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Nursing Responsibilities in Preventing, Preparing for, and Managing Epidural Emergencies

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An increasing number of women receive epidurals during labor and birth. Although the incidence of adverse reactions remains very low, the potential for life-threatening complications still exists. The Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) states that the safety of women undergoing procedures, such as the administration of epidural analgesia/anesthesia, depends significantly on the competence, attentiveness, and experience of those responsible for their care. The purpose of this article is to review the significant complications related to obstetric epidural. Recommendations are presented to aid the nurse in preparing for and managing epidural emergencies. Specific responsibilities of nurse managers and educators in competency training, evaluation, and guidance of nurses are also discussed. **Key words:** *analgesia*, *anesthesia complications*, *anesthesia emergencies*, *epidural*, *obstetric analgesia/anesthesia, regional anesthesia*

THE assessment, monitoring, and care of the woman receiving epidural analgesia/anesthesia during the intrapartum period remains a primary responsibility of the labor and delivery nurse. A 1992 anesthesia workforce survey indicated that approximately 29% of women received epidural analgesia/anesthesia during labor and delivery.[1] It is now estimated that more than half of laboring women receive epidural analgesia; however, rates still vary by hospital and geographic area.[2] Although all anesthetic procedures carry some degree of risk, the rate of significant adverse outcomes associated with epidurals has been reduced by the introduction of safer drugs, anesthetic protocols, and biomedical equipment. Furthermore, guidelines for practice that have been promulgated by both the American Society of Anesthesiologists (ASA)[3,4] and the American Association of Nurse Anesthetists (AANA)[5,6] have resulted in reduced rates of complications and negative outcomes for those women receiving epidurals.

Despite the reduction in maternal and neonatal morbidity and mortality related to obstetric anesthesia, serious, and even life-threatening complications still occur with epidural analgesia/anesthesia. And, with the increasing use of epidurals during labor, the relative risk of significant complications can be anticipated to rise. The Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) states that the safety of women undergoing procedures, such as the administration of epidural analgesia/anesthesia depends "significantly on the competence, attentiveness, and experience of those responsible for their anesthetic management."[7(p28)] The labor and delivery

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nurse must receive adequate didactic education, an appropriate period of supervised clinical experience, and skills verification before assuming responsibility for the woman receiving an epidural during labor.[8]

The purpose of this article is to review the significant adverse reactions and major complications related to epidural analgesia/anesthesia, and the nurse's role in preparing for and managing these problems. Evidence-based practice guidelines are presented, and recommendations are made for emergency nursing interventions and supportive care. The central role of nurse educators and managers in preparing nursing staff to provide safe and effective care during epidural administration is discussed. Specific risk management strategies that reduce negative outcomes when complications occur are also described.

COMPLICATIONS RELATED TO EPIDURAL ANALGESIA/ANESTHESIA

Complications associated with obstetric epidurals are classified as either minor or major. Minor problems are often related to the concomitant use of intrathecal narcotics, and include nausea, vomiting, pruritus, and urinary retention. Other unintended adverse outcomes that do not significantly compromise the physiological integrity of the mother and fetus include transient maternal hypotension and fetal heart rate decelerations, maternal temperature elevation, unintentional dural puncture with subsequent spinal headache, and back pain.[9] Although not considered life-threatening emergencies, these adverse reactions contribute to maternal morbidity and often result in additional invasive testing and treatment of both mother and infant.

Major complications of obstetric epidurals are separated into 2 categories: injection-related anesthetic emergencies, and compression problems resulting in spinal cord ischemia. Injection-related complications pose an immediate threat to the well-being of the mother and fetus, and can result in significant maternal and neonatal morbidity and even death. They most commonly occur when the anesthetic agents are initially injected, or during subsequent rebolusing of the epidural catheter. The woman may experience acute respiratory distress, seizures, and even cardiorespiratory arrest. Acute fetal distress occurs when maternal physiological stability is compromised.

Compression problems are due to the formation of an epidural hematoma or abscess. Signs and symptoms of spinal cord compression evolve over time, and result in progressive neurological deficits. Epidural hematoma or abscess can result in permanent paralysis if not promptly recognized and surgical intervention is not instituted to decompress the spinal cord. Every moment counts when cardinal signs of impending paralysis are evident. As a general principle, an epidural hematoma or abscess resulting in spinal cord compression must be relieved within 6 to 12 hours to prevent serious neurological sequelae such as paralysis.[10]

GENERAL PRINCIPLES OF NURSING CARE WHEN EPIDURAL COMPLICATIONS OCCUR

In some circumstances, the development of a major epidural complication requires the prompt initiation of life support measures. Any nurse caring for the woman who has received a labor epidural is well-versed in the correct sequence of steps to take when an epidural emergency arises. The following box illustrates the required response when an epidural complication develops.

