Spontaneous, or negative pressure, ventilation is less harmful to perioperative lung function than pressure control ventilation.

**Background:** Obesity and general anesthesia both impair perioperative lung function.

**Objective:** To evaluate the impact of pressure support ventilation (PSV) versus pressure controlled ventilation (PCV) in moderately obese adults on early postoperative lung function.

**Design:** Prospective, randomized clinical trial.

**Participants:** Adult patients undergoing minor surgery under general anesthesia were evaluated. Patients were excluded if they had gastroesophageal reflux disease, asthma, or heart failure, were undergoing laparoscopy, needed intraoperative Trendelenburg positioning, had severe psychiatric disorders, or were anticipated to have a difficult airway.

**Methods:** Patients underwent general anesthesia with a standard induction and maintenance of anesthesia with propofol and remifentanil. All patients had their airway managed with a laryngeal mask airway (LMA); 50% oxygen in air was used for the duration of the surgery. In the patients randomized to PCV, a maximum peak inspiratory pressure of 30 cm H₂O was permitted, and PEEP was applied at 8 cm H₂O to achieve a tidal volume of 6 to 8 mL/kg. Rate and peak pressure were adjusted to maintain an end tidal CO₂ of approximately 30 to 35 mm Hg. In the PSV group, pressure support was adjusted to achieve a tidal volume of 6 to 8 mL/kg and a maximum end tidal CO₂ of approximately 55 to 60 mm Hg. Arterial blood gases were obtained after the insertion of the LMA, before the end of surgery, and at the end of surgery. Postoperatively, a number of standard respiratory parameters were obtained and compared to spirometry readings obtained at the preanesthetic visit.

**Results:** A number of patients in the PSV group were excluded from the analysis because of insufficient ventilation that leads to excess PaCO₂. Preoperative demographics and respiratory parameters were similar between groups. Oxygen saturation decreased to a greater degree in the PCV group. Postoperatively, the PSV group had significantly better lung function than did the PCV group. Some of these effects persisted for up to 24 hours after surgery. Intraoperatively, there was no difference in the blood gas analyses until the end of surgery when the oxygenation index (as demonstrated by a P/F ratio) was better in the pressure group. The pH and PaCO₂ were respectively lower and higher in the PSV group, but there was no obvious adverse outcome from this finding.

**Conclusions:** Pressure support ventilation maintains better function than pressure controlled ventilation in moderately overweight patients scheduled for minor surgery.

**Reviewer’s Comments:** This nicely done study reinforces the notion that spontaneous ventilation, when clinically feasible, is better than mechanical ventilation of any mode. (Reviewer-Allen Miranda, MD).

© 2010, Oakstone Medical Publishing

Keywords: Pressure Support Ventilation, Pressure Control Ventilation, Functional Residual Capacity

Print Tag: Refer to original journal article
Chronic pain after cardiac surgery may develop in almost 10% of patients.

Background: Cardiac surgery is still one of the most common surgical procedures. Development of chronic pain after cardiac surgery has been reported to occur in anywhere from 20% to 60% of patients. These studies have almost all been retrospective.

Objective: To assess chronic pain and health-related quality of life after cardiac surgery.

Design: Prospective, population-based study.

Participants: >500 adult patients undergoing cardiac surgery.

Methods: Baseline, 6-month, and 12-month evaluations of chronic pain using the Brief Pain Inventory and Norwegian Short-Form Survey. Patients were excluded if they underwent emergency surgery, could not read or write Norwegian, had cognitive or psychiatric impairments, or were in poor general health. Chronic pain was defined as pain arising after surgery and persisting either continuously or intermittently for at least 3 months.

Results: >500 patients were enrolled, and almost 90% participated during the 1-year follow-up. Mortality during the 12 months was <3%. Chronic pain was reported in slightly >10% of patients. Some patients reported chronic pain only at 6 or 12 months, and almost one-half reported pain at both intervals. Age and previous cardiac surgery were risk factors for the development of pain in a univariate analysis. However, in the multivariate analysis, only age remained significant. Younger patients were more likely to develop chronic pain. Patients who reported chronic pain were more likely to report lower scores in the health-related quality of life evaluation. This was significant in every scale except for a "role emotional" scale that included role limitations due to emotional problems. Interestingly, the site of pain was not limited to the chest or the leg vein harvest site, with almost 20% of patients reporting chronic pain at "other sites." Pain intensity was rated at moderate to severe relatively frequently and was more likely to be reported this way if pain was at both the leg and sternum.

Conclusions: This study found a lower prevalence of chronic pain after cardiac surgery than previous trials. However, given the large number of patients having cardiac surgery, this is an important health care issue.

Reviewer's Comments: This is an interesting study, and this subject is something that I do not routinely inquire about in patients when they come back to our institution after cardiac surgery. Further trials that investigate potential mechanisms and therapies to prevent the development of chronic pain are warranted. (Reviewer-Allen Miranda, MD).
Cardiac surgery and spinal fusion surgery are associated with the highest prevalence of perioperative visual loss.

**Background:** Perioperative visual loss (POVL) results from cortical blindness, ischemic optic neuropathy, or retinal vascular occlusion (RVO). The prevalence of POVL is unknown among the most commonly performed operations.

**Objective:** To estimate the prevalence of POVL in the 8 most common nonocular surgeries, and to assess potential risk factors.

**Methods:** The Nationwide Inpatient Sample database was used to estimate the prevalence of POVL in the 8 most common nonocular surgeries. These surgeries included knee arthroplasty, cholecystectomy, hip/femur surgical treatment, spinal fusion, appendectomy, colorectal resection, laminectomy without fusion, coronary artery bypass grafting, and cardiac valve procedures. Approximately 5.7 million patients who underwent any of the 8 surgeries from 1996 to 2005 were included. Patients and surgical characteristics included age, gender, Charlson comorbidity index, blood transfusion, anemia, and admission status. Univariate and multivariate logistic regression analysis were used to identify risk factors for POVL.

**Results:** The overall prevalence of POVL was 2.35 per 10,000 (0.0235%). Cardiac and spinal fusion surgery had the highest rates of POVL (0.09% and 0.03%, respectively) while the lowest rate was for appendectomy (0.001%). Significant risk factors for POVL were male gender, age <18 years, Charlson index >0, blood transfusion, anemia, and spinal (0.03%), orthopedic (0.016%) and cardiac (0.09%) surgery. POVL was secondary to RVO in the majority of cases (66%). There was a decrease over time in the prevalence of POVL from 1996 to 2005.

