Intraoperative anesthesia handovers can be unstructured and of variable quality (1). Verbal, ad hoc handovers are prone to communication failure, information loss, and inaccuracy, all of which can compromise patient safety (2). The purpose of this study was to provide data regarding current intraoperative handover practices at a tertiary-care academic institution, as well as the perceptions of their quality, from anesthesia providers. Presently, there is no intraoperative handover protocol at this institution. The data gathered will inform a future study which will endeavour to develop a standardized institutional protocol for use among anesthesia providers who transfer the care of patients intraoperatively, with an aim to improve the quality of handovers.

Methods: With local REB approval, an online survey was created and distributed using Survey Monkey (Palo Alto, CA). An invitation to participate in the survey was e-mailed to 75 OR anesthesia consultants and 45 anesthesia residents on December 1, 2014. After two weeks, weekly reminder e-mails were sent to non-respondents until a 75% response rate was achieved. There were ten multiple-choice questions and one free text question. Only two questions, which collected demographic information, were mandatory. Responses could not be linked to individual respondents.

Results: 59 consultants and 34 residents responded, yielding a response rate of 77.5%. Responses to selected questions are depicted in stacked diverging bar charts (Fig 1). 67.7% (63/93) of respondents do not have a standardized way of handing over a patient to an anesthesia colleague in the OR, and 81.7% (76/93) do not have a standardized way of receiving such a handover (Fig 1a). When asked to rate the quality of handovers given and received in the last three months, most respondents rated them as “good” or “acceptable” (Fig 1b). Most providers state that they “rarely” experience major or minor intraoperative complications due to poor quality handovers. 9.7% (9/91) of respondents “frequently” feel “uncertain” after receiving a handover and the original provider has left and 46.2% (43/91) “sometimes” do (Fig 1c). There was no association between having a standardized method of either giving or receiving a handover and the frequency of perceived intraoperative complications or feeling uncertain.

Discussion: Standardized communication tools and transition of care practices improve information transfer and reduce errors (3,4). At this institution, most anesthesia providers do not have a standardized way of giving or receiving intraoperative handovers. While intraoperative complications are only rarely attributed to poor quality
handovers, almost 56% of providers routinely feel uncertain about the information received during handovers. The lack of association between reporting a standardized handover practice and perceived complications due to poor handovers or feelings of uncertainty may indicate that individual standardization practices are not effective. The results of this survey suggest that this institution may benefit from a structured handover protocol. This study will be used to begin creating that protocol.

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PREDICTION OF BLOOD PRESSURE RESPONSE IN SURGICAL PATIENTS

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Introduction Pulse pressure variation (PPV) and stroke volume variation (SVV) are excellent predictors of cardiac output response to intravenous fluid bolus administration (1-3). Dynamic arterial elastance (EaDyn), the ratio of PPV/SVV, has been shown to predict mean arterial blood pressure (MAP) increase to intravenous fluid bolus administration in patients with sepsis (4). This study aims to generalize this result to patients undergoing major elective vascular surgery, in order to guide fluid therapy to maximize therapeutic effect and patient safety.

Methods: Ethics approval was obtained from the local research ethics review board. A post hoc analysis was conducted of forty patients undergoing combined general and thoracic epidural anesthesia for open repair of infrarenal abdominal aortic aneurysm in a tertiary care center. Continuous hemodynamic monitoring with a minimally invasive cardiac output monitor was employed for all patients. A 15% increase in MAP with fluid boluses was considered a priori as being clinically significant. Five-minute averages of hemodynamic variable were compared pre and post fluid bolus administration. Receiver operating characteristic curves were then generated to show the sensitivity and specificity of EaDyn for the prediction of mean arterial pressure increase to fluid bolus administration.

