Low-Dose Remifentanil Reduces Incidence, Severity of Cough During Extubation

The Effect of Low-Dose Remifentanil on Responses to the Endotracheal Tube During Emergence From General Anesthesia.

Aouad MT, Al-Alami AA, et al:


Low-dose remifentanil during anesthesia emergence reduces the incidence and severity of coughing.

Background: Coughing during emergence may provoke sympathetic stimulation resulting in hypertension and tachycardia, and can cause increased intraocular and intracranial pressure which can be harmful in certain procedures. Several techniques have been employed to prevent coughing. Opioids during emergence are avoided because they can delay awakening by causing respiratory depression.

Objective: To determine whether low-dose remifentanil decreases the incidence of coughing, non-purposeful movement, hypertension, and tachycardia during anesthesia emergence.

Design: Prospective randomized double-blind study.

Participants/Methods: 61 adult patients, ASA I-II, scheduled to undergo nasal surgery, were randomized into 2 groups. All patients received standardized anesthesia induction with lidocaine, propofol, rocuronium, and remifentanil bolus 1 mcg/kg and were intubated with a tube maintaining the cuff pressure at 30 cm H2O. Anesthesia was maintained with nitrous oxide, oxygen, isoflurane, and remifentanil infusion at a rate 0.05 to 0.5 μg/kg/minute adjusted to maintain systolic blood pressure between baseline and 20% lower. At the end of the surgery the isoflurane was stopped. Remifentanil was stopped in the control group, while in the treatment group the infusion was continued at one tenth the rate of the mean infusion but not <0.01 μg/kg /minute and was stopped after extubation. The following variables were measured every 2 minutes in the emergence period: number and grade of coughing episodes, non-purposeful movement, mean arterial pressure, heart rate, end-tidal (ET) CO2, Ramsay Sedation Scale, and time to respond to verbal command, to eye opening, and to tracheal extubation.

Results: Smoking was equally distributed in the 2 groups. The incidence, number, and severity of coughing as well as non-purposeful movements were significantly higher in the control group when compared to the remifentanil (incidence 80% vs 40%). Coughing and non-purposeful movements occurred mainly in the presence of the endotracheal tube. Mean arterial pressure was similar between the groups but heart rate was higher in the control group after administration of reversal and after extubation (2 and 5 minutes). There was no difference between groups in the sedation, ET isoflurane, time to eye opening, response to verbal command, and in the incidence of sore throat, hoarseness, pain, and postoperative nausea and vomiting.

Conclusions: The antitussive properties of remifentanil are attributed to depression of the cough reflex in the brain stem and are mediated via the opioid receptors. The ultra short half-life of remifentanil provides an advantage over the other opioids by decreasing the risk and duration of respiratory depression. This technique was used in nasal surgery patients and might not be applicable in other surgeries with greater pain medication requirements.

Reviewer's Comments: Several different techniques have been used to prevent coughing: deep extubation, laryngeal mask use, topical use of local anesthetics, administration of propofol, short-acting opioids, and dexmedetomidine. Remifentanil provides an alternative choice but the selection should be tailored to the individual patient's hemodynamic, respiratory, and pain condition. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Remifentanil

Print Tag: Refer to original journal article
Background: Despite its shortcomings, central venous pressure (CVP) monitoring is an important tool in the management of the hemodynamically unstable patient. The normal CVP value is small and has a narrow range. Even a slight change in the atrial filling pressure can be considered a significant change in clinical status. Thus, small measurement errors may result in inaccurate evaluation of the right atrial pressure and can lead to misguided decisions.

Objective: To quantify the degree of variation among health care providers in the placement of CVP transducers, and to evaluate whether the use of a level laser may identify better the anatomic landmarks resulting in reduction of the variation and error of the CVP measurement.

Design: Prospective cohort observational study.

Participants/Methods: 50 health care providers including nurses, anesthesia residents, and anesthesiologists participated in the study. In the first session, they were asked to place the pressure transducer on the same mock patient in 3 positions: flat, 30° head up, and 15° Trendelenburg. The CVP transducer was placed on an IV pole at 1 m distance from the patient. The second session occurred 6 months later and the participants were asked to perform the same task using a laser level on the same mock patient. The distance from the transducer to the floor was measured in both sessions. Descriptive statistics (mean, standard deviation, interquartile range) were performed on the measurements and the variances between the 2 sessions were compared.

Results: The authors reported the standard deviation and interquartile range of the CVP measurement for each position in both sessions. There was significant variation in the measurement in both sessions. In the first session (without the laser level), the standard deviation was the same in the supine and Trendelenburg position, 3.2 mm Hg. Head-up position had the largest variation, with a standard deviation 4.8 mm Hg and an interquartile range 4.2 to 29.7 mm Hg. During the second session, the variability of the measurement was reduced for all 3 positions (2.9 supine, 4.3 head up, 2.6 Trendelenburg). This reduction in variation was not statistically significant.

Conclusions: Error in the measurement of the CVP may be equal or larger than the actual CVP value. The use of the laser level should have reduced the random error. The error observed in session 2 was due primarily to systematic error such as different anatomic landmarks used by the health care providers.

Reviewer's Comments: The authors speculated that different anatomic landmarks among providers might cause the error, but did not provide evidence for this. The valid reference levels should be the uppermost blood level of the right atrium to eliminate the influence of hydrostatic pressure. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Error in Measurement

Print Tag: Refer to original journal article
Multiple anesthesia exposures before age 4 years are associated with learning disabilities.

**Background:** Animal studies have shown that certain anesthetics such as ketamine, nitrous oxide, isoflurane, halothane, propofol, and diazepam can affect neural development and can cause changes in the growing brain.

**Objective:** To explore the potential association between exposure to anesthesia during the first 4 years of life and the development of learning disabilities (LD).

**Design:** Retrospective cohort study.

**Methods:** A birth cohort of children born in Rochester, Minnesota, between January 1976 and December 1982 was used in this study. Children that left the area before age 5 years were excluded. Exposure to general anesthesia before age 4 was determined from the local hospital Surgical Information Retrieval System. Data collected included ASA status, type of surgical procedure, anesthesia duration, number of exposures, age at exposure, and comorbidities. LD was the primary outcome and was determined from the educational school records. A LD score was calculated from the child's IQ score using a regression formula that was issued by the Minnesota Department of Education. Children with a LD score 1.75 SD's below the predicted score were classified as having a LD.