The emergency call system is activated. A clear and concise report about the nature of the problem is promptly conveyed to the staff and appropriate anesthesia and obstetric providers. The nurse establishes and maintains a patent airway. Supplemental oxygen is given to the conscious patient who has spontaneous respirations and a patent airway. Positive pressure ventilation with 100% oxygen by means of an anesthesia bag and mask is immediately initiated if respiratory compromise or arrest is evident. Preparations are made

Nursing Actions When an Epidural Emergency Arises

Events: Severe symptomatic hypotension, diminished responsiveness, loss of consciousness, seizure, respiratory distress, respiratory arrest, cardiac arrest

Within the first 10 to 15 seconds of recognizing the emergency, and even if the anesthesia provider is in the room:

- Call for help/Activate the emergency call system in the patient's room
- Direct the first responding person to stat page an available anesthesia provider and the obstetric provider (if either is not present)
- If the anesthesia provider is present, but the patient's condition is unstable, call for additional help to manage the emergency
  (A second anesthesia provider, emergency room physician, or respiratory therapist)
- With cardiopulmonary arrest or rapidly deteriorating cardiopulmonary status, activate the call system for the resuscitation team/"Code Blue" call
- Direct responder to bring the resuscitation or "code" cart to the room
- Establish and maintain a patent airway (suction as needed)
- If a seizure is in progress, protect the patient from injury

15 seconds to 30 seconds

- If respiratory insufficiency or respiratory arrest is evident, begin positive pressure bag and mask ventilation with 100% oxygen
- Stop the epidural drugs if a continuous infusion is running
- Turn off all infusing drugs such as oxytocin, magnesium sulfate, antibiotics and open the main intravenous line
- Reposition the patient to eliminate or prevent aorto-caval compression
- When the cart arrives place cardiac board under the woman if CPR is initiated
- Initiate full cardiopulmonary resuscitation if cardiac arrest occurs
- Administer drugs as ordered by the physician(s)

for possible full cardiopulmonary resuscitation and invasive procedures including intubation, and arterial blood collection for pH and gas analysis. If full cardiopulmonary resuscitation is not required, consideration is still given to summoning additional help such as the in-house emergency department physician, or a respiratory therapist to assist the anesthesia provider.

If the provider is not an obstetrician (family practice physician or certified nurse midwife), the nurse is directed by unit policy in obtaining the assistance or advice of an on-call or consulting obstetrician when an epidural emergency arises. The process should be similar to the consulting procedure followed when a woman develops a significant obstetric complication and requires a higher level of care. If an obstetrician is not available, an "all-call" may be initiated for any available obstetrician, or an emergency room physician may be summoned for assistance with maternal stabilization.

The nurse initiates intrauterine fetal resuscitation. As noted previously the intravenous infusion rate is increased, and left uterine displacement is implemented. The nurse prepares for possible interventions such as an amniotomy, and the placement of a fetal scalp electrode when there is a nonreassuring Fetal Heart Rate (FHR) pattern. The nursing staff prepares for the likelihood of an emergency cesarean section if the epidural emergency results in fetal distress.

A nursing supervisor or manager is promptly notified about the anesthesia-related emergency. Coordination of the emergency response is often the responsibility of a nurse manager or supervisor, who ensures that providers and staff are promptly notified and summoned to the woman's bedside, emergency equipment is immediately available, and the nursery and pediatric provider or neonatal resuscitation team are apprised of the event. The supervisor can also alert other departments about the need for *stat*

laboratory tests, or diagnostic services such as radiological procedures (MRI, CT scan, chest x-ray).

If the woman experiences cardiopulmonary arrest, the nurse's actions comply with the American Heart Association (AHA) guidelines for the resuscitation of pregnant women.[11] The current AHA recommendations include performing an early "perimortem" cesarean section during a maternal cardiac arrest if cardiopulmonary resuscitation is unsuccessful. The guidelines indicate that the optimum interval from arrest to delivery is within 5 minutes. However, there are reports of intact infant survival after 20 minutes of maternal arrest. When cardiopulmonary arrest occurs, immediate preparations are therefore made for a possible emergency cesarean section. Evidence also supports the administration of ephedrine, a vasopressor, when maternal arrest occurs after receiving an epidural block.[12] Labor and delivery nurses must be familiar with the current guidelines and resources regarding resuscitation of pregnant patients, including AWHONN guidelines for resuscitation of the pregnant woman.[13] An in-depth review of the principles of cardiopulmonary resuscitation is also provided in the AWHONN publication *High-Risk and Critical Care*: *Intrapartum Care*.[14]

Not all women who experience major complications are rendered unconscious. The nurse must maintain a calm and supportive demeanor. When possible, one staff member is assigned to meet the woman's needs for emotional reassurance and support, and to provide information to the family members who are present. The obstetric provider should address the patient's and partner's questions or concerns about fetal well-being. Once the woman's condition is stabilized, a new plan of care for pain management is developed in collaboration with the obstetric and anesthesia providers.

