In patients with catecholamine-dependent septic shock or post-cardiotomy vasodilatory shock, be cautious when using vasopressin because it may worsen perfusion of the mucosa of the bowel.

**Background:** Vasopressin is now frequently utilized to treat hypotension in surgical patients and those suffering from septic shock. However, vasopressin is a potent vasoconstrictor and may constrict the portal vasculature more than the systemic. This may impair perfusion of the intestine.

**Objective:** To determine the effect of substituting vasopressin for norepinephrine on the perfusion of the intestine in patients with catecholamine-dependent septic shock or post-cardiotomy vasodilatory shock.

**Design:** Clinical repeated-measures experiment using 8 patients as their own controls.

**Participants:** Eight mechanically ventilated patients who were in post-cardiotomy vasodilatory or septic shock and who required a norepinephrine infusion to maintain a mean arterial pressure (MAP) >75 mmHg.

**Methods:** Patients all had systemic hemodynamics measured using a pulmonary artery catheter. A second pulmonary artery catheter was fluoroscopically guided into the hepatic vein to obtain post-hepatic blood samples. A laser Doppler flow probe, which measures blood flow to the mucosa of the gut, was also placed fluoroscopically 20 to 40 cm into the jejunum. Finally, gastric mucosal pCO2 was measured using a tonometry nasogastric tube.

**Interventions:** Following baseline measurements, vasopressin was sequentially infused at 1.2, 2.4, and 4.8 Units/hour for 30-minute periods. Norepinephrine was sequentially decreased as the vasopressin was increased to maintain the MAP at approximately 75 mmHg.

**Results:** Vasopressin infusion caused a decrease in jejunal mucosal perfusion and increased the gastric-arterial pCO2 gradient, suggesting that gastric mucosal perfusion was impaired as well. Increasing the vasopressin dose worsened the indices of intestinal ischemia.

**Conclusions:** Vasopressin impaired intestinal mucosal perfusion in a dose-dependent fashion.

**Reviewer’s Comments:** Vasopressin is a profound vasoconstrictor but does not provide inotropic support. This study suggests it may constrict the blood supply to the intestinal mucosa. This is worrisome because mucosal damage from ischemia may allow translocation of microorganisms and endotoxins and worsen the systemic inflammatory response syndrome in patients with vasodilatory shock. (Reviewer-David S. Beebe, MD).

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Keywords: Vasopressin, Hypotension, Intestinal Perfusion

Print Tag: Refer to original journal article
Sugammadex reverses rocuronium so quickly that a patient recovers faster than if he or she had spontaneously recovered from succinylcholine.

**Background:** Sugammadex is a new experimental reversal agent that can rapidly reverse the effects of rocuronium. Rocuronium can be used in place of succinylcholine for a rapid-sequence induction of anesthesia. However, it usually has a long duration of action. In the case of a difficult airway, a short duration of action is necessary if the patient cannot be intubated or ventilated and rapid restoration of spontaneous ventilation is required.

**Objective:** To compare the recovery time of patients administered 1.2 mg/kg of rocuronium followed 3 minutes later by 16 mg/kg of sugammadex versus spontaneous recovery after 1 mg/kg of succinylcholine.

**Design:** Randomized, multicenter, open-label but safety-assessor-blinded clinical study.

**Participants:** 115 adult patients (ASA Physical Status I or II) without a history of neuromuscular disorders or malignant hyperthermia who were scheduled to undergo general anesthesia for which a short duration of neuromuscular blockade was required.

**Methods:** Approximately 50% of patients received rocuronium 1.2 mg/kg for tracheal intubation and 50% received succinylcholine 1 mg/kg. In the patients receiving rocuronium, sugammadex 16 mg/kg was administered intravenously 3 minutes after rocuronium administration. A TOF-Watch SX was used to determine the time for recovery of the T1 twitch to 10% and 90% of the baseline value in each group. In addition, train-of-four ratios were determined in the group that received rocuronium.

**Results:** The recovery times to 10% and 90% of the baseline values were faster in the rocuronium-sugammadex group (4.4 and 6.2 minutes, respectively) than the succinylcholine group (7.1 and 10.9 minutes, respectively; all $P<0.001$). There were no adverse effects of from the sugammadex administration.

**Conclusions:** Patients administered sugammadex at 3 minutes following a dose of rocuronium recovered more rapidly than did patients administered an induction dose of succinylcholine.

**Reviewer’s Comments:** This study suggests that rocuronium may replace succinylcholine for rapid-sequence induction of general anesthesia, even in situations involving a difficult airway where early establishment of spontaneous ventilation may be necessary. Sugammadex reversal of rocuronium is faster than is spontaneous recovery from an intubating dose of succinylcholine. (Reviewer-David S. Beebe, MD).

© 2009, Oakstone Medical Publishing

Keywords: Blockade Reversal, Rocuronium vs Succinylcholine

Print Tag: Refer to original journal article
A small amount of neuromuscular blockade can adversely affect the muscles of the upper airway and cause airway obstruction.

**Background:** Residual neuromuscular blockade can result in airway and other respiratory complications after surgery. A train-of-four (TOF) ratio ≥0.7 has been proposed as a test to determine if the patient may be tracheally extubated.

**Objective:** To determine the effect of small levels of neuromuscular blockade on the integrity of the upper airway in awake, healthy volunteers.

**Design:** A human experiment with a repeated measures design.

**Participants:** 15 healthy male volunteers.

**Methods:** An experimental respirator was used to generate various positive and negative pharyngeal airway pressures, at which time the airway pressures and pressures within the face mask upstream to the area with neuromuscular blockade were measured. The negative inspiratory pressure which caused flow to cease was calculated. Electromyograms were obtained using electrodes in the genioglossus muscle of each subject. The train-of-four (TOF) ratio for each subject was measured using accelerometry with a TOF-watch SX® device.

**Interventions:** Following baseline measurements, rocuronium was administered intravenously until a TOF ratio by accelerometry of 0.5 was obtained for 5 minutes, at which time measurements were obtained. The infusion was then adjusted until the TOF ratio increased to 0.8, and the measurements were repeated. Final measurements were obtained when the TOF ratio returned to 1.