Results: Patients with a 15% increase in MAP with fluid bolus demonstrated a significant decrease in pre vs. post EaDyn from 1.0 ± 0.3 pre fluid bolus to 0.63 ± 0.29 post fluid bolus (P=0.0021). In those patients who did not have a 15% increase in MAP with fluid administration, EaDyn remained unchanged (0.75 ±0.35 vs. 0.73 ± 0.31 pre vs. post fluid, p=NS). There was no change in central venous pressure in MAP responders [9.5 ± 5.1 vs. 11.2 ± 6.2 mmHg, P=0.3713] or MAP non-responders [9.6 ± 3.3 vs. 10.1 ± 3.2 mmHg, P=0.4765] with fluid bolus. Stroke volume index did not differ significantly pre and post IV fluid bolus between MAP responders [40.7 ± 5.4 vs. 45.5 ± 9.6 ml/M², P=0.0342] or non-responders [40.4 ± 8.7 vs. 40.0 ± 8.2 ml/M², P=0.7824]. An EaDyn cutoff value of < 1.1 gives a sensitivity of 87.5% and specificity of 48% for predicting a 15% increase in MAP. Figure 1 shows the receiver operating characteristic curve for EaDyn, arterial stiffness (Pulse Pressure/ Stroke Volume) and systemic vascular resistance.

Discussion: EaDyn successfully predicts MAP response to IV fluid bolus
administration in adult patients undergoing open AAA repair. PPV, as shown previously, predicts cardiac output response to IV fluid bolus administration, and may predict MAP response in some patients. Traditional predictors of fluid responsiveness such as CVP are ineffective. Dynamic arterial elastance is a promising new tool for predicting which surgical patients will benefit from IV fluid bolus, potentially avoiding excessive volume administration and complications.

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86017 - NEUROPATHIC PAIN PATHWAYS IN THE HUMAN SPINAL CORD AND BRAINSTEM

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Introduction: Neuropathic pain is a subtype of chronic pain that affects 3-8% of the population, and presents a major clinical challenge because it is often refractory to conventional and unconventional treatments (1). Investigations of the neural signature of pain in humans have focused primarily on cortical regions, and studies that have included the spinal cord and brainstem have employed experimental models of pain (2, 3, 4). The objective of this study is to further this research by comparing the neural responses to noxious stimuli in healthy participants to those in a patient population diagnosed with peripheral neuropathic pain.

Methods: In this study, high-resolution functional magnetic resonance imaging (fMRI) was used to detect neural activity in the brainstem and cervical spinal cord of thirteen healthy participants and nine carpal tunnel syndrome (CTS) patients while noxious mechanical pressure was applied to the volar forearm overlying the median nerve. CTS results in peripheral neuropathic pain secondary to median nerve damage as it traverses the carpal tunnel. Participants in both groups indicated the pressure to produce a pain rating of 2, 4, and 6 out of 10 on an 11-point pain scale, and fMRI data were acquired with pain applied at each level during noxious stimulation. Standardized pain ratings were used (as opposed to standardized mechanical stimuli) because the pain response is subjective, and varies widely between individuals (5). This study was approved by the appropriate local research ethics board governing human studies.

Results: Revealing similarities and differences in fMRI signal change trends were observed between the groups. Both healthy participants and neuropathic pain patients exhibited a trend of overall positive signal change at a pain rating of 2 to negative signal change at a pain rating of 6 in the midbrain and rostral medulla of the brainstem. However, consistent differences were observed between the two groups in the ipsilateral dorsal horn of the spinal cord, rostral ventromedial medulla, periaqueductal gray matter, regions known to play an important role in nociceptive pain processing as well as the endogenous descending modulation of pain. Please see the attached figure for group results demonstrating regions of the brainstem and spinal cord that responded to stimulation of the right wrist in the area overlying the median nerve at all 3 pressures.
The far right panel shows the contrast between neural activity in CTS patient and control groups.

**Discussion:** This study is one of the first to identify variation in the neural activity associated with pain processing between control and neuropathic pain patient groups. The demonstration of the difference in signal activity between patient and control groups, in particular in regions critical to endogenous analgesia, is a key first step in elucidating the pathophysiology that underlies chronic neuropathic pain syndromes. This work could contribute to future studies investigating endogenous analgesia and pain processing in patient groups, which may facilitate the optimization of pain management and ultimately improve quality of life for patients suffering from chronic neuropathic pain.

