Ketorolac may have beneficial effects on cancer recurrence in patients undergoing surgery for breast cancer.

**Background:** Many perioperative events and treatments related to anesthesia have a known or theoretical effect on cancer recurrence. For example, the stress of surgery is associated with depression of the cellular immune system. Volatile anesthetics induce lymphocyte apoptosis and reduce natural killer cytotoxicity. Opiates can stimulate angiogenesis, which is important for the progression of cancer. On the other hand, inhibition of COX-2 has been demonstrated to reduce the risk of colon, breast, and prostate cancer. Regional anesthesia and TIVA have also been demonstrated to decrease cancer recurrence.

**Objective:** To study the incidence of local or metastatic disease after mastectomy for breast cancer in patients receiving different analgesic treatments (sufentanil, ketamine, ketorolac, or clonidine). **Methods/Patients:** 327 consecutive patient charts were reviewed. All patients underwent surgery by the same surgeon and were treated afterward by the same oncologist. Patients received general anesthesia with thiopental or propofol and sufentanil. Pain control was achieved with sufentanil (0 to 0.5 µg/kg), pre-incisional clonidine (0 to 6 µg/kg), pre-incisional ketamine (0 to 0.5 mg/kg), or ketorolac (20 to 30 mg). In the recovery room, analgesia was achieved with piritramide. All patients received acetaminophen in the first 48 hours and diclofenac 50 mg 3 times a day as necessary. The primary end point was the length of recurrence-free survival.

**Results:** Ketorolac was associated with a decreased cancer recurrence rate compared to other analgesic modalities (6% vs 17%). Age, histologic grade, lymph node invasion, and Nottingham Prognostic Index were significantly associated with cancer recurrence. When adjusting for age, histologic grade, and lymph node involvement, the patients who received ketorolac still had less cancer recurrence.

**Conclusions:** This retrospective study showed that ketorolac decreases the risk of breast cancer recurrence compared to other analgesics.

**Reviewer’s Comments:** More studies indicate that the choice of anesthetic medications can have long-term effects on patients. It is, therefore, important to recognize potential benefits and detrimental effects, especially for drugs we use every day in our practice. This study indicates that the choice of analgesic may affect patient outcome in breast cancer. If further larger studies confirm current human data, our analgesic practice may have to change. (Reviewer-Mojca Remskar Konia, MD).

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Keywords: Analgesics, Cancer Recurrence, Breast Surgery

Print Tag: Refer to original journal article
During and after abdominal surgery, a lidocaine bolus followed by infusion oposite requirements reduces the time to return of bowel function and decreases the length of hospital stay.

**Background:** Lidocaine infusion has been successfully used to treat cancer pain, chronic pain, and pain caused by adiposis dolorosa. It has analgesic, antihyperalgesic and anti-inflammatory properties. The mechanisms of action are believed to be through sodium channel blockers, NMDA receptors, and inhibition of G-protein coupled receptors.

**Objective:** To review the existing literature on intraoperative lidocaine infusion use and its effects on postoperative pain scores, opioid consumption, opioid-related side effects, and length of hospital stay.

**Methods:** MEDLINE, CINAHL, and the Cochrane Library were searched from 1966 to 2009 with the terms lidocaine, intravenous, pain, postoperative, and surgery. Of the 199 articles identified, only 16 were randomized, controlled studies that were included in the meta-analysis. Of the included studies, 12 involved abdominal surgery (8 open and 4 laparoscopic), 1 was orthopedic, 1 was cardiac, 1 was a tonsillectomy, and 1 involved a variety of ambulatory surgeries. Data were collected on postoperative pain, analgesic requirements, return of bowel function, length of hospital stay, intraoperative anesthetic requirements, and adverse effects.

**Results:** In open and laparoscopic surgery, intravenous lidocaine bolus of 1.5 to 2 mg/kg lidocaine followed by infusion of 1.5 to 3 mg/kg per hour throughout the case and 24 hours into the postoperative period has been found to decrease opiate requirements by up to 85%. This regimen also reduces pain scores at rest and during movement in the first 48 postoperative hours. In addition, the effect was observed when infusion was stopped at the end of the surgery. Bowel function was observed to return up to 23 hours earlier. Length of hospital stay was reduced by 1.1 days. These effects were not observed in orthopedic, cardiac, or ENT surgeries. No adverse effects were reported.

**Conclusions:** Perioperative intravenous lidocaine in abdominal surgery improves pain control and speeds up the return of bowel function, thus allowing for a shorter length of hospital stay.

**Reviewer’s Comments:** Lidocaine infusion in abdominal surgery is an attractive option for pain management due to the ease of use and no significant reported side effects. The existing literature is convincing enough to allow this pain management modality to be included in the repertoire of pain management techniques during laparoscopic and open abdominal procedures. Further research will be necessary to help us understand why this technique works in abdominal surgery and not for other procedures. (Reviewer-Mojca Remskar Konia, MD).

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Keywords: Lidocaine Infusion, Pain Control, Abdominal Surgery

Print Tag: Refer to original journal article
There is a need for a change in the clinician’s attitude toward monitoring and reversal of neuromuscular block.

**Background:** A recent survey of European clinicians found that neuromuscular blocking (NMB) agents are often given postoperatively without appropriate monitoring. There are no survey data on neuromuscular use patterns among U.S. clinicians.

**Objective:** To compare anesthesiologists in the United States and Europe in terms of current clinical practice and attitudes regarding the use of NMB drugs and neuromuscular monitoring.

**Design:** An anonymous Internet-based survey of anesthesiologist members of the Anesthesia Patient Safety Foundation (United States) and the European Society of Anesthesiology.

**Methods:** The survey was posted on a dedicated Internet portal for 60 days. After that time, data from the 2 cohorts were compared using chi-square and Fisher’s exact test. Logistic regression analysis was used to identify significant associations between respondent demographic characteristics and attitudes regarding neuromuscular practices.