**Results:** The negative inspiratory pressure where the airway closed was significantly less than baseline at a TOF ratio of 0.5 (mean % decline, 54% ±4.4%) and at a TOF of 0.8 (37% ±4.2%). The negative inspiratory pressure was also less than baseline when the TOF ratio had recovered to 1 (16% ±4.1%). The genioglossus activity measured by electromyogram was also impaired by 57% ±44% and 32% ±6% at TOF ratios of 0.5 and 0.8, respectively.

**Conclusions:** Even low levels of neuromuscular blockade can result in significant impairment of function of the upper airway.

**Reviewer’s Comments:** These results suggest that a TOF value of 0.7 is not adequate to ensure that a patient is strong enough to extubate. The results also suggest that most patients should have neuromuscular blockade reversed because most of our devices to measure TOF ratio are not very sensitive. (Reviewer-David S. Beebe, MD).

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Keywords: Muscle Relaxants, Residual Paralysis, Airway Obstruction.

Print Tag: Refer to original journal article
Epidural etanercept may show promise for the treatment of lumbar radicular pain.

**Background:** Lumbar radicular pain is a common cause of chronic pain and disability. Current modalities include epidural steroid injections and surgery when indicated. Despite these interventions, pain is not always completely relieved. Growing evidence suggests that inflammation may be a component of the pain involved with sciatica. Etanercept is a drug used for several types of inflammatory arthritis.

**Objective:** To evaluate the safety and efficacy of epidurally administered anti-tumor necrosis factor (TNF) agents.

**Design:** Prospective, double-blind, placebo-controlled, dose-response study.

**Participants:** 24 patients with subacute lumbosacral radiculopathy. Animals were used in a pre-clinical study to determine safety.

**Methods:** Patients were randomly assigned to receive either saline or etanercept, a TNF inhibitor, via transforaminal injection. Patients were given 2, 4, or 6 mg of etanercept. All patients received 2 injections 2 weeks apart. Site of injection was correlated to symptoms and imaging findings. Some patients received 2-level injections with divided drug doses. The primary outcome was a numerical rating of leg pain. A positive outcome was at least a 50% reduction in pain with an associated positive perceived effect. Reduction in adjunctive analgesics was also recorded. Follow-up occurred for up to 6 months.

**Results:** In the preclinical safety study, no obvious biochemical, gross, or histologic adverse effects were demonstrated by the administration of etanercept. In the clinical study, no obvious side effects of the etanercept were noted. The saline group had a longer duration and higher severity of pain than did the etanercept groups. However, this difference did not quite achieve statistical significance. Patients who received etanercept had a significant reduction in pain and improvement in the first month. Significantly more patients receiving etanercept had pain reduction and a positive perceived effect than did patients receiving saline. Almost all etanercept patients reduced or were able to discontinue their analgesic usage. However, a distinct dose-response effect was not demonstrated.

**Conclusions:** Transforaminal epidural etanercept may prove to be a beneficial treatment for lumbosacral radiculopathy.

**Reviewer's Comments:** The small study size and the higher pain scores and longer duration of pain in the saline group may temper the results of this study. The apparent safety of this study may provide impetus for further, larger studies. (Reviewer-Allen Miranda, MD).

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Keywords: Sciatica, Epidural Etanercept

Print Tag: Refer to original journal article
Efficacies of Oral and IV Ondansetron Similar for PONV

Efficacy of Orally Disintegrating Ondansetron in Preventing Postoperative Nausea and Vomiting After Laparoscopic Cholecystectomy: A Randomised, Double-Blind Placebo Controlled Study.

Grover VK, Mathew PJ, Hegde H:
Anaesthesia 2009; 64 (June): 595-600

Whether using the oral disintegrating form or the IV form of ondansetron may not matter when being given for the prevention of postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy.

Background: Postoperative nausea and vomiting (PONV) is such a common problem with laparoscopic procedures that many practitioners routinely give PONV prophylaxis to these patients. The most common method is the intravenous administration of a number of different classes of drugs, with the 5-HT3 antagonists being commonly used.

Objective: To study the efficacy of orally disintegrating ondansetron for PONV.

Design: Prospective, randomized, double-blinded, placebo-controlled trial.

Participants: >100 healthy adults undergoing laparoscopic cholecystectomy (LC) under general anesthesia. A history of PONV, anti-emetic therapy within 24 hours preoperatively, pregnancy, or opioid use were reasons for exclusion.

Methods: Prior to the induction of anesthesia, patients in the oral group received either the oral disintegrating ondansetron or placebo. In the intravenous group, the patients received either a placebo or ondansetron after endotracheal intubation. A standard anesthetic was used, including propofol infusion, oxygen, and nitrous oxide. The muscle relaxant was reversed with glycopyrrolate and neostigmine. No narcotic was used intraoperatively, and the NSAID diclofenac was used for postoperative analgesia. Morphine was available as a rescue analgesic. Nausea severity was rated on a 0-to-10 scale, and a 4-point PONV score was used. Metoclopramide was used as a rescue antiemetic. Time to oral intake and time to discharge were recorded. A telephone survey on postoperative day 1 was performed to assess satisfaction.

Results: Demographic variables were similar between the 3 groups. Duration of surgery, anesthesia, and recovery times were similar. PONV was significantly less common in the first 6 hours after surgery in both ondansetron groups compared to placebo groups. There was no difference between the effectiveness of the oral ondansetron compared to the intravenous form. Also, PONV scores were lower (less PONV) in both ondansetron groups. A complete response was experienced by significantly more patients in either ondansetron group than in the placebo group. Predictably, patient satisfaction was higher in the ondansetron groups than in the placebo group.

Conclusions: Orally disintegrating ondansetron is as efficacious as intravenous ondansetron in preventing PONV after LC.

Reviewer's Comments: If the orally disintegrating form is less expensive than the intravenous form, it may prove to be advantageous. A further study that compares the efficacy of the 2 forms of ondansetron when PONV is already present also could be helpful. (Reviewer-Allen Miranda, MD).