MAJOR EPIDURAL COMPLICATIONS

As previously noted, major epidural complications fall into 2 categories of emergencies: injection-related problems and those related to compression of the spinal cord. These complications are discussed in the following section.

Intravenous injection of and toxic reactions to local anesthetic agents

The anatomical and physiological changes induced by pregnancy result in a relatively low venous pressure and engorgement of the epidural venous plexus. Both contribute to an increased risk for accidental cannulation of an epidural vein. Changes in anesthesia practice, including the injection of smaller doses of anesthetic agents at a slower rate, have reduced the incidence of catastrophic toxicity reactions. Some providers also add epinephrine to an initial test dose of lidocaine to rule out intravenous injection. If the catheter is in an epidural vein, there will be a rapid rise in the maternal heart rate with administration of the test dose, when it contains epinephrine.

Symptoms of intravenous injection may be mild and transient. The woman may complain of tinnitus, visual disturbances, a metallic taste, and numbness and tingling around the mouth. Slurring of speech may be noted, as well as jitteriness and agitation. However, even when small doses of anesthetic drugs are administered, the woman may develop sudden and severe problems, including seizures, cardiac arrhythmias, and cardiovascular collapse. Fetal bradycardia rapidly ensues.

Following the general principles for managing a major complication of epidural analgesia/anesthesia, the nurse activates the emergency call system and initiates all indicated life support measures, as outlined in the box titled "Nursing Acions When an Epidural Emergency Arises." The emergency resuscitation cart should be brought into the room. As noted, with acute toxicity to local anesthetic agents, full cardiopulmonary resuscitation may be required. The woman is repositioned to establish and maintain the airway and to begin cardiopulmonary resuscitation when indicated. Left uterine displacement is implemented to prevent aorto-caval compression.

If seizures occur, attention is paid to prevention of injury during the clonic phase of

seizure activity. The nurse can anticipate orders for an anticonvulsant, generally a benzodiazepine such as intravenous diazepam. The main intravenous line is opened for a bolus infusion to correct hypotension and to maintain maternal blood pressure and uteroplacental perfusion. The primary intravenous line is opened and all other drugs that are infusing are turned off. The anesthesia provider may elect to intubate the woman to prevent hypoxemia and acidosis.

Allergic reaction to local anesthetic agents

Allergic reactions to anesthetic agents may occur with or without inadvertent intravascular injection. Reactions range from mild uticaria to laryngeal edema, bronchospasm, and anaphylaxis. Profound hypotension may be another feature of allergic responses to anesthetic agents. Fortunately these reactions are rare. The nurse questions the patient about allergies to medications, including local anesthetics received for dental procedures. Prevention of this complication is possible, when a previous allergy is noted, and alternative pain control methods are selected.

With allergic reactions, care is directed at maintaining a patent airway and preventing cardiovascular collapse. The anesthesia provider may opt to intubate the patient to maintain the airway and for adequate oxygenation. Once the nurse activates the emergency call system, preparations are begun for the administration of oxygen, maintaining a patent airway, and administering emergency drugs. Depending on the severity of the reaction, the anesthesia provider may order an antihistamine such as diphenhydramine, or for more severe cases, epinephrine and intravenous steroids. The primary intravenous line is opened and all other medications and infusions discontinued while fluid resuscitation is implemented, and emergency drugs are given.

Inadvertent high spinal block

Another life-threatening complication is the development of a high spinal block. This problem can develop in 2 ways: the epidural catheter can be accidentally placed into the subarachnoid space, or the catheter can gradually migrate into the subarachnoid space through a needle nick created in the dura mater during initial placement of the catheter. Administration of a *test dose* of lidocaine before giving a bolus dose of the anesthetic agent, followed by careful assessment of the woman's response, reduces the risk of a high spinal blockade. If the catheter is improperly placed in the subarachnoid space, the patient will experience rapid onset of some degree of motor block and a drop in blood pressure with sympathetic blockade. The catheter is then removed by the anesthesia provider, and a decision is made whether to place a new epidural catheter once the maternal and fetal condition are determined to be stable.