**Conclusions:** The results of the study agree with previous findings of a high prevalence of POVL in cardiac and spinal fusion surgery and show, for the first time, a higher risk in orthopedic surgery. The majority of risk factors associated with POVL appear to be unmodifiable. However, health care providers may modify the state of anemia and blood transfusion.

**Reviewer’s Comments:** In 2006, the American Society of Anesthesiologists published a practice advisory for POVL associated with spinal surgery in the prone position. According to the report, the incidence of POVL is <0.2% in spinal surgery. Vascular disease, anemia, prolonged procedures, and substantial blood loss increase the risk of POVL. The use of deliberate hypotensive techniques during spinal surgery has not been shown to be associated with the development of POVL. High-risk patients should be positioned so that their heads are level with or higher than the heart when possible. Consideration should be given to the use of staged spinal procedures in high-risk patients. High-risk patients should also be informed that there is a small, unpredictable risk of perioperative visual loss. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Perioperative Visual Loss, Nonocular Surgery, Prevalence

Print Tag: Refer to original journal article
Cricoid pressure obliterates the hypopharynx even when there is lateral displacement of the cricoid cartilage.

**Background:** Cricoid pressure (CP), described by Sellick in 1961, is a technique used to reduce aspiration during general anesthesia induction by pressing the cricoid cartilage against the cervical vertebra and compressing the esophagus. It has been argued by Smith that the esophagus is lateral to the cricoid cartilage in 50% of subjects without CP and in 90% of subjects after CP. Therefore, CP may be ineffective in compressing the esophagus.

**Objective:** To define the anatomy of CP and to investigate the effectiveness of CP in compressing the hypopharynx.

**Design:** Observational prospective clinical study.

**Participants/Methods:** 24 adult volunteers underwent neck MRI with and without CP in the sniffing, neutral, and extended neck positions. CP was applied by an experienced anesthesiologist using the thumb and index finger, applying 2 to 4 kg of pressure. Measurements included the anteroposterior diameter of the postcricoid hypopharynx, airway diameter inside the cricoid ring, and lateral displacement of the cricoid ring during application of CP. MRIs were obtained from 3 cm above to 3 cm below the cricoid cartilage.

**Results:** CP significantly reduced the AP diameter of the postcricoid hypopharynx by 35% in all 3 neck positions. The mean change was 2.6 mm. The airway diameter was reduced by 1 mm in all positions by the application of CP. CP resulted in lateral displacement of the cricoid cartilage in 17%, 25%, and 33% of subjects in the sniffing, neutral, and extended positions, respectively. The postcricoid hypopharynx was compressed to the same degree in all cases of lateral displacement. The origin of the esophagus was inferior to the cricoid cartilage and was not observed.

**Conclusions:** The hypopharynx, not the esophagus, is compressed by CP. The compressing effect of CP on the hypopharynx is sustained even when there is lateral displacement of the cricoid cartilage. The authors posed the question, "Does 35% compression of the postcricoid hypopharynx prove the efficacy of the Sellick's maneuver?" Based on their results, the authors inferred that the lumen becomes obliterated, and the Sellick's original proposal is confirmed.

**Reviewer's Comments:** CP is a ritual and essential part of rapid sequence induction applied to prevent aspiration of gastric contents. This study demonstrates the efficacy of CP in obliterating the hypopharynx by 2.6 mm but not completely occluding it. Recent studies have shown that CP may decrease lower esophageal sphincter pressure, which may actually increase the risk of reflux in patients with a full stomach. There are also concerns of esophageal rupture and the effectiveness of this technique in difficult or failed intubation. Therefore, CP should not be used nonselectively but should be directed to individuals with a risk of reflux and aspiration. (Reviewer-Ioanna Apostolidou, MD).

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**Keywords:** Cricoid Pressure, Hypopharynx, Esophagus

**Print Tag:** Refer to original journal article

Overall, there is no association between intraoperative hypotension and 1-year death rate.

**Background:** Prolonged intraoperative hypotension (IOH) compromises organ perfusion and may result in end-organ damage or death. There is no consensus on the correct definition of IOH. Recent publications reported a wide range of IOH incidence that was attributed to different definitions. In addition, studies on the association between IOH and adverse outcomes produced conflicting results. Indeed, a recent meta-analysis supports the idea that moderate hypotension may improve the outcome in orthopedic surgery by reducing blood loss and transfusion requirements.

**Objective:** To assess the association between IOH and 1-year mortality after noncardiac surgery with a series of frequently used definitions of IOH.

**Design:** Observational prospective cohort study.

**Methods:** The study sample was selected from a previous prospective study, the Outpatient Preoperative Evaluation by Nurses study; 1705 consecutive adult patients who underwent general and vascular surgery under general, spinal, epidural, or combined general-epidural anesthesia from 2002 to 2003 were selected for the study. Preoperative data were obtained from the preoperative evaluation, and intraoperative data were obtained from electronic record-keeping systems. Definitions of IOH were decided using 4 systolic blood pressure (BP) thresholds (100, 90, 80, and 70 mm Hg), 4 mean BP thresholds (70, 60, 50, and 40 mm Hg), and 4 relative thresholds to baseline (10%, 20%, 30%, and 40% decrease from baseline) lasting for 1, 5, or 10 minutes. A total of 48 definitions were created. The end point was 1-year mortality after surgery. Multivariate regression model analysis was used to adjust for confounding variables such as age, sex, body mass index, smoking, comorbidities, surgery type, and cumulative exposure to anesthetics.

**Results:** The overall 1-year mortality after surgery was 5.2% (88 patients), with cancer being the predominant cause of death (22%). Although Kaplan-Meier curves for patients with and without IOH showed differences in survival, these differences were not observed after adjustment for confounding variables. However, additional analysis in elderly patients showed an association between IOH and 1-year mortality. There was also a trend toward greater 1-year mortality with lower BP thresholds (systolic BP of 80 mm Hg, mean BP of 60 mm Hg, and mean BP of 40% to 50%).

**Conclusions:** This study did not find an association between the various thresholds of IOH and 1-year mortality. The authors noted that there was a trend of increasing risk, but that it was not statistically significant with the most frequently used definition of IOH. They concluded that the issue remains debatable, and no firm conclusions can be made on the lowest acceptable IOH threshold.