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Keywords: Laparoscopic Cholecystectomy, PONV, Ondansetron

Print Tag: Refer to original journal article
Serum Lactate Levels Predictive of Postop ARF

Risk and Outcome Analysis of Renal Replacement Therapies in Patients After Cardiac Surgery With Pre-Operatively Normal Renal Function.

Hauer D, Kilger E, et al: Anaesthesia 2009; 64 (June): 615-619

In patients with preoperatively normal renal function undergoing cardiac surgery, the need for postoperative renal replacement therapy may be predicted by serum lactate levels.

Background: Perioperative acute renal failure (ARF) is associated with both significant morbidity and mortality.

Objective: To evaluate the risk factors and outcome analysis of ARF in patients undergoing cardiac surgery who had normal preoperative renal function.

Design: Prospective, observational study.

Participants: Patients were adults undergoing coronary artery bypass grafting (CABG), valve surgery, or combined procedures using cardiopulmonary bypass. Patients were excluded if they had preoperative renal dysfunction or if their renal dysfunction developed after the third postoperative day.

Methods: Patients had a standard anesthetic, and central venous pressure was monitored in all patients. Pulmonary artery catheters were placed in select patients. Cardiopulmonary bypass was performed with mild hypothermia and a flow rate to maintain a mean arterial pressure of >60 mmHg. Cold hyperkalemic cardioplegia was used for cardiac protection. ARF requiring renal replacement therapy was defined as oliguria despite diuretics, uremia, fluid overload despite diuretics, or hyperkalemia. Postoperative lab variables included lactate, interleukin-6 (IL-6), and physiologic parameters. Duration and maximum dose of norepinephrine (used as the postoperative vasopressor) were also recorded. Patients with postoperative ARF were subdivided into survivors and nonsurvivors, and a further analysis was performed.

Results: <5% of the patients developed postoperative ARF in the first 3 days. Predictably, patients who developed ARF tended to have a lower ejection fraction, had longer surgical procedures, and had a greater need for circulatory and ventilatory support. Transfusion was also more common in the ARF group. The single most important predictor for ARF requiring renal replacement therapy was a serum lactate level >1.1 mmol/L with the first 24 hours after surgery. In patients who did not achieve a lactate level >1.1 mmol/L, a maximum dose of norepinephrine >0.19 μg/kg per minute was also predictive of the development of renal insufficiency. Among the patients in whom ARF developed, higher doses of norepinephrine, higher maximum lactate levels, and higher serum CK, bilirubin, and IL-6 levels were more frequent in those who did not survive.

Conclusions: Lactate might be a valuable tool for the early initiation of renal replacement therapy.

Reviewer's Comments: The development of ARF in any population, not just perioperative patients, often means the difference between life and death. ARF is often much easier to prevent than it is to treat. Although the authors of this study do not suggest that any anesthetic factors contributed to renal failure, we must remember that control of intraoperative factors can have significant effects on postoperative outcomes. (Reviewer: Allen Miranda, MD).

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Keywords: Postop Renal Failure, Risk Factors, Outcomes

Print Tag: Refer to original journal article
Small doses of flumazenil may produce a faster wake up in patients even if they have not received benzodiazepines.

**Background:** Flumazenil is a benzodiazepine antagonist that is often used to reverse the sedative effect of benzodiazepines. The effects of endogenous benzodiazepines can also be reversed by the administration of flumazenil, as has been demonstrated in patients with hepatic encephalopathy.

**Objective:** To determine if flumazenil, 0.5 mg, administered to healthy unpremedicated patients during propofol/remifentanil anesthesia would increase the bispectral index (BIS) value and expedite recovery from anesthesia.

**Design:** Prospective, randomized, placebo-controlled study.

**Participants:** 60 patients (ASA Physical Status I or II) were scheduled to undergo a surgery of approximately 3 hours duration and expected to have a blood loss of <1L. Patients were excluded if they were already receiving drugs that might affect BIS or had a medical condition that could affect level of consciousness. Propofol was administered using a target-controlled infusion system. Rocuronium was used for neuromuscular blockade, and remifentanil was the narcotic for maintenance after induction of anesthesia. BIS was maintained at 40 during surgery. The study drug was administered 30 minutes before the end of surgery. Time to spontaneous respiration, following commands, extubation, and recollection of birthday were recorded.

**Results:** No demographic or surgical differences were noted between the groups. The 2 groups were similar for times to loss of consciousness, propofol and BIS values at loss of consciousness, surgical duration, blood loss, and propofol requirements during surgery. In the group that received flumazenil, all parameters of recovery were significantly shorter than in the control group. Starting at approximately 6 minutes after the administration of the flumazenil, BIS scores became significantly higher than in the control group. No obvious side effects of the flumazenil were recorded.

**Conclusions:** Flumazenil significantly increases the BIS value and allows earlier emergence from anesthesia.

**Reviewer's Comments:** Although the authors state that propofol's mechanism of action is not definitively known to be a GABA receptor phenomenon, there is evidence to suggest that this may be at least part of the mechanism. Therefore, this study could also be measuring the reversibility of propofol. Further studies will be needed to clarify this potential point of confusion. (Reviewer-Allen Miranda, MD).
Catheter Misplacement Is Problem With US-Guided Paravertebral Blocks

Ultrasound-Guided Paravertebral Puncture and Placement of Catheters in Human Cadavers: An Imaging Study.
Luyet C, Eichenberger U, et al:

The use of ultrasound guidance for paravertebral blockade provides visualization for needle placement but does not improve accuracy of catheter placement.

**Objective:** The authors devised a new technique utilizing ultrasound guidance for paravertebral blockade and catheter placement.

**Methods:** Paravertebral blockade was attempted at one thoracic level between T4 and T8 bilaterally in 10 human cadavers. A curved array transducer was placed longitudinally between 2 transverse processes and then oriented slightly oblique until the paravertebral space was visualized between the superior costotransverse ligament and parietal pleura. An 18-gauge Tuohy needle was then introduced under real-time visualization until the paravertebral space was entered. The paravertebral space was then dilated with 15 mL of normal saline, watching the space expansion with ultrasound. A catheter was introduced approximately 5 cm beyond the needle tip. If catheter advancement was not possible, the needle was turned slightly, and catheter advancement was attempted again. If catheter advancement still was not successful, a new attempt at paravertebral blockade was performed at 1 interspace level below. Once catheter insertion was complete, 10 mL of contrast dye was injected, and follow-up CT imaging evaluating dye spread was performed.

