



## Review Article

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# Patient Safety and Wellbeing in Obstetric Anesthesia

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We recently noticed a worsening of patient's quality and safety of care in the Obstetric Unit. The recent quality of care is influenced more by hospital financials, as well as health care provider's convenience. Our goals as physicians are to provide the safest and best patient care with no bias, financial concerns or convenience for us as providers. Patient safety and wellbeing should be discussed, maintained and improved. It should be based on clinical research and experience. In this manuscript we will try to discuss instances related to these issues. An anesthesia provider should evaluate all obstetric patients who are admitted to the labor floor as quickly as possible. This is to facilitate an organized and thorough history and physical exam for better and safer care[1]. It may be more convenient to see the patient only upon request for epidural analgesia or a need for a cesarean section. However, by then, there will be no time to evaluate and to provide the best care. Shortage of anesthesia health care providers affects obstetric patients' safety and wellbeing [2]. The obstetric anesthesia provider should be immediately available for urgent matters and should not leave the obstetric floor. The shortest time to delivery may be critical for the safety and wellbeing of the newborn.

An intravenous line should be initiated first on the back of the non-dominant hand and not in the antecubital vein. Following unsuccessful antecubital vein cannulation and then placing an IV more distal to there may lead to leak of blood and IV fluids from the already pierced antecubital vein [3]. Applications of local anesthetic cream on the patient's back along with adequate local anesthetic

injections can reduce the painful and traumatic experience of placement of neuraxial anesthesia [4]. We encountered several patients who have labored in the past and were still horrified from their last neuraxial experience. Providing a sterile technique for regional anesthesia application is crucial for avoiding infections such as meningitis or back abscesses. Chlorhexidine solution was found to be more superior than betadine solution, given that it may take longer for the betadine to provide asepsis [5]. In addition, there are more reports of meningitis from betadine solutions than from chlorhexidine [6]. Applications of mask, gloves, sterile drapes, and chlorhexidine Tegaderm to the sterile injection site must be maintained. The chlorhexidine Tegaderm must be placed on the injection site before removal of the drape. Sharps must be placed on the epidural tray container and not on the paper sterile cover. They may pierce the paper and become contaminated [7].

It is safer to place an epidural catheter early in labor in order to avoid the need for unsafe general anesthesia for emergency cesarean section [8]. Pregnant patients have a more difficult airway compared to non-pregnant patients, which may lead to higher incidences of hypoxia and catastrophic events to mother and baby. Furthermore, it was found that following general anesthesia, there is a higher incidence of postpartum depression and suicide attempts [9,10] compared to general anesthesia. We prefer to avoid phenylephrine infusions during regional anesthesia for C/S. We apply regional anesthesia in the lateral position, check blood pressure constantly for 20 minutes to titrate 50-100 mcg phenylephrine to treat hypotension. IV infusion may cause overdose of phenyleph-

rine especially when other medications are injected via the same line, specifically methylergonovine.

Epidural analgesia is safer than natural birth at home or at the labor floor. We would like to mention two cases of natural birth that we are aware of to demonstrate this difference. In one case the patient who was scheduled to deliver at home was found to have a fetal transverse lie. It took an hour to transport the mother to the hospital to find a case of fetal demise. Another case was a patient who was scheduled to have a natural delivery at the hospital and had contractions every 3 min for 3 days and nights. The mother was exhausted and hallucinating when the Midwife told her that she made some progress of her cervical dilation from 2 cm to 4 cm. When the Midwife examined her later again she told the patient "Sorry, you are only 2 cm Dilated." At this time the patient whispered to the Midwife to call the anesthesiologist for an epidural. When her husband saw the anesthesiologist enter, he was horrified and told his wife "but honey we decided to have a natural birth". The patient yelled back "You son-of-a-b\*\*\*\*I am having the pain, not you! Now get out of here I am going to have the epidural." We started an IV, placed the epidural and, once comfortable, started her on IV Pitocin. She immediately fell asleep and became fully dilated in an hour, delivered 15 minutes later and asked to remove the epidural catheter in order to be "natural" again. Labor pain raises catecholamine blood level and delays progress of labor. Pain relief lowers their blood levels and provides effective uterine contractions and reduces the chance of instrumental delivery. Fetal bradycardia may occur in active labor upon initiation of CSE due to faster reduction of norepinephrine level than epinephrine which causes uterine hyperactivity and reduction of uteroplacental perfusions. In our study, a "walking epidural" for labor pain provided adequate analgesia, less hypotension, less motor block and can reduce the need for a bladder catheterization, which has the potential to cause urinary tract infections without affecting labor durations [11]. However, it did not gain popularity due to the fact that it requires more time, more staff intervention, more expenses and is not covered by medical insurance.