If a high spinal block occurs at the time the epidural is initiated, or during a rebolus of the anesthetic agent, the woman may rapidly develop profound hypotension. She will begin to have difficulty in breathing, and will be unable to speak (loss of phonation). The patient may quickly lose consciousness. With paralysis of the muscles of respiration, the woman's airway must be established and maintained, and positive pressure ventilation with 100% oxygen is initiated with an anesthesia bag and mask until a qualified provider can intubate the trachea. Maternal hypotension is treated with rapid intravenous infusion of a non-glucose-containing solution, such as Ringer's lactate. Ephedrine, a vasopressor, and epinephrine may be ordered. Left uterine displacement is maintained. If narcotics such as fentanyl have been combined with the anesthetic agent, Naloxone may be administered.

Fetal status is dependent on adequate oxygenation and ventilation of the mother, and maintenance of blood pressure. Care must be taken to prevent aorto-caval compression. With respiratory arrest or loss of consciousness, the nurse summons the hospital's resuscitation ("code blue")team. With adequate support of ventilation and circulation, the woman and fetus can survive. The anesthetic agent will be metabolized, and motor and sensory functions will return.

Not all high spinal blocks occur with the initiation of the epidural. As noted, catheters can and do migrate. The woman may begin to exhibit gradual signs of a rising level of motor and sensory blockades. The nurse must perform frequent respiratory assessments. AWHONN recommends a frequency for blood pressure monitoring of every 5 to 15 minutes,[15] but does not provide guidelines for respiratory assessment. Stem[16] recommends that the maternal pulse and respirations be assessed at least every 15 minutes, with blood pressure evaluation. Further research will be necessary to establish evidence-based practice recommendations regarding the optimum frequency for respiratory assessments. This is crucial in order to eliminate unnecessary monitoring activities that interfere with supportive nursing care during labor and birth.[17]

The nurse also determines the level of motor and sensory blockade using the dermatome model, illustrated in Fig 1. Should the level of blockade rise above dermatome T-10, the approximate level of the umbilicus, the anesthesia provider is immediately notified. As the level of blockade exceeds T-6, the area around the tip of the breast bone, the risks for respiratory compromise and hypotension increase.[16] The nurse turns off the epidural

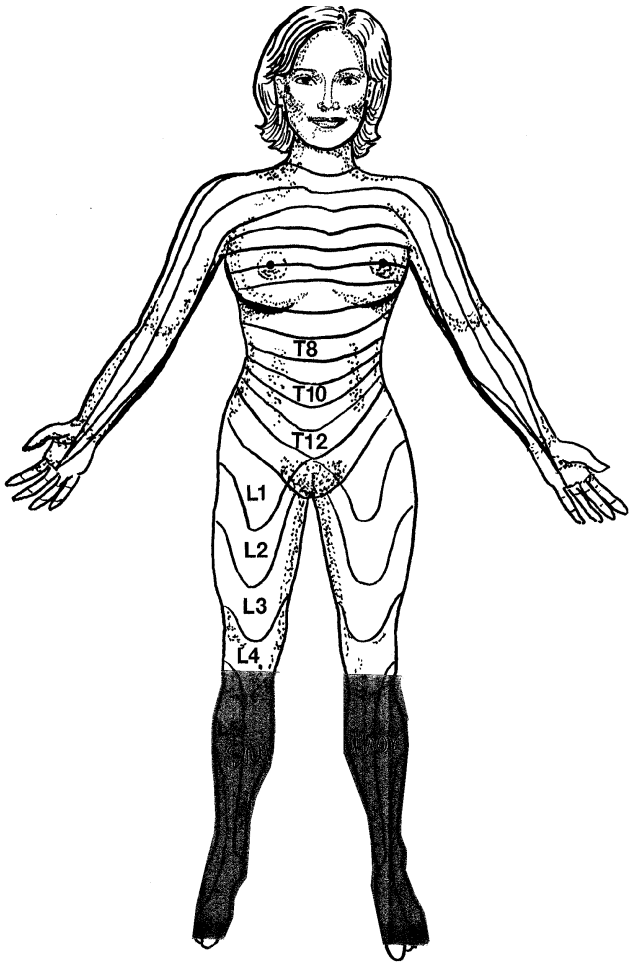

Fig 1. The dermatome model.

infusion and promptly summons the provider for further evaluation of the patient.

Epidural hematoma

A serious but rare complication results from the development of an epidural hematoma, a hemorrhagic infusion into the epidural space. Hematoma formation is more common in women with underlying thrombocytopenia and platelet counts below 100 000/μL, and in women receiving anticoagulation therapy (low-molecular-weight heparin, for example). Hematomas can also form as a result of traumatic needle insertions or repeated punctures. Hematoma formation can occur during labor or delivery, and in some cases bleeding begins at the time of epidural catheter removal. Presenting signs and symptoms develop gradually with progressive neurological impairment. The most common presenting symptom is back pain. As blood continues to fill the epidural space, the spinal cord is compressed, and results in sensory and motor deficits, and possible bowel or bladder incontinence.[18]

The American College of Obstetricians and Gynecologists (ACOG) indicates that the risk of hematoma formation can be reduced by waiting at least 12 hours after the last dose of low-molecular-weight heparin, and not resuming the drug for at least 2 hours after the epidural catheter is removed.[19] Close monitoring of the woman's platelet count is essential when thrombocytopenia has been diagnosed. It is generally considered safe to administer epidural analgesia/anesthesia when the platelet count is at least 100 000/μL.