**Results:** Of 5357 children, 593 had general anesthesia for procedures before age 4 years. Exposed to general anesthesia children had lower birth weight, lower gestational age, were more likely to be male, and had mothers with higher education than unexposed children. Of the exposed children, 76% had a single exposure, 74% were ASA I, and most anesthetics were halothane and nitrous oxide. After adjustment for confounders, the incidence of LD before age 19 years was 20.5%. LDs were significantly higher in children with multiple anesthetic exposures and longer anesthesia duration, but not with a single exposure. The risk of LD was 21% for no exposure, 20% for single exposure, and 35% for multiple exposures. In other words, the risk of LD was 1.6 times higher in children with 2 anesthesia exposures and 2.6 times higher in children with ≥3 exposures as compared with no exposure. Multiple anesthesia exposures were associated with higher ASA status and more comorbidities.

**Conclusions:** Multiple anesthesia exposures before age 4 years were associated with LD diagnosed by age 19. The association between anesthesia and neurodevelopment is supported further by the dose-response relationship found in this study: duration and number of exposures were associated with LD. Limitations of this study discussed by the authors included unknown confounders that might have influenced their findings.

**Reviewer's Comments:** Several models of immature animal brains demonstrated the neurotoxic potential of general anesthetics. How applicable these data are to humans and children is still unknown. This retrospective study does not prove a cause-effect phenomenon, but provides good evidence for hypothesis generation and incentive for prospective investigation of this theory. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Early Anesthesia Exposure

Print Tag: Refer to original journal article
The combination of transdermal scopolamine with ondansetron results in better PONV prophylaxis than ondansetron only without increasing the risk of side effects.

**Background:** Recently, a consensus panel of the Society of Ambulatory Anesthesia recommended transdermal scopolamine (TDS) as one of the first- and second-line antiemetics.

**Objective:** To compare the antiemetic response of ondansetron (OND) alone with the combination of ondansetron and transdermal scopolamine (OND TDS) during the first 24 hours postoperatively.

**Design:** Prospective experimental randomized double blind multicenter study.

**Participants/Methods:** 620 adult females at risk for postoperative nausea and vomiting (PONV) undergoing laparoscopy or breast augmentation surgery lasting 1 to 3 hours were randomized into 2 groups. Both groups received 4 mg IV ondansetron 2 to 5 minutes prior to induction. The OND TDS group received a transdermal scopolamine patch over the mastoid process 2 hours prior to surgery and for 24 hours postop while the OND group received a placebo patch. Anesthesia was induced with propofol and maintained with 30% to 50% nitrous oxide, isoflurane, or sevoflurane, and fentanyl as needed and muscle relaxants if needed. All patients had an OG tube placed during the surgery. Ondansetron was used as a rescue antiemetic in the PACU and promethazine tablets 12.5 mg were given for home use. A nonsteroidal anti-inflammatory drug or a COX-2 inhibitor was used for postop pain. The primary outcome was complete antiemetic response defined as no nausea, vomiting/retching, or rescue antiemetic use. The incidence of these events was recorded at several intervals postop in the PACU and up to 48 hours postop using questionnaires.

**Results:** The antiemetic response was significantly higher in the combination group (48%) versus 39% in the OND group during PACU and the first 24 hours postop (9.0% reduction), but not after discharge (6.9% reduction). The combination group had less severe nausea during the first 48 hours and higher patient satisfaction scores (89 vs 82 using a 0 to 100 visual analog scale). The incidence of adverse events not related to surgery was less in the combination group, but there was no difference in the anticholinergic effects (blurred vision, dry mouth, dizziness, urinary retention).

**Conclusions:** The combination of OND and TDS reduces the incidence of PONV in high-risk patients without increasing the risk of side effects. Concerns of scopolamine use are its anticholinergic effects. These are less with TDS when compared to IV, but TDS has a slow onset of action (4 hours). Therefore, we should apply the patch a few hours prior to surgery for short procedures. A meta-analysis of 23 randomized studies evaluating TDS concluded that TDS has postop antiemetic effects, but is associated with higher incidence of side effects, which differs from the current study.

**Reviewer's Comments:** The choice of antiemetic should be based on the patient's risk. A combination therapy is recommended for patients with increased risk. Besides dexamethasone and droperidol, TDS should be considered as the second antiemetic along with the 5-HT3 antagonists. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Transdermal Scopolamine + Ondansetron

Print Tag: Refer to original journal article
Cervical Spine Displacement During Intubation Similar in Trachlight and Flexible FOB

A Comparison of Cervical Spine Motion During Orotracheal Intubation With the Trachlight® or the Flexible Fiberoptic Bronchoscope.

Houde BJ, Williams SR, et al:

Anesth Analg 2009; 2009 (May): 1638-1643

Cervical spine displacement is comparable if TL or flexible FOB are used for oral endotracheal intubation together with in-line neck stabilization in the asleep patient.

Background: Cervical spine instability following trauma is a major concern during endotracheal intubation. Awake flexible fiberoptic bronchoscope (FOB) intubation is often chosen, but can expose the patient to unexpected movement or cough and worsened neurological outcome. Asleep FOB intubation is a second method of choice. Trachlight (TL) has a high intubation success rate and has been demonstrated to cause less cervical spine motion compared to laryngoscopy.

Objective: To compare the extent of cervical spine displacement during asleep oral endotracheal intubation with FOB and TL and manual neck in-line stabilization.

Design/Participants: Prospective randomized cross-over controlled study with 20 patients.

Methods: Exclusion criteria included patients with cervical abnormalities, GERD, emergent intubations, known difficult airway, BMI >35, upper airway tumors, ASA class IV and V, or those with contraindications to neuromuscular blockade. Anesthesia was induced in a standard fashion with the use of muscle relaxants. Each patient was then orally intubated with both FOB and TL by an experienced anesthesiologist. The sequence of the intubation method was determined by randomization. Cinefluoroscopy was used to monitor cervical spine displacement from cranium to C5 vertebrae in a lateral view.