**Results:** A total of 20 catheters were placed. The authors found initial needle placement into the paravertebral space easy to perform. However, subsequent catheter placement was more difficult. Approximately 30% of the catheters required further needle manipulation, and 20% of the attempted catheter placements required a new paravertebral block attempt at a lower thoracic level. The mean depth of needle insertion to the paravertebral space was 4.4 centimeters. On follow-up CT, 11 of the 20 catheters provided paravertebral spread across 2 to 6 intercostal levels. However, the remaining catheters revealed contrast spread into the pleural space, posterior mediastinum, or epidural space.

**Conclusions:** With the use of ultrasound guidance, the initial needle insertion for paravertebral blockade was simple and easy to verify under real-time visualization with saline expansion. The introduction of a paravertebral catheter, however, was more difficult and often resulted in spread to unintended areas, such as the pleural space, posterior mediastinum, or epidural space. Due to this, the authors cautioned about the use of replacing thoracic epidural catheters with proposed paravertebral catheters for postoperative analgesia.

**Reviewer's Comments:** The use of paravertebral catheters for postoperative analgesia is attractive because of the advantages of unilateral block and a decreased incidence of hypotension. However, this small cadaver study reveals that the catheter has only about a 50% probability of ending up in the correct place. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Paravertebral Block, Catheter Placement, Ultrasound Guidance

Print Tag: Refer to original journal article
Intraneural Needles Most Likely to Enter Connective Tissue

Structural Injury to the Human Sciatic Nerve After Intraneural Needle Insertion.

Sala-Blanch X, Ribalta T, et al:

Reg Anesth Pain Med 2009; 34 (May-June): 201-205

For the sciatic nerve, a needle placed intraneurally tends to enter adipose connective tissue rather than nerve fascicles.

**Objective:** To assess the extent of damage caused to a peripheral nerve after needle puncture during a peripheral nerve block.

**Methods:** The sciatic nerve was exposed from the ischial tuberosity down to the popliteal fossa in a human cadaver. A series of 10 needle punctures were made directly into and through the sciatic nerve. Two types of Stimuplex needles were used in the experiment. Group A utilized a Stimuplex A 21-gauge 30-degree bevel needle, while group D utilized a Stimuplex D 22-gauge 15-degree bevel needle. Each needle type was used for 5 needle insertions. After all 10 needles had been inserted through the sciatic nerve, the nerve was dissected free of the cadaver and fixed in 10% formaldehyde. Serial cuts of the 10 needle-in-nerve specimens were prepared for histological analysis. Each specimen was stained to identify neurofilaments, myelin basic protein, and actin. An optical microscope was then used to examine the sample cuts.

**Results:** In 8 of the 10 specimens, the needle insertion pathway was able to be ascertained. There were approximately 134 fascicles identified within the immediate area of the needle pathway. Four of these 134 fascicles were found to be damaged (axonal damage, n=2; ruptured perineurium, n=2). These findings were all in group D. There were no damaged fascicles seen in the samples from group A. In addition, only 1 intraneural blood vessel was found to be structurally damaged, which was also seen only in group D.

**Conclusions:** Insertion of a needle directly into the sciatic nerve resulted in injury to only 3.2% of fascicles in the immediate area next to the needle pathway. Because of the plentiful number of adipocytes surrounding intraneural fascicles and blood vessels, it is much more likely that a needle penetrating a nerve will pass through adipose connective tissue versus entering the tougher perineurium causing fascicular damage. This may help to explain why significant neurologic injury may not occur despite actual intraneural needle puncture.

**Reviewer's Comments:** For those who perform regional anesthesia on a routine basis, you know all too well that you are the very first person to be held responsible for any postoperative neurologic injury. I have been blamed for a sciatic nerve injury in a patient who did not even have a sciatic nerve block. The surgeon naturally assumed that he could not have been the cause. The actual incidence of neurologic injury following peripheral nerve blockade is quite low. Information provided in this study may help to explain why. Perhaps it is really just that difficult to pierce and damage a peripheral nerve during block performance. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Peripheral Nerve Block, Neurologic Injury

Print Tag: Refer to original journal article
US Guidance of PNS Does Not Decrease PNB Complications

Adverse Outcomes Associated With Stimulator-Based Peripheral Nerve Blocks With Versus Without Ultrasound Visualization.

Orebaugh SL, Williams BA, et al:

The use of ultrasound in conjunction with peripheral nerve stimulation does not decrease the incidence of nerve injury during peripheral nerve blockade.

**Objective:** To determine if the use of ultrasound (US) guidance with peripheral nerve stimulation (PNS) helps to decrease the incidence of complications related to peripheral nerve blocks (PNBs).

**Design:** Retrospective review of all PNBs performed from January 1, 2006, through April 1, 2008, utilizing the departmental Quality Improvement and billing databases at the University of Pittsburgh.

**Methods:** Using the Quality Improvement database, the following adverse events were searched: seizure, cardiovascular toxicity, local anatomic injury related to needle trauma, unintended neuraxial blockade, pneumothorax, and peripheral nerve injury. The particular single-shot PNBs reviewed included interscalene, axillary, femoral, sciatic (gluteal or subgluteal), and popliteal sciatic blocks. PNBs were performed with PNS alone or in combination with US guidance. The choice of technique was at the discretion of the attending anesthesiologist. PNS was performed with Stimuplex needles, seeking appropriate motor stimulation at a current of 0.25 to 0.5 mA. If US guidance was utilized, the needle and nerve were first visualized. When the stimulating needle was in close proximity to the intended nerve, stimulation was started at a current of 0.8 to 1.0 mA to verify an appropriate motor response for the intended target.

**Results:** 5436 single-shot PNBs were performed during the study. Of these, 3290 were performed with PNS alone, and the remainder were performed in conjunction with US guidance. Five episodes of seizure activity were reported. Four of these cases were associated with brachial plexus blockade, and the remaining case was associated with femoral nerve blockade. The incidence of seizures with PNS alone was statistically higher compared to PNS with US guidance. Three cases of peripheral nerve injury were documented with sensory loss, neuropathic pain, and variable motor dysfunction. All three cases were associated with the popliteal sciatic approach using PNS alone (no US guidance). However, the incidence of nerve injury was not statistically different between the 2 methods.

