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CASE SERIES

Anaphylactic shock in pregnancy: a case study and review of the literature

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ABSTRACT
We describe a 22-year-old previously healthy primigravida who presented with spontaneous rupture of membranes at 40 weeks of gestation. Because of her history of inadequate prenatal care, a chemoprophylaxis regimen against group B streptococcal infection was prescribed upon admission. Within a few minutes after initiation of an i.v. infusion of penicillin G, the patient developed generalized erythema and severe hypotension, which was essentially unresponsive to intravenous boluses of ephedrine. Following stabilization of maternal blood pressure with incremental doses of epinephrine, emergency cesarean section was performed with delivery of a severely depressed neonate. Postoperative recovery of the mother was uneventful, although the baby was diagnosed to have suffered significant neurological damage. This unfortunate event highlights the therapeutic dilemma in anaphylaxis during pregnancy, a relatively rare but potentially life-threatening event. A critical review of the scientific literature reveals several etiological agents for anaphylaxis during the perioperative period, with penicillin as the leading cause of anaphylaxis-related mortality. Although epinephrine is the vasopressor of choice during hemodynamic resuscitation in the non-pregnant patient, during pregnancy it may pose a risk to the placental-fetal circulation. Additionally, upon review of the various published reports to date, timing and mode of delivery of the neonate in the face of anaphylactic shock remains controversial.

Keywords: Anaphylaxis; Group B streptococcal prophylaxis; Epinephrine; Vasopressin; Anaphylactic shock

Introduction

Anaphylaxis (Greek origin, *Ana*: backwards, *Phylax*: guard) is a systemic reaction mediated by vasoactive amines released from mast cells and basophils sensitized by immunoglobulin E (IgE). The features of an immediate hypersensitivity reaction commonly involve at least two of the major organ systems: cutaneous (generalized hives, pruritus, swollen lips-tongue-uvula), cardiovascular (hypotension), respiratory (dyspnea due to laryngeal edema, bronchospasm, stridor), gastrointestinal (vomiting, diarrhea, abdominal cramps).[1]

The occurrence of anaphylaxis in the general population was reported to be 30 per 100 000 person-years in one community in the United States,[2] while another study found that the annual occurrence rate ranged from 1.21-15.04% in the US population.[3] The incidence of severe anaphylaxis has been estimated to be 1-3 per 10 000 people per year, while the risk of death from anaphylactic shock is approximately 1-3 per million per year.[4] A variety of foods, several drugs, latex and insect bites are the most common allergens that produce IgE-mediated anaphylaxis. Drugs commonly involved in anaphylaxis and anaphylactoid reactions (a clinically indistinguishable phenomenon, but probably not mediated by IgE) include antibiotics, muscle relaxants, non-steroidal anti-inflammatory drugs, and radioactive contrast media.[5]

Anaphylaxis is a relatively infrequent event during pregnancy. The significance of this life-threatening event to both mother and baby poses serious challenges for the obstetrician, neonatologist and the anesthesiologist. This report highlights a case of severe anaphylaxis in a laboring patient, which resulted in a devastating complication of hypoxic ischemic encephalopathy in a term baby; the incident occurred while the mother was receiving intrapartum prophylaxis with penicillin to prevent group B streptococcal infection.

Case report

A 22-year-old female (gravida 1, para 0) presented to the labor and delivery triage unit at 40 weeks of gestation, complaining of amniotic fluid leakage per vagina. Past

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medical and surgical history was unremarkable; she denied any history of drug allergies. Her obstetric history was described as uneventful, even though she had not received any formal prenatal care during pregnancy. Obstetric examination during admission revealed a single intrauterine pregnancy with rupture of membranes; the fetus was noted to be in the vertex position at −2 station with a normal fetal heart rate tracing.