**Results:** Completed surveys were received from 2636 respondents. Significantly more respondents from Europe than from the United States practiced at a university hospital and in a department with >30 anesthesiologists. Significantly more U.S. anesthesiologists (88.1%) than European anesthesiologists (78.6%) had never observed patients with residual neuromuscular numbness during postanesthesia care. Sixty-four percent of respondents in the United States estimated the incidence of clinically significant postoperative residual neuromuscular weakness to be <1%; 52.2% of respondents from Europe gave a similar estimate. European respondents were 40% more likely than U.S. respondents to believe that the incidence of postoperative residual neuromuscular weakness could be reduced by the routine use of nerve stimulators or monitors; although routine pharmacologic reversal was less common in Europe (18% vs 34.2%). Significantly more European (70.2%) than U.S. anesthesiologists (22.7%) reported access to quantitative train-of-four (TOF) monitors; however, in the United States, monitors were more likely to be available in every operating room. Among institutions with both conventional nerve stimulators and TOF monitors available, 19.3% of European anesthesiologists reported never using neuromuscular monitors, as opposed to 9.4% of those in the United States. Most respondents did not support the routine use of conventional nerve stimulators or TOF monitors as minimum standards.

**Conclusions:** There is lack of a consensus among providers on the best way to monitor neuromuscular function after surgery; improved awareness and education are needed.

**Reviewer’s Comments:** Several recent studies have emphasized the importance of NMB and shown that reversal reduces postoperative morbidity and mortality. Despite focused editorials and guidelines, the management of neuromuscular blocks in the operating room differs in the United States and Europe. To avoid postoperative residual neuromuscular block, there is a need for a change in the clinician’s attitude toward monitoring and reversal in both continents. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Neuromuscular Block, Current Practice, United States, Europe

Print Tag: Refer to original journal article
Residual neuromuscular block frequently remains unrecognized, and more awareness and education are needed.

**Background:** This is the first in a 2-part review designed to provide an overview of perioperative neuromuscular management based on available clinical data. The authors begin by stating that, although the negative impact of neuromuscular blockings drugs on perioperative death has been appreciated since the 1950s, residual neuromuscular blockade is still under-recognized and not appropriately managed.

**Design/Methods:** The article provides a narrative review of the clinical literature related to the identification, epidemiology, and impact of residual neuromuscular blockade. The article begins by reviewing definitions of residual neuromuscular block based on train-of-four (TOF) ratios. The authors explain that most people define residual block in terms of some threshold TOF ratio. Several studies suggest that a TOF ratio of <0.7 reflects inadequate neuromuscular recovery, whereas more recent data favor a threshold ratio of <0.9 as a more appropriate standard for ensuring optimal patient safety. The currently accepted definition of residual neuromuscular block is a TOF ratio of <0.9 as measured with mechanomyography. The authors emphasize that both objective and clinical assessments are needed to precisely characterize residual block.

**Results:** The high incidence observed in many clinical settings likely relates to the administration of large doses of intermediate-acting neuromuscular blocking drugs (NMBDs). The authors make the important point that it is critical to tease out the effects of residual neuromuscular weakness from potential secondary or residual effects of drugs used during anesthesia. To address this question, the paper provides a review of data related to pharyngeal function, airway muscle function, hypoxic ventilatory drive, and subjective weakness from studies with volunteers and with patients. Data from studies with volunteers can provide information on residual neuromuscular blockade in the postoperative recovery period only (ie, the effect of NMBD without anesthesia), whereas studies on actual patients are best considered in light of the fact that both NMBD and perioperative anesthesia may have contributed to apparent residual blockade. Studies in both populations revealed acute respiratory events and unpleasant symptoms of muscle weakness, suggesting that these are likely to be residual effects of NMBD alone as distinct from those adverse events related to neuromuscular blockade in the perioperative period (ie, in patients also receiving anesthesia). In contrast, prolonged hospital stay, delayed extubation, and increased risk of pulmonary complications are related to incomplete neuromuscular recovery in the early postoperative period.

**Conclusions:** Residual neuromuscular block clearly has an impact on outcomes in the perioperative period, and more awareness and education on this topic is urgently needed among physicians.

**Reviewer's Comments:** As recognition improves, physicians will need to develop appropriate techniques for assessing and treating residual neuromuscular paralysis. This is the topic of the second article in this series. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Residual Neuromuscular Block, Definition, Neuromuscular Blocking Agents

Print Tag: Refer to original journal article
Background: Numerous studies have demonstrated that the risk of residual blockade (defined as train-of-four [TOF] ratio <0.7) is as much as 3 times higher after long-acting neuromuscular blocking drugs (NMBDs) relative to shorter-acting agents. The authors point out, however, that, in spite of the consistent data from the medical literature, data from real clinic settings have not found a reduced incidence of residual paralysis. The authors believe that most clinicians rely on clinical presentation and/or tests of neuromuscular weakness. In fact, the authors conclude that most clinical assessments cannot reliably exclude residual neuromuscular paralysis unless the TOF ratio is <0.5.

Objective: To review data regarding qualitative neuromuscular monitoring, including various types of peripheral nerve stimulation (eg, double-burst stimulation [DBS], TOF). Taken together, the literature shows that neuromuscular monitoring does not substantially reduce the incidence of residual blockade, with the caveat that available studies did not use optimal methodologies and that larger and more rigorous studies are required.

Results: The review moves on to address quantitative methodologies for assessing neuromuscular weakness postoperatively, including mechanomyography, electromyography, kinemyography, phonomyography, and acceleromyography. Each methodology is described in detail (including clinical advantages and limitations), and clinical studies using these assessment methods in the context of neuromuscular monitoring are summarized. The article then reviews the nomenclature for monitoring equipment and underscores the lack of consistency in terminology currently used. Only a minority of clinicians routinely reverse this blockade at the end of a procedure. The authors advocate routine perioperative monitoring of evoked neuromuscular responses and the use of monitoring to guide management. They emphasize the importance of timely reversal of neuromuscular blockade. They also make the point that the time required for reversal is often underestimated, and that clinicians may believe prematurely that reversal has been achieved. The authors argue that, in addition to the prevention of postoperative residual block and perioperative monitoring, there is a need for NMBDs that can be reversed without acetylcholinesterase inhibition; agents in the early clinical phase development are reviewed.

Conclusions: Based on the available literature, the authors outline a number of suggestions for avoiding, reducing, and reversing postoperative residual neuromuscular blockade.