**Reviewer’s Comments:** The results of this study remind us that the BP required to maintain adequate blood flow to vital organs varies between patients, and factors other than BP determine tissue perfusion. Anesthesiologists should continue using relative rather than absolute thresholds for IOH and customize therapy to each patient. (Reviewer-Ioanna Apostolidou, MD).

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Keywords: Intraoperative Hypotension, 1-Year Mortality

Print Tag: Refer to original journal article
In patients undergoing subarachnoid block, those positioned sitting upright have a decreased incidence of needle-induced paresthesia.

**Objective:** To evaluate the incidence of needle-induced paresthesia related to patient positioning during subarachnoid block.

**Design:** This study was prospective in nature with patients being enrolled over a 2-year period.

**Participants:** Adult patients aged 18 to 80 years who were scheduled for surgery under spinal anesthesia.

**Methods:** Patients enrolled in the study received a subarachnoid block in either the sitting or lateral decubitus position. The position chosen was based on the type of surgical procedure scheduled. For instance, for single lower-limb surgery, spinal anesthesia was performed in the lateral decubitus position, while patients undergoing perineal surgical procedures were positioned sitting upright. Premedication prior to block placement consisted of 1 to 2 mg midazolam. All subarachnoid blocks were performed by 1 of 2 anesthesiologists at either the lumbar 3-4 or lumbar 4-5 interspace via a midline approach. A 25-gauge 90-mm Sprotte spinal needle was utilized with the local anesthetic, and the dose was chosen at the discretion of the anesthesiologist performing the block. If a paresthesia was elicited during block placement, needle advancement was stopped, and the needle was redirected. If the paresthesia resolved, the anesthesiologist then checked for cerebrospinal fluid. If there was a return of cerebrospinal fluid, the dose of local anesthetic was administered, and the block was completed. However, if the elicited paresthesia did not resolve with needle redirection, a new puncture was performed. No local anesthetic was administered on any paresthesia encountered.

**Results:** 620 patients were enrolled in the study. Of these, 478 patients had subarachnoid block performed in the lateral decubitus position, with the remaining 142 patients positioned sitting upright during block placement. No significant difference was found in the number of puncture attempts or success rate between the 2 positions. However, overall there was a significantly higher incidence of needle-induced paresthesia with the lateral decubitus position (17% vs 9%). If only a single-pass attempt was needed for the successful return of cerebrospinal fluid, there was no statistical difference in the incidence of needle-induced paresthesia between the 2 positions. No patient enrolled in the study complained of any postoperative nerve injury.

**Conclusions:** There was a higher incidence of needle-induced paresthesia with lateral decubitus positioning when >1 puncture attempt was necessary. This may be due to unintentional introduction of the spinal needle out of the sagittal plane, resulting in needle contact with a spinal nerve root. This may be related to lumbar spine rotation or movement of the spinal roots downward with lateral decubitus positioning.

**Reviewer's Comments:** The elicitation of a paresthesia during any type of regional block should always be appreciated by the anesthesiologist performing the block. One should never ignore this type of patient feedback. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Spinal Anesthesia, Paresthesia

Print Tag: Refer to original journal article
The use of ultrasound guidance for thoracic paravertebral blockade provides visualization of key landmarks that assist in performing the block.

**Objective:** To demonstrate an ultrasound technique for performing thoracic paravertebral blockade.

**Participants:** The study participants were female patients scheduled to undergo mastectomy or wide local excision with or without associated lymph node sampling or axillary clearance.

**Methods:** The authors first utilized a male cadaver as a developmental means for establishing an ultrasound-guided technique for performing thoracic paravertebral blockade and subsequent catheter placement. With ultrasound guidance, 5 thoracic levels on each side were visualized in order to identify key landmark structures such as the transverse processes, superior costotransverse ligament, paravertebral space, and parietal pleura. Dye injection or actual catheter placement was performed to assess the accuracy of ultrasound guidance in hitting the intended target. Actual dissection was then performed as a secondary follow-up for assessment. The information obtained from the cadaver initiated the study consisting of 10 patients. The thoracic third vertebral level was palpated by counting downward from the vertebra prominens. The ultrasound transducer was then placed 2.5 cm lateral to this level to obtain visualization of the transverse process, superior costotransverse ligament, and parietal pleura. An 18-gauge Tuohy needle was advanced using the needle-in-plane approach looking for real-time visualization of entry past the superior costotransverse ligament. An initial dose of saline was injected to visualize displacement of the parietal pleura. A catheter was then threaded into the paravertebral space and bolused with 0.3 mL/kg of 0.25% bupivacaine. Block assessment was performed 20 minutes after block completion. All patients then underwent a standardized general endotracheal anesthetic intraoperatively. After completion of surgery, a continuous infusion of 0.25% bupivacaine at 5 mL/hr was administered through the paravertebral catheter.

**Results:** Of the 10 study patients, 9 had successful preoperative placement of a thoracic paravertebral catheter. At the 20-minute assessment period, two-thirds of the patients had partial or complete sensory loss. This number increased to 100% when block assessment was performed again in postoperative recovery.

**Conclusions:** The use of ultrasound with the described technique provides a consistent visualization of the intended structures, resulting in successful thoracic paravertebral blockade and catheter placement.

**Reviewer's Comments:** At our institution, we had a patient who suffered a pneumothorax related to thoracic paravertebral blockade requiring chest tube insertion. We perform blockade at multiple thoracic levels, as we feel this provides for greater and more complete coverage compared to the single-level injection technique. With the technique utilizing multiple levels, it would be reasonable to assume that the chance of having a pneumothorax complication would be higher. Perhaps with the use of ultrasound visualizing the parietal pleura such as described in this article, we will be able to avoid this particular complication in the future. (Reviewer-Michelle L. Schlunt, MD).

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Keywords: Ultrasound, Paravertebral Block

Print Tag: Refer to original journal article
Cerebral Oxygenation Improves With Increases in FiO2 and PETCO2

The Influence of Inspired Oxygen Fraction and End-Tidal Carbon Dioxide on Post–Cross-Clamp Cerebral Oxygenation During Carotid Endarterectomy Under General Anesthesia.

Picton P, Chambers J, et al:

Anesth Analg 2010; 110 (February): 581-587

Increased FiO2 and increased PETCO2 are associated with improved regional cerebral oxygenation during carotid endarterectomy with general anesthesia.