**References:**
PERIARTICULAR KETOROLAC INJECTION AND ESTIMATED BLOOD LOSS

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Introduction: Total knee arthroplasty (TKA) is associated with significant blood loss. There is large variation in the reported blood loss and transfusion rates, and a number of factors are reported to influence it\textsuperscript{1,2}. Periarticular multimodal injection, including Ketorolac, is a common mode of analgesia for patients undergoing TKA\textsuperscript{3-5}. Ketorolac has a known anti-platelet effect and its intravenous use has been reported to be associated with increased blood loss\textsuperscript{6-9}. The effect of periarticular Ketorolac on blood loss following TKA has not been studied.

The primary purpose of this study is to determine whether periarticular Ketorolac injection is associated with increased estimated blood loss following TKA. The secondary purposes are to determine if blood transfusion is more common and if postoperative analgesia is better following periarticular Ketorolac injection.

Methods: All patients in this study had provided consent to access their files, and ethical approval for this study was received from our institutional Research Ethics Board. This was a single centre retrospective cohort study of patients who have undergone a primary total knee arthroplasty under spinal anesthetic. The study group is patients who have received periarticular Ketorolac (n=57) and the control group is patients who did not receive Ketorolac (n=33). Patients with chronic diseases that would increase the risk of blood loss or transfusion, perioperative anticoagulant or NSAID use, or perioperative tranexamic acid use were excluded. The primary outcome is estimated blood loss following surgery, which was calculated using established formulas\textsuperscript{10,11}; secondary outcome measures include postoperative blood transfusion requirements, pain scores and opioid consumption, hospital length of stay, and intraoperative and postoperative fluid administration and balance.

Results: There was no difference in estimated total blood loss between the two groups (1.24 ± 0.38 L in control vs. 1.41 ± 0.44 L in Ketorolac, p=0.07). One patient in each group required postoperative blood transfusion. There was less pain at rest on postoperative day 1 (POD1) in the Ketorolac group (3.6 ± 1.6 vs. 2.8 ± 1.7 numeric rating scale (NRS), p=0.02), but this difference was not seen on POD2, and there was no difference in opioid consumption between the two groups (p=0.18). There was no difference in hospital length of stay between the two groups.
Discussion: Periarticular Ketorolac does not seem to be associated with an increased blood loss in patients who are at relatively low risk for blood loss undergoing primary TKA. The reduction in NRS pain score at rest on POD1 is not clinically significant and does not result in reduced opioid consumption, and is not seen past the first postoperative day. Given that patients at high risk for blood loss were excluded from this study, it is still unknown how these patients respond to a multimodal periarticular injection with Ketorolac. Going forward, periarticular Ketorolac for analgesia following arthroplasty should be assessed for increased blood loss in higher risk patients, and the benefits of its use should be carefully weighed against potential risks on a patient-by-patient basis.

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Introduction: Morbidly obese patients are at high risk of hypoxemia following induction of general anesthesia. Patient’s position and ventilation strategy used during pre-oxygenation influence the safe non-hypoxic apnea length by their effect on functional residual capacity (FRC). Head-elevated positions including beach-chair position (ramp position) are currently recommended and used to provide a better laryngoscopic view during tracheal intubation. A positive pressure ventilation strategy during pre-oxygenation might benefit FRC, but is not used systematically. We hypothesized that FRC will be better after pre-oxygenation simulation in head-elevated positions (beach-chair and reverse Trendelenburg position) than supine position and after spontaneous ventilation with positive pressure versus spontaneous ventilation at zero inspiratory pressure.