Reviewer's Comments: NMBDs should be administered only to patients who require them, and dosing should be individualized. Long-acting NMBDs should be avoided. Clinical tests of muscle function (head lift, jaw clenching, grip strength, tidal volume, etc) are unreliable predictors of recovery of neuromuscular function. Ideally, neuromuscular function should be monitored objectively (quantitatively) in all patients receiving NMBDs. The timing of tracheal extubation should be guided by quantitative monitoring tests such as TOF >0.9 or DBS >0.9. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Neuromuscular Blocking Drugs, Residual Block

Print Tag: Refer to original journal article
The use of an intravenous lidocaine infusion decreases pain perception in an ischemic pain model simulating deep-tissue pain.

**Objective:** To determine the analgesic effect of an intravenous lidocaine infusion on deep-tissue pain.

**Participants:** 16 adult healthy volunteers (6 males and 10 females).

**Methods:** Each volunteer received testing with various sensory stimuli. The experimental testing included response to increasing heat applied to the right forearm, electrical pain delivered via a peripheral nerve stimulator, cold tolerance by immersion of the foot in ice water, and repetitive handgrip exercise with an upper arm tourniquet in place to produce ischemic pain. Each volunteer had testing performed at baseline, during a 20-minute infusion of intravenous lidocaine, and 30 minutes after discontinuation of the lidocaine infusion. Additional pinprick testing was also performed to determine if intravenous lidocaine had any effect on altering a volunteer's normal sensation. The lidocaine infusion was delivered via a computer-assisted controlled infusion device to achieve a plasma concentration of 2 µg/mL. The total dose administered was approximately 2 mg/kg.

**Results:** There was a significant decrease in pain perception in the ischemic pain model, which simulates deep-tissue pain. This difference was noted both during the lidocaine infusion and after cessation of the infusion compared to baseline. However, the lidocaine infusion had no effect on normal sensation as noted by pinprick testing or any other significant effect on the other sensory modalities tested. No remarkable adverse effects were noted in the volunteers related to the lidocaine infusion.

**Conclusions:** The use of a short-term intravenous lidocaine infusion provides significant pain relief both during the infusion and after cessation of the infusion in an ischemic pain model. The authors believe that, because postoperative pain contains both superficial and deep-tissue pain components, the use of a lidocaine infusion may be useful in treating acute postoperative pain.

**Reviewer’s Comments:** The use of intravenous lidocaine is being proclaimed more in the current literature. It appears to have an effect on improving pain control, yet I know at our institution it made many nurses very nervous on the floor during infusion. This may be related to its prior use as an anti-arrhythmic, and it simply makes care providers and patients nervous because of this association. It was interesting to note that, of our patients who complained of palpitations during one of the lidocaine infusion studies, both patients had placebo saline infusions. It will take much more education and familiarity with lidocaine infusions before its use for postoperative pain management will really take off. (Reviewer-Michelle L. Schlunt, MD).
The use of patient-controlled epidural analgesia provides safe and successful pain control after lower-extremity orthopedic surgery.

**Design/Objective:** The purpose of this prospective survey was to determine the safety and effectiveness of patient-controlled epidural analgesia (PCEA) for pain control after major orthopedic surgery.

**Participants:** Patients scheduled for elective major lower extremity orthopedic surgery between March 2009 and September 2009 were evaluated.

**Methods:** All patients received postoperative pain control utilizing PCEA via lumbar administration. The epidural infusion consisted of 0.06% bupivacaine combined with hydromorphone 10 μg/mL initiated at 4 mL/hr. Patients had a bolus capability of 4 mL every 10 minutes with a lockout volume of 20 mL/hr. Each patient was assessed twice daily by the Acute Pain Service, and verbal pain scores were recorded 3 times daily by the nursing staff. The adverse effects associated with epidural analgesia such as pruritus, nausea, sedation, respiratory depression, and hypotension (defined as a systolic blood pressure <90 mm Hg) were also documented.

**Interventions:** All patients were started on oral nonsteroidal medication on the evening of surgery unless contraindicated. For the hip replacement patients, deep venous thrombosis prophylaxis (DVT) entailed twice-daily aspirin administration, while coumadin was utilized for the knee replacement patients.

**Results:** 3736 patients were included in the analysis. The majority of patients underwent combined spinal-epidural anesthesia intraoperatively, with the surgical cases consisting primarily of total hip and knee arthroplasties. The mean verbal pain scores were 2 to 3 at rest and 3 to 4 with activity. Only 1 patient required discontinuation of the epidural and was changed to intravenous patient-controlled analgesia for inadequate pain control. The main adverse effects noted were a 30% incidence of nausea, a 15% incidence of pruritus, and a 10% incidence of hypotension. There was a 0% incidence of respiratory depression.

**Conclusions:** After major lower-extremity orthopedic surgery, the use of PCEA provides successful and safe acute pain management.

**Reviewer's Comments:** At this institution, there is obviously a collaborative effort between the Acute Pain Service and Orthopedic Service in managing these patients based on the choice of PCEA for postoperative use. Unfortunately, due to the current guidelines for DVT prophylaxis, the majority of orthopedic surgeons are utilizing low-molecular-weight heparin, which prevents the use of epidural analgesia. This article does point out, in the discussion, that the use of peripheral nerve blocks versus continuous epidural infusions provides comparable pain control for these types of surgical cases. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Epidural, Joint Replacement, Patient-Controlled Epidural Analgesia

Print Tag: Refer to original journal article
The use of an intravenous lidocaine infusion may be an acceptable alternative to thoracic epidural analgesia for postoperative pain management after colon surgery.

**Objective:** To compare the effect of thoracic epidural analgesia against an intravenous lidocaine infusion on postoperative ileus and pain management.

**Design:** This clinical trial was prospective and randomized in design.

**Participants:** The study participants enrolled were adult patients aged 18 to 74 years scheduled for open colon resection between April 2005 and July 2006.

**Methods:** Patients were enrolled on the day of surgery and randomized to 1 of 2 groups: the thoracic epidural group or the intravenous lidocaine infusion group. All patients received a standardized general anesthetic with an inhalational agent. Patients in the thoracic epidural group had their epidural placed preoperatively somewhere between thoracic levels 8 and 12. An epidural infusion consisting of 0.125% bupivacaine in combination with hydromorphone 6 µg/mL was initiated at 10 mL/hr within an hour of the conclusion of surgery. Patients in the intravenous lidocaine group had their infusion started after the induction of general anesthesia. The rate was based on the patient’s weight: those weighing <70 kg received 1 mg/min, and those weighing ≥70 kg received 2 mg/min. All patients received morphine patient-controlled analgesia on the floor with a maximum of 10 mg/hr to assess opioid consumption. Each patient was instructed to report the time of first flatus and bowel movement. On the day after recovery of bowel motility, the lidocaine or epidural infusion was stopped, and the study ended.

