic Therapy

Once the diagnosis of septic abortion is made, antibiotics should be given immediately, after vaginal and cervical swabs and blood cultures have been taken.

The recommended combination is amoxycillin (500 mg every 8 h) and metronidazole (400 mg every 8 h) or a cephalosporin (500 mg every 8 h), and metronidazole. If the patient's condition is more serious, a combination of gentamicin (80 mg every 8 h), amoxycillin (500 mg every 8 h) and metronidazole (500 mg every 8 h) given intravenously should cover most organisms whilst awaiting results of bacteriological cultures. If the expense or availability of drugs is a problem, a combination of chloramphenicol (500 mg every 6 h) and penicillin (5 MU every 6 h) is also effective (Chow et al. 1977). If clostridial infection is suspected, high-dose intravenous penicillin or ampicillin should be given.

Curettage

Once the patient's condition has been stabilised and antibiotics given intravenously, the uterus must be evacuated within 6 h (Cavanagh et al. 1985). There is no advantage to be gained in waiting for the antibiotics to take effect since this will only delay removal of the source of infection.

Uterine evacuation must be performed by an experienced operator, preferably using suction curettage, since there is a risk of uterine perforation. An oxytocin agent should also be given to reduce the uterine bleeding.

Surgery

If the patient's condition does not improve within 6–12 h of initial treatment, laparotomy and hysterectomy should be considered. The indications for laparotomy are as follows (Botes 1973; Richards et al. 1985):

1. Pelvic peritonitis or septicaemic shock not responding to medical treatment
2. Uterine size more than 16 weeks
3. Uterine perforation
4. Uncontrollable uterine haemorrhage

5. Abortion induced with chemical agents e.g. soaps and detergents

6. Superimposed clostridial infection

Medical stabilisation and resuscitation and correction of anaemia and fluid and electrolyte balance is very important prior to laparotomy. The anaesthetic should be performed by an experienced anaesthetist.

The laparotomy should be performed through a midline incision to give full access. Purulent fluid may be found between loops of bowel in the abdominal cavity, as well as in the peritoneal spaces, particularly the subphrenic. Loops of bowel should be separated and inspected for evidence of perforation; careful handling is essential since they are extremely friable. Purulent exudate should be removed from the abdominal cavity. The peritoneal cavity should be lavaged thoroughly with warm saline. At the end of the procedure, large-bore Portex drains should be inserted in all four quadrants of the abdomen.

Hysterectomy is necessary if the uterus is larger than 16 weeks; shows evidence of perforation or necrosis or is actively bleeding (Richards et al. 1985). If the ovaries appear normal, they may be preserved (De Jonge and Venter 1988). However, if they are involved in tubo-ovarian masses, one or both should be removed. This is mutilating surgery since the patients are often young and primigravid, but early hysterectomy does improve survival (Richards et al. 1985).

The merits of early hysterectomy in clostridial infections are disputed. Decker and Hall (1966) recommend immediate hysterectomy if there are general signs of sepsis, uterine tenderness and clostridial organisms are identified from a cervical swab. In their series, mortality was reduced to 9% compared to previous reported rates of up to 70%. However, O'Neill and Schwartz (1970) managed their 7 cases conservatively without fatalities. They recommend curettage, antibiotics and a readiness to perform hysterectomy if the woman's condition does not improve.

If diffuse peritonitis is found at laparotomy, further management should be considered as well as debridement and drainage. Continuous peritoneal lavage may be instituted by inserting three large Portex drains through separate incisions, one to each sub-phrenic space and one to the pouch of Douglas. Rivlin and Hunt (1986) have described a method of irrigating the abdominal cavity with 2 l of warm peritoneal dialysis solution every 3 h. Each litre of solution contains 15 mg gentamicin and 4 mEq potassium chloride. Each tube was used in turn to irrigate, leaving the other two tubes to drain. The tubes were removed when the lavage fluid became clear, usually after 2 to 3 days. These authors reported a mortality of 27% in women with septic abortion. However, an important aspect of their improved survival figures was the addition of an anti-anaerobic antimicrobial to the systemic treatment.

