In this article, the authors discuss basic anesthetic considerations in complicated pregnancies, with specific focus on the management of patients with preeclampsia, third trimester vaginal bleeding, fetal distress, breech presentation, and multiple gestation.

Pregnancy can be complicated by many situations which threaten the safety of mother and fetus. These situations consist of: (1) disease processes that are unrelated to pregnancy, and (2) conditions that result from pregnancy. Although they may be challenging, the coincidental processes, such as hyperthyroidism or rheumatic heart disease, usually antedate pregnancy which allows sufficient time for thorough evaluation and treatment prior to parturition.

Complications resulting from pregnancy, such as preeclampsia and abruptio placentae, however, tend to be more acute in nature, frequently yielding little time to establish optimal anesthetic conditions. As a result, they often challenge the expertise and proficiency of anesthesia personnel. The purpose of this article is to discuss the anesthetic considerations in some of these obstetrically related complications.

Basic considerations

Anesthesia remains a leading cause of maternal mortality, and it may be a common source of maternal and fetal morbidity when injudiciously administered. This is especially so in the complicated pregnancy, where the depletion of maternal and fetal physiologic reserves may produce a decreased safety margin to anesthetics. As a result, the high risk pregnancy often necessitates optimal anesthetic management.

During periods of maternal or fetal compromise, the quality of anesthetic management depends upon the skill, motivation, and efficiency of all members of the patient care team. They must be courteous, cooperative, communicative, and considerate. And, their function should not be hampered by a paucity of fetal and maternal monitoring devices, modern anesthesia equipment, and complete, full-time laboratory services. These factors, in addition to the preferences of the obstetrician, anesthetist, and patient, will determine the choice of anesthesia for a particular situation. Desirable outcome will prevail with the realization that no single anesthetic approach can ideally fit all obstetrical indications, and that best results are achieved on the basis of individual selection and compromise.

The obstetrician can facilitate good anesthetic management by seeking consultation services soon after a complication becomes apparent. This allows the anesthetist sufficient time to obtain the pre-anesthetic history and to prepare the necessary drugs and equipment. Furthermore, if anesthesia personnel are to administer the anesthetics, then
they must be allowed to provide substantial input regarding the selection of anesthesia.

The anesthesia team should reciprocate by being readily available. In addition to having a basic understanding of maternal and fetal physiology, they must be well versed in a variety of anesthetic/analgesic techniques (Table 1). Both the obstetrician and the anesthetist should be aware of the specific alterations in maternal and fetal physiology and how these changes would be affected by each anesthetic/analgesic technique. It is with this understanding that the indications or contraindications of each anesthetic approach becomes apparent.

### Specific considerations

**Preeclampsia**

Controversy flourishes concerning the best anesthetic technique for labor and delivery in patients with hypertension of pregnancy. This is understandable considering the many pathophysiological changes occurring in preeclampsia (Table 2). The coexistence of hypertension and hypalbuminemia produces hypovolemia, increasing the likelihood of hypotension following epidural, caudal, or spinal anesthesia. However, since there is arteriolar vasospasm with reduced uteroplacental, hepatic, and renal blood flow, the sympathetic blockade and vasodilation

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**Table 1**

**Anesthetic/analgesic techniques for use in complicated obstetrics**

I. **Systemic**
   A. Intramuscular: narcotics, tranquilizers
   B. Intravenous analgesia: ketamine, narcotics
   C. Inhalation analgesia: nitrous oxide, methoxyflurane
   D. General anesthesia:
      1. Thiopental-nitrous oxide-relaxant
      2. Ketamine-nitrous oxide-relaxant
      3. Halothane
      4. Enflurane

II. **Regional**
   A. Lumbar epidural block
   B. Lumbar sympathetic block
   C. Caudal epidural block
   D. Subarachnoid block (saddle and lateral)
   E. Pudendal block

III. **Psychoprophylaxis**

IV. **Combinations**

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**Table 2**

**Pathophysiology of preeclampsia**

1. Central Nervous System: CNS irritability, ↑ intracranial pressure, seizures (eclampsia)
2. Cardiovascular: generalized vasospasm, hypertension, ↓ intravascular volume, hemoconcentration, ↓ tissue perfusion, ↑ myocardial work, possible congestive heart failure.
3. Renal: glomerular defect, albuminuria, ↓ renal blood flow, ↓ glomerular filtration rate
4. Hematologic: generalized fibrin deposition, ↑ incidence of disseminated intravascular coagulation
5. Placental: ↑ dysfunction, fetal hypoxemia, fetal growth retardation
provided by these anesthetics will enhance control of hypertension and may improve tissue perfusion.\(^8\)