**Interventions:** If there was no return of bowel function as evidenced by flatus or bowel movement by postoperative day 5, the lidocaine infusion was terminated. However, for the epidural group, the epidural infusion could be continued based on the pain and surgical teams’ preference.

**Results:** For the final analysis, a total of 20 patients in the epidural group and 22 patients in the lidocaine group were included. No difference was found in time to first flatus or bowel movement. There was also no difference in median pain scores or opioid consumption. Both groups had similar hospitalization times.

**Conclusions:** An intravenous lidocaine infusion is just as effective as thoracic epidural analgesia in promoting return of bowel function and controlling postoperative pain.

**Reviewer's Comments:** I find it surprising that there was no difference in opioid consumption between groups. For instance, on postoperative day 1, the median morphine usage was 57 mg in the epidural group versus 48 mg in the lidocaine infusion group. This does not even take into account the morphine equivalents of the epidural hydromorphone or that a higher concentration of bupivacaine was being used. I have to say that, if I have a thoracic epidural in place with a patient requiring an additional 57 mg of intravenous morphine for break-through pain, I would have high suspicion that the epidural is not in the correct space. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Intravenous Lidocaine, Thoracic Epidural, Local Anesthetics

Print Tag: Refer to original journal article
Transfusion-related acute lung injury can be caused by transfusion of aged blood in patients with an underlying inflammatory condition (e.g., sepsis or surgery).

**Objective:** To determine the extent of the pulmonary inflammatory and injury response caused by aged rat erythrocytes in healthy rat lungs and in lipopolysaccharide-induced inflammatory injured lungs. The latter event represents the "first hit" in the "two-hit" model of transfusion-related acute lung injury (TRALI), and the transfusion of aged blood is the "second hit."

**Methods:** Unwashed and washed aged rat erythrocytes (14 days of storage) and the supernatant of the stored erythrocytes were transfused in rats with a prior inflammatory insult (lipopolysaccharide pretreated) and without a prior inflammatory insult (healthy lungs). Histological and inflammatory markers (biochemical and coagulopathic) were measured to assess lung injury and inflammatory response.

**Results:** In rats with lipopolysaccharide-induced pulmonary inflammation (first hit), transfusion of aged blood (second hit) caused further lung injury and inflammatory response, particularly as evidenced by signs of increased coagulopathy. When given separately, supernatant of aged erythrocytes caused further pulmonary coagulopathy and inflammation, which was not the case with washed aged erythrocytes. Although transfusion of aged erythrocytes in healthy rats caused no coagulopathy, a mild pulmonary inflammatory response was still detected.

**Conclusions:** In healthy lungs, aged erythrocytes can induce an inflammatory injury, albeit mild. In previously injured lungs (first hit), aged erythrocytes (second hit) significantly augment pulmonary inflammation. Transfusion of the supernatant but not washed aged erythrocytes augments the inflammatory response.

**Reviewer's Comments:** TRALI in its most severe form is indistinguishable from acute respiratory distress syndrome (ARDS) and is the primary cause of transfusion-related deaths. A major cause of TRALI in addition to the passive transfer of donor-related antibodies directed at patient leukocytes is the "two-hit" model and is similar to that purported to cause ARDS. The first hit, a pre-existing patient-derived inflammatory event, results in granulocyte priming, pulmonary sequestration, and pulmonary endothelial activation. The second hit is caused by transfusion of proinflammatory agents in aged blood that, in the absence of granulocyte priming or activation, could not initiate enough additional pulmonary inflammatory for TRALI to develop; that is, to reach the inflammatory threshold needed to initiate the clinical signs of TRALI, one needs priming of the lung neutrophils so that they can be readily further activated by inflammatory mediators in stored blood to cause severe, clinically apparent lung injury. The important clinical implication of this study is that patients who require a blood transfusion and who were previously exposed to a severe inflammatory stimulus (e.g., sepsis) should receive washed erythrocytes of stored, aged blood or relatively "fresh blood" in order to reduce the incidence of TRALI. (Reviewer-Douglas E. Koehntop, MD).

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A fascia iliaca block, which does not require a nerve stimulator, is as effective as a femoral nerve block in providing pain relief for adolescents undergoing reconstructive knee surgery.

**Background:** Both femoral nerve blocks and fascia iliaca blocks have been used to provide analgesia in adolescents after knee surgery, but their relative effectiveness is unknown.

**Objective:** To determine if the fascia iliaca block is as effective as the femoral nerve block in providing analgesia after reconstructive knee surgery.

**Design:** Prospective, randomized, single-blind study.

**Participants:** 23 ASA 1 or 2 patients aged 8 to 16 years scheduled to undergo anterior cruciate ligament reconstruction under general anesthesia with preoperative femoral or fascia iliaca peripheral nerve block.

**Methods/Interventions:** All patients had general anesthesia induced before placement of their peripheral nerve blocks. One-half of the patients had femoral nerve blocks placed with 0.5 mL/kg of 0.2% ropivacaine using a peripheral nerve stimulator. The other half of the patients had the same dose of local anesthesia placed using a blunt needle one-third of the distance from the anterior superior iliac spine. The fascia lata was first identified when placing the needle as a distinct "pop," followed by the fascia iliaca. Pain scores were recorded by an investigator blinded to the type of block administered at 9 points postoperatively up to postoperative day 2. The amount of morphine consumed was noted in each group and was compared among the groups.

**Results:** Both groups of patients had similar visual analog scores throughout the observation period. The amount of morphine consumed was also similar between groups.

**Conclusions:** The fascia iliaca block provided similar pain relief as the femoral nerve block in adolescents undergoing reconstructive knee surgery.

