Chapter 18
ECG II

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You are on the obstetrics ward. You are answering an "Anesthesia Stat" call to the operating room. As you walk into the operating theater, this is the rhythm that is present on the vitals monitor:

A parturient, gravida 7 para 6 at 38 weeks gestation, was placed under general anesthesia for an emergent C-section secondary to fetal bradycardia (Category III fetal heart rate tracings).

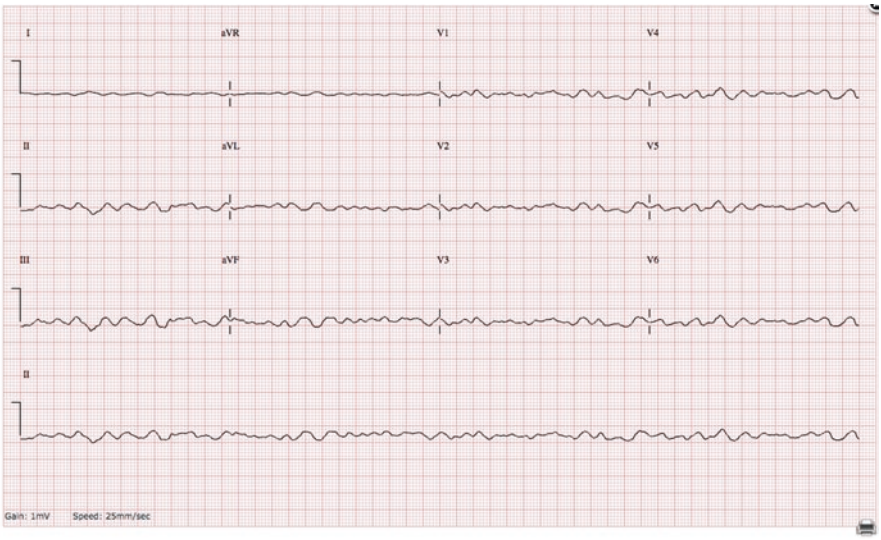

Fig. 18.1 Observed EKG in obstetrics operating theater

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The anesthesiologist who performed the induction briefs you that a rapid sequence induction included cricoid pressure, 100 μg of fentanyl, 120 mg of propofol, and 100 mg of succinylcholine administered intravenously. A grade I view of the airway was obtained with laryngoscopy and a #7 oral endotracheal tube placed without difficulty. Initially, $ETCO_2$ was positive and auscultation of the lungs revealed bilateral breath sounds.

Preinduction vital signs were SpO_2 100%, pulse 88, BP 110/56, temp 36.6, and weight 55 kg.

1. How would you describe this arrhythmia?
2. In general, what are the potential causes of this arrhythmia in parturients?
3. What are the common causes and prevalence of maternal cardiac arrest?
4. What are your next steps in managing this case?
5. What laboratory tests would you order to help in your management?
6. When should perimortem C-section start?

An OR team member identifies an empty 250 mL bag of 0.25% ropivacaine and 2 μg of fentanyl per mL. With more investigation, the team realizes that this bag was accidentally brought into the OR and administered as “antibiotics.”

7. Knowing this information how would you manage the case?
8. Which medications would you avoid in treating this disorder?
9. Is there an upper limit to the amount of medicine/treatment that you would give in this situation?

Answers

1. If the EKG leads are attached and accurate, this is cardiac arrest presenting as pulseless fine ventricular fibrillation.

2. In 2015, the American Heart Association released its first statement regarding maternal cardiac arrest. In that statement they listed common etiologies of maternal arrest and mortality. This list is a mnemonic of the letters A through H, most of which are listed below.

   Anesthetic complications - (neura xial, hypoxia, hypotension) and accidents/trauma (trauma and suicide)

   Bleeding—coagulopathy, placental causes, uterine atony and/or rupture, surgical causes

   Cardiovascular causes—myocardial infarction, cardiomyopathy, pulmonary hypertension, valvular disease, aortic dissection

   Drugs—oxytocin, magnesium, drug error (local anesthetic), illicit drugs, opioids, insulin, and anaphylaxis

*Note that many anesthetic drugs may cause prolonging of the QT interval (volatile anesthetic agents, ondansetron, antibiotics such as ciprofloxacin, erythromycin, etc.) which may result in ventricular fibrillation.