Another method of management is to leave the abdominal wound open after the first laparotomy in order to allow infected peritoneal fluid to drain. The wound can be covered with gauze (Korepanov 1989) or a polypropylene mesh (Richardson and Polk 1981). However, Maetani and Tobe (1981) have shown that open drainage will not always drain residual collections and repeat laparotomy was necessary in 30% of their patients.

Repeat laparotomy is indicated if there are signs of continuing intra-abdominal sepsis. A policy of planned repeat laparotomy is carried out in some units (Schein et al. 1988): laparotomy is repeated every 2 to 3 days, irrespective of the patient's clinical condition, until a clean abdominal cavity is found. Between laparotomies, the open abdominal wound is covered with a Marlex mesh over the bowel and a

plastic adhesive drape over the skin defect. Schein et al. (1988) reported a 32% mortality rate using this technique in general surgical patients, an average of 2.5 reoperations being required. A Marlex mesh with a zip sewn to the fascia of the wound allows easy access for abdominal exploration and debridement 1 to 3 times per day (Walsh et al. 1988).

All women should be nursed on an intensive care unit with close supervision of ventilation, fluid balance, antibiotic therapy and total parenteral nutrition. Unfortunately, countries in which the problem of septic abortion is common often do not have these facilities.

Management of Septic Shock

The patient must be treated in an intensive care unit with a multidisciplinary team approach. On admission, a large bore intravenous cannula is inserted and blood drawn for the investigations outlined in Table 8.4. Various bacteriological and radiological investigations are instituted. Monitoring of haemodynamic changes and urine output is essential. An indwelling urinary catheter is inserted. If the patient remains hypotensive after initial resuscitation, a central venous pressure line should be inserted and, if necessary, a Swan Ganz cannula to the pulmonary artery to measure pulmonary capillary wedge pressure (PCWP). The main steps of treatment are as follows: maintain oxygenation, support the circulation and control infection.

Table 8.4. Investigations in suspected septic shock

Full blood count
Clotting studies: prothrombin time, partial thromboplastin time, fibrin degradation products
Cross match blood
Urea and electrolytes
Glucose
Liver function tests
Arterial blood gases
Chest X-ray
Bacteriological specimens
Midstream specimen of urine
High vaginal swab
Endocervical swab
Swab products of conception
Blood cultures

Oxygenation

Respiratory failure is usually related to the onset of adult respiratory distress syndrome (ARDS). ARDS occurs in approximately 10%–40% of septic patients (Balk and Bone 1989). It is characterised by hypoxaemia with pulmonary oedema detectable on chest X-ray in the absence of fluid overload or cardiac failure.

Ventilation should be commenced when there is evidence of respiratory failure with a pO_2 of <50 mmHg and a pCO_2 of >50 mmHg in room air with a decreasing pH (Lee et al. 1989). Early ventilation may also allow blood flow to be directed away from the respiratory muscles to improve circulation to the brain and other vital organs. Positive end-expiratory ventilation is usually necessary in patients with ARDS.

There has been much debate as to the value of high-dose corticosteroids in patients with septic shock. In a recent review, Nicholson (1989) concluded that high-dose glucocorticoid treatment in the early septic state neither improves outcome nor prevents or reverses ARDS. There remains uncertainty as to whether steroids might reduce mortality in patients with gram-negative septicæmia (Veterans Administration 1987) and further studies are awaited.

Circulatory Support

Resuscitation must be initiated rapidly by fast infusion of 1–2 l of normal saline or similar crystalloid. Colloid solutions should also be used when there is significant hypotension. While monitoring the PCWP with a Swan Ganz catheter, a monitored fluid challenge of 500 ml normal saline over 10 min can be given. If the PCWP rises by more than 7 mmHg the next bolus is withheld. If it does not increase by at least 3 mmHg, then a further bolus of fluid is given. This is known as the “7–3” rule (Pearlman and Faro 1990) and may be sufficient to achieve the required PCWP of 12–16 mmHg.