**Reviewer's Comments:** This study shows the fascia iliaca block is as effective as a femoral nerve block in adolescent patients undergoing reconstructive knee surgery. This is important because you do not need a peripheral nerve stimulator to do a fascia iliaca block. The fascia iliaca block also relies on diffusion of the local anesthetic beneath the fascia plane rather than direct contact of the needle to the nerve itself and may therefore result in a lower incidence of nerve injury. Finally, the fascia iliaca can now be identified easily using ultrasound, which should further increase the utility of this block. (Reviewer-David S. Beebe, MD).

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Keywords: Fascia Iliaca Block, Femoral Nerve Block, Knee Surgery

Print Tag: Refer to original journal article
It is important to emphasize that drug errors can occur; we need to influence the climate in operating rooms (responsibility, actions, and leadership), report errors, and encourage feedback.

**Background:** Medication errors are common, and prospective studies suggest that there is approximately 1 error in every 133 anesthetics. **Overview:** A review set up by the National Patient Safety Agency (NPSA) showed that in the ICU or high-dependency units, among 355 different drugs involved in medication-associated incidents, the most common drugs involved were morphine, gentamicin, and norepinephrine, while the drugs most often associated with harm to the patient were norepinephrine and insulin. In many cases, the problem was communication between the staff. Another study showed that most errors occur during the maintenance phase of anesthesia. Based on the reported rate of 1 error for every 133 anesthetics, the average anesthetist would be expected to make 7 drug administration errors per year. There are several mechanisms of drug errors: doctors writing wrong units (e.g., mg instead of µg); tiredness; multitasking; understaffed wards; memory failure; lack of experience; violation from standard instructions, etc). In general, only 1.7% of medication errors are potentially lethal. Some specific recommendation regarding the avoidance of drug error include the following: (1) the label on any drug, ampule, syringe should be carefully read before use; (2) the legibility and contents of labels on ampules and syringes should be optimized according to the agreed standards; (3) syringes should be labelled; and (4) organization of drug drawers and workspace should be used; (5) labels should be checked by a second person; (6) errors in IV administration should be reported; and (7) similar packing and presentation of drugs should be avoided. General measures published by the NPSA include building a safety culture, leading and supporting the staff, integrating your risk management activity, promoting reporting, being involved and communicating with patients and the public, learning and sharing safety lessons, and implementing solutions to prevent harm.

**Conclusions:** It is important to have an awareness program to influence the climate in the operating rooms (responsibility, actions, and leadership) and to report errors and encourage feedback.

**Reviewer's Comments:** The power to minimize drug errors lies in one’s own action and influence. Error reporting, labelling instructions, special standards and policy of quality management might be helpful, but the goal is to improve one’s own alertness. (Reviewer-Olga Plattner, MD).
Ondansetron 4 mg is as effective as diphenhydramine 25 mg in treating pruritus induced by morphine administered in the subarachnoidal space in parturients.

**Background:** Subarachnoid (SA) morphine is highly effective for the management of postoperative pain after cesarean section, but it is associated with a high incidence of pruritus as an unpleasant side effect.

**Objective:** To compare the efficacy of ondansetron with diphenhydramine in the treatment of the pruritus caused by SA morphine.

**Design:** Prospective, randomized, double-blinded study.

**Participants:** 118 parturients who required additional treatment after receiving spinal anaesthesia with morphine.

**Methods:** Parturients were monitored, and spinal anaesthesia was performed with 0.75% hyperbaric bupivacaine 1.7 mL and 0.2 mL of morphine at the level of L2-L3 or L3-L4. Management (oxygen application, IV treatment, and evaluation of the sensory blockade level) was routinely performed. At 0.5, 2, 4, 6, 8, 12 and 24 hours, the patients were asked to grade the degree of pruritus on a scale of 1 to 4. Patients who had a score ≥3 were randomly assigned to either the 4-mg ondansetron group or the 25-mg diphenhydramine group. If pruritus decreased to 1 or 2, it was regarded as a successful treatment, and hourly checkups were performed to evaluate the duration of the anti-pruritus response. However, in cases of no response, the study drug was considered a failure, and naloxone was administered intravenously. Side effects were also recorded. Pain, sedation, and nausea and/or vomiting were determined before and 30 minutes after the study drug was administered. The pain level was graded on a 10-cm visual analog scale, the sedation level on a scale of 1 to 3, and nausea or/vomiting on a scale from 1 to 4. Analysis was performed using the SPSS and a $P < 0.05$ was considered significant.

**Results:** 113 patients were analyzed. The treatment success rate was similar in both groups (70% vs 70%). The recurrence of moderate to severe pruritus was comparable in both groups.

**Conclusions:** Ondansetron 4 mg is as effective as diphenhydramine 25 mg in treating pruritus induced by morphine administered in the subarachnoidal space in parturients.

**Reviewer’s Comments:** The patients who did not respond to either medication responded to naloxone. A multimodal treatment of pruritus might be even better. (Reviewer-Olga Plattner, MD).

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Keywords: Ondansetron, Morphine-Induced Pruritus, Treatment, Diphenhydramine

Print Tag: Refer to original journal article
Tracheal Intubation Devices Show No Difference in Intubation Time

Tracheal Intubation Using the Airtraq®: A Comparison With the Lightwand.

Park EY, Kim JY, Lee JS:

Anaesthesia 2010; 65 (July): 729-732

There are no differences in intubation time, success rate, and hemodynamic variables between the Airtraq® and the lightwand.

**Background:** The Airtraq® is a newer tracheal intubation device that has been developed for the care of patients with normal and difficult upper airways. The lightwand has long been proven to be effective in cases of difficult intubations.

**Objective:** To compare the efficacy of these 2 devices.

**Design:** Randomized clinical study.

**Participants:** 100 patients scheduled for general anesthesia.

**Methods:** Anesthesia was induced after standard monitoring was applied. Propofol, remifentanil, and rocuronium were administered, and after complete relaxation, the trachea was intubated using one of the 2 devices in a random fashion by 1 of 2 anesthesiologists who had experience with both devices. To visualize the cords, jaw thrust was allowed. Failure to intubate was defined as one of oesophageal intubation, inability to place the tube within 120 seconds, or >3 attempts required. The end point was the time for intubation, defined as the time taken to insert the device into the mouth between the teeth until removing it from the oral cavity. The secondary end point was the success rate of the endotracheal intubation. The ease of intubation was recorded by the anesthetists, and sore throat scoring was recorded in the recovery room at discharge. For analysis, the t-test, Fisher’s exact test, and the Mann-Whitney U-test were used. A P <0.05 was considered significant.