**Conclusions:** For brachial plexus blockade, the use of US guidance plus PNS decreased the incidence of seizure activity. All seizures in this review occurred during or immediately after injection of local anesthetic, suggesting intravascular injection as the cause. Neurologic injury related to PNB was no different between the 2 methods.

**Reviewer's Comments:** At our institution, we believe in training our residents in both techniques. Many hospitals and ambulatory surgery centers still do not have US machines due to their cost. By becoming proficient in both methods, they will be able to offer their patients the benefits of regional anesthesia techniques, even if an US machine is not available. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Peripheral Nerve Block, Nerve Stimulation, Complications

Print Tag: Refer to original journal article
Anesthesiologists Are Primary Impediment to Performing RA
Survey of the Utilization of Regional and General Anesthesia in a Tertiary Teaching Hospital.
Hanna MN, Jeffries MA, et al:
Reg Anesth Pain Med 2009; 34 (May-June): 224-228

The primary reason for not offering regional anesthesia to potential surgical candidates is anesthesiology related.

Objective: To determine the frequency and reasons for not performing regional anesthesia (RA) in applicable surgical procedures.
Design: Prospective observational study.
Methods: From December 2005 through September 2006, all scheduled surgical cases in a designated operating room suite were evaluated for the possibility of RA for either intraoperative use or postoperative analgesia. The final decision regarding the option of RA was made by the anesthesiologist responsible for the intraoperative anesthetic. Data collected for each evaluated surgical case included the type of anesthetic used for surgery, type of faculty anesthesiologist performing RA, and the reasons for not performing RA. The reasons for not performing RA were grouped into one of four categories: anesthesiology related reasons, surgeon-related reasons, patient refusal, or medical contraindication.
Results: Of the 2301 surgical cases amenable to RA, approximately 36% received RA. A regional anesthesiologist was predominantly involved in performing RA, with an equal use of neuraxial and peripheral nerve blocks. When general anesthesiologists performed RA, they heavily favored neuraxial techniques. The main two reasons for not performing RA in relevant surgical cases was anesthesiology related reasons (40%) and surgeon-related (34%).
Conclusions: The primary reason for RA not being offered and performed in applicable surgical cases was anesthesiology related. Compared with designated regional anesthesiologists, general anesthesiologists are more likely than not to perform RA. If a general anesthesiologist does perform RA, he or she tends to favor central neuraxial blocks over peripheral nerve blocks.
Reviewer’s Comments: It is not surprising that an anesthesiologist trained in RA would tend to perform more RA compared to a general anesthesiologist. However, it is surprising to learn that anesthesiology related reasons are the primary cause for RA not being offered to potential candidates in this large teaching hospital. This fact is especially surprising when you consider that there was a separate dedicated anesthesiology team to perform the block ahead of time in the preoperative area. This was similar to our institutional situation when we started our Acute Pain Service. Many of the other attending anesthesiologists did not want our involvement for supposed medicolegal reasons. We respected this and concentrated mainly on our own cases that we supervised intraoperatively and those cases in which patients came in with specific requests. As time progressed, we have noticed a substantial change in attitudes toward RA. The use of RA in conjunction with general anesthesia is now expected in a number of surgical cases, which is a huge step forward to our residency program and for patient comfort. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Regional Anesthesia, Utilization

Print Tag: Refer to original journal article
New Intubation Technique Successful in Cervical Spine Instability

When Fiberoptic Intubation Fails in Patients With Unstable Craniovertebral Junctions.

Maktabi MA, Titler SS, et al:

Anesth Analg 2009; 6 (June): 1937-1940

Patients with an unstable cervical spine may be intubated with an oral endotracheal tube (OET) while the process is visualized on a video monitor connected to a fiberoptic bronchoscope inserted behind the OET.

**Background:** Airway management in patients with unstable occipitocervical and upper cervical (C1-C2) junctions presents a challenge to anesthetists. Fiberoptic intubation (FOI) is used frequently in these patients. However, the laryngeal inlet might be difficult to access.

**Objective:** To describe the authors’ experience with the use of a fiberoptic bronchoscope (FOB) to obtain a view of the glottis before inserting an oral endotracheal tube (OET) in patients with cervical spine instability in whom FOI failed.

**Participants:** 2 children and 3 adults with occipitocervical and upper cervical instability and laryngeal displacements.

**Methods:** After Institutional Review Board approval, all patients were monitored and mildly sedated. After application of effective topical anesthesia, the OET was placed around the FOB, sliding within the tube. In all patients, the tip of the bronchoscope could not be introduced into the trachea, although the vocal cords were visible. When this occurred, the FOB was removed and another bronchoscope was inserted in the laryngopharynx and connected to a video monitor. An angled stylet was introduced into the OET, and while the view of the glottis was maintained, the tube was inserted over the introducer into the trachea. No patient was injured, and all patients were intubated successfully.

**Results:** In some cases, FOI may be difficult, and, therefore, visualization with the video monitor connected to the FOB and an angled stylet in the OET can lead to a successful intubation under vision.

**Conclusions:** Patients with an unstable cervical spine can be orally intubated with the OET without any neck movements during the procedure while monitored with the FOB.

**Reviewer’s Comments:** This is a known technique, but it is applied only in very rare cases. An alternative is the nasal fiberoptic approach, but I would recommend this technique be used only in the absence of nasopharyngeal injury and prior expertise in nasopharyngeal intubations. (Reviewer-Olga Plattner, MD).

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Keywords: Intubation, Cervical Spine Instability

Print Tag: Refer to original journal article
In patients on COX inhibitors who were scheduled for total knee replacement, preoperative PFA-100 prolongation correlated with increased postoperative drain output (impaired primary hemostasis).

**Background:** Impairment of platelet function or primary hemostasis shows up as prolonged closure times (CT) for surgery and is related to an increase in the platelet function analyzer (PFA-100®) test.