It is crucial for the nurse to monitor the degree and level of motor blockade while the epidural is in place. A deepening block may be indicative of hematoma formation. Hematomas produce neurological signs and symptoms at the level of cord compression. The site may be located by identifying the corresponding dermatome level (see Fig 1). Complaints of back pain after the insertion of the epidural should be carefully assessed (location, intensity, radiation, relieving or precipitating factors). The back is inspected for bleeding or leakage around the epidural insertion site, as it may be an early sign of coagulopathy in the woman with preeclampsia or with an abruption. A deepening motor block is promptly reported to the anesthesia provider. Any new complaints of back pain are also conveyed in a timely manner. Women do experience back pain during labor and delivery, particularly in the sacral region. However, any new complaints of pain, after epidural placement, including the postdelivery period, must be investigated and promptly reported. If motor and sensory deficits are identified during the assessment, the nurse must implement general safety and fall precautions.

When the epidural infusion is discontinued, a continued dense motor block, beyond approximately 1 hour, or complaints of tingling, numbness, or burning sensations in the lower extremities are immediately reported to the anesthesia provider. As noted previously, early recognition of an epidural hematoma is crucial, because surgical decompression of the spinal cord must be effected within the first 6 to 12 hours to prevent permanent ischemic cord damage and permanent paralysis. When epidural hematoma is suspected, the nurse can anticipate orders to transport the patient for diagnostic studies, including an MRI. A nursing supervisor or manager is promptly notified, and any requests for consultation with a neurologist or spinal surgeon are facilitated by the manager. The surgical unit and appropriate team members are placed on alert, so that rapid spinal decompression can be implemented, if the diagnosis of epidural hematoma is confirmed by radiological studies.

Epidural abscess

The formation of an epidural abscess in the postpartum patient is a rare event. It is unlikely to be seen in the immediate postpartum period, before the woman is discharged. Immunosuppressed women, for instance those who are HIV positive, are at greater risk for development of an epidural abscess, as are polysubstance abusers, with bacteremia. Women who have an epidural catheter in place for

more than 2 days are also at increased risk for abscess formation.[20] Spinal cord compression results in the progression of neurological signs and symptoms including motor and sensory deficits, and possible fecal and urinary incontinence. Focal signs of pain, erythema, and swelling may be evident over the site of catheter insertion.

Nursing responsibilities are comparable to those required when investigating the possibility of epidural hematoma. Should the postpartum woman present in an outpatient setting or OB triage unit with neurological complaints and a history of labor epidural, an anesthesia provider as well as the obstetric provider are notified. The nurse performs an assessment of neurological function, and implements general safety and fall precautions if sensory or motor deficits are identified. The risks of spinal cord compression require expeditious implementation for diagnostic studies, including MRI. As with epidural hematoma, a nursing supervisor may be alerted to assist in the rapid transfer of the patient for diagnostic tests, and to the operating room if the diagnosis is confirmed.

PREPARING FOR POSSIBLE EPIDURAL EMERGENCIES

Staffing considerations

Major epidural complications most often occur during or shortly after the initial administration of the anesthetic agents, and during rebolusing procedures. AWHONN recommends a 1:1 nurse–patient ratio during the initiation of the epidural, so that the nurse is available for continuous maternal and fetal monitoring.[15] In labor units where there is a designated charge nurse, he or she is promptly advised about the plan for an epidural. The primary nurse collaborates with the obstetric providers, and when necessary with nurse managers, to ensure a 1:1 staffing ratio until the epidural procedure is completed and maternal stability and fetal well-being are confirmed.

Maternal assessment and evaluation

Prevention of significant adverse outcomes and effective management of major emergencies is in part predicated upon appropriate patient evaluation prior to placement of the epidural catheter. The final determination that it is safe and appropriate to proceed with a labor epidural is clearly a collaborative decision, and is based upon a nursing assessment and the examination of the patient by both the obstetric and anesthesia providers. AWHONN[7] states that regional anesthesia should be administered only after the patient has been examined by a qualified anesthesia provider. A preanesthetic evaluation affords the anesthesia provider an opportunity to recognize anatomic characteristics, such as a small jaw, or limited jaw mobility, that may prove an obstacle to successful intubation. The nurse often will be asked to provide the anesthesiologist or nurse anesthetist with essential data such as the baseline vital signs and the current vital sign measurements. In some cases, the results of laboratory tests such as a platelet count or clotting studies will be required before the anesthesia provider can safely proceed with the epidural. As noted previously, the risk of epidural hematoma is increased in women with thrombocytopenia. The nurse anticipates the anesthesia provider's questions, and is ready to provide data in a prompt fashion.