Results: Successful endotracheal intubation was performed in all patients on first attempt with FOB and TL, except for one patient in whom third attempt with TL was successful. Maximal vertebral displacement with FOB was 11° ± 5°, and 12° ± 6° with TL (P=0.5) and occurred mostly during introduction of the endotracheal tube. The occipitoatlantal articulation was affected most. Conclusion: TL and FOB oral endotracheal intubation with manual in-line stabilization causes comparable cervical spine displacement in anesthetized patients.

Reviewer's Comments: This study compares cervical spine displacement during oral endotracheal intubation performed with FOB and TL. The methods appear to be comparable and highly successful. TL has the benefit of being small and simple to use. Limitations of the study are a small sample size, which may have precluded demonstration of a better outcome with one method or the other. The study was further limited to patients with intact cervical spines, which may not reflect intubating conditions in injured patients. Cervical spine was imaged in one plane only, and C6 and C7 segments were not imaged. (Reviewer-Mojca Remskar Konia, MD).

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Keywords: Cervical Spine Displacement

Print Tag: Refer to original journal article
In children aged ≥6 months, the glottis is the narrowest portion of the airway.

**Background:** Historically, based on post-mortem measurements, cricoid cartilage was believed to be the narrowest portion of the funnel-shaped pediatric airway. Newer studies used magnetic resonance imaging and videobronchoscopy to measure the airway dimensions and gave conflicting results. A technique that would allow a standardized measurement of the airway dimensions in an actual patient would therefore be of great interest.

**Objective:** To determine the size of the pediatric airway and to establish whether the shape of the airway changes during development from funnel-shaped to cylindrical.

**Participants/Methods:** 135 pediatric patients aged 6 months to 13 years were enrolled in the study. Anesthesia was induced in a standard fashion. The airway dimensions were measured with the use of the rigid telescope. Suction catheter was attached to the telescope and was used to define the distance from the photographed object. The graph paper with 1 mm count was first photographed and was used as a calibration tool to measure the area. The glottic and the cricoid cartilage openings were then photographed and surface calculated with the computer software.

**Results:** The cricoid cross-section in all participants was larger than the glottic cross-section. Both cross-sectional areas increased linearly with age. The ratio of the cricoid and the glottic cross-sectional area started decreasing after participants reached 25 kg.

**Conclusions:** The glottis is the narrowest portion of the pediatric airway in children aged ≥6 months. The pediatric airway is cylindrical in shape.

**Reviewer's Comments:** Most of us have been taught during our training that cricoid cartilage is the narrowest portion of the pediatric airway. To prevent pressure injury to the trachea, uncuffed endotracheal tubes (ETTs) were used in the pediatric population. The presented study demonstrated that the glottis is the narrowest portion of the airway in patients aged ≥6 months. This is in accordance with recent clinical experience with improved cuffed ETTs, which have been safely used in a pediatric population. However, the study was limited to patients aged >6 months and cannot be extrapolated to younger children. (Reviewer-Mojca Remskar Konia, MD).
Oxygen 100% Speeds Collapse of Non-Ventilated Lung After One-Lung Ventilation

The Use of Air in the Inspired Mixture During Two-Lung Ventilation Delays Lung Collapse During One-Lung Ventilation.

Ko R, McRae K, et al:

Use of FIO₂ 1.0 during two-lung ventilation will speed lung collapse after initiation of one-lung ventilation compared to oxygen/air mixture.

**Background:** Lung isolation allows for better surgical exposure during thoracotomy and thoracoscopy. After initiation of one-lung ventilation, the non-ventilated lung collapses due to passive elastic recoil and gas uptake from the alveoli. The first mechanism decreases the lung volume to the closing capacity. Further collapse is dependent on the absorption of gas into the pulmonary capillary blood determined by gas solubility.

**Objective:** To study the effect of different gas mixtures (100% oxygen vs oxygen/nitrous oxide mixture vs oxygen/air mixture) on the speed of the non-ventilated lung collapse. The authors further investigated whether the use of different gas mixtures during two-lung ventilation affects oxygenation during one-lung ventilation with 100% oxygen.

**Participants/Methods:** Patients undergoing thoracotomy or thoracoscopy were assigned to receive two-lung ventilation with 100% oxygen (oxygen, n=33), a mixture of oxygen and nitrous oxide FIO₂ 0.4 (oxygen/nitrous, n=34), or a mixture of oxygen and air FIO₂ 0.4 (oxygen/air, n=33). After initiation of one-lung ventilation with 100% oxygen in all patients, the extent of lung collapse was assessed by 2 surgeons blinded to gas mixture used at 10 and 20 minutes with a number from 0 (no collapse) to 10 (maximum collapse). Arterial blood gases were obtained prior to induction, during two-lung ventilation with different gas mixtures, and during one-lung ventilation with 100% oxygen.

**Results:** After 10 minutes, the lung collapse was the fastest in the oxygen/nitrous group and the slowest in the oxygen/air group. At 20 minutes, the oxygen group and oxygen/nitrous group were similarly better than oxygen/air group. Oxygenation was better in the oxygen group during the first 15 minutes of one-lung ventilation and did not differ between the groups 15 to 30 minutes after initiation of one-lung ventilation.

**Conclusion:** Oxygen 100% will speed the collapse of non-ventilated lung after the initiation of one-lung ventilation compared to oxygen/air mixture. The authors further demonstrated that “the oxygenation during one-lung ventilation will not be affected by the gas mixture used during two-lung ventilation.”

**Reviewer's Comments:** The collapse of non-ventilated lung during the use of double-lumen tube is usually fast. However, the results of the presented study may be particularly helpful in cases when bronchial blocker is used for lung isolation. In these cases, gas absorption from the alveoli is an even more important mechanism of lung deflation. The limitations of the study are a low number of subjects and the scale used by surgeons for the evaluation of lung collapse, which was subjective. (Reviewer-Mojca Remskar Konia, MD).

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Keywords: Lung Collapse

Print Tag: Refer to original journal article
Reduced Propofol Dose Required for LOC During Early Pregnancy

Predicted Propofol Effect-Site Concentration for Induction and Emergence of Anesthesia During Early Pregnancy.

Mongardon N, Servin F, et al:


The propofol dose required for LOC is reduced in pregnant patients as compared to non-pregnant patients, and the site-dose concentration is decreased in pregnant patients.