**Objective:** To determine if PFA-100 measurements in patients taking cyclooxygenase (COX) inhibitors are correlated with perioperative bleeding.

**Design:** A clinical, blinded study.

**Participants:** 30 patients scheduled to undergo a knee replacement operation and who were taking COX inhibitors.

**Methods:** 15 mL of whole blood was taken before anaesthesia was started for blood count (BC), prothrombin time (PT), activated partial thromboplastin time (aPTT), fibrinogen (FIB) concentration, and PFA-100 assessments. PFA 100 was also measured with and without hemodilution in vitro to simulate the situation which develops after surgery. The blood for PFA-100 was prepared per brochure instructions, and collagen/epinephrine and collagen/ADP cartridges were used. Anesthesia and surgical care were standardized. Blood loss was recorded, and the surgeon indicated ease of hemostasis during the operation on a scale of 1 to 10. The drain volume was recorded by a nurse 24 hours postoperatively. Correlations between blood loss, surgeon assessment of hemostasis, postoperative drain output, and the PFA-100 measurements preoperatively, along with and without hemodilution, as independent variables were analyzed.

**Results:** 31 patients were studied, involving 51 knees. Patients took diclofenac, piroxicam, or naproxen. A prolonged CT using the epinephrine cartridge predicts more bleeding after the operation, especially with a 20% in vitro hemodiluted sample. Also, diluted PFA measurements correlated with surgeon rating of hemostasis.

**Conclusions:** Preoperative PFA-100 prolongation is correlated with increased postoperative drain output.

**Reviewer's Comments:** The diluted samples may not present the intraoperative situation accurately. However, this may be a good way to evaluate platelet function in patients taking nonsteroidal antiinflammatory drugs. (Reviewer-Olga Plattner, MD).

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Keywords: Periop Bleeding Risk Assessment, Anticoagulant Use

Print Tag: Refer to original journal article
Postoperative orthostatic intolerance is most likely due to impairments in cardiac output and total peripheral resistance in patients who have undergone open prostatectomy.

**Background:** Orthostatic intolerance may hinder early postoperative mobilization, especially after intraoperative blood and fluid losses, preoperative medications, anesthesia, and the use of postoperative analgesia, including opioids.

**Objective:** To evaluate the incidence of orthostatic intolerance before and shortly after open radical prostatectomy and to determine its relationship to cardiovascular variables.

**Design:** Clinical study.

**Participants:** 16 patients scheduled to undergo open radical prostatectomy.

**Methods:** A central vein catheter was inserted on the day before surgery. Preoperatively and again at 6 hours and 22 hours after surgery, continuous stroke volume (SV), cardiac output (CO), and total peripheral resistance (TPR) were calculated using a non-linear three-component model of arterial impedance. All measurements were taken according to a protocol in different positions (supine rest, leg elevation, mobilization standing, moving). During mobilization, patients rated their pain on a 0-to-10 verbal scale. Blood samples were obtained for central venous oxygen saturation at the end of each period. Orthostatic intolerance was defined as intolerable dizziness, nausea and vomiting, feeling heat, or blurred vision. Decreases in blood pressure were determined. Premedication, intraoperative management, fluid administration, and postoperative pain medication were standardized. Discharge from the post-anesthesia care unit was according to the Aldrete criteria.

**Results:** Before surgery, no patient had symptoms of orthostatic intolerance. Six hours after surgery, 8 patients terminated the procedure because of nausea/vomiting and dizziness. An additional 2 patients showed orthostatic intolerance. Patients with orthostatic intolerance showed a decline in CO and TPR. The blood pressure response differed from the preoperative response on sitting and standing due to the impaired CO and TPR. After 22 hours, 2 patients had orthostatic intolerance, but their blood pressure did not differ from the preoperative value.

**Conclusions:** Postoperative orthostatic intolerance is most likely due to an impairment in CO and TPR.

**Reviewer's Comments:** The limited number of patients in this study hinders conclusions regarding the pathophysiology of the orthostatic intolerance. Pain treatment might induce orthostatic intolerance or it might allow for early mobilization. The vessel tonus decrease reduces the preload and CO. (Reviewer-Olga Plattner, MD).

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Keywords: Postop Mobilization, Orthostatic Intolerance

Print Tag: Refer to original journal article
Anesthetic Maldistribution Likely Cause of Failed Spinal Anesthesia

Bupivacaine Concentrations in Lumbar Cerebrospinal Fluid in Patients With Failed Spinal Anaesthesia.

Steiner LA, Hauenstein L, et al:

Br J Anaesth 2009; 102 (June): 839-844

Maldistribution of the local anesthetic that leads to failed spinal anesthesia is most likely due to anatomic factors, including the configuration of the spinal column (kyphosis, fibrous attachments, etc).

Background: Spinal anaesthesia (SA) has a high success rate. Nonetheless, there are numerous reports of failed SA (FSA).

Objective: The lumbar bupivacaine concentration was measured to test the hypothesis that the primary reason for FSA is an inadequate concentration of local anesthetic in the cerebrospinal fluid (CSF).

Design: Clinical study.

Participants: Patients with an inadequate block after subarachnoid injection with bupivacaine 0.5% in whom a second spinal injection of local anesthetic was performed.

Methods: After the first injection of local anesthetic, the extent of the sensory block was assessed. If the patient fulfilled entry criteria for inadequate injection, consent was taken. A second puncture was performed, and 1 mL of lumbar CSF was obtained before administration of the second local anesthetic injection. The sample was frozen, and the CSF bupivacaine concentration was measured using high performance liquid chromatography.

Results: FSA was observed in 71 patients. In 22 patients, the bupivacaine concentrations were measured (other patients preferred general anaesthesia; 4 patients received hyperbaric bupivacaine). The data were analyzed for 20 patients. CSF concentrations of bupivacaine ranged from 3.36 to 1020 μg/mL. In 12 of 20 patients, the concentrations of bupivacaine were >73 μg/mL, a concentration that should lead to an adequate block. An explanation for inadequate block is maldistribution. Administration of a second injection of local anesthetic after FSA should be considered reasonable, even though there are concerns of neurotoxicity.