**Results:** 100 patients were enrolled in the study and all patients were successfully intubated at first attempt by each of the devices.

**Conclusions:** There were no differences in intubation time, success rate, and hemodynamic variables between the two devices.

**Reviewer’s Comments:** The Airtraq is very helpful in the management of the difficult airway. The problem that can occur is that the cords are visualized but difficult to reach with the tube. This might be easier with the lightwand, but placing the lightwand is more difficult since it is a blind technique. (Reviewer-Olga Plattner, MD).

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Keywords: Lightwand, Airtraq®

Print Tag: Refer to original journal article
In rapid sequence spinal anaesthesia for category-1 urgency caesarean section, it takes approximately 8 minutes from performance of a rapid sequence spinal until the start of surgery.

**Background:** Regional anaesthesia is preferred in obstetrics because it is safer; however, because of time restraints general anaesthesia is used for emergency caesarean section (immediate threat to life of woman or fetus).

**Objective:** To describe rapid sequence spinal anaesthesia for emergency category-1 cases in a series of 25 deliveries.

**Design:** A review of rapid sequence spinals in the unit.

**Participants:** 25 parturients having emergency caesarean section under spinal anaesthesia.

**Methods:** A new approach to provide spinal anaesthesia for the most urgent obstetric cases was described as follows. An IV canula is inserted, and monitoring and preoxygenation of the patient is performed by other staff. Sterile gloves are used for the equipment. Skin preparation is commenced with 1 wipe of 0.5% chlorhexidine solution. If no opioid, consider using 3 mL 0.5% hyperbaric bupivacaine; otherwise, 25 µg of fentanyl are added to the local anaesthesia. No local infiltration; one attempt at spinal, and start surgery when the block is below T10 and still ascending. One has to be prepared for a conversion to a general anaesthesia, and the mother has to be informed. In total, 25 cases were performed. Twenty-two cases had a severe compromise of the fetus, and in 3 cases, the umbilical cord prolapsed. Spinal anaesthesia was performed in the lateral position and only 1 in the sitting position.

**Results:** The mean decision-delivery interval was 22.5 minutes (range, 14 to 41 minutes). Nerve block was adequate to start surgery in 6 to 8 minutes. In 3 cases, the spinal space could not be identified, and general anaesthesia was performed.

**Conclusions:** Rapid sequence spinal anaesthesia for category-1 urgency caesarean section took about 8 minutes from spinal performance until the start of surgery according to this overview.

**Reviewer’s Comments:** A comparison in start of surgery time between the general performance and the spinal performance would be more efficient for comparing the efficacy of each procedure in emergency cases. (Reviewer-Olga Plattner, MD).

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**Keywords:** Spinal Anaesthesia, Urgency Caesarean Section

**Print Tag:** Refer to original journal article
**Objective:** To study the prevalence of atypical musculocutaneous nerve localization and its association with patterns of median, ulnar, and radial nerve localizations.

**Design/Participants:** Prospective, clinical study involving 381 adult patients, operated under axillary block performed with ultrasound guidance and nerve stimulation.

**Methods:** Before needle insertion into the coracobrachialis muscle (the first muscle lateral to the axillary artery), musculocutaneous, median, ulnar, and radial nerves were localized using ultrasound. A nerve stimulator was used in case of uncertain nerve identification. In case of musculocutaneous nerve localized close or fused with the median nerve, the anatomical relationship was observed during slow injection of local anesthetics, allowing recognizing a common trunk or separation of the nerves. Collected data included age, gender, weight, side and indication of surgery, as well as anatomical nerves localization.

**Results:** 387 blocks were performed in 380 patients. Joined median, ulnar, and radial nerves, joined median and ulnar nerves, isolated ulnar nerve, and joined ulnar and radial nerve patterns were identified in 374 of the 387 cases. The musculocutaneous nerve was outside the coracobrachialis muscle in 83 blocks (22%) and near the axillary artery in 22 cases (6%). The musculocutaneous and median nerves represented a common nerve trunk in 61 cases (16%). The common trunk persisted after local anesthetic injection in 15 of the 61 cases (26%) and separated into the musculocutaneous and median nerves in 37 cases (61%). In 6 cases (10%), 2 roots of the median nerve appeared with or without a separated musculocutaneous nerve. Two cases remained undefined. The single axillary vein was identified in 42% of the cases, 2 veins were in 38% of cases, 3 veins were in 18% of cases, and 4 in 2% of the cases. Two arteries were observed in 7 patients. The atypical musculocutaneous nerve position was associated with a lower incidence of joined median and ulnar nerves and with a higher incidence of isolated ulnar nerves.

**Conclusions:** The musculocutaneous nerve was outside the coracobrachialis muscle in 1 of 5 cases of axillary block, near the axillary artery and often joined with the median nerve.

**Reviewer’s Comments:** This study found that the musculocutaneous nerve was found to be outside the coracobrachialis muscle much more often than expected (according to other studies, 0% to 8%) proving implicitly the value of performing neuromuscular blocks using ultrasound guidance. (Reviewer-K. George Bojanov, MD).

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Keywords: Musculocutaneous Nerve Anatomical Position, Axillary Block

Print Tag: Refer to original journal article
Propofol anesthesia results in less postoperative pain in patients for laparoscopic gynecologic day-surgery compared to sevoflurane anesthesia.

**Objective:** To determine whether patients anesthetized with IV propofol will have less pain after laparoscopic day-surgery compared to patients anesthetized with sevoflurane.

**Design/Participants:** 80 ASA physical status I and II adult patients for diagnostic laparoscopic day-surgery.

**Methods:** Patients were randomized into 2 groups, with 40 patients in each group. Group P patients were anesthetized with propofol and Group S patients were anesthetized with sevoflurane. In Group S, anesthesia was induced via inhalation of 8% sevoflurane in oxygen and maintained with sevoflurane, titrated to a bispectral index value of 40. In Group P, anesthesia was induced with 2.5 mg/kg propofol and maintained with IV propofol titrated to a bispectral index value of 40 also. Postoperative pain in the postanesthesia care unit was treated with boluses of IV morphine until a visual analog scale pain score of <4 was achieved. Pain scores, sedation, and quality of recovery were recorded.