Background: Inspired oxygen fraction (FiO2) and end-tidal carbon dioxide (PETCO2) have an effect on cerebral vasculature. Studies in awake patients undergoing carotid endarterectomy (CEA) have demonstrated that increasing FiO2 improves regional cerebral oxygenation (rSO2).

Objectives: To determine the effects of FiO2 and PETCO2 on rSO2 in patients undergoing CEA under general anesthesia. Methods/Patients: 20 patients undergoing CEA under general anesthesia were enrolled in the study. Of these, 10 patients had shunts placed, and 10 did not. rSO2 was recorded bilaterally. Measurements were obtained after the patient has been exposed for 5 minutes to: (1) FiO2 30%, PETCO2 30 to 35 mm Hg; (2) FiO2 100%, PETCO2 30 to 35 mm Hg; and (3) FiO2 100%, PETCO2 40 to 45 mm Hg. Patients served as their own controls.

Results: In unshunted patients, an increase of FiO2 while maintaining PETCO2 at 30 to 35 mm Hg resulted in an 8% increase in rSO2 on the operative side and a 6% increase in the nonoperative side. Increasing PETCO2 to 40 to 45 mm Hg increased rSO2 by 6% on the operative side and 5% on the nonoperative side. In shunted patients, the increase in rSO2 due to increased FiO2 was 4% in both hemispheres. A PETCO2 increase to 40 to 45 mm Hg induced a 3% increase in rSO2 on the operative side and a 4% increase on the nonoperative side.

Conclusions: Increasing FiO2 and PETCO2 can improve rSO2 in patients undergoing CEA under general anesthesia.

Reviewer's Comments: All of us intuitively think that more oxygen and less hypocapnia deliver more oxygen to the brain tissue. Whether the theoretical improvement translates into a clinically significant improvement of outcome remains to be elucidated. Currently, we do know that in several case reports of patients undergoing CEA under regional anesthesia, transient neurologic deficits could be reversed by 100% FiO2. The results of the presented study add to the reports of beneficial effects of supplemental oxygen on cerebral oxygenation during CEA under general anesthesia with no serious side effects. Whether additional clinical benefit can be induced by an increase of PETCO2 to high normal remains to be shown. Currently, we have reports of improved rSO2 with increase of PETCO2 from 30-35 to 40-45 mm Hg. This is supported by physiologic principles of cerebral vasoconstriction and leftward shift of oxygen dissociation curve induced by hypocapnia. On the other hand, there are reports in the literature that show paradoxical improvement in cerebral blood flow during CEA induced by hypocapnia, explained by preferential flow to ischemic brain. Contradictory results may be explained by different individual responses of patients, and further studies are necessary to clarify the clinical significance of reported effects. (Reviewer-Mojca Remskar Konia, MD).

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Keywords: Inspiratory Oxygen Fraction, Regional Cerebral Oxygenation, CEA, General Anesthesia, End-Tidal Carbon Dioxide

Print Tag: Refer to original journal article
Preoperative pulse pressure is a predictor of long-term survival after coronary artery bypass grafting.

**Background:** Previous studies have demonstrated that widened pulse pressure (PP) predicts coronary disease better than systolic or diastolic blood pressure and is a risk factor for cardiovascular mortality. Studies have further demonstrated an association between increased PP and adverse renal, cerebral, and cardiac outcome during hospital stays following cardiac surgery. 

**Objective:** To demonstrate that widened PP prior to surgery is associated with decreased long-term survival in patients undergoing coronary artery bypass graft (CABG) surgery.

**Design/Participants:** This retrospective, observational study enrolled 973 subjects undergoing CABG. 

**Methods:** Preoperative PP was defined as a median of 3 measurements before initiation of anesthesia. Recorded covariates were mean arterial pressure, systolic and diastolic blood pressure, diabetes, aprotinin use, cardiopulmonary bypass time, and Hannan risk index.

**Results:** The median follow-up period was 7.3 years. A total of 220 deaths were recorded during that period, 94 of which were of cardiovascular causes. Widened PP prior to induction of anesthesia, Hannan risk index, diabetes, and duration of cardiopulmonary bypass were predictors of decreased long-term survival. Systolic, diastolic, and mean blood pressure prior to anesthesia were not demonstrated to be associated with long-term survival. The authors point out that the hazard ratio for PP was 1.11 per 10 mm Hg increase in PP.

**Conclusions:** Preoperative PP is a predictor of long-term survival following CABG. Classical parameters, such as systolic and diastolic pressure or mean arterial pressure, are not predictors of long-term survival in these patients.

**Reviewer's Comments:** PP reflects changes in the stiffness of the central arterial system. As the aorta and large arteries become less compliant, the PP increases. The decreased compliance of the arterial system results in increased left-ventricular end-systolic afterload and stress, hypertrophy of the left-ventricle, increased myocardial oxygen consumption, and diastolic dysfunction. Several studies, including the presented study, have demonstrated an association between PP and cardiovascular morbidity and mortality. Based on the results of this study and previous studies, it would seem prudent to include PP in the models of surgical risk assessment. Usually recorded parameters, such as systolic blood pressure and diastolic blood pressure, seem to be poor predictors of surgical risk. (Reviewer-Mojca Remskar Konia, MD)
Dexmedetomidine and propofol have similar effects on lower esophageal sphincter pressure.

**Background:** Laxity of the lower esophageal sphincter (LES) or increased abdominal pressures lead to regurgitation of the gastric contents and aspiration. This LES pressure (LESP) is governed by many neurotransmitters, hormones, and peptides. Many anesthetic agents, IV as well as inhalational, have a variety of effects on the LES, which could lead to decreased LES tone and aspiration, thus increasing morbidity. Propofol, a commonly used agent, relaxes the LES, which may increase aspiration. Dexmedetomidine acts via a similar pathway as propofol and should relax the LES, though its effects on the LES have not been studied.

**Objective:** To evaluate the dose-dependent effects of propofol and dexmedetomidine on LESP and gastroesophageal pressure gradient (GEPG).