Applying epidural analgesia in the left lateral decubitus position is safer for mother and fetus than the more convenient sitting position [12-14]. Partial aortocaval compression in the sitting position causes less uteroplacental perfusion and higher fetal morbidity, especially when uteroplacental perfusion is already compromised in early aging of the placenta secondary to diabetes, preeclampsia or partial separation of the placenta from the uterine wall. Before inserting the epidural needle with the stylet, the skin should be pierced with an 18g needle in order to reduce the incidence of inadvertent placement of skin tissue in the spinal canal. The reason is because this can potentially develop into an epidermoid tumor which can cause sciatic pains and even paralysis [15]. The initial insertion of the epidural needle should not be deeper than 2 cm in order to avoid accidental dural puncture when the epidural space is less than the average 5 cm distance from the skin. In one of our patients, we punctured the dura at 2.1 cm from the skin, which later required a blood patch for a post-dural puncture headache.

The stylet should be reinserted following each advancement of the epidural needle in order to remove blood clots and biopsied tissues from the lumen of the needle. Without doing this, the provider may have impairment of tactile feel of the loss-of-resistance to air or saline. This impairment can increase the risk of unexplained post-dural-puncture headache [16]. Using the gravity technique of local anesthetic administrations increases success rate by helping to determine the correct position of the epidural needle in the epidural space. This technique also reduces the electric shock sensations from epidural catheter insertions and accidental catheter intravascular penetrations [17, 18].

The position of the epidural catheter should be about 5 cm within the epidural space. To confirm adequate placement, first the catheter should be lowered for 15 seconds, paying close attention for any CSF or blood leaks. Next, perform a hanging drop technique by applying a drop of the local anesthetic to the adapter and watching it move into the catheter by gravity. Lastly, a catheter test dose injection with lidocaine plus epinephrine should be used as an additional confirmation that the catheter is within the epidural space. The catheter should be looped and secured to the skin at the insertion site, at the adapter and along the patient's back in order to avoid catheter disconnect and the need for reinsertion. We determined that epidural sufentanil is safer than epidural fentanyl in a combination of ropivacaine and epinephrine. In our study, we compared epidural sufentanil 1 mcg/ml with fentanyl 2 mcg/ml (which has become more common practice to use in epidural solutions) along with bupivacaine 0.015% and epinephrine 2 mcg/ml for labor pain. The fentanyl group had higher pain scores, required more rescue doses of 5 ml 0.25% epidural bupivacaine for stages I&II, and had lower overall patient satisfaction. In addition, both arms of the study were comparable with regards to duration of labor stages I&II, side effects, infusion duration, labor and delivery outcome and APGAR Scores [19].

Following a review of this study, Breen TW commented in his Editorial that epidural sufentanil along with bupivacaine and epinephrine was twice as potent as fentanyl with less required rescue Bupivacaine doses and no neonatal respiratory depression [20]. Epidural epinephrine constricts epidural blood vessels and makes them smaller targets for catheter penetration and accidental intravascular injection. By binding to alpha-2 receptors in the spinal cord, epinephrine provides analgesia and by constricting epidural vessels it prolongs the analgesic effects of the local anesthetic and the epidural opioid. Accidental intravascular infusion of epidural epinephrine will cause tachycardia and palpitations and will alert the obstetric anesthesia provider of this problem, and allows reinsertion of the catheter before the intravascular local anesthetic would cause systemic toxicity.

Epidural ropivacaine provides safer epidural analgesia when accidentally injected in an epidural blood vessel. It provides superior analgesia with more sympathetic block and less motor block than the cheaper epidural bupivacaine. Cardiotoxic effects can occur when large doses of local anesthetic are accidentally administered intravenously. Ropivacaine has a lower systemic toxicity and simi-

lar duration of action as bupivacaine. Local anesthetic cardiotoxicity is determined by the speed of detachment of its molecule from sodium channel receptors inside the cardiac conduction system, in which ropivacaine scores much better than bupivacaine. Ropivacaine is a better alternative to bupivacaine due to its greater margin of safety. Its high concentrated doses are still toxic and should be administered in the lowest concentration and in small divided doses. There are several reports of successful resuscitation from epidural ropivacaine for cesarean section [21].