This is especially apparent during labor and delivery when profound analgesia is required to prevent the exaggerated response to catecholamines seen in preeclampsia. When carefully administered, spinal and lumbar epidural analgesia are not associated with excessive blood pressure reductions,\(^9\),\(^10\) and fetal status and maternal renal function are not compromised.\(^1\) Placental dysfunction, premature labor, fetal hypoxemia, and perinatal mortality are more prevalent in preeclampsia.\(^12\)-\(^14\) And, the use of conduction anesthesia prevents the superimposition of depressant drugs on a possibly compromised fetus.\(^15\)

Therefore, conduction anesthesia offers several advantages for preeclamptic patients. In comparison to other regional techniques, we generally prefer continuous lumbar epidural analgesia. With the use of small amounts of local anesthetic, it reliably provides profound, long-lasting analgesia for both labor and delivery. Moreover, the epidural catheter can be used to provide anesthesia for operative vaginal or cesarean deliveries should they become necessary.

Although lumbar epidural analgesia has numerous merits, its safety in severely hypertensive patients depends upon pre-anesthetic blood pressure control with magnesium sulfate and vaso- dilators in addition to intravascular volume expansion with crystalloid or colloid. Monitoring of central venous pressure, urine output, and pulmonary artery wedge pressure (in patients with left ventricular failure) will allow better cardiovascular assessment before and during epidural analgesia.

When unfavorable conditions preclude the establishment of sufficient patient preparation and monitoring, the judicious use of intravenous narcotics for labor and pudendal-nitrous oxide or saddle block analgesia for delivery appears to be a safer approach. Patients with increased intracranial pressure may be jeopardized by epidural, spinal, or narcotic analgesia; and lumbar sympathetic block. Pudendal or continuous caudal analgesia would be less hazardous for vaginal delivery.

For cesarean section, lumbar epidural analgesia is a desirable approach based on the reasons previously cited. Furthermore, marked maternal hypertension secondary to tracheal intubation during general anesthesia is alarming since cerebrovascular accidents and hypertensive encephalopathy are possible.\(^4\) Therefore, the anesthetist should be well prepared to treat hypertension with intravenous chlorpromazine, phen tolamine, or trimethaphan should general anesthesia be utilized. In addition, the augmentation of muscle relaxants by magnesium sulfate should be remembered.\(^16\)

### Third trimester vaginal bleeding

The source of third trimester vaginal bleeding may be: (1) vaginal or cervical, (2) an abruptio placentae, (3) a placenta praevia, or (4) a coagulation defect. Whereas bleeding from a vaginal or cervical site is not often a specific concern, blood loss from the latter three conditions may threaten maternal and fetal survival. During episodes of profound hemorrhage, anesthesia personnel can promote good patient outcome by offering their expertise about maternal resuscitation techniques besides providing anesthesia services.

The precise cause of premature placental separation is not understood, but it more commonly occurs in gravidas with hypertension, multiple pregnancy, high parity, and a previous history of abruption.\(^17\) Although hemorrhage varies with extent and duration of abruption, it is noteworthy that more than 5 liters of blood may be concealed within the uterus, while blood pressure and pulse measurements in the recumbent position may remain deceptively normal.\(^18\)

Some obstetricians favor conserva-
tive management with blood replacement and vaginal delivery, whereas others believe maternal and fetal well being to be improved by cesarean section. For labor and delivery, conduction analgesia would be advantageous to an asphyxiated, premature fetus with decreased ability to metabolize narcotics. However, techniques causing sympathetic blockade might deter maternal ability to compensate for hemorrhage. Unless the abruption is small, small doses of meperidine for labor and a combination of nitrous oxide and pudendal analgesia for delivery are preferable. Low-dose intravenous ketamine will provide more profound analgesia when required for operative vaginal deliveries (forceps).

In hypovolemic patients, general anesthesia is used for cesarean section, and induction is undertaken with intravenous (IV) ketamine in a dose of 0.8 mg/Kg. It is absolutely mandatory that hypotensive patients be tilted to prevent vena caval occlusion regardless of the type of delivery or method of anesthesia.