**Participants/Methods:** 11 patients (age range, 11 to 40 years) were recruited. Those with a history of gastroesophageal reflux disease (GERD), alcohol abuse, pregnancy, and heartburn were excluded from the study. Patients were randomized to 1 of 2 groups (propofol or dexmedetomidine were given as target controlled infusions). Propofol was given as 1, 2 and 4 µg/mL, and dexmedetomidine was given as 0.6, 1.2 and 2.4 ng/mL. Each was maintained for 40 minutes and then increased to the next higher concentration. In addition to routine monitoring, Bispectral Index (BIS) monitoring, as well as esophageal monitoring, with 4 pressure sensors was done. Pressures were recorded at baseline of the gastric, LES, and distal esophageal peristalsis and again after 20 and 40 minutes of starting the sedative infusions.

**Results:** The demographic data of the 11 patients were comparable. The LESP was similar at baseline and after each dose of either propofol or dexmedetomidine, and the difference was not statistically significant. The difference in mean GEPG was again not statistically significant between propofol and dexmedetomidine. Mean arterial pressures and heart rate differed significantly between the groups. **Discussion:** At baseline, LESP and GEPG were similar and within the normal range. Since the drugs produced similar effects on LESP and GEPG, their choice for sedation should be based on characteristics other than LESP/GEPG. Neither drug increased the aspiration potential; therefore, other side effects, such as respiratory depression and bradycardia, should be considered rather than regurgitation and reflux. Dexmedetomidine has better respiratory stability, easier arousability, and minimal hypotension and bradycardia, while propofol can induce respiratory depression, hypotension, and negligible bradycardia. BIS values were identical, thereby concluding that the 3 doses of drugs had similar effects on LESP and GEPG.

**Reviewer's Comments:** This interesting study shows that the effects of dexmedetomidine and propofol were similar on LESP's and can be effectively used for sedation. However, a watch should be kept for bradycardia during dexmedetomidine administration and hypotension during propofol administration. (Reviewer-Sunita Goel, MD).

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**Keywords:** Dexmedetomidine, Propofol, LES Pressure

**Print Tag:** Refer to original journal article
Cricoid force of 30 N, used often during rapid sequence induction, leads to compression and distortion of the airway in children.

**Background:** Cricoid force (CF) is often used to prevent regurgitation of the stomach content during rapid sequence induction.

**Objective:** To determine the effects of different CFs on the calibre of the upper airway in children.

**Design:** Prospective clinical study.

**Participants:** 30 children having routine bronchoscopy or another operation requiring general anesthesia with intubation of the trachea.

**Methods:** In cases of routine bronchoscopy, the ENT surgeon carried out the procedure, while in cases of another procedure, the bronchoscopy was carried out by the principal investigator. All bronchoscopies were carried out with the rigid telescope 4 mm Hopkins Rod. Two anaesthetic protocols were used (bronchoscopies: sevoflurane, 100% oxygen, and lidocaine spray; other procedures: IV induction and atracurium). The cricoid pressure device included a force gauge calibrated to 1 Newton (N). The device was placed on the neck and had a variable aperture that mimicked the fingers. After insertion of the bronchoscope, visualization on a full screen was performed, and the cricoid pressure was applied posteriorly at a perpendicular angle to the neck. The force of the device was slowly increased until the subglottic airway became distorted or narrowed by 50%. The CF was then stopped, and the force was recorded in Newtons; afterwards, anesthesia was performed as usual. Data were analyzed as 4 groups: A <1 year; B, 1 to 4 years; C, 4 to 8 years; and D <8 years. The groups were compared using a Student’s t-test.

**Results:** The mean CF to produce 50% occlusion in A, B and C was 7.88 N, 9.19 N, and 10 N, respectively, compared to 16.22 N in D, the older children. There was a linear relationship between age, weight, and CF.

**Conclusions:** A force of approximately 15 N would be reasonable in children ≥10 years of age, but the recommendation of 30 N appears to be excessive in all pediatric age groups.

**Reviewer’s Comments:** Since there were 2 small groups, one with and the other without skeletal muscle relaxants, a larger group may be required to evaluate this to see if there is any difference in pressure required to produce 50% occlusion of the airway. (Reviewer-Olga Plattner, MD).

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Keywords: Children, Cricoid Force, Airway Calibre

Print Tag: Refer to original journal article
Ibuprofen plus acetaminophen provides very good pain relief after oral surgery.

**Background:** Nonsteroidal anti-inflammatory drugs (NSAIDS) are often used to treat postoperative pain. Acetaminophen is also used to treat postoperative pain at a dose of 4 g/day. A combination of NSAIDS plus acetaminophen (Maxigesic®) is available for use in the marketplace.

**Objective:** To evaluate the efficacy of Maxigesic in comparison to single use of either acetaminophen or ibuprofen in postoperative pain relief.

**Design:** Randomized, blinded, prospective, clinical study.

**Participants:** Adult patients having oral surgery (wisdom tooth or teeth extraction).

**Methods:** Patients were randomly assigned following the exclusion criteria according to the protocol to either group: (1) acetaminophen 500 mg plus ibuprofen 150 mg per tablet; (2) acetaminophen 500 mg per tablet; or (3) ibuprofen 150 mg per tablet. The patients were asked to take the tablets according to their randomization before the operation and then 4 times per day, up to 48 hours. If the pain relief was not adequate, fentanyl IV was given in the hospital or codeine after discharge. Pain was recorded on a 100 m visual analog scale (VAS) in a certain time order. The VAS ratings and the area under the curve (AUC) divided by time at rest and on activity was the primary outcome of the study. Side effects were also recorded. Pharmacokinetic data (plasma concentrations of acetaminophen and ibuprofen) were obtained through blood samples from 30 patients. Data were analyzed using SPSS version 15.0. A one-tailed $P \leq 0.05$ was statistically significant.

**Results:** 135 patients participated and 122 were analyzed. Time-adjusted AUCs were significantly lower at rest and on activity in the combined drug group than in either of the other two.

**Conclusions:** The combination of ibuprofen and acetaminophen provides very good pain relief after oral surgery.

**Reviewer's Comments:** The data are consistent with other studies showing that the combination of ibuprofen and acetaminophen provides more pain relief than application of either drug on its own. However, the optimal dosage has not been evaluated yet and could modify the pain relief. (Reviewer-Olga Plattner, MD).

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Keywords: Oral Surgery, Postoperative Pain, Acetaminophen, Ibuprofen

Print Tag: Refer to original journal article
Plasmapheresis for Cardiac Surgical Patients With HIT

Plasmapheresis and Heparin Reexposure as a Management Strategy for Cardiac Surgical Patients With Heparin-Induced Thrombocytopenia.