**Background:** Pregnancy is associated with decreased anesthetic requirements, which has been attributed to the increased levels of progesterone. Due to its pharmacokinetic profile, propofol has become a drug of choice for short duration procedures. The effects of pregnancy on propofol dose required for loss of consciousness have not been thoroughly investigated.

**Objective:** To investigate the propofol dose and predicted effect-site concentration in patients during early pregnancy.

**Participants:** Study subjects were healthy women scheduled to undergo either early termination of pregnancy (TOP) or transvaginal oocyte retrieval for in vitro fertilization (IVF).

**Methods:** Effect-site concentration of propofol was calculated using the Base Primea pump (Fresenius-Vial Company). Also measured was the total infused dose of propofol and the time elapsed from the start of the infusion. Women were monitored with the usual monitors plus BIS. Anesthesia was induced with continuous propofol infusion until loss of consciousness (LOC), as defined by loss of verbal response. Immediately before start of surgery all subjects received a bolus of alfentanil 10 μg/kg. Anesthesia was maintained with a target control propofol infusion, which was stopped at the end of surgery and the time for eye-opening was measured. Blood samples to measure progesterone were collected from all patients.

**Results:** Data were analyzed from 57 women in the TOP group and 55 women in the IVF group. The demographic characteristics of both groups were similar except for age, which was higher in the IVF group (32 vs 27 years). The mean propofol dose to achieve LOC was significantly lower in the TOP group as was the time between the start of the infusion and LOC (193.8 vs 209.5 minutes). The site-effect concentration also was significantly lower in the TOP group. The mean propofol dose infused for the procedures was lower in the TOP group, but this may reflect the shorter time for these procedures. Finally, there was no association between progesterone concentration and propofol dose.

**Conclusions:** The propofol dose required for LOC is reduced in pregnant patients as compared to non-pregnant patients. Furthermore, the site-dose concentration is decreased in pregnant patients. There was no correlation between levels of progesterone and propofol dose.

**Reviewer's Comments:** There are several assertions in this study that require clarification. The authors have admitted to some of these problems with the study. The explanation of how site-effect concentration was calculated is not totally clear and is somewhat subjective and not an actual concentration. Part of the problem is that arterial and venous blood levels of propofol are not assayed. The use of alfentanil and its effects on emergence may confuse the results. Overall, an important concept is analyzed, but a larger sample is needed for significant results (as the authors acknowledge). (Reviewer-Errol Lobo, MD).

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Keywords: Propofol Effect-Site Concentration

Print Tag: Refer to original journal article
Tight control of insulin in the perioperative period reduces major cardiovascular events.

**Background:** Current evidence suggests that hyperglycemia is an independent risk factor for cardiovascular disease, and that aggressive glycemic control by insulin infusion decreases cardiac morbidity and mortality.

**Objective:** To determine whether tight perioperative blood glucose control reduced cardiovascular events in patients undergoing vascular surgery.

**Design/Participants:** Prospective randomized study involving patients scheduled for vascular surgery.

**Methods:** Subjects were divided into 2 groups. Group CII was randomized to receive continuous infusions of insulin to maintain a target blood glucose concentration of between 110 and 150 mg/dL. Group IIB was the control group that received sliding scale insulin to maintain blood glucose in the 100 to 150 mg/dL range. The primary end points were death, myocardial Infarction, and congestive heart failure.

**Results:** 114 patients were randomized to Group CII and 122 to Group IIB. With tight glucose control for 48 hours, there were fewer major myocardial events in Group CII (3.5%) versus 12.3% for Group IIB. In total, 6% of patients in Group IIB had perioperative myocardial infarctions versus 0% for Group CII. Other perioperative events, such as graft failure, were also less for Group CII. As expected, the incidence of hypoglycemia was increased in Group CII, but unexpected was the higher incidence of wound infection. Of note, perioperative myocardial events occurred primarily in patients with a history of heart disease.

**Conclusions:** This study demonstrates that tight glucose control in vascular surgery patients with diabetes reduces myocardial events. **Reviewer Comments:** The authors of this paper are quick to point out that the number of study subjects may be too small for any significant conclusion. Nevertheless, they do point out that this study is unique in that insulin control was started in the operating room. They also point out that perhaps tighter control was necessary since there were more wound infections in Group CII. I feel that the population that should have been studied should have only included patients with diabetes. This would have left less confusion with the results, especially with respect to the observation that only patients with preexisting cardiac disease developed perioperative cardiac events. (Reviewer-Errol Lobo, MD).

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**Keywords:** Insulin Control

**Print Tag:** Refer to original journal article
CSEA offers rapid onset, profound neuraxial block and prolonged blockade at a lower total drug dose.

**Background:** The use of combined spinal-epidural anesthesia (CSEA) in obstetric and gynecologic surgery has increased in the past few years. CSEA can also be used for labor analgesia. What is unknown is how much local anesthetic given in the epidural space enters the subarachnoid space through the dural puncture from the spinal needle.

**Objective:** To estimate the spread of epidural lidocaine into the subarachnoid space from the meningeal puncture and dural puncture sites.

**Participants:** ASA I or II women scheduled for gynecologic surgery.

**Methods:** Patients were randomly divided into 2 groups with 30 patients in each group. Each group was subdivided into 3 subgroups. For each subgroup (10 patients each), epidural catheters were placed at different levels: L3-L4, L1-L2, and T11-T12. For Group I, each subgroup was given 10.0 mL of 1% lidocaine via the epidural catheter, cerebrospinal fluid (CSF) was then obtained from L4-L5 interspace, and 2.0 to 2.4 mL of 0.5% tetracaine was given prior to surgery. For Group II, epidural catheters were placed in all subgroups but not activated. An intrathecal dose of tetracaine was given prior to surgery. Patients were given 10 mL of 1% lidocaine via epidural catheter at the end of surgery, and 10 minutes later CSF was obtained at level L4-L5. All CSF samples obtained were analyzed for lidocaine concentration.

**Results:** CSF lidocaine concentration was greatest near the site of epidural injection and decreased with increasing distance from the epidural injection site. The concentrations of CSF lidocaine were similar regardless of the presence of a meningeal hole as in Group II, or the absence of a meningeal hole as in Group I.

**Conclusions:** The data presented in this study show that epidurally administered lidocaine enters the subarachnoid space even when there is no meningeal hole. Moreover, the concentration of epidural lidocaine in the CSF remains near the site of epidural injection with limited spread, even when a meningeal hole is placed, implying that CSEA is a generally safe technique.

