ORIGINAL ARTICLE

Post-Caesarean Septicaemia in Kandang Kerbau Hospital, Singapore, 1993-1995

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Summary

We reviewed all documented cases of septicaemia following caesarean deliveries in Kandang Kerbau Hospital between 1st January 1993 to 31st December 1995. There were 22 cases of septicaemia among 8201 caesarean births, and hence the incidence is 2.7:1000. There were 45,412 deliveries, and the overall caesarean section rate was 18.1%

Among the 22 documented cases of septicaemia which came under this study, the most common clinical conditions found were endomyometritis (7 cases), urinary tract infection (6 cases), and wound infection (3 cases). One of the three cases with wound infection also had pneumonia. There was one patient who had mild transient myocarditis. We could not determine with certainty any site of infection in five patients. The most common bloodstream bacterial isolates was *Staphylococcus aureus* (16), while the uncommon ones were *Acinetobacter baumanii* (2), *Escherichia coli* (1), *Klebsiella sp.* (1), *Staphylococcus epidermidis* (1), Streptococcus Group F (1), *Peptostreptococcus* species and *Veillonella* species (1). There was no mortality and prompt, vigorous treatment had led to uneventful recovery in all the cases.

Key Words: Caesarean section, Septicaemia, *Staphylococcus aureus*

Introduction

Post-caesarean septicaemia (or sepsis) is an obstetric emergency. If left unattended, it could lead to more ominous sequelae, culminating in septicaemic shock, multiple organ dysfunction syndrome and death[1]. Since the mid-seventies the incidence of caesarean section has increased steadily in the western world[2]. It is now considered to be the tenth most common surgical procedure in the United States[3] and, despite widespread concern, there is no evidence that this trend will be reversed[4].

The morbidity of the operation is high, with a significant risk of excessive blood loss at, or after, delivery, an increased risk of thromboembolic disease and a risk of post-delivery febrile illness due to infection which is nearly ten times higher compared with vaginal delivery[5]. The increased risk of infection after caesarean section may be due to a number of factors including the tissue damage created by the uterine incision and its repair, intra-uterine manipulation, and the presence of suture material and tissue necrosis within the wound, and the possibility of haematoma formation.

Infection is the major cause of postcaesarean section morbidity, accounting for up to two-thirds of the postoperative complication[6], and serious complications such as life-threatening septicaemia can occur. Recently, in the United Kingdom, septicaemia has accounted for about 10% of maternal deaths following caesarean section (Report on Confidential Enquiries into Maternal Death 1986)[7].

Materials and Methods

We reviewed the results of all blood cultures from patients admitted to our hospital and who had undergone caesarean sections between 1st January 1993

and 31st December 1995. Our definition of septicaemia is the same as the term "sepsis" as proposed in 1992 by the American College of Chest Physicians/Society of Critical Care Medicine (CCP/SCCM)[1] i.e., culture-proven or documented infection, with two or more of the following conditions: temperature > 38°C or 36°C, pulse > 90 beats per minute, respiratory rate >20 breaths per minute or Pa CO2 < 32 mm Hg, and white blood cell > 12,000/mm^3, or > 10% immature (band) forms.

The case-records of all such patients with septicaemias were reviewed and we noted the relevant clinical diagnosis, antibiotic therapy, length of hospital stay, and laboratory data. For each patient, we note the duration of febrile morbidity (defined as oral temperature of > 38°C), and any major complications in these patients, such as shock, myocarditis, wound dehiscence, urinary infection, chest infection, ileus, peritonitis, septic pelvic thrombophlebitis, haematoma, abscess, and death. The house staff consisting of junior doctors and specialists based the diagnosis of infection on the usual clinical criteria. For endomyometritis, these criteria include fever, lower abdominal pain, uterine tenderness, foul-smelling lochia and no other site of infection.

Results

The clinical course of 22 post-caesarean patients with septicaemia were reviewed. The patient's ages ranged from 17 to 43 years. Six of our patients were aged 35 years or more. Their average height was 146 cm. The patient's weights ranged from 64 kg to 112 kg, with a mean of 78.8 kg. More than half (12 patients) are over 80 kg in body weight.

Table I shows the clinical conditions present among the 22 patients with post-caesarean septicaemia.

Table II shows some measures of morbidity by diagnosis. There was no maternal death, and multiple organ dysfunction was not found. We could not determine with certainty any site of infection in five patients, although all had *Staphylococcus aureus* as isolates from the bloodstream, and this group of patients included one who had eclampsia, requiring emergency caesarean section.

