

Case Study:
General Anesthesia for acute appendectomy in a pregnant woman

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Case Study Introduction:

Nonobstetric surgery in the parturient is a challenge for the anesthesia provider and may be required at any period of during pregnancy. Surgery in the parturient population may occur at incidence rates approaching 1% to 2% but may be more considering the concept that women may have surgery in the first weeks of pregnancy without knowing (Rosen, 1999). The most common nonobstetric surgery during pregnancy is emergent appendectomy which accounts for up to 2/3 of all gastro-intestinal surgery during pregnancy (Norris, 2000).

This short introduction to the subject of general nonobstetric surgery in the parturient will be through a case study. An examination of airway and positioning issues in the parturient and anesthetic choices for fetal wellbeing will be considered.

Case Summary:

Blanca is a twenty year old woman in her 23rd week of pregnancy that presented to the emergency department after 3 days of right lower quadrant pain, anorexia and persistent nausea and vomiting. The diagnosis of acute appendicitis was made based on her presenting symptoms of acute right lower abdominal pain which was tender to touch, fever, nausea and vomiting. The diagnosis of appendicitis is often a presumptive one and complicated in pregnancy by the displacement of the appendix upward and laterally as the gravid uterus expands (Chestnut, 2004).

This young woman's medical history was unremarkable. She denied any previous health issues without any respiratory, cardiac, renal or hepatic health issues and has had an unremarkable gestational period. Her last obstetrician visit was two weeks ago during her 20 week routine checkup. The only medications which Blanca has been taking are her prenatal multivitamins, folate and iron sulfate. She denied any past surgical history while her parents have had several general surgical procedures for which there were no anesthetic sequelae.

Physical examination of Blanca was again unremarkable except for the obvious abdominal tenderness and pain with movement due to her right lower quadrant pain. Vital signs were blood pressure 127/ 68, heart rate 86, respiratory rate of 18 and a temperature of 97.5 F. Blanca's weight was 98 kilograms and her height was 5 feet and 8 inches giving her a body mass index of 32.9 cm/m². Her lungs, heart and general appearance were all within normal limits for her gestation. Airway assessment was again reassuring. A Mallampati score of 2 with intact dentition, full range of neck motion and a thyromental space of greater than 5 centimeters, in addition a wide mouth opening all led to the impression that airway management would not lead to difficulties. In this case a smaller than normal endotracheal tube was selected.

Preoperative testing for Blanca consisted of an examination of her cell counts; specifically looking for leucocytosis and status of her hemoglobin. She exhibited slight leucocytosis with a White Blood Cell Count (WBC) count of 12,000/ mm³ and her hemoglobin was 12.1 with a hematocrit of 34.9 %; platelet count was 306,000/mm³. It was not considered necessary to obtain blood chemistries

due to her unremarkable health history and age. Her last solid food and drink were at 1:00 PM this afternoon and it was now 2300 hours.

A general anesthetic using a rapid sequence induction technique and cricoid pressure was chosen for Blanca due to her increased risk for aspiration considering her pregnancy and history of recent nausea and vomiting. She was premeditated with oral Bicitra 30 ml and metoclopramide 10 mg were added to her liter bag of Ringers lactate that was infusing into a patent peripheral intravenous catheter. Anxiolysis was provided with a therapeutic use of self, information about her surgery and a calm demeanor from the anesthesia staff. Positioning on the operating room table was facilitated with a right sided hip roll to displace her gravid uterus reducing the risk of aortocaval compression. Anesthesia induction was delayed until the surgical team was scrubbed and the patient was prepped to facilitate surgical expediency and minimal time for anesthetic exposure to both of the patients, the mother and the unborn child. Thiopental 3 mg/kg, fentanyl 3 mcg/kg, lidocaine 100 mg and succinylcholine 100 mg were given in rapid sequence prior to securing her airway with a cuffed 6.0 endotracheal tube. Anesthetic maintenance was facilitated with sevoflurane 1.5 % exhaled and an air to oxygen mix of 50%. A single dose of nondepolarizing muscle relaxation was chosen to improve surgical exposure with rocuronium 10 mg which was later reversed with a small dose of neostigmine and glycopyrrolate. Cefazolam was used for antibiotic prophylaxis. Total anesthetic time was 45 minutes due to the surgical skill of the on call trauma team and expertise of the operating room staff.

Following surgical closure from the abdominal incision, anesthesia was terminated, small doses of fentanyl were titrated to respiratory rate and the patient was awakened. Endotracheal extubation occurred when the patient was fully awake and Blanca was recovered in the post anesthesia recovery unit without sequelae and evidenced good pain control.

Discussion:

The anesthetic issues for nonobstetric surgery in the parturient can be examined by considering that there are two patients receiving the anesthetic agents – both the mother and the fetus share most if not all of the medications used in general anesthetic management. Additionally, anesthesia in the second trimester after organogenesis has occurred is more reassuring despite the evidence that no anesthetic agent has been shown to be teratogenic in therapeutic doses (Shepard, 1992). All but emergency surgery should be forgone during pregnancy and the risk benefit analysis to the women and her unborn child is considered before surgery is planned. The most common nonobstetric surgery during pregnancy is appendectomy which is an emergency and can not be delayed until after delivery (Norris, 2000).