**Results:** Patients in both study groups were similar with regard to demographic characteristics. Patients in Group P experienced significantly less pain postoperatively than the patients in Group S. The mean postoperative morphine consumption in Group P was 3.62 mg and 4.62 mg in Groups S (not statistically different between the groups). The incidences of nausea, vomiting, and sedation were similar between Group P and Group S.

**Conclusions:** Patients anesthetized with IV propofol anesthesia for gynecological laparoscopic day-surgery experienced less pain than patients anesthetized with sevoflurane.

**Reviewer's Comments:** As the authors point out, it is not clear whether the observed difference in postoperative pain is attributable to the analgesic properties of propofol or to the hyperalgesic properties of sevoflurane. It is going to be interesting to investigate whether there is a gender or procedure variation if the study is applied to other surgical procedures, including adults of different gender. (Reviewer-K. George Bojanov, MD).

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Keywords: Day-Surgery, Propofol, Sevoflurane, Postoperative Pain

Print Tag: Refer to original journal article
Masimo Rainbow’s methemoglobin readings are most accurate when arterial oxygen saturation is >95%.

**Objective:** To determine the ability of the Masimo Rainbow pulse CO-Oximeter to estimate percentage of methemoglobin (%MetHb) accurately during hypoxia and to compare it to the standard 2-wavelength pulse oximeter in estimating arterial oxygen saturation (Sao\textsubscript{2}) during normoxia and hypoxia when MetHb is present.

**Design/Participants:** Prospective clinical study on 2 groups of healthy adults (n=8 and n=6).

**Methods:** The first portion of the study was conducted on 8 adults, with an equal number of men and women spanning a range of skin pigmentation. Participants had adult nondisposable clip-on-type Rainbow sensors on the index and the middle fingers that were connected to 2 Radical-7 oximeters. Radial artery cannula was started on either the right or left wrist for collecting arterial blood samples for Sao\textsubscript{2} and %MetHb levels. Arterial blood gas analysis was performed on a multiwavelength optical blood analyzer. After collecting arterial blood for baseline measurements, elevated MetHb was induced by IV administration of 300 mg of sodium nitrite for a target %MetHb level of 7% to 8%. After another blood gas sampling, hypoxia was induced to target Sao\textsubscript{2} by having the subject breathe a mixture of nitrogen, air, and carbon dioxide. A second group of 6 adults was also studied; they had a similar procedure but with %MetHb level elevated to a target of 15%. A conventional 2-wavelength pulse oximeter was added, and the Radical-7 carboxyhemoglobin (SpCO) and methemoglobin (SpMet) readings were recorded during each blood draw.

**Results:** 135 blood draws were obtained during the first part of the study and 35 from the second. None of the subjects were anemic. SpMet reading accuracy was best when Sao\textsubscript{2} was >95%. The trend was to overestimate %MetHb as the Sao\textsubscript{2} decreased. SpMet reading bias over the entire studied span of 66.2% to 99% Sao\textsubscript{2} was 7.7% ± 13.0%. SpO\textsubscript{2} readings were biased -6.3% ± 3.0% in the 95% to 100% Sao\textsubscript{2} range, with 4% to 8.3% MetHb. Beginning with %MetHb at normal level and Sao\textsubscript{2} >95%, the reading bias of SpCO increased systematically as %MetHb increased. For %MetHb of >7%, SpCO readings stabilized at or near 50% value. Both pulse oximeters accurately detected decreases in Sao\textsubscript{2} <90%, with 4% to 15% methemoglobin, despite showing low SpO\textsubscript{2} readings when Sao\textsubscript{2} was >95%.

**Conclusions:** Rainbow SpMet readings were significantly inaccurate at Sao\textsubscript{2} <95%, and SpO\textsubscript{2} readings became biased and reading low at normal Sao\textsubscript{2} when MetHb increased beyond normal levels. Both types of oximeters were sufficiently accurate in detecting oxyhemoglobin desaturation in the presence of MetHb.

**Reviewer's Comments:** One should know the limitations of monitoring devices, and if elevated methemoglobin is suspected, blood gas should be analyzed using a laboratory multiwavelength oximeter. (Reviewer-K. George Bojanov, MD).

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Keywords: Methemoglobin Detection, Pulse CO-Oximetry, Hypoxia

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The lower esophageal sphincter pressure and the barrier pressures decrease significantly during anesthesia induction in obese and non-obese patients.

**Objective:** To evaluate the upper esophageal sphincter (UES), lower esophageal sphincter (LES), and barrier pressure (BrP) in obese patients during induction of anesthesia and compare them with pressures in non-obese patients.

**Design/Participants:** Prospective, clinical study involving 28 adult patients, 14 with body mass index (BMI) ≥35 kg/m² for laparoscopic gastric bypass surgery and 14 with BMI ≤30 kg/m² for laparoscopic cholecystectomy.

**Methods:** High-resolution solid-state manometry catheters containing 36 circumferential sensors were placed transnasally and positioned to record pressures from the hypopharynx to the stomach. At a bispectral index (BIS) value of 40, patients were paralyzed with rocuronium and tracheally intubated. Remifentanil and sevoflurane were used for anesthesia maintenance and titrated to an end effect-site concentration of 8 ng/mL and a BIS of 40 to 45, respectively. Ventilation was adjusted to end tidal carbon dioxide between 37 and 42 mm Hg. After positioning of the laparoscopic instruments, intra-abdominal pressure increased to 12 to 13 mm Hg, and pressures were measured. Study check points for pressure measurements included baseline, remifentanil at target concentration of 4 ng/mL, 2 minutes after propofol administration, during apnea before muscle relaxant, during endotracheal intubation, immediately before application of abdominal pressure, and during increased intra-abdominal pressure.

**Results:** UES pressures decreased significantly in comparison to baseline in both groups after anesthesia induction and before intubation, with no significant difference between the groups. There were no significant differences in the pressures in the esophagus within or between the groups. In the obese group, there was a significant decrease in LES pressure after remifentanil, before, during and after intubation, in comparison to baseline. In the non-obese group, LES pressure decreased significantly in comparison to baseline before and during intubation and before gas insufflation of the abdominal cavity. LES was significantly lower in obese patients than in non-obese patients. The BrP decreased in both groups after remifentanil infusion and remained significantly lower during the whole study. The BrP was significantly lower in the obese group patients.