Table I
Clinical conditions present among the septicaemic patients

Conditions	Number of cases
Endomyometritis	7
Urinary tract infection	6
Wound infection	3
Pneumonia	1
Acute myocarditis	1
No clinical finding other than septicaemia	5

Note: One patient had wound infection and pneumonia

Table III shows the bacterial isolates by clinical conditions

In our study, 21 patients each had one bacterial species isolated from her blood cultures. Only one patient was noted to have polymicrobial isolates from the bloodstream, and this particular patient had urinary tract infection due to Group B Streptococcus during mid-trimester which responded to oral ampicillin. She subsequently had an elective caesarean section at term because of cephalo-pelvic disproportion. This was followed by febrile morbidity and septicaemia on the third post-operative day, with blood cultures showing Streptococcus Group F and two anaerobes (*Peptostreptococcus* species and *Veillonella* species). Clinically she had signs and symptoms of endomyometritis during the post-operative period.

Table IV shows our hospital's antiobiogram for the years 1993-1995. The predominant micro-organisms are in descending order of prevalence. The recommended antibiotic therapy is cloxacillin for *Staphylococcus aureus* and gentamicin for the Gram-negative bacilli.

Discussion

The single most important risk factor for postpartum infection is caesarean birth[5,8,9,10,11], and septicaemia following abdominal delivery represents a serious phase

Table II
Clinical parameters of patients with post-caesarean septicaemia

Parameters	UTI	Endomyometritis	Wound infection	Chest infection
Duration of fever (days)	4.1	3.8	3.4	2
Hospital stay (days)	7.2	10.6	8.2	8
Oral temperature at blood culture (°C)	39.2	39.0	39.1	39.2
Leukocyte count (x 10^3 cell/mm^3)	14.1	17.5	15.3	12.0

Table III
Organisms isolated from the blood stream versus clinical diagnosis of infection

Organism	Total	Endomyometritis #	UTI *	Wound infection	Pneumonia	No other infection
S. aureus	16	4	3	3	1	5
Acinetobacter sp	2		2			
E. coli	1	1				
Klebsiella sp	1	1				
S. epidermidis	1		1			
Strept. group F	1	1				
Anaerobes	1	1				

 # One patient with endomyometritis had two bacterial isolates, namely Streptococcus group F and anaerobes.
** Urinary tract infection*

the systemic inflammatory response syndrome (SIRS)[1] of puerperal infection. Gibbs[5] reported a rate of endomyometritis after caesarean section of 38.5 percent versus only 1.2 percent among patients delivered vaginally. Blanco *et al*[12] reviewed 176 patients with obstetric bacteraemia, and found that whereas 3% of patients undergoing caesarean section had bacteraemia, the corresponding figure for those who delivered vaginally was only 0.1%.

In our study, the incidence of septicaemia complicating abdominal deliveries in Kandang Kerbau Hospital is 2.7 per 1000, while we had not encountered any significant obstetric septicaemia following vaginal delivery during the same period.

Among the 22 patients under study, the mean height and weight are 146 cm and 78.8 kg, respectively. More than half (12 patients) are over 80 kg in body weight. Obesity is a well-known risk factor for post-caesarean complications including infections. Other factors associated with an increased risk of postpartum

Table IV
Kandang Kerbau Hospital antibiogram, 1993-1995

Predominant micro-organisms	Antibiotic sensitivity
Gram-positive	
Staphylococcus aureus	Cloxacillin or Cefazolin
Gram-negative	
Klebsiella sp	Gentamycin or Ceftriaxone
Acinetobacter sp	
Pseudomonas aeruginosa	
Enterobacter sp	
E. coli	

infection after caesarean section are prolonged rupture of membranes (7 cases)[13,14] and prolonged labour (12 cases)[5,15,16].

The true incidence of infectious morbidity following caesarean section is difficult to determine. One problem is the lack of an accurate diagnosis of infections. Fever alone occurs in about 20% of women delivered abdominally[17]. The aetiology of such post-operative pyrexia is unclear, but can be due to dehydration or to mild, spontaneously resolving endomyometritis. However, fever and infections are not synonymous. Febrile morbidity is traditionally defined as a temperature of 38.0°C (100.4°F) or higher on any 2 of the first 10 days postpartum except in the first 24 hours[18]. In our study, every one of our patients had febrile morbidity and all had achieved an oral temperature of 39.0°C or higher. Ledger *et al*[19] reported an oral temperature of 38.9°C in their bacteraemic patients, while Blanco *et al*[12] found that 49% of their bacteraemic population had oral temperatures below 38.9°C.

Febrile morbidity of course does not explain the origin or site of infection. In general, infectious morbidity following caesarean section arises by two major mechanisms, i.e. cross-infection and endogenous infection[20]. Cross-infection involves the transfer of micro-organisms to the patient from external sources such as other humans or the environment. Endogenous infection arises in patients when micro-organisms from contaminated surfaces (e.g. vagina, and skin) are surgically transferred to sterile tissues. It is believed that during the caesarean operation, one or both of these mechanisms are initiated for the infectious process to occur, and that the most common nidus for post-caesarean septicaemia is endometritis[21,22]. From the uterine cavity, myometritis then follows, eventually leading to parametritis, adnexitis, pelvic abscess and septicaemia.

