Clinical Reports

Maternal death following epidural anaesthesia for Caesarean section delivery in a patient with unsuspected sepsis

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Sepsis in the parturient may be difficult to recognize in light of the physiological changes associated with pregnancy. The purposes of this report are to highlight the signs and symptoms which indicate an underlying septic process and the management of these patients in the peripartum period. This 32-yr-old GII PI woman with twin gestation presented at 36 wk in labour. Her temperature was 35.3° C, she was normotensive and had a normal white blood cell count. After epidural anaesthesia was administered for Caesarean section, she became apnoeic, pulseless and unresponsive. Despite aggressive cardiopulmonary resuscitation, neither she nor her twin babies survived. Post mortem blood work revealed a considerable left shift of her white blood count (>60% bands) and an anion gap acidosis. Autopsy revealed evidence of widespread Group A beta-haemolytic streptococcal sepsis. Diagnosis of sepsis in the parturient involves assessment of the patient's temperature, WBC and differential and acid-base status. Evaluation of the intravascular volume must precede anaesthetic intervention. Epidural anaesthesia may be considered in the labouring and Caesarean section patient who has been fluid-resuscitated. Emergency operative delivery may result in cardiovascular compromise in the patient with severe sepsis.

Pendant la grossesse, le diagnostic de septicémie peut s'avérer difficile à cause des changements physiologiques. Le but de ce travail consiste à mettre en évidence les signes et symptômes de processus septique et la gestion du péripartum. Une parturiente de 32 ans PI GII de 36 semaines avec gemellité débute son travail à la 36e semaine de grossesse. Sa température est à 35,3° C, elle est normotendue et sa formule blanche est normale. Après la mise en marche d'une épidurale pour césarienne, elle devient apnéique et inerte, son pouls est imperceptible. Malgré une réanimation cardiorespiratoire agressive, elle et ses jumeaux décèdent. Les examens sanguins post-mortem montrent une déviation vers la gauche considérable de la formule blanche (>60% de neutrophiles non segmentés) et un trou anionique. L'autopsie révèle une septicémie disséminée au streptocoque bêta-hémolytique du groupe A. Le diagnostic de septicémie chez la parturiente nécessite la mesure de la température, de la formule blanche avec décompte différentiel et de l'équilibre acide-base. L'évaluation du volume sanguin doit précéder l'intervention chirurgicale. Une épidurale doit être considérée pour la patiente en travail et la candidate à la césarienne dont le volume sanguin a été restauré. En cas d'urgence, la chirurgie césarienne peut provoquer chez la parturiente septique un collapsus cardiovasculaire grave.

Key words

ANAESTHESIA: obstetrics;

ANAESTHETIC TECHNIQUES: epidural;

COMPLICATIONS: sepsis, death.

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There has been a recent resurgence in Group A streptococcal infections causing morbidity and mortality in young immunocompetent individuals.¹ There are no reports in the literature, however, of an obstetrical patient presenting with Group A streptococcal sepsis at the time of labour or delivery. In this unfortunate case, maternal and fetal death followed the institution of epidural anaesthesia for Caesarean section in a patient with unsuspected Group A streptococcal sepsis. It is important to recognize that the obstetrical population has a higher morbidity

when severe sepsis develops.² As well, the diagnosis of sepsis in the parturient may be confusing due to the physiological changes that accompany pregnancy. Management of the septic parturient involves monitoring of both fetus and mother. Fetal heart rate and scalp pH abnormalities are important indications of fetal distress. The diagnosis of sepsis in the mother involves history, physical and laboratory findings. Temperature $>38^{\circ}\text{C}$, $<36^{\circ}\text{C}$ or an abnormal white blood count including a left shift are important diagnostic indicators.³ Antibiotics should be started early and meticulous attention must be paid to the mother's intravascular volume. Urinary output and central venous pressure are needed to assess the patient with severe sepsis adequately. Fluid resuscitation must precede any elective anaesthetic intervention to avoid catastrophic cardiovascular compromise. The need for urgent operative delivery must be carefully assessed if the patient is severely hypovolaemic.