Following abortion, a large quantity of blood may be lost which should be replaced within the fluid requirements. Anaemia may also be secondary to haemolysis caused by the septicaemia. Disseminated intravascular congestion (DIC) must be treated in consultation with the haematology department. This will involve giving fresh frozen plasma and possibly other clotting factors and platelets.

If fluid and blood fail to restore cardiovascular function, inotropic drugs are necessary. Dopamine, which has dose-dependent actions, is the first choice. At the lowest rate (0.5 – 3.0 $\mu\text{g/kg/min}$), it should increase urine output and cause naturesis (Boyd et al. 1989). At a higher dose (5 – 10 $\mu\text{g/kg/min}$), it has a β -adrenergic effect with a positive inotropic action on the heart; at a dose of more than 15 $\mu\text{g/kg/min}$ it has an α -adrenergic effect causing general vasoconstriction. The usual starting dose is 2 – 5 $\mu\text{g/kg/min}$.

The systemic blood pressure may still remain low, due either to depressed left ventricular function or to persistent vasodilatation. If the myocardium is depressed, further inotropic drugs such as dobutamine, isoprenaline or amrinone may be used. Phenylephrine or noradrenaline are given as vasoconstrictors to treat peripherical vasodilatation. The above scheme is depicted in Fig. 8.1 in the form of an algorithm obtained from Lee et al. (1988).

Infection Control

Antibiotic therapy must be initiated immediately using a combination with broad spectrum activity. These can then be adjusted once bacteriological results are available. An intravenous combination of high-dose ampicillin (2 mg every 6 h),

Fig. 8.1. Haemodynamic algorithm for obstetric septic shock. BP, blood pressure; PCWP, pulmonary catheter wedge pressure; SBP, systolic blood pressure; SVRI, systemic vascular resistance index. Reproduced with permission from Lee W, Clark SL, Cotton DB et al. (1988) American Journal of Obstetrics and Gynecology 159:410-416

gentamicin (2 mg/kg loading then 1.5 mg/kg every 8 h) and metronidazole (500 mg every 8 h) is effective against the usual organisms causing septic abortion. Ampicillin is omitted if the patient is allergic to penicillin. In countries with limited access to antibiotics, the combination of benzyl penicillin, chloramphenicol and metronidazole is usually effective. When gentamicin is used, peak and trough blood levels must be routinely monitored to avoid nephrotoxic effects.

Surgical removal of retained products of conception must be expedited and further surgery may be necessary, as already discussed.

If pyrexia continues in spite of the above treatment, septic pelvic vein thrombosis should be considered and full heparin anticoagulation commenced. Some authors consider that heparin should be used routinely in the management of septic abortion since platelet aggregation is one of the underlying pathological mechanisms (Margulis et al. 1971; Botes 1973). The dose is 5000 units i.v.

followed by an infusion of 500–700 units/h, closely monitored by clotting times. More recent reviews on the management of septic shock do not advocate heparin (Pearlman and Faro 1990), though it might be useful in the very early hypercoagulable phase of DIC, if this were recognised in time (Beller 1985).

There are exciting developments in the use of monoclonal antibodies directed at the lipid A domain of endotoxins. Ziegler et al. (1991) have reported a multicentre study of the use of HA-1A (a monoclonal antibody that binds to lipid A) in septic patients. There was a statistically significant reduction in mortality in those patients with gram-negative septicaemic shock treated with the antibody compared to a placebo.

The technology of monoclonal antibodies leads to the possibility of antibodies directed against other pathogenic factors in bacterial shock such as the cytokines, tumour necrosis factor and interleukin 1 (Wolff 1991).

Conclusion

Septic abortion can present with various degrees of severity, but the medical staff must be prepared for the rapid decline in the patient's condition and must not hesitate to perform a laparotomy if she does not respond to supportive therapy, antibiotics and uterine curettage. The obvious way to reduce the incidence of septic abortion and associated mortality is to liberalise abortion laws worldwide.