**Reviewer’s Comments:** This was an interesting study which demonstrated the safety of CSEA. There are some potential criticisms and these have to do with the limited epidural dose of 10 mL. Perhaps a larger dose or multiple doses should have been used. Also, as the authors have acknowledged, there is potential for contamination based on their technique, and it is interesting to speculate whether other local anesthetics and/or opioids with different lipid solubilities would behave in the same way. (Reviewer-Errol Lobo, MD).

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Keywords: Spread of Lidocaine

Print Tag: Refer to original journal article
Preop Anemia Is Common Condition, Independently Linked to Increased Postop Mortality

Risk Associated With Preoperative Anemia in Noncardiac Surgery: A Single-Center Study.
Beattie WS, Karkouti K, et al:
Anesthesiology 2009; 110 (March): 574-581

Safely correcting anemia preoperatively could significantly reduce postoperative mortality.

**Objective:** To determine the prevalence of preoperative anemia in non-cardiac surgical patients and to assess the relationship between preoperative anemia and postoperative mortality.

**Design:** Retrospective, single-center cohort study.

**Participants:** 7759 consecutive non-emergent, non-cardiac, non-transplant surgical patients between 2003 and 2006.

**Methods:** Data collected included preoperative comorbidities and hemoglobin concentration, red blood cell (RBC) transfusions used within the first 7 days of the hospital stay, and in-hospital mortality within 90 days of surgery. Preoperative anemia was classified as a hemoglobin <13 g/dL for men and <12 g/dL for women. Statistical analysis of the unadjusted and adjusted relationship between preoperative anemia, perioperative transfusion, and mortality was done using logistic regression and propensity analysis.

**Results:** Both men and women had a 40% incidence of preoperative anemia. After adjusting for a number of perioperative confounders, particularly transfusions, preoperative anemia was still associated with increased mortality (odds ratio, 2.36) within 90 days of surgery. The increased mortality was evident by 14 days after surgery. Transfusion of RBC occurred twice as often in anemic patients as in non-anemic patients and further increased the odds of postoperative death.

**Conclusions:** Preoperative anemia is an exceedingly common finding in the general, elective surgical population and is a significant independent risk factor for increased postoperative mortality. Also, preoperative anemia doubles the chance of requiring a RBC transfusion, which is also associated with an additional increased risk of postoperative mortality.

**Reviewer’s Comments:** Because this is a retrospective observational study, it is not possible to establish a definitive causal relationship between preoperative anemia and increased mortality. However, 2 aspects of the study strongly suggest that there is a high likelihood of a direct connection between preoperative anemia and postoperative mortality. First, several extensive statistical methods were used to adjust for a number of important confounders. Second, the finding that non-anemic patients (despite losing more blood and yet receiving the same amount of blood as preoperative anemic patients) had superior outcomes compared to anemic patients. If one is reasonably confident that the aforementioned connection between preoperative anemia and postoperative mortality is valid, then there needs to be a much greater focus and effort on minimizing the incidence of preoperative anemia in elective, general surgical patients. How this can be most effectively and safely accomplished remains to be determined. (Reviewer-Douglas E. Koehntop, MD).

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Keywords: Anemia

Print Tag: Refer to original journal article
I-Gel Supraglottic Airway More Successful With Bigger-Than-Recommended Airway

A Randomised Crossover Trial Comparing the I-Gel Supraglottic Airway and Classic Laryngeal Mask Airway.

Janakiraman C, Chethan DB, et al:
Anaesthesia 2009; 64 (June): 674-678

The success rate for the i-gel supraglottic airway increases with use of a bigger-sized airway than that recommended by the manufacturer.

Background: Many new supraglottic devices have been introduced.
Objective: To compare the new i-gel supraglottic airway with the classic laryngeal mask airway (cLMA).
Design: Prospective, randomized crossover study.
Participants: 50 ASA I-II patients undergoing general surgery.
Methods: Standard monitoring and induction of anesthesia was performed according to protocol. Once adequate depth of anesthesia was achieved, airways were inserted in randomized order. According to the manufacturer's recommendation, the i-gel 3, 4, or 5 or the cLMA 3, 4, or 5 was inserted. The cLMA was cuffed in 5-mL increments of air until a good seal was achieved. Absence of air and a square wave pattern on capnography indicated a good seal and adequate ventilation. If the pressure in the cuff was >60, the cuff was deflated and the minimal pressure at which gas leakage was noted was recorded (airway leak pressure). The position of the device was checked fiberoptically. Five minutes later, the device was replaced with the other airway device. Two insertion attempts were allowed for each device. Replacement was done in the presence of audible leak or the absence of a square wave on the capnography. The ease of insertion was graded 0 to 2 (easy, moderate, and difficult). The first time success rate was the primary outcome. Results were analyzed with the Wilcoxon signed rank test.

Results: 50 patients were analyzed. The i-gel and cLMA were successfully inserted at the first attempt 54% and 86% of the time, respectively. The overall success rate after 2 attempts was 84% for the i-gel and 92% for the cLMA. It was noted that the success rate for i-gel improved because a bigger-sized airway was used during the second attempt.

Conclusions: With the current sizing recommendations for i-gel, cLMA performed better.
Reviewer's Comments: The seal of the i-gel depends on the fit of the oval-shaped groove surrounding the glottis. A short i-gel mask will lead to an inadequate seal and as a consequence to high leakage, which explains the improvement of the airway with a bigger-sized i-gel replacement. (Reviewer-Olga Plattner, MD).

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Keywords: Supraglottic Airway

Print Tag: Refer to original journal article
**Background:** There are a number of techniques for use in the CICV (can't intubate, can't ventilate) scenario. One should be able to rapidly access the airway using equipment that is readily available and that includes motor skills of the user. One should be able to oxygenate the patient before securing the airway with a cuffed airway device.