Case report

A 32-yr-old GII PI woman with known twin gestation presented to the delivery room at 36 wk in labour. She had complained of nausea and abdominal pain for a number of hours before admission and had vomited once. She was experiencing contractions every three minutes and vaginal examination revealed an 80% effaced, 1 cm dilated cervix. Ultrasound examination showed the presenting twin in a breech position and the second twin in a transverse lie. Although the fetal hearts were not seen at this time, the babies were noted to be moving. Due to the malpresentation, it was decided to perform a Caesarean section.

She was a previously healthy woman with no medical or surgical problems. Both the present and past pregnancies had been uneventful. She had no allergies nor did she take any medications. She had had an epidural anaesthetic four years before admission for labour and delivery without incident. An ultrasound one week before admission was normal and revealed the position of the babies to be breech/breech. Further inquiry about the abdominal pain she was experiencing confirmed it was related to her contractions.

Physical examination revealed an extremely anxious, obese woman (102 kg on prenatal record) with a blood pressure of 142/84 mmHg, heart rate of 104 bpm and oral temperature of 35.3°C . Her respiratory rate was not noted. Continuous external fetal heart rate monitoring was not possible due to her obesity and inability to lie still, but a heart rate of Twin B was noted to be 138 bpm at one point in time. Since the patient was being prepared for an imminent Caesarean section, no scalp electrode was applied.

Urinalysis showed 1^{+} protein, sugar negative and 2^{+}

acetone. Complete blood count revealed a haemoglobin concentration of $123\text{ g} \cdot \text{L}^{-1}$ and a white blood cell count of $7.3\text{ cells} \cdot \text{mm}^{-3}$. The haematology laboratory reported the platelets to be "clumped, but adequate." This result implies that the platelet count has been deemed normal in number by the laboratory technologist who has examined the smear but has not individually counted the platelets. Since they were "clumped," their numbers were not able to be accurately assessed by the usual automatic counter.

The patient was transferred to the delivery room for institution of epidural anaesthesia before Caesarean section. An intravenous catheter was *in situ* and the patient had received approximately 1000 ml Normosol-R within 30 min. An automatic blood pressure cuff was applied and the patient placed in the right lateral position. Her baseline blood pressure was 135/84 mmHg and she was receiving oxygen by face mask. She complained of nausea, shortness of breath and vomited once. No oxygen saturation was noted at this time.

An epidural puncture was performed without difficulty at the L_{3-4} interspace using the loss-of-resistance technique. A mixture of carbonated lidocaine 2% with 1:200,000 epinephrine and mepivacaine 2% in a 1:1 ratio was used for anaesthesia. Twelve millilitres were given through the needle after it was ascertained that no blood or CSF was present. This was given over a period of two to three minutes. A further six millilitres were given after the epidural catheter was threaded and secured.

She turned onto her back with some assistance and the operating room table was tilted to ensure left uterine displacement. Her blood pressure was 150/85 mmHg. She again complained of shortness of breath and a pulse oximeter was applied. The saturation was noted to be 78%. She became rapidly unresponsive. Approximately eight minutes had elapsed since the initial dose of local anaesthetic. Although the larynx was not well visualized, the trachea was intubated and the lungs were ventilated with 100% oxygen. No drugs were used to facilitate intubation. The ECG showed a wide complex idioventricular rhythm and there was no cardiac output. Cardiopulmonary resuscitation was begun and it was decided to proceed with the Caesarean section.

One milligram of epinephrine and 0.6 mg atropine were given *iv*. The idioventricular rhythm persisted with electromechanical dissociation. Repeated doses of epinephrine totalling 4 mg were given over 5–7 min. Ventricular tachycardia developed and was treated with a bolus of 100 mg of lidocaine followed by a lidocaine infusion. Defibrillation at 200 J was performed resulting in an idioventricular escape rhythm with no output. One gram of calcium chloride and 50 meq sodium bicarbonate were given. Air entry was noted to be equal bilaterally.

Ventricular fibrillation then developed and defibrillation at 200, 300 and 400 J resulted in conversion to a wide complex idioventricular rhythm. An intravenous infusion of dopamine was started, a pericardiocentesis performed and one milligram epinephrine was injected intraventricularly. There was no change in the cardiac rhythm and no output. The patient was pronounced dead 35 min after CPR was begun.

The babies were delivered within four minutes of the maternal arrest and were managed immediately by the neonatology team. One minute Apgar scores were zero and zero. Both babies were pronounced dead 20 min after resuscitation was begun. Cord gases obtained from twin A revealed severe acidosis.