Welsby IJ, Um J, et al:

Anesth Analg 2010; 110 (January): 30-35

Intraoperative plasmapheresis is effective in treating patients with known heparin-induced thrombocytopenia.

Objective: To review the use of intraoperative plasmapheresis in the management of patients with a history of heparin-induced thrombocytopenia (HIT) undergoing cardiac surgery requiring cardiopulmonary bypass (CPB).

Design/Participants: Retrospective chart review of 11 adult patients with a history of HIT undergoing cardiac surgery with CPB.

Methods: This retrospective review included all cardiac surgical patients with a documented history of HIT and a positive antiheparin/platelet factor 4 (anti-HPF4) antibody titer, who received intraoperative plasmapheresis between November 2004 and June 2008 and were managed with heparin anticoagulation during CPB. Plasmapheresis was performed after induction of general anesthesia and endotracheal intubation. If hemodynamic conditions allowed, plasmapheresis was performed before heparinization. But, if necessary, heparin was given and plasmapheresis accomplished during CPB. Because heparin is removed during plasmapheresis, additional heparin was infused. Postoperatively, bivalirudin anticoagulation was started if the platelet count was suggestive of HIT. Coumadin was used to manage postoperative anticoagulation for patients with mechanical heart valves, ventricular assist devices, and/or HIT.

Results: The median preoperative antibody titer was 0.8, and a single plasmapheresis reduced titers by 50% to 84%. After treatment, 6 of the 9 patients with available postoperative studies had normal HPF4 titers. In the other 3 patients, titers were reduced by 48%, 68%, and 78%, respectively. In these 3 patients, platelet counts recovered to normal after surgery and were stable. Anticoagulation was not required to treat HIT in any of the patients. Seven of the 11 patients were not electively anticoagulated after the surgery, while the remaining 4 patients, with mechanical heart valves or ventricular assist devices, were bridged to Coumadin with IV bivalirudin. Three of the 11 patients died and 1 had an ischemic foot, all due to secondary causes not related to HIT.

Conclusions: Intraoperative plasmapheresis effectively reduces antibody load and decreases the thrombotic risk associated with high anti-HPF4 titers in addition to decreasing the urgency for postoperative anticoagulation.

Reviewer’s Comments: Currently, the American College of Chest Physician guideline recommends that patients with a history of HIT should not be re-exposed to heparin until antibody titer levels are undetectable. Non-heparin anticoagulants such as recombinant hirudin, argatroban, danaparoid, fondaparinux, ancrod and bivalirudin, are available and associated with various technical difficulties and possible complications when used to manage anticoagulation during CPB. (Reviewer-K. George Bojanov, MD).

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Keywords: Heparin-Induced Thrombocytopenia, Heparin Reexposure, Plasmapheresis

Print Tag: Refer to original journal article
Remifentanil PCA is more effective than meperidine and fentanyl, but is also associated with more sedation and itching compared to the others.

**Background:** Epidural anesthesia is most effective for pain relief during labor. However, if contraindicated or refused, the alternatives are opioids.

**Objective:** To evaluate the efficacy of meperidine, remifentanil, and fentanyl in patient-controlled analgesia (PCA).

**Design:** Prospective, randomized, blinded clinical study.

**Participants:** 180 parturients.

**Methods:** The women were randomly assigned to 1 of the 3 following preprogrammed PCA devices. Group R women received remifentanil in a 40-µg loading dose followed by remifentanil 40 µg per bolus with a lockout time of 2 minutes and a maximal dose of 1200 µg/hr. Women in Group P received meperidine in a 49.5-mg loading dose and 5 mg boluses with a lockout time of 10 minutes and a maximum dose of 200 mg. Group F women received fentanyl given as a 50-µg loading dose and boluses of 20 µg with a lockout time of 5 minutes and a maximum of 240 µg per hour. Measurements were made by blinded observers. Vital parameters were measured every 30 minutes, and adverse effects were treated. Nausea, vomiting, and itching were recorded. Pain scores were assessed with the visual analog scale (range, 0 to 10) each hour during contractions. A sedation score (1 = awake to 5 = unrousable) was recorded hourly. Two hours after delivery, the women were asked to score their overall satisfaction on a 10-point scale. Neonatal outcome including Apgar scores, cord blood gas analysis, including opioid concentrations, and the Neurologic and Adaptive Capacity Score (NACS) was recorded at certain time points. Mothers’ blood samples were also measured for opioid concentrations. Numerical variables between the groups were compared using the two-tailed Kruskal-Wallis test and post hoc Dunn’s multiple comparison test. \( P < 0.05 \) was considered significant.

**Results:** 159 parturients completed the study. In all groups, baseline pain scores decreased significantly from baseline 1 hour after start of treatment. Three hours after treatment, pain scores did not differ from baseline in any group. At 2 hours, pain scores in Group P were similar to baseline. Intergroup comparisons showed that the decrease in pain scores after 1 hour was greater in Group R compared to the other groups.

**Conclusions:** Remifentanil PCA was more effective than meperidine and fentanyl, but also showed more sedation and itching compared to the others.

**Reviewer’s Comments:** The maximal decrease in pain scores was above 4.5 on the visual analog scale, and therefore, a background infusion next to the bolus applications could have improved analgesia treatment. One also needs to see transplacental passage and effects on the baby. One would suspect that remifentanil would be better in this regard. (Reviewer-Olga Plattner, MD).
Can the GlideScope Facilitate NGT Insertion?

The GlideScope Facilitates Nasogastric Tube Insertion: A Randomized Clinical Trial.
Moharari RS, Fallah AH, et al:
Anesthesiology 2010; 110 (January): 115-118

The GlideScope can speed insertion of nasogastric tubes in anesthetized adult patients.

**Objective:** To evaluate the effectiveness of the GlideScope as an aid to nasogastric tube (NGT) placement.

**Design/Participants:** Prospective, controlled clinical study involving 80 adult surgical patients requiring NGTs during operations on the gastrointestinal tract, gallbladder, and/or biliary tract.

**Methods:** Patients were randomized into 2 groups, control and GlideScope. A single anesthesiologist was responsible for inserting the NGTs in both groups. While no assistive device was used in the control group, the blade of the GlideScope was used in the GlideScope group to lift the tongue and the tracheal tube in order to provide better visualization of the pharynx. In both groups, the NGT was passed through the patient's nose, while the endotracheal tube cuff was released and the patient's chin lifted. A successful NGT insertion was defined as passage of the tube in <3 attempts. The number of NGT insertion attempts, repositioning, duration of the NGT placement, and complications were compared between the 2 groups.