We determined whether increasing the concentration of epidural fentanyl would provide adequate analgesia with less rescue 0.25% bupivacaine and without neonatal adverse effects. All patients (n=150) received epidural bupivacaine 0.015% along with epinephrine 2 mcg/ml and fentanyl in GI: 2, GII: 4, and GIII: 6 mcg/ml. There were no differences with respect to: demographics, outcome of labor and delivery, infusion durations, pain scores, satisfaction scores, side effects, APGAR scores, Neonatal neurobehavioral assessment (1hr & 24hr > 35: Max = 40), and with still high required total rescue epidural 0.25% bupivacaine doses. The frequently required top offs of epidural bupivacaine for even the group with higher concentrations of epidural fentanyl makes it a less attractive choice for a busy Obstetric floor.

The administration of bupivacaine or ropivacaine at concentrations greater than 0.1% for labor pain provided excellent analgesia with minimal staff interventions. However, these medications may cause: hypotension, reduced uterine contractility, prolonged 2nd stage of labor, and increased risk of instrumental delivery. Epidural Bupivacaine or ropivacaine less than 0.1% along with opioid and epinephrine provide minimal or no motor block, allow ambulation, lower the risk of instrumental delivery but more often requires more top-offs on the obstetric floor [22]. When epidural-PCA infusion is applied, the preferred lock-out time is 5 minutes. Longer times may require more calls for the obstetric anesthesia provider on the busy unit.

Obstetric patients that are treated with epidural-PCA analgesia should be instructed to call the nurse if they have pain, nausea and vomiting, dizziness or complete motor block. The nurse should contact the anesthesia provider immediately given these signs can be a sign of a misplaced catheter out of the epidural space, potentially inserted in a blood vessel or the subarachnoid space. Left untreated, this complication may require general anesthesia for non-reassuring fetal heart rate. General anesthesia should be avoided for the risks of difficult airway and postpartum depression. The obstetric anesthesia providers should stay in the patient's room for at least 20 minutes and complete the chart in the room in order to detect loss of consciousness from systemic absorption of the epidural opioids. The provider should also look out for one sided analgesia, total spinal anesthesia, hypotension, vasovagal response, tachycardia, tachyarrhythmia, nausea, vomiting and pain. Adequate sensory and motor blocks should be checked on a regular basis and left lateral decubitus position should be maintained during labor and delivery in order to maintain adequate uteroplacental perfusion. High sympathetic block causes uncompensated peripheral vasodilation which reduces maternal venous return and causes maternal

hypotension along with reduced uteroplacental perfusion. Over the years, we encountered several patients with epidural catheters entering the subarachnoid space causing sensory levels of T6 and complete bilateral motor blocks of all four extremities. This risk may be reduced by keeping the index finger of the hand that holds the epidural needle as close as possible to the patient's skin. Leaving a space between them and applying excessive force to pierce the ligamentum flavum may push the epidural needle too deep and nick the dura. This can allow the epidural catheter to enter the subarachnoid space later on. We encountered a patient who presented with loss of consciousness after epidural placement secondary to systemic absorption of epidural sufentanil. At first they misdiagnosed the patient with eclampsia and started treating her with IV magnesium sulfate, but only after titrating doses of IV naloxone did the patient wake up. In this situation, we changed the epidural solution to bupivacaine and epinephrine until delivery. We also encountered a patient screaming in pain from one sided epidural analgesia not knowing that she should have called us for help. She was found to have one sided analgesia and the catheter was pulled back 4 cm to provide adequate bilateral analgesia. Later on when she had non-reassuring fetal heart rate general anesthesia was avoided along with its potential complications.

If a C-section is called, the anesthetic epidural medications should be administered only in the operating room in which resuscitative measures to secure the airway are immediately available. We are aware of several cases in which epidural anesthetic doses were administered outside the operating room in order to save time to deliver the baby by C/S which led to apnea, cardiac arrest and death by the time the patient was brought into the OR. Sudden total sympathectomy from high epidural or total spinal in a supine unmonitored patient can cause apnea, hypoxia and cardiac arrest.