References

- Adadeuoh BK, Akinla O (1970) Postabortal and postpartum tetanus. *J Obstet Gynaec Brit Comm* 77:1019–1023
- Adetoro OO (1986) Septic induced abortion at Ilorin, Nigeria: an increasing gynaecological problem in the developing countries. *Asia Oceania J Obstet Gynaecol* 12:201–205
- Aggarwal VP, Mati JK (1980) Review of abortions at Kenyatta National Hospital, Nairobi. *East Afr Med J* 57:138–143
- Ashworth MF (1990) Harare hospital maternal mortality report for 1987 and a comparison with previous reports. *Cent Afr J Med* 36:209–212
- Balk RA, Bone RC (1989) The septic syndrome: definition and clinical implications. *Crit Care Clin* 5:1–8
- Barnes AB, Ulfelder H (1964) Septic abortion. *JAMA* 189:919–923
- Beller FK (1985) Sepsis and coagulation. *Clin Obstet Gynecol* 28:46–52
- Botes M (1973) Septic abortion and septic shock. *S Afr Med J* 47:432–435
- Boyd JL, Stanford GG, Chernow B (1989) The pharmacotherapy of septic shock. *Crit Care Clin* 5:133–150
- Butler HM (1945) Bacteriological studies of clostridium welchii infections in man. *Surg Gynecol Obstet* 81:475–486
- Cates W, Roach RW, Grimes DA, Tyler CW (1978) Legalized abortion: effect on national trends of maternal and abortion-related mortality (1940 through 1976). *Am J Obstet Gynecol* 132:211–214
- Cavanagh D, Rao SP, Roberts WS (1985) Septic shock in the gynaecologic patient. *Clin Obstet Gynecol* 28:355–364
- Chow AW, Marshall JR, Guze LB (1977) A double blind comparison of clindamycin with penicillin plus chloramphenicol in treatment of septic abortion. *J Infect Dis* 135:335–39