**Conclusions:** Both the LES and the BrP decreased during anesthesia induction in obese and non-obese patients but were significantly lower in the obese group.

**Reviewer's Comments:** The implication of the study is that obese patients are at higher risk of regurgitation and aspiration in the period immediately after anesthesia induction and before endotracheal intubation secondary to significantly lower LES and barrier pressures. (Reviewer-K. George Bojanov, MD).

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Keywords: Manometry, Upper/Lower Esophageal Sphincter, Obesity, Anesthesia Induction

Print Tag: Refer to original journal article
Obesity Influences Failure Rate, Complications of Axillary Brachial Plexus Block

Multiple Injection Axillary Brachial Plexus Block: Influence of Obesity on Failure Rate and Incidence of Acute Complications.

Hanouz J-L, Grandin W, et al:

Anesth Analg 2010; 111 (July 1): 230-233

Obesity decreases the success rate of axillary brachial plexus blocks performed using nerve stimulation.

**Objective:** To test the hypothesis that the axillary brachial plexus block technique is more difficult to perform in obese patients because of increased difficulty in identifying the axillary artery.

**Design/Participants:** Prospective, clinical study involving 605 consecutive adult patients scheduled for elbow, forearm, wrist, and hand surgery under axillary brachial plexus block.

**Methods:** All blocks were performed in an anesthesia room by 1 of 5 senior anesthesiologists. A triple injection technique was used involving the following needle insertions: superior to the axillary artery to locate the musculocutaneous and the median nerves and inferior to the artery to locate the radial nerve. For the median and radial nerves, distal motor responses of the wrist or the fingers were sought before injecting local anesthetics. Bupivacaine 0.5% was injected at stimulation current of 0.4 mA. Age, weight, height, body mass index, the minimal intensity of stimulating current, intensity of pain induced by the block, complications, and sensory and motor blockade were recorded and evaluated. Block success was defined as adequate analgesia allowing surgery without any pain.

**Results:** 85 patients (14%) were obese, 3 of who were morbidly obese (body mass index ≥40 kg/m2). Time to block completion was significantly longer in obese compared to the non-obese patients. The overall success rate was 97%, and the success rate in obese patients was 91% compared to 98% in the non-obese patients. Obesity resulted in an increased risk of failure. Additional nerve blocks at the elbow were performed more frequently in obese than in non-obese patients. Acute complications, including axillary artery puncture and unintentional paresthesia, were close to 3 times more frequent in obese patients. Pain reported after block performance was similar between obese and non-obese patients. Overall patient satisfaction was 93% (87% in obese and 94% in non-obese patients).

**Conclusions:** Obesity decreased the success rate and resulted in more frequent immediate complications of axillary brachial plexus block.

**Reviewer’s Comments:** This study is in concert with several other studies reporting a similar increase in the rate of acute complications in obese patients using several block techniques. As expected, the time for block completion was longer in obese than in non-obese patients. I wonder if results and outcome would have been different if an ultrasound was used. (Reviewer-K. George Bojanov, MD).

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Keywords: Axillary Brachial Plexus Block, Failure Rate, Complications, Obesity

Print Tag: Refer to original journal article
Adding Fentanyl Enhances Quality, Duration of Cervical Plexus Block

The Addition of Fentanyl to Local Anesthetics Affects the Quality and Duration of Cervical Plexus Block: A Randomized, Controlled Trial.
Sindjelic RP, Vlajkovic GP, et al:
Anesth Analg 2010; 111 (July 1): 234-237

Adding fentanyl to the mixture of local anesthetics enhances the quality and duration of cervical plexus block in patients undergoing cervical endarterectomy.

**Objective:** To test the hypothesis that the addition of fentanyl to the mixture of local anesthetics improves the quality of cervical plexus block in patients undergoing carotid endarterectomy (CEA).

**Design/Participants:** Prospective, randomized, clinical study involving 80 consecutive adult patients scheduled for elective CEA under cervical plexus block at a single clinical center.

**Methods:** Patients were randomly allocated to receive deep cervical plexus block with either fentanyl 1 mL (50 µg) or a saline placebo 1 mL in a mixture of local anesthetics. Patients were blinded to the treatment group. The local anesthetic mixture included 10 mL bupivacaine 0.5% and 4 mL lidocaine 2%. A superficial cervical plexus block was performed by injecting a similar local anesthetic mixture subcutaneously along the posterior border of the sternocleidomastoid muscle in caudal and cranial directions. An observer, blinded to the study group, tested sensory block every 3 minutes until 20 minutes after injection. Pain was assessed using a verbal rating scale at identified time points. The primary end point was the quality of anesthesia, and secondary outcomes included rescue adjuvants, number of patients requiring postoperative analgesia, time to first request for analgesia after surgery, and onset of sensory blockade.

**Results:** From the 77 patients meeting the inclusion criteria, 38 were in the fentanyl group and 39 were in the placebo group. Both groups were comparable in demographics. Verbal rating scores were significantly lower at all times in the fentanyl group than in the placebo group. Patients in the fentanyl group required less adjuvant propofol during the surgery and had less analgesia requirements over the first 24 hours postoperative. Patients in the fentanyl group requested first analgesia later than the patients in the placebo group. Sensory blockade onset did not differ between the groups. The patients in the fentanyl group had higher median Observer Assessment of Alertness and Sedation scored before carotid cross clamping than the patients in the placebo group. Incidences of bradycardia, hypercapnia, hypotension, and hypoxemia were similar between the groups.

**Conclusions:** The addition of fentanyl to local anesthetics improved quality and prolonged the duration of cervical plexus block for CEA.

**Reviewer’s Comments:** It is impressive that the addition of fentanyl doubled the time to the first request for postoperative analgesia. A methodological weakness of the study is the lack of a control group receiving systemic fentanyl, thus throwing more light with regard to possible mechanisms of analgesic action. (Reviewer-K. George Bojanov, MD).

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Keywords: Cervical Plexus Block, Fentanyl, Block Quality, Block Duration

Print Tag: Refer to original journal article