	PO_2 mmHg	PCO_2 mmHg	pH units	Base excess meq $\cdot$ L ⁻¹
<i>Umbilical vein</i>				
Normal	30	40	7.32	-5
Twin A	12	103	6.63	-31
<i>Umbilical artery</i>				
Normal	15	50	7.24	-7
Twin A	23	56	6.45	-41

Post-mortem assessment of the mother's electrolyte concentrations on admission revealed: sodium 137 meq $\cdot$ L⁻¹, potassium 4.3 meq $\cdot$ L⁻¹, chloride 103 meq $\cdot$ L⁻¹ and HCO₃⁻ 14 meq $\cdot$ L⁻¹. The anion gap was 19 meq $\cdot$ L⁻¹. As well as this anion gap acidosis, a post-mortem differential of the white blood cell count revealed a marked left shift with 60% bands.

At autopsy, serum lidocaine concentrations were normal and the epidural catheter was correctly positioned in the epidural space. Both babies and mother had evidence of widespread Group A beta-haemolytic streptococcal sepsis.

Discussion

As early as the 1700s, physicians described patients with puerperal sepsis but it wasn't until 1928 that Group A streptococcus was identified as the pathogen responsible.⁴ Over the following decades, severe obstetrical infections with Group A streptococcus began to decline.⁵ In the mid-1980s however, worldwide reports appeared describing a resurgence of serious diseases caused by Group A streptococcus (GAS).¹ This was brought to the public's attention in 1990 with the death of Jim Henson, creator of the Muppets.⁶

Demers *et al.*, published a report, which includes this patient, of 50 cases of serious GAS infections in Ontario between 1987 and 1991.⁷ The median age was 47 yr and

the overall mortality was 58%. No focus of infection was identified in 12 patients (24%), and in this group the mortality rate was 75%. Bacteraemia was present in our patient but no source of infection was identified. There are no reports in the literature of maternal or fetal death during labour and/or delivery associated with GAS.

Clinically, Group A streptococcus presents most commonly with a skin or respiratory infection and may rapidly progress to shock.^{5,7} Associated abnormalities include renal impairment, hypocalcaemia, abnormal PT and PTT, hypoalbuminaemia, left shift and lymphopaenia and an increased creatine phosphokinase.^{7,8}

Treatment of GAS includes antibiotics such as penicillin, erythromycin or clindamycin. Other therapy includes neutralization of cytokines by immunoglobulins, plasma exchange and the use of antithrombin to prevent the deterioration of the complement and coagulation cascade.⁹

Despite the underlying cause of infection, the obstetrical population has a higher morbidity when severe sepsis develops.² This may be explained by decreases in IgG as well as a decrease in the absolute number of lymphocytes. As well, it appears that the immunological activity of the lymphocytes is impaired. Animal studies have indicated that susceptibility to endotoxins associated with infectious processes increases during pregnancy.¹⁰

Five percent of septic shock in the obstetrical population is caused by gram positive bacteria and 95% by gram negative organisms.¹⁰ Early in the course of septic shock, the patient may experience a high cardiac output, a decreased peripheral resistance and an increased oxygen consumption. These changes mirror the normal physiological conditions in the parturient. Later, in the course of septic shock, as splanchnic ischaemia increases, a myocardial depressant factor is released. There is a resultant decrease in cardiac output, increased sympathetic activity and intense vasoconstriction. Vascular permeability increases and fluids leak from the vascular to the interstitial spaces leading to hypovolaemia.¹¹ The central venous pressure is low, urine output is decreased, extremities are cold, blood lactate is increased and cyanosis may be present.¹¹ Arterial blood gas analysis reveals a metabolic acidosis with a compensatory respiratory alkalosis.

The normal increase in alveolar and minute ventilation associated with pregnancy, results in a PCO₂ of 32 mmHg and a HCO₃⁻ of 22 meq $\cdot$ L⁻¹.¹² This must be taken into account when analyzing blood gases in the septic parturient. As well, the increase in oxygen consumption associated with pregnancy and sepsis and the 20% decrease in functional residual capacity in the parturient puts these patients at high risk for the development of hypoxaemia.¹²

Fetal cardiovascular reserve is negatively affected with

increasing maternal temperature.¹³ Fetal tachycardia, an increased cardiac output and oxygen consumption all occur and arrhythmias may develop. Fetal scalp pH values decrease and may result in intrauterine death or severe depression at birth. Fetal scalp pH in a febrile parturient may be used to evaluate the course of the fetus *in utero*.