Conclusions: Maldistribution is most likely due to anatomic factors, including the configuration of the spinal column (kyphosis, fibrous attachments, membranous structures in the subarachnoid space, etc).

Reviewer's Comments: This study raises 2 issues. First, the speed of the injection time was not controlled even though it has an influence on the distribution of the local anesthetic (faster injection means greater spread). Second, the time when the spinal sampling took place ranged from 15 to 45 minutes after the first injection and was not standardized. (Reviewer-Olga Plattner, MD).

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Keywords: Bupivacaine, Failed Anesthesia, Cause

Print Tag: Refer to original journal article
Objective: To examine the long-term survival for cardiac surgical patients exposed to small quantities of red blood cell (RBC) transfusions, such as 1 or 2 units.

Design/Participants: Prospective, observational study of 9079 adult patients (after exclusion) undergoing first-time coronary artery bypass graft (CABG) surgery, valve surgery, or CABG/valve surgery in northern New England from 2001 to 2004 in 8 hospitals.

Methods: Data collected included demographics, procedure characteristics, amount of RBCs used, and timing of transfusion (preoperative, intraoperative, or postoperative). The main outcome measure for analysis was all-cause mortality during a 5-year period. Mortality was determined by a probabilistic match between the regional registry and the Social Security Administration's Death Master File.

Results: 36% of the patients (n=3254) were exposed to perioperative RBC transfusion (postoperative transfusion, 56%; intraoperative, 43%; preoperative, 1%). Patients who received blood were significantly more likely to be female, have small body surface area, have lower preoperative hematocrit, have comorbid illnesses, have an ejection fraction <40, have had a myocardial infarction within 7 days, have longer preoperative lengths of stay, have preoperative intraaortic balloon pump, have intraoperative or postoperative intraaortic balloon pump, and have lower core temperatures. The overall annual incidence rate of death was 2.7% per 100 person years. Significant independent predictors of long-term mortality included age, diabetes, peripheral vascular disease, congestive heart failure, chronic obstructive pulmonary disease, dialysis, preoperative creatinine, preoperative white blood cell count, preoperative hematocrit, ejection fraction <40, preoperative length of stay, preoperative intraaortic balloon pump, and priority of surgery. After adjustment for preoperative characteristics, there was still a 16% increased hazard of death with RBC transfusion.

Conclusions: In patients undergoing cardiac surgery, exposure to 1 to 2 units of RBCs is associated with decreased long-term survival.

Reviewer's Comments: Whatever the cause for the observed findings, one thing is clear - adopting a conservative RBC strategy in combination with strategies geared toward preventing anemia could significantly reduce the need for even small-dose RBC transfusion. (Reviewer-Krasimir George Bojanov, MD).

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Keywords: RBC Transfusion vs Long-Term Survival

Print Tag: Refer to original journal article
Oral midazolam premedication decreases the functional residual capacity and respiratory homogeneity in pediatric patients whose ages ranged from 3 to 8 years.

**Objective:** To investigate midazolam's effect on respiratory function in spontaneously breathing children before and after premedication with oral midazolam. The hypothesis was that midazolam would decrease functional residual capacity (FRC) 20 minutes after oral administration.

**Design/Participants:** Prospective clinical study of 18 children (age range, 3 to 8 years) without cardiorespiratory disease or thoracic defects who were scheduled for elective surgery.

**Methods:** FRC and lung clearance index (LCI) were measured during tidal breathing using a sulfur hexafluoride multi-breath washout technique. LCI was used as a measure of the degree of ventilation distribution and an indicator of peripheral airway collapse. Respiratory mechanics, including respiratory resistance and elastance, were assessed from the input impedance obtained using the forced oscillation technique (FOT). All measurements were obtained at baseline and 20 minutes after administering 0.3 mg/kg midazolam oral premedication. The level of sedation was also evaluated using the University of Michigan Sedation Scale (UMSS).

**Results:** Oral premedication with 0.3 mg/kg midazolam resulted in a UMSS score of 1 (range 1 to 2; 1 = wide awake). After premedication with midazolam, FRC decreased significantly by 6.5% (baseline, 25 mL/kg; after premedication, 23.4 mL/kg), and LCI increased significantly by 7.8% (baseline, 6.4; after premedication, 6.9). Also after premedication with midazolam, respiratory resistance increased by 7.4%, and elastance increased by 9.2% ($P < 0.001$). There was a significant correlation between the percentage changes before and after premedication in FRC, LCI, resistance, and elastance ($P < 0.001$).

**Conclusions:** Premedication with small doses of oral midazolam led to small but statistically significant decreases in FRC, an increase in ventilation homogeneity, and an alteration in respiratory mechanics.

**Reviewer's Comments:** Midazolam premedication in this study achieved anxiolysis and no sedation. Because higher doses of midazolam are commonly used for sedation, greater changes in respiratory function should be expected at 20 or even 30 minutes. The results of previous studies indicate that peak clinical effect from midazolam administered orally might be after 30 minutes. One should expect more changes in respiratory dynamics in pediatric patients with preexisting lung/chest disease and obesity. (Reviewer-Krasimir George Bojnov, MD).

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Keywords: Pediatric Anxiolysis, Oral Midazolam, Respiratory Function

Print Tag: Refer to original journal article
Attending anesthesiologists most accurately predicted children's anxiety displayed during anesthesia induction.

**Objective:** To assess and compare the ability of health care providers and mothers to predict anxiety levels in children during anesthesia induction.

**Design/Participants:** Prospective, clinical study of 125 pediatric patients (age range 2 to 16 years; ASA Physical Status I or II) who were scheduled for elective outpatient surgery under general anesthesia.

**Methods:** Preoperatively, anesthesiologists and mothers were asked to predict each child's anxiety level on entering the operating room using the Visual Analog Scale. Children and maternal anxiety levels were also assessed by research personnel using the Modified Yale Preoperative Anxiety Scale (mYPAS) for the children and the State-Trait Anxiety Inventory (STAI) for the mothers. These anxiety levels were assessed at baseline in the preoperative holding area on the day of surgery and in the operating room at induction of anesthesia. In addition, a well-established temperament assessing tool for children known as the emotionality, activity, sociability, and impulsivity (EASI) instrument of child temperament along with the STAI were obtained at recruitment before the day of surgery.