- Crowther C (1986) The prevention of maternal deaths: a continuing challenge. *Cent Afr J Med* 32:11–14
- Deane RM, Russell KP (1960) Enterobacillary septicaemia and bacterial shock in septic abortion. *Am J Obstet Gynecol* 79:528–541
- Decker WH, Hall W (1966) Treatment of abortions infected with *Clostridium welchii*. *Am J Obstet Gynecol* 95:394–399
- De Jonge ETM, Venter PF (1988) Hysterectomy for septic abortion – is bilateral salpingo-oophorectomy necessary? *S Afr Med J* 74:291–292
- Department of Health and Social Security (1989) Report on Confidential Enquiries into Maternal Deaths in England and Wales 1982–1984. Her Majesty's Stationery Office, London
- Douglas GW, Beckman EM (1966) Clinical management of septic abortion complicated by hypotension. *Am J Obstet Gynecol* 96:633–644
- Foreman H, Stadel BV, Schlesselman S (1981) Intrauterine device usage and fetal loss. *Obstet Gynecol* 58:669–677
- Grimes DA, Cates W, Selik RM (1981) Fatal septic abortion in the United States, 1975–1977. *Obstet Gynecol* 57:739–744
- Hogge WA, Schonberg SA, Golbus MS (1986) Chorionic villus sampling: experience of the first 1000 cases. *Am J Obstet Gynecol* 154:1249–1252
- Keirse MJNC, Ohlsson A, Treffers PE, Kanhai HH (1989) Prelabour rupture of the membranes preterm. In: Chalmers I, Enkin M, Keirse MJNC (eds) *Effective care in pregnancy and childbirth*, Oxford University Press, Oxford, pp 663–693
- Kowen DE, Hanslo DH, Botha PL, Davey DA (1979) Incidence of aerobic and anaerobic infection in patients with incomplete abortion. *S Afr Med J* 55:129–132
- Korepanov VI (1989) Open abdomen technique in the treatment of peritonitis. *Br J Surg* 76:471
- Lee W, Clark SL, Cotton DB et al. (1988) Septic shock during pregnancy. *Am J Obstet Gynecol* 159:410–416
- Lee RM, Balk RA, Bone RC (1989) Ventilatory support in the management of septic patients. *Crit Care Clin* 5:157–175
- Maetani S, Tobe T (1981) Open peritoneal drainage as an effective treatment of advanced peritonitis. *Surgery* 90:804–809
- Margulis RR, Dustin RW, Lovell JR, Robb H, Jabs C (1971) Heparin for septic abortion and the prevention of endotoxin shock. *Obstet Gynecol* 37:474–483
- Marini A, Suma V, Baccichetti C, Lenzini E (1988) A case of septic miscarriage, a probable complication of chorion villus sampling. *Prenat Diagn* 8:399–400
- Mathai S (1986) Abortion and its associated problems – editorial. *East Afr Med J* 63:769–770
- Mills AM (1984) An assessment of pre-operative microbial screening on the prevention of post-abortion pelvic inflammatory disease. *Br J Obstet Gynaecol* 91:182–186
- Munday D, Francome C, Savage W (1989) Twenty one years of legal abortion. *Br Med J* 298:1231–1234
- Nicholson DP (1989) Review of corticosteroid treatment in sepsis and septic shock: pro or con. *Crit Care Clin* 5:151–155
- O'Neill RT, Schwarz RH (1970) Clostridial organisms in septic abortion. *Obstet Gynecol* 35:458–461
- Pearlman M, Faro S (1990) Obstetric septic shock: a pathophysiologic basis for management. *Clin Obstet Gynecol* 33:482–492
- Richards A, Lachman E, Pitsoe SB, Moodley J (1985) The incidence of major abdominal surgery after septic abortion – an indicator of complications due to illegal abortion. *S Afr Med J* 68:799–800
- Richardson JD, Polk HC (1981) Newer adjunctive treatments for peritonitis. *Surgery* 90:917–918
- Rivlin ME, Hunt JA (1986) Surgical management of diffuse peritonitis complicating obstetric/gynecologic infections. *Obstet Gynecol* 67:652–655
- Rotheram EB, Schick SF (1969) Nonclostridial anaerobic bacteria in septic abortion. *Am J Med* 46:80–89
- Schein M, Saadia R, Freinkel Z, Decker GAG (1988) Aggressive treatment of severe diffuse peritonitis: a prospective study. *Br J Surg* 75:173–176
- Shepherd JM, Benny PS (1984) Septic abortion in Wellington 1960–1979. *NZ Med J* 97:322–324
- Smith JW, Southern PM, Lehmann JD (1970) Bacteraemia in septic abortion: complications and treatment. *Obstet Gynecol* 35:704–708
- Tatum HJ, Schmidt FH, Jain AK (1976) Management and outcome of pregnancies associated with the copper T intrauterine contraceptive device. *Am J Obstet Gynecol* 126:869–879
- Templeton JS (1974) Septic abortion and the Dalkon shield. *Br Med J* ii:612
- Unuigbo JA, Oronsaye AU, Orhue AAE (1988) Abortion related morbidity and mortality in Benin City, Nigeria: 1973–1985. *Int J Gynaecol Obstet* 26:435–439

- Veterans Administration Systemic Sepsis Cooperative Study Group (1987) Effect of high-dose glucocorticoid therapy on mortality in patients with clinical signs of sepsis. *N Engl J Med* 317:659–665
- Walsh GL, Chiasson P, Hedderich G, Wexler MJ, Meakins JL (1988) The open abdomen. The Marlex mesh and zipper technique: a method of managing intraperitoneal infection. *Surg Clin North Am* 68:25–40
- Williams P, Johnson B, Vessey M (1975) Septic abortion in women using intrauterine devices. *Br Med J* iv:263–264
- Wolff SM (1991) Monoclonal antibodies and the treatment of gram negative bacteremia and shock – editorial. *N Engl J Med* 324:486–488
- Ziegler EJ, Fisher CJ, Sprung CL et al. (1991) Treatment of gram-negative bacteremia and septic shock with HA-1A human monoclonal antibody against endotoxin. *N Engl J Med* 324:429–436