**Results:** Patients in the study groups were similar in respect to demographic characteristics. The NGT was not placed successfully within 3 attempts in 4 of the control group patients and in 1 patient in the GlideScope group. The first attempt for inserting the NGT was successful in the majority of patients in the GlideScope group (34 vs 23; \( P =0.007 \)). The mean intubation time in the control group was 38.6 ± 29 seconds compared to 10.9 ± 9 seconds in the GlideScope group. The difference between the mean intubation times between the 2 groups was statistically significant. Complications, including pharyngeal bleeding and mucosal injury, were observed in 14 patients (35%) in the control group and 8 patients (20%) in the GlideScope group (\( P=ns \)).

**Conclusions:** GlideScope can improve NGT insertion speed and possibly reduce complications in anesthetized patients.

**Reviewer's Comments:** This study has 2 minor limitations. The sample size is insufficient to unequivocally reject the null hypothesis regarding success and complication rates, and patients with known difficult pharyngeal pathology were excluded from the study. In addition GlideScope-assisted NGT insertion was not compared to the use of any of the direct laryngoscopy blades in assisting NGT insertion. (Reviewer-K. George Bojanov, MD).

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Keywords: GlideScope, Nasogastric Tube Insertion

Print Tag: Refer to original journal article
Smaller diameter needles for regional anesthesia are recommended to minimize severity of nerve injury.

**Background:** Regional anesthesia carries the risk of nerve injury.

**Objective:** To compare nerve injury caused by cannulas with different diameters.

**Design:** An experimental animal study involving 5 pigs.

**Methods:** The pigs were anesthetized according to the protocol. The axillary plexus was opened by blunt dissection on both sides. The nerve connective tissue within the vascular nerve sheath was not removed. After identification of the nerves (musculocutaneous, median, radial, and axillary) 24 G and 19 G needle perforations were performed (group 19 G, n=4; group 24 G, n=4). The cannulas were left in place 40 seconds before removal. Then the tissues were closed and sutured, and antibiotics were given. After 48 hours, the wound was reopened, photos were taken, and the tissue was removed for analysis. Histology (hematoxylin-eosin staining) and immunohistochemistry was performed to detect puncture sites, inflammatory cells, and hematoma. Macrophages or myelin was detected by the Kluver-Barrera technique of staining. A specific injury score was developed: 0=no injury signs; 1=areas with slight accumulation of inflammatory cells; 2=areas with distinctive signs of inflammation; 3=areas with distinctive signs of inflammation plus hematoma; and 4=areas with distinctive signs of inflammation plus myelin damage. SPSS software for windows was used to perform statistical analysis.

**Results:** 48 nerves were examined. Hematoma and myelin damage was associated with the accumulation of inflammatory cells and occurred predominately in the larger size diameter group (19 G). The nerve injury score was lower in group 24 compared to group 19.

**Conclusions:** Smaller diameter needles for regional anesthesia are recommended to minimize severity of incidental nerve injury.

**Reviewer's Comments:** This experimental study was well demonstrated, but there was lack of functional assessment and post-interventional assessment. Patients are usually sedated or awake and not completely anesthetized, which also prevents nerve injuries due to perforation. (Reviewer-Olga Plattner, MD).
There is no association between the depth of anesthesia and the occurrence of POCD.

**Background:** Monitoring of depth of anesthesia is gaining increasing interest, and there are several different monitors available to record the cerebral state.

**Objective:** To evaluate the postoperative cognitive dysfunction (POCD) 1 week after anesthesia in patients scheduled for elective noncardiac surgery.

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

**Participants:** 70 patients ≥60 years of age and having elective noncardiac surgery were included.

**Methods:** All patients were anesthetized with propofol, remifentanil, or fentanyl. Premedication was not routinely used, and nitrous oxide was not used. Neuromuscular blocking agents were used at the discretion of the anesthesiologist. For the postoperative pain therapy, the standardized hospital practice was used. The depth of anesthesia was assessed by electroencephalography (EEG) using the cerebral state monitor (CSM). The cerebral state index (CSI) is a value on the scale between 100 (fully awake) and 0 (flat EEG) similar to the bispectral index (BIS) between 40 and 60, which indicates adequate depth of anesthesia. Several neuropsychological tests were performed the day before surgery and 1 week after surgery. The duration of each test was approximately 30 minutes. The tests were the Visual Verbal Learning test, the Concept Shifting test, the Stroop Colour Word Interference test, and the Letter Digit Coding test. The cumulative number of words recalled, the delayed recall, the time and number of errors, and the number of correct answers was analyzed. To correct for learning effects, normative data had been previously obtained from 176 healthy age-matched controls. The resulting difference between preoperative and 1 week after surgery were divided by the SD of the controls resulting in a Z score for each test. POCD was defined as when the Z scores were >1.96.

**Results:** 65 patients were analyzed. The mean CSI was 43, with no significant difference in the occurrence of POCD. Deep anaesthetic time and light anaesthetic time were not different between the groups. No correlations were found between the Z scores.

**Conclusions:** There was no association between the depth of anesthesia and the occurrence of POCD.

**Reviewer's Comments:** Opioid use should have been standardized because it is known that after the use of remifentanil, the postoperative pain medication requirements are higher than in patients who received longer lasting opioids. Also, the use of muscle relaxation has been previously shown to interfere with the CSI values. (Reviewer-Olga Plattner, MD).

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Keywords: Anesthesia Depth, Cognitive Dysfunction

Print Tag: Refer to original journal article
Avoiding Oral Intubation During Gynecological Laparoscopic Surgery

Sparing the Larynx During Gynecological Laparoscopy: A Randomized Trial Comparing the LMA Supreme and the ETT.
Abdi W, Amathieu R, et al:

Acta Anaesthesiol Scand 2010; 54 (February): 141-146

The LMA Supreme™ is a good alternative to ETT in routine gynaecological pelvic laparoscopy.