The diagnosis of sepsis in the obstetrical patient may be accomplished by attention to the history, physical examination and laboratory findings. Historically, the patient may have had a recent upper respiratory or urinary tract infection, premature rupture of the membranes or other conditions predisposing to the development of sepsis. Appropriate cultures should be sent and broad spectrum antibiotics begun until culture results are available.¹⁴ Other criteria for the diagnosis of sepsis have been suggested by a recent consensus conference. These include a temperature of $>38^{\circ}\text{C}$ or $<36^{\circ}\text{C}$ and a white blood cell count $>12,000\text{ cells}\cdot\text{mm}^{-3}$, $<4,000\text{ cells}\cdot\text{mm}^{-3}$ or $>10\%$ immature (band) forms.³ Should these criteria be present, acid-base status should be evaluated by arterial blood gas analysis and electrolytes. Metabolic acidosis, altered mental status and oliguria are all signs of hypoperfusion associated with severe sepsis.³ Continuous fetal heart rate monitoring is indicated and if fetal tachycardia develops, fetal scalp pH sampling should be performed.

The anaesthetic management of the septic parturient involves a thorough assessment of the patient's intravascular volume before any anaesthetic intervention is contemplated. Tachycardia and hypotension are unreliable signs of hypovolaemia, necessitating an assessment of urine output and central venous pressure by invasive monitoring. In severe cases, pulmonary artery catheterization may be required. The need for emergency operative delivery must be weighed against the need for preoperative fluid resuscitation of the mother.

Sympathetic blockade, as with epidural anaesthesia, may be catastrophic in patients with late stage sepsis. Since they are already hypovolaemic from loss of fluid through leaky capillaries and have a low cardiac output, they may be unable to compensate for a decreased afterload and venous return. The labouring patient with mild sepsis may receive epidural anaesthesia provided that the intravascular volume has been optimized and the patient has received at least one dose of a broad spectrum antibiotic.¹⁴ A low-dose local anaesthetic infusion with added narcotic will provide adequate analgesia with minimal sympathetic blockade. For non-urgent Caesarean section, appropriate monitors must be instituted, intravascular volume assessed and treated and the patient's airway evaluated for ease of intubation. Epidural anaesthesia can be considered in the resuscitated individual

and should be slowly titrated to patient response. Should urgent operative delivery be required in a patient with severe sepsis, a foley catheter and a CVP line should be placed before the induction of anaesthesia to determine the intravascular volume status. If the central venous pressure is low, general anaesthesia should be induced using a rapid-sequence technique with ketamine $1\text{ mg}\cdot\text{kg}^{-1}$ and succinylcholine $1\text{ mg}\cdot\text{kg}^{-1}$. Maintenance of anaesthesia can be managed according to the patient's clinical condition. As well, there should be ongoing fluid resuscitation and the neonatology team should be present to manage a neonate who may be depressed.

In the case presented in this report, the implication of a temperature of 35.3°C was not appreciated. The left shift in the white blood cell count was not available before induction of anaesthesia. Had this information, as well as the presence of a metabolic acidosis been known, the severity of the patient's condition may have been recognized. The obstetrical and anaesthetic management could have been altered accordingly. However, reviewing the literature of patients presenting with Group A streptococcal sepsis with no source of infection, the mortality rate has been reported to be 75%.⁷

In conclusion, Group A streptococcal sepsis in pregnancy is an extremely unusual condition associated with a high mortality. Other causes of sepsis in the obstetrical population are more common and may have significant physiological consequences. Careful assessment of the parturient with suspected sepsis is crucial. This requires establishment of the diagnosis, treatment with antibiotics and most importantly, assessment of intravascular volume. Appropriate monitoring and resuscitation of the parturient must precede anaesthetic intervention. Monitors may include a foley catheter, CVP line and in severe cases, a pulmonary artery catheter. Labouring patients may receive epidural anaesthesia if antibiotics have been given and intravascular volume is normal. The need for urgent operative intervention in a severely septic patient with cardiovascular compromise must be carefully evaluated.

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