ACOG guidelines indicate that the maternal and fetal status and the progress of labor are evaluated "by a physician with credentials in obstetrics who concurs with the initiation of anesthesia and is readily available to supervise the labor and manage any obstetric complications that may arise."[21(p107)] AWHONN[7] states that regional analgesia/anesthesia is not initiated until after a qualified individual has examined the patient and assessed maternal and fetal status and the progress of labor. If a major epidural complication develops, it is essential that the obstetric provider (obstetrician, family practice physician, or certified nurse midwife) be readily available to evaluate both maternal and fetal status and

determine whether additional obstetric interventions such as an amniotomy, placement of an internal fetal scalp electrode, or emergency cesarean section is indicated.

AWHONN guidelines[7,15] define the nurse's responsibilities for assessment and monitoring during epidural analgesia/anesthesia. These recommendations are crucial for the prevention or early identification of major epidural complications. The labor nurse must be familiar with the patient's history, risk factors, and the current maternal and fetal status before the epidural is administered. The woman is asked whether there is a history of allergy to local anesthetic agents or previous adverse reactions related to regional anesthesia. A focused assessment and measurement of vital signs are conducted by the registered nurse "according to the facility's protocol and is consistent with professional nursing guidelines."[15(p11)] They provide the baseline data necessary to promptly identify significant changes in maternal status, and early signs of a significant complication when epidural analgesia/anesthesia is administered.

The nurse is also knowledgeable about the contraindications for regional anesthesia, including factors that may increase the risk of a major epidural complication. Contraindications to epidural analgesia/anesthesia are listed in the following box. Provision 3 of the American Code of Ethics for Nurses states that the nurse promotes, advocates for, and strives to protect the health, safety, and rights of the patient.[22] Concerns about the advisability of epidural anesthesia should be promptly discussed with the obstetric and anesthesia providers.

Fetal heart rate (FHR) assessment

Because the first sign of epidural complications may be the development of a nonreassuring FHR pattern, the nurse assesses and closely monitors the fetal heart rate (FHR). AWHONN[7,15] provides guidelines for FHR assessments during and after initiation of the epidural. The FHR is assessed "as possible during the procedure."[7(p33)] The FHR is assessed after the initiation of the epidural or a rebolus of drugs. "FHR may be assessed every five minutes for the first 15 minutes. More or less frequent monitoring may be indicated . . ."[15(p16)] The subsequent frequency of FHR assessment is based on factors such as the type of analgesia/anesthesia, route and dose of medication used, the maternal and fetal response to

Contraindications to Epidural Analgesia/Anesthesia

Maternal considerations

- Maternal refusal
- Maternal inability to cooperate
- Allergy to local anesthetics
- Active maternal hemorrhage
- Maternal coagulopathy
- Maternal use of once-daily dose of low-molecular-weight heparin within 12 h of the epidural procedure
- Untreated maternal bacteremia (septicemia)
- Skin infection over the site of epidural needle placement
- Refractory maternal hypotension
- Increased intracranial pressure caused by a mass lesion

Other factors

- Lack of resuscitation equipment
- OB provider is unavailable to manage obstetric complications (that may be related to anesthesia complications)
- Inability to establish an intravenous line with a large bore catheter

medication, as well as preexisting maternal and fetal risk factors, obstetric complications, and the stage and progress of labor.[15,23] The nurse is guided by AWHONN guidelines and standards, such as the *Fetal Heart Monitoring Principles and Practices*,[24] to determine the appropriate frequency of and methods for fetal monitoring, as well as agency policies.

Patient preparation to prevent, modify, and manage emergencies

The nurse ensures intravenous access with a large bore intravenous catheter for the administration of emergency drugs and fluid resuscitation should an emergency arise. A non-glucose-containing isotonic crystalloid solution such as Ringer's lactate is recommended for fluid resuscitation. The rapid infusion of glucose-containing solutions may contribute to the development of metabolic acidosis. They may cause neonatal hypoglycemia in the postbirth period.

There is insufficient evidence to determine the benefit of giving a clear antacid, such as bicitra, before placement of a labor epidural. Although nausea and vomiting occur in nearly one half of women receiving regional analgesia/anesthesia,[21] the risk of aspirating stomach contents is very low because they do not lose their protective gag and swallow reflexes. While the risk of aspiration increases when an epidural emergency occurs, there are currently no definitive guidelines for administration of a nonparticulate antacid before the procedure.