**Objective:** To evaluate the efficacy of different techniques in a training program used in a CICV situation.

**Design:** CICV session consisting of 2 parts (a manikin part and a wet lab part using anesthetized sheep).

**Participants:** 10 anesthetic staff members.

**Methods:** In the manikin session, participants were taught to proceed through a number of critical steps for cannula cricothyroid puncture (CCP), scalpel bougie (SB), Melker emergency cricothyroidotomy (MK), and scalpel finger needle (SFN). All techniques were also performed on anesthetized sheep in the lab once oxygen saturation dropped to 70%. Participants had to cannulate the cricothyroid membrane and ventilate with high-flow jet or a low-flow oxygen system. Surgical airway techniques followed. A difficult neck was created with infusion of 1 L crystalloid solution into the sheep's neck, and candidates had 5 attempts of blind cannulation before performing the above-mentioned procedures. Time to first effective ventilation, time to oxygen saturation <90%, number of attempts, and complications were recorded. The procedure was terminated if time exceeded 4 minutes.

**Results:** Each technique was performed with 10 participants. There was a success rate of 100% for SB, 80% for surgical cricothyroidotomy, 90% for MK, 90% for Mini-trach II, 40% for CCP in the difficult neck, and 100% for SFN in the difficult neck.

**Conclusions:** In a CICV scenario, a cannula cricothyroidotomy or tracheostomy should be the ideal first-line technique.

**Reviewer’s Comments:** I believe that this training program should be available in each hospital with the equipment used in that hospital. Only regular training with available equipment in a hospital can improve skills and improve outcomes once a CICV situation occurs. (Reviewer-Olga Plattner, MD).

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Keywords: Airway Management

Print Tag: Refer to original journal article
Desflurane Increases Lung Resistance Via Tachykinin Pathways

Desflurane but Not Sevoflurane Can Increase Lung Resistance Via Tachykinin Pathways.
Satoh J-I, Yamakage M, et al:
Br J Anaesth 2009; 102 (May): 704-713

Background: Volatile anesthetics relax airway smooth muscles in vitro, but desflurane increases lung resistance in vivo.
Objective: To examine mechanisms of desflurane and sevoflurane on lung resistance.
Design: Experimental animal study.
Methods: 99 guinea pigs weighing about 250 g were prepared and anesthetized using a standardized protocol. The right jugular vein was cannulated, the intrapleural pressure was measured via a water-filled cannula that was placed in the lower third of the esophagus. The transpulmonary pressure was determined by monitoring the difference between the pressure in the external end of the tracheal cannula and the pressure in the cannula of the esophagus (P_{TP}). The respiratory flow rate and volume changes were recorded. Total lung resistance (R_L) and dynamic lung compliance (C_{Dyn}) were obtained using the equation of motion of the respiratory system (where t is time and V is volume changes): P_{TP} (t) = C_{Dyn} x V + R_L x V (t). There were 10 groups with 6 pigs each. Sixty animals were exposed to 0, 0.5, 1.0, 1.5, or 2.0 minimum alveolar concentration (MAC) of desflurane or sevoflurane for 10 minutes; 39 animals were used for pretreated studies. Pretreatment was with atropine or vagotomy, tachykinin neurokinin 1 (NK_1) and tachykinin neurokinin 2 (NK_2) antagonists, and capsaicin depletion. All animals were killed by exsanguination. Significant changes between sevoflurane and desflurane were determined with the unpaired t-test or ANOVA.
Results: Exposure to high concentrations of desflurane (2.0 MAC=12.8%) resulted in R_L peaks biphasically, which returned slowly to normal after exposure. Sevoflurane had little effect on the R_L. Pretreatment with atropine had little influence, while vagotomy inhibited changes by 32% at the first peak in the desflurane group. Under NK_1 and NK_2 antagonists and capsaicin depletion, desflurane at 2 MAC had no effect on the R_L.
Conclusions: Desflurane increases R_L in high concentrations. Pretreatment with tachykinin antagonists and capsaicin depletion inhibited the elevation in lung resistance induced by desflurane.
Reviewer's Comments: This is an experimental animal study with interesting aspects. For clinical purposes, these findings are valuable. Nevertheless, desflurane at 2 MAC (12.8%) is not used in this concentration in anesthesia. (Reviewer-Olga Plattner, MD).

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Keywords: Volatile Anesthetics

Print Tag: Refer to original journal article
Sevoflurane at 3% combined with sufentanil 0.32 ± 0.10 μg/kg seems to provide the best condition for tracheal intubation in children.

**Background:** Opioids improve the quality of intubation conditions.

**Objective:** To evaluate the optimal dose of sufentanil for intubation conditions under various sevoflurane concentrations in children.

**Design:** Randomly assigned, prospective, blinded clinical study.

**Participants:** 63 children aged 2 to 8 years undergoing elective surgery.

**Methods:** Children were assigned to 1 of 3 groups: 2.5% sevoflurane, 3.0% sevoflurane, or 3.5% sevoflurane. Premedication was standardized and after induction with sevoflurane 6% in oxygen via face mask. Once apneic children were ventilated with a volume of 10 mL/kg and a rate to maintain Eco₂ 4.0 to 4.7 kPa, the inspired sevoflurane was adjusted to maintain 2.5%, 3.0%, or 3.5%. An IV line was established, and sufentanil 0.6, 0.5, or 0.3 μg/kg in groups 2.5%, 3.0%, or 3.5%, respectively, sevoflurane was administered and, 6 minutes later, intubation was performed. The modified Dixon's up-and-down method was used to determine the sufentanil ED₅₀. If intubation failed, the sufentanil dose for the next patient was increased by 0.1 μg/kg in the 2.5% and 3.0% groups and 0.05 μg/kg in the 3.5% group. If intubation was successful, the sufentanil dose was decreased by the same amount. Intubation quality was assessed with the Viby-Mogensen score (jaw relaxation, vocal cord position, movement, coughing, and limb movement was assessed and scored from excellent to poor). Children were included until 6 independent pairs of consecutive subjects in which a success score followed a failure score were obtained in each group. A logistic model was used to calculate the sufentanil dose required, and ANOVA and x² test was used to compare characteristics and anesthetic data between groups.

**Results:** Sufentanil ED₅₀ values were 0.6 μg/kg in group 2.5%, 0.3 μg/kg in group 3.0%, and 0.1 μg/kg in group 3.5%.

**Conclusions:** Excellent intubation conditions were achieved: 61% in group 3.5% sevoflurane, 60% in group 3.0%, and 50% in group 2.5%. Sevoflurane at 3% seems to be the best as it allows tracheal intubation with a sufentanil dose in the range of clinical use.