The patient was admitted to the labor and delivery suite, and shortly thereafter an i.v. infusion of penicillin G (5 million units) was ordered for chemoprophylaxis against group B streptococcal infection. Within a few minutes after initiation of the infusion, the patient developed diffuse erythema and hypotension. Her blood pressure decreased to a range of 60-40/20 mmHg-unobtainable; her heart rate was noted to be around 155 beats/min. Also observed was a sustained fetal bradycardia, with fetal heart tones remaining at 60-70 beats/min. The patient received diphenhydramine 50 mg i.v., followed by 15 mg of i.v. ephedrine (5 mg per dose; total of three doses). However, since hypotension persisted, incremental doses of epinephrine (100, 300, and then 600 μg) were administered at 2-3 min intervals. The blood pressure finally responded to i.v. epinephrine and gradually increased to approximately 120/70 mmHg.

The patient's airway remained patent and she was breathing spontaneously without any obvious respiratory distress. She was given humidified oxygen via mask at 4-6 L/min during this time, and her oxygen saturation was in the range of 94-98%. During this entire period of resuscitation, she remained supine with a wedge under the right hip for left uterine deviation.

Following relative hemodynamic stabilization, and approximately 30 min after the onset of the anaphylactic event, the patient was taken to the operating room for emergency cesarean delivery because of a persistent non-reassuring fetal heart rate pattern. General anesthesia was induced by rapid sequence with i.v. etomidate and succinylcholine, and the patient was intubated uneventfully with a 7.0 mm cuffed endotracheal tube. Anesthesia was maintained with oxygen, air and isoflurane (0.8-1%). The mother's vital signs remained relatively stable throughout the procedure (heart rate 130-140 beats/min, blood pressure 130-140/70-80 mmHg, oxygen saturation 96-100%). A male infant was delivered with Apgar scores of 1, 3 and 5 at 1, 5 and 10 min, respectively. Umbilical artery blood gas investigation revealed a pH of 6.64, and base excess −31.4 mEq/L; the neonate was severely hypotonic, bradycardic and without spontaneous respirations. He was intubated, resuscitated, and transferred to the intensive care nursery for further care.

The mother was kept intubated at the end of the surgical procedure and was transported to the intensive care unit. Ventilatory support was continued until the next day; she was successfully extubated 24 h after the anaphylactic event. The rest of her hospital course remained uneventful and she was discharged home two days later. The baby, however, was not so fortunate; he had seizures within half an hour after birth and the electroencephalogram demonstrated a pattern consistent with encephalopathy. The intermittent seizures were eventually controlled with phenobarbital after the third week of life. Although the initial diagnostic images of the brain were essentially normal, follow-up studies exhibited changes consistent with hypoxic-ischemic encephalopathy. The neonate required mechanical ventilatory support for several days; he also underwent gastrostomy and Nissen fundoplication because of ineffective sucking reflex and improper swallowing. The biochemical and infection screens were normal. At subsequent follow-up on the second and third months of life, the infant showed persistent abnormal neurological signs with significant developmental delay.

Discussion

This case represents a life-threatening complication to both mother and her baby following the standard practice of intrapartum antibiotic prophylaxis against group B streptococcal infection. This treatment was instituted in accordance with guidelines from the Centers for Disease Control and Prevention (CDC: *vide infra*). Anaphylaxis was diagnosed clinically but was not subsequently confirmed by laboratory testing.

For induction of general anesthesia for the emergency cesarean delivery, etomidate was preferred to sodium pentothal because it provides greater cardiovascular stability. Succinylcholine was used to induce rapid muscle relaxation, despite its potential capacity to release histamine. Although hemodynamically stable during the intraoperative period, the patient was not extubated at the conclusion of surgery for two reasons: (i) she had recently been resuscitated from a life-threatening situation and (ii) there was the possibility of a biphasic anaphylactic reaction,[6] characterized by recurrence of symptoms, usually within eight hours of the first episode.

Anaphylaxis in the perianesthesia setting

Anaphylaxis is a potentially life-threatening event, and is widely recognized in anesthesia practice. Because general anesthesia and controlled ventilation can mask several of the usual clinical features of anaphylaxis, continuous vigilance, adequate knowledge and a high degree of suspicion are essential for prompt diagnosis and aggressive management. Muscle relaxants remain the most common cause of severe anaphylaxis during anesthesia, followed by latex and antibiotics.[4] A six-year study from Norway found that neuromuscular blocking