**Results:** No children were offered sedative premedication, and all mothers were present at anesthesia induction. Correlation analyses revealed a good association between what the attending anesthesiologist predicted and actual child anxiety. In contrast, predictions made by resident anesthesiologists and mothers were poor and were not related to the actual anxiety level of the child. The ability to accurately predict children's anxiety did not improve with increased number of years in residency. The predictions of attending anesthesiologists were significantly related to a child's age and a child's anxiety in the preinduction areas.

**Conclusions:** Attending anesthesiologists practicing in pediatric settings are better than mothers at predicting the anxiety levels of children during anesthesia induction.

**Reviewer's Comments:** The clinical implication of this study's results is that anesthesiologist collaboration with parents in deciding on anxiolytic treatment might provide better anxiolysis during anesthesia induction. The open question is whether the conclusions of the study stand valid when applied to attending anesthesiologists practicing in mixed adult/pediatric anesthesia practices. (Reviewer-Krasimir George Bojanov, MD).

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**Keywords:** Induction, Predicting Anxiety Levels

**Print Tag:** Refer to original journal article
Colloid, Normal Saline Have Similar Effects on PONV

Does Infusion of Colloid Influence the Occurrence of Postoperative Nausea and Vomiting After Elective Surgery in Women?

Haentjens LL, Ghoundiwal D, et al:

Anesth Analg 2009; 108 (June): 1788-1793

In women undergoing surgery with limited fluid shifts and blood loss, the effect of hydroxyethyl starch 130/0.4 infusion on the incidence of postoperative nausea and vomiting was similar to that of 0.9% NaCl.

Objective: To determine if the administration of colloids, like hydroxyethyl starch (HES) 130/0.4, would decrease the occurrence of postoperative nausea and vomiting (PONV) compared with crystalloid solutions, like 0.9% NaCl (NS), in a population of women undergoing elective surgical procedures.

Design/Participants: Prospective, double-blind, randomized, clinical study of 115 consecutive women (ASA Physical Status I and II) scheduled for elective gynecological or breast surgery.

Methods: During the preoperative visit, patients were evaluated for characteristics known to be predictive of PONV. All patients were premedicated with alprazolam orally 1 hour before surgery. In the operating room, a background infusion of 5% dextrose in 0.45% NaCl was administered for hydration at a rate of 0.5 mL/kg per hour starting at induction of anesthesia and continuing for 24 hours. In addition, 500 mL of the study solution (HES 130/0.4 or NaCl 0.9%) was administered in a blinded fashion before anesthesia induction, followed by a continuous infusion of 1 mL/kg per hour for 24 hours. Blood pressure decreases of >20% were treated with additional fluid boluses delivered by increasing the flow rate of the randomized study solution. The primary end point was the occurrence of any PONV during the first 24 postoperative hours.

Results: Outcomes were analyzed for 56 patients receiving HES and 58 receiving NS. Both groups were similar with respect to demographics. The 2 study groups demonstrated no differences in the duration of anesthesia and surgery or in the length of postoperative care unit stay. The incidence of PONV and the severity of nausea were similar between the HES and NS groups. Both groups also were similar for the need for antiemetic rescue treatment, number of hypotensive episodes, and postoperative pain scores.

Conclusions: In women undergoing gynecological or breast surgery involving minimal blood loss, HES 130/0.4 and 0.9% NaCl, given in the volumes used in this study, had similar effects on the incidence of PONV.

Reviewer's Comments: As previous studies have shown, administration of high-volume perioperative fluid administration can decrease the incidence of PONV. However, giving too much fluid can result in increased intestinal edema and poor gastrointestinal recovery, which delays hospital discharge. Logically, hemodynamic goal-directed protocols should achieve best results with the lowest incidence of PONV. (Reviewer-Krasimir George Bojanov, MD).

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Keywords: Fluid Replacement Therapy, PONV in Women

Print Tag: Refer to original journal article
Ultrasound imaging provides reasonable estimation of the depth to the epidural space and the skin puncture site in obese women who are in labor.

Objective: To assess the feasibility of transverse plane lumbar ultrasound (US) scanning for estimating the depth to the epidural space and the optimal skin puncture site for epidural anesthesia in obese women in labor.  

Design/Participants: Prospective, cohort study of 46 women in labor (ASA Physical Status I, II, and III) with full-term singleton pregnancies who requested labor epidural analgesia.  

Methods: All US studies were performed before epidural placement, using a 2 MHz to 5 MHz curved array US transducer. Participants were in a sitting position with legs flexed and crossed. Buttock crease was used as a starting point. Moving the US probe cephalad in the paramedian longitudinal plane allowed for identifying the upper border of the sacrum, and then the L3-4 interspace by counting the laminae and the interspaces. The US depth (UD) to the epidural space was measured, and the quality of image was rated. Epidurals were then preformed by investigators blinded to the UD, using the visible skin marking. Needle depth (ND) to the epidural space was recorded.  

Results: The Pearson correlation coefficient between the UD and the ND was 0.85. The mean ND was 6.6 ±1.0 cm, while UD was 6.3 ±0.8 cm (P = 0.002). There was a direct correlation between the body mass index and the ND and UD. In 63% of the patients, the spinous process could be palpated on deep palpation. Epidural needle placement was done without reinsertion in 76% of patients and without redirection in 67% of patients. None of the patients had a dural puncture or paresthesia. Mean time of US examination was 4.5 ±2.9 minutes, and the duration of the epidural placement was 8.3 ±7.3 minutes. Pain relief was achieved within 10.3 ±7.5 minutes.  

Conclusions: Ultrasonography is useful in predicting the depth to the epidural space in obese parturients and can reliably determine the skin puncture site.  

Reviewer's Comments: Absolute agreement between UD and ND was achieved within 1 cm in all but 3 patients, making US useful in facilitating epidural placement without making obsolete the loss-of-resistance technique. (Reviewer-Krasimir George Bojanov, MD).  

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Keywords: Labor Epidural Anesthesia, Needle Placement, Obese Patients  

Print Tag: Refer to original journal article