Background: The laryngeal mask airway (LMA) Supreme™ (SUP) with the built-in tube for stomach drain suctioning might be an alternative to endotracheal tube (ETT) intubation during abdominal procedures.
Objective: To compare postoperative pharyngolaryngeal discomfort and ventilation efficiency using SUP versus ETT.
Design: Prospective, randomized, clinical study.
Participants: 138 female patients having pelvic laparoscopy.
Methods: Anaesthesia care was according to the protocol (aimed at maintaining hemodynamic stability within 20% preinduction values and the bispectral index values ranging between 40 and 50). Patients were randomly assigned to either ETT or SUP for airway management. All patients were relaxed with atracurium 0.5 mg/kg. ETT size was 7.0 mm placed with direct laryngoscopy performed utilizing a plastic, single-use blade size of 3 or 4; in the other group, the SUP was either size 3, 4 or 5. The cuff of the LMA was inflated to 50 cm H₂O. If positioning failed after 2 attempts, an ETT was inserted. When ventilation was confirmed with SUP, a 14-gauge catheter was placed in the stomach for suctioning and later removed. Leak pressure was measured as follows. Three cycles of pressure-controlled ventilation at 20, 25, and 30 cm H₂O were applied while antero-lateral neck auscultation was performed. The 3 inspiratory pressure-induced volumes were used during volume-controlled ventilation to measure leak volume. The sealing pressure was the highest inspiratory pressure free from audible leak. Further management was standardized for both groups. The surgeon was blinded to the airway care plan, while the senior anaesthetist rated the airway management from 0 to 100 using a visual analog scale. Postoperative recordings were by a blinded observer (vomiting, pharyngolaryngeal discomfort, hoarseness, and other findings). For analysis, Student’s t-test and the Mann-Whitney U-test were used.
Results: No ventilation failure occurred in either group. Airway placement and weaning was shorter in the SUP group compared with the ETT group. Postoperative pharyngeal discomfort was significantly higher in the ETT group.
Conclusions: The SUP is a good alternative to ETT in routine gynaecological pelvic laparoscopy.
Reviewer's Comments: The SUP is a good alternative to the ETT in pelvic laparoscopic procedures. However, I would be reluctant to use it in procedures requiring higher abdominal pressures than for standard pelvic laparoscopy. (Reviewer: Olga Plattner, MD).

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Keywords: LMA Supreme™, ETT
Print Tag: Refer to original journal article
Hemofiltration during cardiopulmonary bypass does not decrease the incidence of atrial fibrillation after cardiac surgery compared with placebo.

**Objective:** To test the hypothesis that hemofiltration during cardiopulmonary bypass (CPB) can decrease the incidence of atrial fibrillation (AF) after cardiac surgery.

**Design/Participants:** This retrospective review included 185 adult cardiac surgical patients undergoing elective primary coronary artery bypass grafting (CABG) and/or valvular replacement/repair requiring CPB.

**Methods:** All patients were previously enrolled in a prospective, randomized, double-blind, placebo-controlled trial assessing the clinical benefits of steroid treatment versus hemofiltration. There were 3 study groups. Group I received placebo and no hemofiltration, and Group II received 1 g of methylprednisolone IV before anesthesia induction and another 4 mg of dexamethasone IV every 6 hours for 24 hours and no hemofiltration. Group III received placebo and hemofiltration during CPB. Patient charts and electronic records were reexamined to determine any incidence of AF.

**Results:** There were no demographic differences among the study groups. Ninety-two patients underwent CABG alone, 85 had valve repair/replacement alone, and 8 had combined CABG and valve surgery. Sixty patients (32%) developed postoperative AF. The incidence of AF did not differ among the study groups. From a secondary analysis, the only risk factor significantly associated with the development of AF was age—65.4 ± 10.1 years versus 61.4 ± 11.5 years for patients with and without AF, respectively (P =0.024). Procedure type, gender, smoking, body mass index, and duration of aortic cross-clamping, CPB, surgery and anesthesia were not associated with the incidence of postoperative AF.

**Conclusions:** Hemofiltration during CPB did not decrease the incidence of AF after cardiac surgery.

**Reviewer's Comments:** The physiology of AF after cardiac surgery is uncertain, and it is very likely multifactorial. It is known that levels of complement cascade components, white blood cell count, and C-reactive protein are increased in patients developing perioperative AF compared to patients remaining in sinus rhythm, suggesting that inflammation may play a significant role. (Reviewer-K. George Bojanov, MD).

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Keywords: Atrial Fibrillation, Cardiac Surgery, Hemofiltration, Cardiopulmonary Bypass

Print Tag: Refer to original journal article
**Objective:** To study the effectiveness of the loss of resistance (LOR) media used for identification of the epidural space on analgesic outcomes in laboring patients.

**Design/Participants:** Retrospective study using anesthesia records of 929 labor analgesics.

**Methods:** Anesthesia records of all patients requesting labor analgesia during two 1-month periods separated by 1 year were reviewed. Data extracted from the records included demographic information, details of anesthetic technique including epidural or combined spinal-epidural, use of air or saline for LOR, analgesic outcomes, and complications. The primary outcome was defined as 1 or more of the following: absence of initial comfort after block initiation; initial block asymmetry; intravascular catheter; intrathecal catheter; or catheter replacement. Choice of air or saline for LOR was calculated for each operator who performed ≥10 blocks during the included study period. Preference for LOR medium was defined as ≥70% use of either air or saline.

**Results:** Of the total 929 labor analgesics, 52.6% were performed with LOR to air and 47.4% with LOR to saline. The preference for LOR medium varied across operators. Thirty-four anesthesiologists performed at least 10 blocks during the study period. Eighty percent of the anesthesiologists used 1 medium at least 70% of the time. Air for LOR was used more often when combined spinal-epidural was performed ($P <0.001$). There were no differences between groups in patient demographics, anesthetic technique, interspace used, patient position, and block success. Attending physicians and fellows more frequently used saline for LOR, while junior and senior residents more frequently used air for LOR. Among operators with a preference for one medium, the use of the preferred technique was associated with fewer attempts, fewer paresthesias, and fewer unintentional dural punctures.

**Conclusions:** When using one’s preferred technique, there was no significant difference in block success between air and saline for localization of the epidural space by LOR.

**Reviewer’s Comments:** A limitation of the study is its retrospective design. Other than proving the obvious, that “one is best with what one feels comfortable with”, the study finds that when doing combined spinal-epidural, failed blocks and the need for catheter replacement were less frequent when air was used for LOR. (Reviewer-K. George Bojanov, MD).

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Keywords: Air, Saline, LOR, Epidural Space

Print Tag: Refer to original journal article