   Embolic causes—pulmonary embolism, amniotic fluid embolism, cerebrovascular event

   Fever—sepsis and infections

   General—Hs and Ts (hypoxemia, hypovolemia, hypo-/hyperkalemia, hydrogen ion (acidosis), hypothermia, tension PTX, tamponade—cardiac, toxins, thrombosis—coronary, thrombosis, pulmonary)

   Hypertension—preeclampsia, eclampsia, HELLP syndrome, intracranial bleed

3. According to Suresh and colleagues, the major causes of maternal cardiac arrest are:

   Pulmonary embolism 29%
   Hemorrhage 17%
   Sepsis 13%
   Peripartum cardiomyopathy 8%
   Stroke 5%
   Preeclampsia-eclampsia 2.8%
   Anesthesia complications (failed intubation, LAST, aspiration) 2% [1]
   Mhyre et al. reported different findings for the Nationwide Inpatient Sample (NIS) from 1998 to 2011:
   Postpartum hemorrhage 27.9%.
   Antepartum hemorrhage 16.8%.
   Heart failure 13.3%.
   Amniotic fluid embolism 13.3%.
   Sepsis 11.2%.
   Anesthesia complications 7.8%.
   Maternal cardiac arrest occurs in 1 in 12,000 hospitalizations for delivery [2].

4. Help should be summoned by announcing maternal code blue. In this cardiac arrest scenario, it is vital to start immediate cardiopulmonary resuscitation (chest compressions of 100–120 per minute, 2 inches in depth with full recoil, and the person doing compressions should switch every 2 min). For a parturient with a uterus located at or above the umbilicus, a left uterine tilt of 15° should be instituted, or if enough help is available, a manual lateral tilt might provide better resuscitation results [1, 3]. Maintaining the airway and avoiding hyperventilation is paramount. ACLS guidelines should be followed.

   An AED or defibrillator should be obtained as quickly as possible, pads placed, and the patient defibrillated with the manufacturer recommended joules, 360 J if it is monophasic or the maximum amount of energy if the recommended energy is unknown. Internal fetal monitors should be removed before defibrillation to reduce chances of team member electrocution [1]. Anesthetic gases should be discontinued and 100% oxygen administered. For the anesthesiologist, it is imperative to verify that the endotracheal tube is secured despite an easily placed airway. Effective chest compressions should show $EtCO_2$ of >10 mmHg. A backboard may not be necessary on a minimally cushioned OR table but should be considered.

   A person should be assigned to document the event. Epinephrine 1 mg IV should be given after the second defibrillation and repeated every 3–5 min. Amiodarone 300 mg IV may be administered for ventricular fibrillation resistant to defibrillation (after three shocks) [4, 5].

   Intravenous access should be present above the diaphragm. A crisis checklist should be used if available and team members are trained in using one.

5. If time permits an arterial blood gas or venous blood gas will permit quick assessment of electrolyte abnormalities, blood status, oxygenation, and ventilation status. A transthoracic echocardiogram or transesophageal echocardiogram will allow quick assessment of the cardiac function. A chest X-ray may help with assessment of the thorax.

6. Perimortem C-section should start at 4 min and the baby delivered by 5 min. However, the obstetric team should prepare for Cesarean section before this time [6].

7. Local anesthetic toxicity treatment requires Intralipid 20% administered in an initial dose of 1.5 mL/kg infused intravenously with simultaneous high-quality CPR maintained. A continuous infusion of 0.25–0.5 mL/kg/min is recommended. Dosages of epinephrine should be decreased to 1 μg/kg. Notify appropriate personnel for cardiac bypass [7].

8. Medications to avoid in local anesthetic toxicity would be lidocaine (once a treatment for ventricular tachycardia or PVCs), calcium channel blockers, vasopressin, and beta-blockers. Propofol should not be substituted for Intralipid [7].

9. ASRA recommends an upper level of 10 mL/kg of lipid emulsion infused over 30 min. Infusion longer than this may indicate other causes of cardiac collapse [7].

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