Placenta praevia is a serious disorder occurring once in 200 to 400 pregnancies. Symptoms include painless hemorrhage and a high fetal presentation. Definitive diagnosis via the “double set-up exam” has been greatly replaced by ultrasonographic and roentgenographic techniques. In practically all cases, cesarean section is the accepted method of delivery.

As for the abruption, hypovolemic patients are best anesthetized with a ketamine induction and 50-70% nitrous oxide and relaxant for maintenance. Even in normovolemic patients, who can be managed with epidural, spinal, or balanced general anesthesia, the use of two large intravenous lines is advisable, because brisk hemorrhage can follow placental separation from the lower uterine segment and cervix.

Unexpectant and poorly defined hemorrhage is alarming and suggests the presence of defective hemostasis. Congenital or prenatally acquired thrombocytopenias, coagulopathies, or telangiectasias are uncommon and are usually appreciated before the third trimester. Coagulation problems most commonly result from disseminated intravascular coagulation (DIC), which is relatively frequent in patients with abruptio placentae, amniotic fluid embolism, severe preeclampsia, retained dead fetus syndrome, and septic shock (amnionitis).

DIC is diagnosed by the presence of generalized hemorrhage, an altered coagulation profile, and increased circulating fibrin degradation products. Vaginal delivery confers less maternal morbidity than cesarean section, which is restricted to cases where a viable fetus can be salvaged.

Since DIC remits soon after pregnancy is terminated, heparin therapy is not often used, and clotting components are given until after delivery. Because hemorrhage can occur at any site of needle puncture, intramuscular injections or conduction anesthetics are absolutely contraindicated. Therefore, labor is managed with IV narcotics, while nitrous oxide or low dose ketamine analgesia is used for vaginal delivery. Methoxyflurane is best avoided, as reduced renal perfusion and acute renal failure are commonly associated with DIC.

Fetal distress

At parturition, many situations can cause fetal hypoxemia and acidosis (Table 3). The degree of asphyxia varies with the extent and duration of uteroplacental insufficiency or reduced umbilical cord blood flow. It is of note that dissimilar patterns of brain damage have been experimentally produced by two different types of asphyxia: (1) acute, total and (2) prolonged, partial.

When fetal distress is severe and uncorrectable, anesthesia personnel must promptly provide anesthesia for cesarean section. The time frame usually necessitates general anesthesia, which can be safely and rapidly accomplished.
only if the patient’s anesthetic history, the necessary drugs, and equipment have been previously secured. If immediate delivery can be achieved vaginally, ketamine analgesia or thiopental-nitrous oxide-relaxant anesthesia are indicated. The latter technique is more time consuming, but it produces better perineal relaxation for application of forceps.

When fetal distress is less severe and warrants observation, no anesthetic approach is clearly ideal for labor. Most obstetricians prefer withholding analgesia, since any approach may complicate the interpretation of electronically monitored fetal heart rate patterns. However, should analgesia be provided, selection depends upon the etiology of distress. When caused by placental dysfunction or umbilical cord compression, lumbar epidural analgesia offers several advantages over other techniques.

First, with 2-chloroprocaine or bupivacaine, drug effects on the fetus are negligible. The provision of profound analgesia will prevent maternal hyperventilation, hypocarbia, and the greater affinity of maternal hemoglobin for oxygen at the placenta. Furthermore, reduced maternal oxygen consumption and a lower degree of maternal and fetal metabolic acidosis occurs with epidural analgesia as compared to narcotic analgesia. Finally, the continuous epidural will provide anesthesia for cesarean section should the fetus deteriorate.

However, since uterine blood flow is directly related to mean arterial blood pressure, maternal blood pressure must remain normal after epidural analgesia to prevent further fetal compromise. This can be assured with frequent blood pressure measurements, lateral uterine displacement, intravenous hydration, and if necessary, IV ephedrine, 12-25 mg.

Paracervical block is contraindicated in any situation where fetal distress is more likely to occur, because fetal bradycardia, acidosis, and death have been associated with the technique. Lumbar sympathetic block analgesia can increase uterine contractility, possibly resulting in decreased uterine blood flow.