Likewise, current data do not permit a specific recommendation regarding oral intake once epidural analgesia/anesthesia is planned. The ASA (*Guidelines for Regional Anesthesia in Obstetrics*) recommends that "oral intake of modest amounts of clear liquids may be allowed for uncomplicated laboring patients,"[4] The ASA states that when patients have additional risk factors for aspiration, for instance morbid obesity, a difficult airway, or an increased risk for an operative delivery, the restriction of oral intake should be determined on a case-by-case basis. The ASA does recommend that solid foods be avoided in laboring patients. Nurses are also guided by the hospital's policies and anesthesia and obstetric provider orders for oral intake with epidural placement.

As noted in the box titled "Contraindications to Epidural Analgesia/Anesthesia," the inability of the patient to cooperate with the placement of the epidural is a contraindication to the procedure. In some cases, the patient will have difficulty following directions because of severe pain. The risk of trauma resulting in neurological injury or hematoma formation is increased if the patient cannot maintain an appropriate position and remain still during the procedure. The nurse may advocate for administration of a narcotic analgesic, so that the patient's ability to assist in the procedure is enhanced. The agreement and approval of both the obstetric and anesthesia providers may be necessary when a decision is made to administer intravenous narcotics just prior to the administration of epidural analgesia/anesthesia.

If the inability to cooperate is due to developmental immaturity or delays, or a mental health problem, consultation with a psychiatric provider may be indicated in order to plan for adequate pain management during labor. This may not be feasible in some settings and when access to psychiatric resources are limited. The optimum time for a psychiatric consultation is prior to the onset of labor.

Similarly, when language barriers prevent adequate communication and cooperation, an interpreter skilled in medical terminology must be present during the process of informed consent and during the initiation of the epidural. An interpreter may be needed to obtain the medical and obstetric history, to give the patient directions during the procedure, and to monitor for adverse reactions in the immediate postprocedure period. The failure to plan for and have an interpreter during the epidural procedure can pose a significant risk to the patient's well-being.[25] If the facility does not have an in-house translator with the appropriate language skills, consideration is given to planning for a qualified translator in advance of the patient's admission.

Ensuring a safe environment for epidural placement

Preparing emergency supplies and equipment. The nurse is responsible for creating a safe physical environment for care. Essential resuscitation equipment must be immediately available in the labor room, including a self-inflating resuscitation bag and mask for positive pressure ventilation, and an oxygen flow meter. Functioning suction and a suction catheter, such as a Yankauer suction tip, is also ready for use. The equipment is tested prior to starting the procedure. Loose tubing connections or holes in anesthesia bags will delay the prompt initiation of cardiopulmonary support.

If drugs such as magnesium sulfate, insulin, or oxytocin are infusing, the lines should be clearly identified prior to placement of the epidural. The nurse prominently labels the primary intravenous line that will be used for rapid fluid infusions, or for the injection of drugs such as ephedrine, to correct maternal hypotension. The anesthesia provider is made aware of the intravenous lines in use, and which line is the primary line. Nurses or providers may inadvertently administer boluses of drugs such as oxytocin, when the primary intravenous tubing is not clearly labeled, and a "piggyback" line is accidentally used to administer emergency drugs or fluid boluses.

In most obstetric units, electronic blood pressure and pulse monitors are used to measure maternal vital signs. Alarms should be tested and alarm limits set before beginning the procedure. In some cases, the maternal pulse is separately monitored with a pulse oximeter, which also measures oxygen saturation levels. Current evidence-based practice guidelines do not require the routine use of continuous pulse oximetry when labor epidurals are placed.[15] However, the *ASA Guidelines for Regional Anesthesia in Obstetrics* states, "additional monitoring appropriate to the clinical condition of the parturient and the fetus should be employed when indicated."[3] Use of pulse oximetry may be indicated when the patient has medical complications that may compromise cardiopulmonary status such as morbid obesity, asthma, or pulmonary disease secondary to smoking, or when intrathecal narcotics are administered. Unit policy and anesthesia orders provide the nurse with guidelines for additional monitoring. A pulse oximeter may be applied at any time, when in the nurse's judgment, additional information about the patient's respiratory status and oxygenation is required.

Lastly, the nurse has additional bags of intravenous fluid immediately at hand, as well as syringes for the administration of emergency drugs should they be ordered by the anesthesiologist or nurse anesthetist. The nurse ensures that a vasopressor, such as ephedrine, used to correct maternal hypotension is immediately available.