Combined-spinal-epidural anesthesia is safer and preferred over a single shot spinal for elective C/S. Spinal block may fail due to inadequate local anesthetic dose, injection of the local anesthetic slowly without mixing it with CSF or saline, leaks of the local anesthetic from the subarachnoid space to the epidural space and injection into tissue or in a blood vessel. Having the backup epidural catheter in place allows providing regional anesthesia and avoids general anesthesia for C/S. If regional anesthesia does not provide adequate anesthesia, additional sevoflurane 1% along with 100% O<sub>2</sub> by mask allows to start the surgical incision to speedup delivery until adequate epidural anesthesia is achieved. Pain and anxiety may be alleviated by this technique along with analgesic doses of ketamine. Titrating small doses of phenylephrine is safer than starting a phenylephrine infusion for 15-30 minutes following initiation of a regional block for treatment of maternal hypotension. Additional boluses of other medications may push high doses of phenylephrine and severe hypertension. IV midazolam should be avoided during regional anesthesia for C/S which may cause amnesia of the delivery of the baby and is resented by the mothers.

Applications of P6 electric stimulation at the wrist are safer than IV Metoclopramide or ondansetron which are currently administered for treatment of nausea and vomiting during C/S. Both medications may be transferred to the baby via the placenta and

the breast milk. The effects of these medications on the baby is unknown and can be avoided [23]. Walking epidural-PCA post C/S delivery is safe, provides excellent post C/S analgesia and avoids the need for PO opioids by replacing them with PO acetaminophen and ibuprofen. Several studies demonstrated that post C/S PO opioids increase the incidence of opioid misuse among naïve opioid post C/S patients along with high incidence of drug abuse and death. Yet this epidural-PCA analgesia technique was replaced by intrathecal Duramorph which provides inadequate post C/S analgesia with the need for PO opioids and no postpartum follow-up. TAP block did not eliminate the need for postpartum PO opioids. The longer the post C/S patients are provided with PO opioids the higher the chance of becoming drug misuse.

A differential diagnosis of postpartum headache in order to avoid a blood patch for post-dural-puncture headache that causes stagnation cerebral vein blood flow especially with preeclampsia may cause cerebral vein thrombosis which we encountered over the years. In one case a 22 year old preeclamptic lady had post-partum headache that was treated with a blood patch and was discharged home where she had seizures, was diagnosed with cerebral vein thrombosis and was treated with IV heparin. She was ended up with troubled speech and difficulty walking [24]. Inhalation anesthetics for C/S and D&E cause higher incidence of morbidity and mortality when compared with IV Propofol and should be avoided for these operations. In our study we found much more blood loss for the group that received inhalation agents that relax the uterus and cause excessive vaginal bleedings [25,26].

Inhalation anesthesia for cancer surgery suppresses the patient's immune system and increases the incidence of recurrence of cancer when compared to IV propofol. Every anesthesia provider should be aware of this risk and avoid general anesthesia with inhalational agents for these patients. BIS monitor should be applied for every patient who receives general anesthesia with muscle relaxant for Cesarean section in order to avoid awareness during the surgery and decrease the risk of post op depression and anxiety. We are aware of cases in which the anesthesia provider was away from the patient who was paralyzed and did not notice the vaporizer ran out of inhalation agent. The patient had anxiety and depression. Blood glucose must be checked immediately before general anesthesia for cesarian section with diabetes patients and should be repeated hourly during surgery. Their hypoglycemic medications should be stopped preop. Anesthesia providers should not be rushed to the OR before obtaining a preop glucose level. We have encountered preop patients with preop blood glucose as low as 29-33 mg/dL. Coma and brain damage may occur with values this low. We should always look at our patients as our own and to care for them like they are a loved one, instead of "just providing the anesthesia". We should encourage them to quit smoking, and to stop drinking alcohol and doing drugs.

In the past we encountered patients with central anticholinergic syndrome post general anesthesia for C/S with IV propofol that were treated with IV physostigmine and became alert and oriented postop and we reported some of these cases [27]. Many anesthesia providers are not aware of this issue and treat these patients

with IV Dexmedetomidine. On the other hand, drug companies stop manufacturing physostigmine, which I suspect is due to lack of profits. Recently we noticed this trend of money before patient safety and wellbeing and this may be one example of such instance. Sphenopalatine ganglion block may cure any type of headache, including post-dural puncture headache and migraines. SPGB is simple, cheaper and safer than a blood patch to treat, and even cure, migraines.

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## Conflict of Interest

No Conflict of interest.

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