In our study, 7 of the 22 patients had endomyometritis, which was the most common clinical diagnosis. Charles and Larsen[22] believed that 5 to 10% of patients with postpartum fever either have no obvious clinical infection or infection at some site other than the genital tract (i.e. urinary tract, chest, breast, intravenous infusion site, or surgical wound). In our series, 6 patients had urinary tract infection, which is the second most common diagnosis, and 5 patients had no obvious site of infection other than the finding of septicaemia. Charles and Larsen[22] cautioned that continuous fever in a puerperal patient who has had a genital tract infection may be the first indication of septic thrombophlebitis with its attendant risk of pulmonary embolism.

Infections of the endomyometritis are usually polymicrobial[23, 24], involving one or more of the four main groups of bacteria - aerobic streptococci, anaerobic Gram-positive cocci, aerobic and anaerobic Gram-negative bacilli. We have not routinely relied on or chosen to perform an endometrial culture, but we do take high vaginal swabs for aerobic and anaerobic bacterial cultures. We usually perform blood and urine cultures before the initiation of antibiotic therapy. The organisms isolated from blood cultures in post-caesarean septicaemic patients should reflect those that have been reported in various obstetrical and gynaecological soft tissue infections including endomyometritis. These include single organism isolation of both aerobic[25,26,27] and anaerobic organisms[28] as well as polymicrobial bacteraemia (one patient)[29]. In our study, almost all the micro-organisms that we managed to identify in the blood stream are aerobic, with *Staphylococcus aureus* being the most common (72.7%). We have not found Group B

Streptococcus among the isolates from the blood stream, and *Escherichia coli* is uncommon (4.5%). In the United States, in a study on obstetric bacteraemia, Blanco *et al*[12] found a greater predominance of *Escherichia coli* among the Gram-negative aerobes and of Group B Streptococcus among the Gram-positive aerobes. In their series, *Escherichia coli*, Group B Streptococcus and *Staphylococcus aureus* were responsible for 30%, 15.3%, and 4.3% of obstetric bacteraemia, respectively. The reasons for these differences are unclear, but variation in antibiotic utilization may have an important role.

The successful management of the patient with post-caesarean septicaemia requires a careful systematic review of the patient, with prompt institution of adequate fluid resuscitation, oxygen administration, and intravenous antibiotic therapy. The goal is to prevent the progression of the condition to septicaemic shock and multiple organ dysfunction syndrome (MODS)[1].

In almost all cases of post-caesarean septicaemia, the infection is polymicrobial in origin, with the flora from the genital tract playing an important. The bacteraemic isolates represent the "tip of the ice-berg" and septicaemia is a serious phase in the continuum of infective events starting from an early or "warm" stage of systemic inflammatory response syndrome (SIRS) and leading to the stage of multiple organ dysfunction syndrome (MODS)[1].

While there are numerous antibiotic regimens available and a number of new antibiotics have been introduced in the past decade, there is little proof that any regimen other than triple antibiotics improves outcome. The ampicillin-gentamicin-metronidazole or the ampicillin-gentamicin-clindamycin combinations are commonly employed. Where *Staphylococcus aureus* is a suspected pathogen, as is prevalent in our study, a semisynthetic penicillin (e.g. cloxacillin) may be substituted for ampicillin.

Control measures aimed at preventing post-caesarean sepsis must take into account cross-infection and endogenous infection as the major mechanisms of pathogenesis. Control of cross-infection is achieved by preventing transmission and isolating the patient from contact with external micro-organisms. These measures basically involve aseptic and anti-septic techniques, and they include sterilization of instruments, disinfection of the environment and improved protective masks, clothing, drapes and procedures. Control of endogenous infection is best achieved by prophylactic antibiotics with concomitant meticulous surgical technique. In our study, only one patient had intravenous cefazolin (1 g.) at the time of cord clamping. We advocate the use of antibiotic prophylaxis particularly for those patients with risk factors for postpartum infection.

Conclusion

The decision to opt for caesarean section should not be taken too lightly, as the health and economic consequences of the upward trend in abdominal delivery are enormous. Obstetricians performing this operation have a responsibility to ensure that the risk of infection is reduced. Proper aseptic and anti-septic procedures should be scrupulously followed. If the patient is at high risk of infectious morbidity following a prolonged labour, or prolonged rupture of the membranes, considerations should be given to prophylactic antibiotic therapy. Vigilant post-operative care is mandatory in every patient. We advocate that each case of obstetric septicaemia should undergo a thorough audit.

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