Although deleterious fetal effects are not observed after bupivacaine sympathetic blocks in the normal pregnancy, any reduction in uterine perfusion may be poorly tolerated by the compromised fetus. Due to its small

Table 3
Differential diagnosis of fetal hypoxemia and acidosis

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The Journal of the American Association of Nurse Anesthetists

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drug requirements, simplicity, and reliability, saddle block analgesia is excellent for emergency operative vaginal deliveries if time permits. As in epidural analgesia, the same considerations exist regarding blood pressure control.

**Breech presentation**

When compared to cephalic presentations, the breech is associated with a greater incidence of: (1) prematurity, (2) prolapsed cord, (3) low-lying placenta, (4) severe asphyxia, (5) birth trauma, and (6) perinatal mortality.\(^{51,52}\) Neonatal morbidity usually results from difficulty in delivering the aftercoming head. The fetal risk incurred by vaginal delivery is determined by evaluation of fetal status, fetal size, and pelvic dimensions. Therefore, pelvimetry and fetal monitoring are necessary. Since breech extraction invokes excessive morbidity, it is uncommonly utilized, and cesarean section has been increasingly used to improve neonatal outcome.\(^{53,57}\)

Should vaginal delivery be employed, the following conditions must be established. The maternal bearing-down reflex must be controlled in the first stage of labor to prevent delivery of the body through an incompletely dilated cervix, which results in head entrapment. During expulsion, uncomplicated delivery of the aftercoming head mandates: (1) good maternal pushing efforts, and (2) perineal relaxation for the application of forceps. As a result, maternal awareness and cooperation must be preserved; this precludes the excessive use of narcotics and sedatives.

For the patient with good self-control, nitrous oxide or methoxyflurane analgesia combined with pudendal blockade can be satisfactorily used for expulsion. When necessary, thiopental-nitrous oxide-relaxant anesthesia is given for better analgesia and perineal muscle relaxation for the placement of forceps. The addition of 2\% halothane or 2-3\% enflurane to the balanced technique may facilitate delivery of the head by providing relaxation of the lower uterine segment.

Since epidural, spinal, and caudal analgesia may inhibit the bearing down reflex, many obstetricians have avoided their use for breech deliveries. However, Crawford\(^{58}\) has reported that continuous epidural analgesia with *bupivacaine* is advantageous, because it controls the bearing-down reflex in labor and provides perineal relaxation at delivery. He found the incidence of severe neonatal depression to be lower in epidural patients, irrespective of birth weight. The incidence of breech extraction was not increased, and the second stage of labor was not markedly prolonged.

It must be emphasized that patients under epidural analgesia can push effectively when properly coached,\(^{59}\) and they will have good analgesia for the application of forceps. Epidural analgesia is certainly desirable in patients with poor pain tolerance, because it will lessen the need for narcotics and general anesthesia\(^{60}\) and will produce a more quiescent, cooperative patient.

**Multiple pregnancy**

The choice of anesthesia for the labor and delivery of twins must be individualized due to the common coexistence of abruptio placentae, preeclampsia, prematurity, umbilical cord prolapse, and malpresentations.\(^{61,62}\) The delivery of the first twin is usually uncomplicated, but the birth of the second twin is frequently accompanied by uterine atony and the need for operative-manipulative procedures.\(^{68}\) This is more likely to occur when the second twin is transverse or breech. Version and breech extraction maneuvers are preferably avoided, and assisted-spontaneous delivery of the second twin is desirable. Therefore, local infiltration supplemented by nitrous oxide analgesia has been touted as being superior to spinal, epidural, or pudendal blocks.\(^{53}\)

Several recent reports have described good neonatal outcome with
continuous lumbar epidural analgesia with bupivacaine. As for the breech, this technique eliminates the need for narcotics, provides a controlled delivery over a relaxed perineum, and produces good analgesia for forceps application. General anesthesia becomes less necessary when cesarean section or version extraction is required to deliver the second twin.

For the breech presentation, twin gestation, or situations where excessive sympathetic blockade is best avoided, the "double catheter technique" is superior to other conduction anesthetic approaches. The combined use of high lumbar epidural and caudal catheters will provide profound analgesia while keeping local anesthetic doses, sympathetic blockade, and motor blockade to a minimum.

In comparison to lidocaine or mepivacaine, bupivacaine is superior for epidural blocks since motor blockade is minimal. Conversely, saddle block anesthesia appears to be the least desirable conduction technique for the breech and twin delivery due to unpredictable levels of motor block combined with a greater possibility of diminished maternal bearing-down efforts.

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