**Reviewer's Comments:** The anesthesia depth could have been additionally controlled with the Bispectral Index monitoring. This would make the groups more comparable and give more information during intubation. (Reviewer-Olga Plattner, MD).

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Keywords: Sufentanil After Sevoflurane Induction

Print Tag: Refer to original journal article
**Inguinal Compression, Valsalva Maneuver Increase CSA of Femoral Vein in Children**

*The Effect of Inguinal Compression, Valsalva Maneuver, and Reverse Trendelenburg Position on the Cross-Sectional Area of the Femoral Vein in Children.*

Kim J-T, Park C-S, et al:

Anesth Analg 2009; 108 (May): 1493-1496

Compression above the inguinal ligament significantly increases the cross-sectional area of the femoral vein in anesthetized children.

**Objective:** To investigate the cross-sectional area (CSA) of the femoral vein with inguinal compression, Valsalva maneuver, and the reverse Trendelenburg position in pediatric patients.

**Design/Participants:** Prospective, clinical study involving 50 pediatric patients scheduled for elective ophthalmic, plastic, or orthopedic surgery under general anesthesia.

**Methods:** All measurements were made after completion of procedure with surgical level of anesthesia and in supine position. Participants were stratified into 2 study groups: small children (group S, aged <2 years, n=25) and large children (group L, aged >2 years, n=25). The CSA of the femoral vein was measured with a 2-dimensional, 10-MHz linear transducer. Images were recorded during horizontal supine position (control), with inguinal compression, in Trendelenburg position, in Trendelenburg position 15° plus inguinal compression, with Valsalva maneuver using positive inspiratory pressure of 25 cm H₂O for 10 seconds, and in reverse Trendelenburg position 15°. Inguinal compression was achieved by broad compression near the arterial pulsation 1 to 2 cm above the inguinal ligament with 3 fingers. Change in the CSA of >20% was considered clinically significant.

**Results:** Inguinal compression increased the CSA in both the supine and the Trendelenburg positions in both groups. Inguinal compression during the Trendelenburg position increased the CSA of the femoral vein by 43% and 74% in group L and S, respectively (P <0.001). Valsalva maneuver was more effective in increasing the CSA of the femoral vein in group S, while gravitational position changes had little effect on the size of the femoral vein in both groups.

**Conclusions:** Inguinal compression and Valsalva maneuver increase the cross-sectional area of the femoral vein, while reverse Trendelenburg has little effect on the size of the femoral vein in anesthetized children.

**Reviewer's Comments:** The significance of the study is not only the finding that inguinal compression increases the cross-sectional area of the femoral vein in children more than adults (presented elsewhere), but also that it showed that inguinal compression is effective even in hypovolemic children simulated by Trendelenburg position. (Reviewer-K. George Bojanov, MD).

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Keywords: Femoral Vein Cannulation

Print Tag: Refer to original journal article
Colloid Preload Is Better Than Coload for Maintaining Maternal CO During C-Section

Colloid Preload Versus Coload for Spinal Anesthesia for Cesarean Delivery: The Effects on Maternal Cardiac Output.

Teoh WHL, Sia ATH:


Colloid preload of 15 mL/kg significantly increases maternal cardiac output and stroke volume within 5 minutes after spinal anesthesia for cesarean delivery.

**Objective:** To test the hypothesis that there is no significant difference on maternal cardiac output (CO) between a colloid preload and an identical "coload" (administering the fluid bolus at the time that the local anesthetic block is starting to settle).

**Design/Participants:** Prospective, clinical study involving 40 ASA I and II parturients with term singleton pregnancies, scheduled for elective cesarean delivery under spinal anesthesia.

**Methods:** Patients were randomized to receive either 15 mL/kg of hydroxyethyl starch (HES) 130/0.4 preload (group P, n=20) or identical fluid load initiated at the time of identification of cerebrospinal fluid as coload (group C, n=20). No additional fluid was given after administration of the calculated colloid bolus. Spinal anesthesia was administered in right lateral position using 5% hyperbaric bupivacaine 10 mg and morphine 100 μg at L3/4 level. Heart rate (HR), systolic blood pressure (SBP), stroke volume (SV), and non-invasive CO were measured and recorded at predetermined study intervals in addition to phenylephrine requirements, neonatal outcomes, and side effects.

**Results:** Groups were similar in demographics. There was no group difference with respect to volume of colloid infused and duration of infusion. Baseline SV was significantly lower in group C, while baseline CO and HR were similar for both groups. Five minutes after spinal anesthesia induction, CO was significantly higher in group P, but this difference did not persist past 10 or 20 minutes after spinal anesthesia. Also, 90% of group P and 75% of group C experienced >10% SBP decrease, but the minimum SBP was not significantly different. Nausea was rare in both groups and associated with hypotension. Neonatal outcome, reflected by Apgar scores, was similar between groups.

**Conclusions:** 15mL/kg of colloid preload significantly increased maternal CO in the first 5 minutes after spinal anesthesia for cesarean delivery. However, there were no differences in maternal BP, vasopressor requirements, and neonatal outcomes between groups.

**Reviewer's Comments:** There are few study limitations. There was no control group allowing for estimation of the absolute reduction in the incidence of hypotension. The coload group started with a significantly lower SV, which might have influenced the finding that the preload group maintained better CO within the first 5 minutes after spinal anesthesia. (Reviewer-K. George Bojanov, MD).

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Keywords: Spinal Anesthesia During Cesarean Delivery

Print Tag: Refer to original journal article
Effect-Site Concentration of 2 ng/mL Remifentanil Optimal for Cobra PLA Insertion

The Use of Remifentanil to Facilitate the Insertion of the Cobra Perilaryngeal Airway.

Jeon WJ, Kim KH, et al:


In this study, optimal conditions for inserting the CobraPLA on the first attempt with minimal hemodynamic instability and a shorter duration of apnea were achieved with effect-site concentration of 2 ng/mL remifentanil before 6 μg/mL effect-site concentration of propofol.

**Objective:** To determine the most suitable effect-site concentration of remifentanil which would provide optimal conditions for Cobra Perilaryngeal Airway (CobraPLA) insertion co-administered with propofol.

**Design/Participants:** Prospective randomized clinical study involving 100 adult ASA I and II patients undergoing minor elective surgery.