Airway management becomes particularly problematic in the parturient due to the normal physiologic changes that take place during pregnancy. The success of regional anesthesia in this population owes its popularity mainly to the airway complications that general anesthesia entail. Anesthesia related mortality, 1.9 deaths per million in regional vs. 32 per million in general anesthesia,

is directly related to airway complications which are more prevalent in parturient's receiving general anesthesia than those having regional techniques (Koonin, 1997). For the parturient who is facing an emergent appendectomy with full stomach precautions, the increased potential for aspiration with a regional technique is suspect and a rapid sequence intubation is preferred (Chestnut, 2004).

Additionally, vascular engorgement of the respiratory tract during pregnancy may lead to tracheal intubation difficulties. Edema in the airways lead to friable tissues and increased potential for bleeding and the necessity of using smaller sized endotracheal tubes in the parturient (Chestnut, 2004). Other compounding airway issues include weight gain, increased breast size as well as a decreased functional residual capacity (FRC), increased oxygen consumption and the potential for aortal and venocaval compression in the supine position during intubation. These issues all may lead to rapid desaturation, potential lower cardiac output and placental fetal compromise and asphyxia during delayed attempts at securing the parturient's airway.

The effect of anesthetic medications on the developing fetus is of great concern to anesthesia providers and much research has gone into animal testing to determine the safety of anesthetic agents during pregnancy. The studies of teratogenicity are often species specific and do not readily cross over to humans. Currently there is no specific data linking anesthetic induction or inhalational agents with cellular changes that initiate teratogenic defects (Shepard, 1992). In the 1970's there were several studies linking chronic benzodiazepine use in the first trimester with increased incidence of cleft lip and palate. However, more recent studies by Rosenberg and colleges dispute these inferences (1983). The prejudice against the use of midazolam as an anxiolytic does persist in some circles despite these data and the decision was made not to use midazolam in this case even though the patient was in her 2nd trimester further lowering the risks for developmental derangements.

Nitrous oxide has been indicated in older studies to increase spontaneous abortions in operating room staff and in dental office settings while newer studies have failed to reproduce the similar evidence. In a study with female anesthesiologists compared to other female physicians, Spence (1987) found that the incidence of spontaneous abortion did not differ among the groups. This leaves the question of nitrous oxide use open for further study but currently it would seem prudent to avoid nitrous oxide in the parturient presenting for nonobstetric surgery until this issue is further elucidated. The incidence of more spontaneous abortions and low birth weight is statistically relevant in the parturient population that presents for general surgery. It is a question whether it is the anesthetic or the underlying disease process that is the main factor in these data (Shepard, 1983; Chestnut, 2004)

The induction agent thiopental was chosen because it has the longest track record in obstetric anesthesia (Chestnut, 2004). Propofol as an induction agent in obstetrics has a recent history and is gaining acceptance. Because uteroplacental blood flow is blood pressure dependent the use of an agent with the potential to lower maternal blood pressure more than thiopental is viewed with caution

by many providers. Recent evidence supports the use of propofol as an induction agent. However, because it does have the potential of increased hypotension propofol is still a second agent to thiopental as an induction agent in this population (Rosen, 1999).

The most important risk associated with surgery in the parturient is fetal asphyxia (Chestnut, 2004). Fetal oxygenation is passive through diffusion from maternal oxygen hemoglobin concentrations driven through uteroplacental perfusion. The critical issues are the maintenance of maternal oxygenation and avoiding hypotension for these patients. Supine hypotension is a phenomenon caused by aortocaval and venocaval compression due to the gravid uterus. The displacement to the left by elevating the right hip 15 degrees with a wedge is common practice. Maternal mechanical hyperventilation is avoided to prevent vasoconstriction and reduce venous return leading to reduced uteroplacental blood flow. Normocapnia for the patient is ideal considering that the parturient is normally hyperventilated by 25% by the fourth month of gestation with PaCO₂ averaging 28-32 with normal to slightly alkaline pH values about 7.44 with a decrease in serum bicarbonate (Chestnut, 2004). Considering these data it is prudent to ventilate the parturient to end titled CO₂ values slightly less than 40 mm Hg and not down to the low 30's which may constrict uteroplacental blood flow.

Continuous fetal heart rate (FHR) monitoring is another issue that does not have consensus among anesthesia providers (Chestnut, 2004). It seems prudent that FHR monitoring could provide additional protection to the fetus by recognizing heart rate decelerations and modifying treatment to improve fetal circulation. In a case study by Ong and his colleges (2003), a report of severe fetal bradycardia is reported in a surgical case where the parturient does not evidence any hypotension or desaturation. The current recommendation for continuous FHR monitoring is that it should be considered on a case by case situation (American College of Obstetricians and Gynecologists, 2003).

Conclusion:

Nonobstetric anesthesia in the parturient is a stressful event for patients and anesthesia providers alike. Concern for the patient includes care of the parturient's unborn child through the maintenance of maternal blood pressure and oxygenation, choice of anesthetic agents and meticulous attention to detail and vigilance.

Emergency appendectomy is the most common nonobstetric general anesthetic performed during pregnancy, is a relatively safe procedure for mother and fetus and provides an opportunity for the anesthesia provider to use all of their skills to ensure a positive outcome for the patient. .

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