Ongoing maternal assessments and monitoring

Prompt recognition of significant adverse reactions and complications is essential for successful management of potentially life-threatening events. AWHONN[15] states that there is insufficient evidence to support a definitive recommendation for the frequency of blood pressure monitoring, but blood pressures may be assessed every 5 minutes or more frequently, depending on the woman's condition, for the first 15 minutes of epidural administration and with each rebolus. As noted previously, the use of pulse oximetry is not currently recommended in the low-risk woman. The nurse and anesthesia provider remain with the woman until maternal vital signs are stable. The nurse is responsible for ongoing fetal assessment and support of fetal well-being.

The nurse is also responsible for periodic evaluation of the degree of motor blockade.[15] This is critical in identifying possible epidural catheter migration into the subdural or subarachnoid space, and the subsequent development of a high spinal block. The nurse undergoes competency validation in the assessment of motor and sensory function in the woman receiving a labor epidural, and

determining the level of the motor blockade. A dermatome chart, such as the one shown in Figure 1, is available to assist the nurse in determining the level of anesthesia. Various numerical criteria including the Bromage Scale are also available to evaluate motor function and the degree of motor blockade. Using this tool, the nurse evaluates the ability of the woman to move her feet and flex her knees and ankles.

Documentation issues

Both the nurse and anesthesia provider are responsible for documenting individual assessments and maternal responses to initiation of the epidural. The hospital provides a protocol that guides the nurse relative to the frequency and nature of nursing assessments, and documentation of maternal responses and vital signs. The policy clarifies the documentation requirements when the maternal blood pressure and pulse are automatically annotated to the fetal monitor strip or entered in the electronic record. One of the benefits of electronic systems is the elimination of redundant charting.

Responsibilities of nurse educators and managers

Nurse educators and managers play a special role in the education, training, and competency verification of nurses caring for the woman with an epidural, including the preparation for and management of major complications. Periodic epidural emergency drills are planned by the leadership and education team in collaboration with the obstetric and anesthesia providers to foster establishment of a *high-reliability* perinatal unit.[26] High-reliability units are characterized by extremely efficient operations that focus on patient safety, which significantly reduces preventable adverse outcomes. They also develop a rapid response team, capable of managing emergencies when they arise, to limit damage and improve outcomes.

The nursing leadership and education team ensures that policies, procedures, and protocols relative to epidural analgesia/anesthesia clearly delineate the responsibilities of the nurse. These responsibilities are defined by the state Nursing Practice Act, the RN licensing board's rules and regulations, and by national standards and guidelines promulgated by AWHONN, ACOG, ASA, and AANA. In order to provide 24 hour availability of epidural analgesia/anesthesia, some institutions are requesting that nurses develop a broader repertoire of skills relative to epidurals, in some cases beyond the legal scope of practice. Managers and educators ensure that there is congruence between state law (Nursing Practice Act), national standards, and hospital policies and protocols regarding epidural analgesia/anesthesia.

The environment created by nurse leaders and educators fosters continuous performance improvement. Ongoing evaluation of nursing performance in the preparation for and management of epidural emergencies is conducted. As noted, periodic epidural emergency drills should be conducted to evaluate the nurses' skills in management of epidural emergencies. These *mock* emergencies reduce reaction time, improve correct sequencing of essential activities, and enhance team coordination. Effective communication between and among team members is encouraged and highly rewarded. High-reliability units are distinguished by the efficiency of teams, regardless of the individuals comprising the teams.

Nursing leadership works with risk management when adverse outcomes related to labor epidurals occur, so that debriefing can occur in a safe learning environment. Careful consideration must be given to confidentiality of debriefing sessions, so that participants do not fear exposure to claims of liability. Nurse managers collaborate with the agency's risk manager and legal counsel to ensure protection for the content of formal debriefing meetings. All members of the team—nurses, obstetric and anesthesia providers, respiratory therapists, for example—are encouraged to attend debriefings.

CONCLUSION

Nurses play a central role in preventing, planning for, and managing major complications of epidural analgesia/anesthesia. Close collaboration with obstetric and anesthesia providers is essential to ensure that important information about the woman's history and the maternal and fetal status is shared. The nurse must acquire expertise in performing focused assessments, and preparing for the possibility of potential emergencies before the epidural is administered. The nurse is fully familiar with the range of major epidural complications and is skilled in detected the first signs of developing problems. The nurse enhances the safety and quality of care for the woman receiving an epidural by using evidence-based clinical guidelines whenever they are available to direct practice. She relies upon standards and guidelines promulgated by professional organizations whenever possible.

Nurse managers and educators support the development of competence and expertise in the nursing care of women experiencing epidural emergencies. They provide opportunities for ongoing education and skill development. Planning for mock emergencies is a particularly effective way to promote continuous quality improvement relative to managing significant epidural complications. Nurse leaders and educators also contribute to patient safety and improved outcomes when there are epidural complications, by developing appropriate policies or protocols, monitoring performance, and evaluating the team response to epidural emergencies.

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