**Methods:** Participants were randomly allocated to 1 of 4 groups. Group R1 received target effect-site remifentanil concentration of 1 ng/mL, Group R2 received remifentanil 2 ng/mL, Group R3 received remifentanil 3 ng/mL, and Group R4 received remifentanil 5 ng/mL. Target-controlled infusion (TCI) was used to administer study medications. On entry to the operating room, TCI remifentanil was started at the respective target concentration. Anesthesia was started using TCI propofol with target effect-site setting concentration at 6 μg/mL. Insertion of CobraPLA was attempted at loss of consciousness (LOC) and BIS below 40. The ease of insertion of the CobraPLA was graded and the effect-site concentration of propofol at LOC, propofol induction dose, and insertion time was recorded.

**Results:** Study groups were comparable to demographics. The patients with the best conditions for the first CobraPLA insertion were in Group R4 - significantly more than in Groups R1 and R2 ($P<0.01$). The apnea incidence was significantly less in Group R1 than in any other group ($P<0.01$). Groups R1 and R2 showed significantly increased incidence of hypertension 1 minute after CobraPLA insertion ($P<0.01$). Group R4 patients experienced significantly more hypotension at 1 minute after CobraPLA insertion compared to all other groups ($P<0.01$). There were no differences in the incidence of bradycardia among the groups, while Group R1 experienced significantly more tachycardia 1 minute after CobraPLA insertion ($P<0.01$).

**Conclusions:** Optimal conditions for inserting the CobraPLA on the first attempt with minimal hemodynamic instability and a shorter duration of apnea were achieved with effect-site concentration of 2 ng/mL remifentanil before 6 μg/mL effect-site concentration of propofol.

**Reviewer’s Comments:** A limitation of the study is that it did not include a propofol-only control group. Insertion of the CobraPLA was found elsewhere to provide comparable stimulation to insertion of laryngeal mask airway. (Reviewer-K. George Bojanov, MD).

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Keywords: Remifentanil

Print Tag: Refer to original journal article
Vertebra prominens (C7) is a more accurate surface landmark than the tip of the scapula in identifying T7.

Objective: To compare the clinical accuracy of vertebra prominens (C7) and the inferior scapular tip in predicting the position of T7.

Design/Participants: Prospective study involving 210 adult patients presenting to an outpatient diagnostic imaging department for chest radiography.

Methods: Participants were randomized to either C7 (n=106) or a scapular tip study group (n=104). With patients in anatomic position, a senior anesthesia resident attempted to identify the T7 spinous process using 1 of the 2 surface landmarks, depending on the study group designation. A radio-opaque marker was then affixed at the presumed level of the T7 spinous process, and posterior-anterior and lateral chest radiographs were obtained. A radiologist, blinded to the landmarking technique used, interpreted each radiograph and reported the radiologic level of the marker. Data were collected by blinded investigators and statistically analyzed.

Results: Patient demographic characteristics were equally distributed between the study groups. Counting down from vertebra prominens (C7) accurately identified T7 spinous process in 29% of patients compared to the scapular landmark, which identified T7 correctly in only 10% of patients ($P < 0.001$). When identifying T7 ±1 level, the C7 spinous process was also more accurate than the scapular tip (78% versus 42%, respectively). Errors were more common in caudal direction. Age, gender, and height did not influence the accuracy of either method in locating T7. Body mass index <25 allowed for more accuracy in using the service landmarks for T7 identification (44% vs 8% for the C7 and scapular tip landmarking, respectively).

Conclusions: Palpating down from C7 is the more reliable method for determining thoracic vertebral level, and is successful in 78% of patients within 1 interspace.

Reviewer's Comments: A limitation of the study is that all landmarking tasks were conducted by a single researcher. An important point is that in obese patients, neither landmark is accurate in identifying desired thoracic level. Other studies have shown that the intercristal line identifies L4 or the L4-L5 interspace in 78.6% of patients. (Reviewer-K. George Bojanov, MD).

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Keywords: Vertebral Level

Print Tag: Refer to original journal article
These findings question the reliability of anatomical landmarks of the parasacral block technique and raise the possibility of frequent visceral structure puncture.

**Objective:** To examine the anatomy relevant to the parasacral block in healthy volunteers.

**Design/Participants:** Prospective MRI study involving 10 healthy adult volunteers.

**Methods:** Body mass index was calculated for all volunteers. Participants were positioned in lateral position on the MRI table with limb flexed at the hip and knee. Posterior superior iliac spine (PSIS) and the most distal aspect of the ischial tuberosity were marked with MRI markers. A third marker was placed at a point 5cm along a line drawn between the PSIS and the ischial tuberosity. After imaging, a computer-simulated needle was inserted perpendicular to all planes of the skin to assess proximity of the simulated needle tip to the sacral plexus. Structures encountered were noted and distances measured. Following clinical guidelines, if a bone is contacted or there is a failure to elicit a sciatic nerve response to redirect the needle caudally, the simulated needle was "reinserted" at 2 MRI cuts caudad.

**Results:** The computer-simulated needle encountered the sacral plexus 40% of the time on first pass. In 1 individual, the sciatic nerve was encountered rather than the plexus. All plexus contact points were in close proximity to visceral structures. Small bowel was 1.5, 2.3, and 1.7 cm away in 3 volunteers. Ovary was 0.8 and 2.7 cm away in 2 volunteers. In 1 volunteer, the needle encountered a large blood vessel on the way to the sacral plexus and, in another, a major blood vessel <1 cm away. In volunteers with unsuccessful plexus contact (n=5), first needle pass encountered: small bowel, rectum, blood vessels, seminal vesicles, bone, acetabulum, and sacrum. Caudal redirection was unsuccessful in all cases. After caudal redirection, the rectum was pierced in 1 case, perirectal fat was entered in 3, and bone was contacted in 1. PSIS was accurately identified in 9 of 10 cases.

**Conclusions:** The findings question the reliability of anatomical landmarks of the parasacral block technique and raise the possibility of frequent visceral structure puncture.

**Reviewer's Comments:** It seems to me that parasacral blocks are risky endeavors, despite the fact that the study included a very small cohort group and that positioning used might not have been optimal. (Reviewer-K. George Bojanov, MD).

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Keywords: Parasacral Block

Print Tag: Refer to original journal article