Methods: Using a prospective crossover randomized trial design, we compared the FRC (helium dilution method in a physiology lab) following simulation of pre-oxygenation period according to different positions and ventilation strategies. After approbation of the local REB and written consent obtained, subjects underwent, in a randomized order, 6 simulations of pre-oxygenation strategy during 5 minutes. Pre-oxygenation strategies included a combination of one of three positions: supine (S), beach-chair (BC; 25° back inclination), reverse Trendelenburg (RT; 25° table inclination) and one of two ventilation strategies: spontaneous ventilation at zero inspiratory pressure (ZEEP-SV) or spontaneous ventilation with positive pressure provided by a mechanical ventilator (PP-SV) set to an inspiratory pressure of 8 cm H₂O, PEEP of 8 cm H₂O and FiO₂ of 0.21. A mouthpiece and a nose clip were used in PP-SV and for FRC measurement to minimize leak. Pre-oxygenation simulations were separated by 20-minutes intervals in sitting position to minimize a potential alveolar recruitment from the previous intervention.

Results: Seventeen obese patients (BMI = 50 ± 8 kg/m²) were included. Mean FRC
was significantly higher in RT compared to BC position (2483 ± 521 versus 2338 ± 469 mL, p=0.009), while there was no difference between S and BC (2359 ±519 mL versus 2338 ± 469 mL, p=0.894). Mean FRC in the three positions (S, BC, RT) was also significantly higher using PP-SV compared to ZEEP-SV (2571 ± 477 versus 2215±481 mL, p < 0.001). The pre-oxygenation strategy using PP-SV in RT position was associated with a 465 mL (21%) increase in FRC compared to ZEEP-SV in BC position (2684±473 versus 2219 ± 477 mL; p < 0.001).

**Conclusion** Compared to supine, the beach-chair position did not increase FRC. Significant increases in FRC are observed when the patient is moved from beach-chair to reverse Trendelenburg position. Significant increases in FRC are observed when the spontaneous ventilation at zero inspiratory pressure is switched to positive pressure spontaneous ventilation. Finally, the strategy using the reverse Trendelenburg position combined with spontaneous positive pressure ventilation is superior to beach-chair position associated with spontaneous ventilation at zero inspiratory pressure.
Introduction: Persistent Post Thoracotomy Pain (PPTP) is a recognized complication following thoracic surgery, with an incidence between 44%-67% (1). Its etiology is considered to be multifactorial, with both surgical and patient factors involved (2). It is uncertain whether the pathophysiological process involved is predominantly inflammatory, neuropathic, or mixed (2). The burden of PPTP after Video Assisted Thoracoscopic Surgery (VATS) is considered to be less, although previous studies have shown conflicting results (3). Since the use of Epidural Analgesia (EA) is less with VATS, it is unclear if this influences the chances of PPTP (4). Our primary objectives were: 1) assessing the incidence of PPTP at 6 months after surgery, as compared to Open Thoracic Surgery (OTS) and VATS; and 2) identifying the type of pain if present (neuropathic versus non-neuropathic). The secondary objectives were to: 1) analyze the effect of EA on PPTP between the 2 groups; and 2) analyze other predictive factors of PPTP development.

Methods: Approval from REB was obtained for a mixed cohort (retrospective and prospective) study of thoracic surgery patients aged 18 or greater, performed at our center. Patients were contacted by a mailed questionnaire regarding the presence or absence of pain, its type and other pertinent factors. Non-responders were reminded by a phone call. Demographical, surgical, and postoperative analgesia details were collected from health records, acute pain database, and the thoracic surgery database. The patients were divided into 2 groups (OTS or VATS). Sample size of 90/group, was calculated using the primary outcome of difference in proportions; P1: 25%, P2: 45%, (Alpha: 0.05 and Power: 80%). The data was analyzed using a multivariable logistic regression analysis, with adjusted odds ratio for primary and secondary outcomes.
**Results:** Out of 353 patients initially approached, 130 patients responded; 5 patients were excluded due to selection criteria, and 18 responses could not be appropriately analyzed. Final analysis involved a total of 106 patients. A logistic regression model, with surgeons treated as clusters, indicated a significantly lower incidence of PPTP in the VATS group; adjusted OR: 0.33(0.13, 0.86). In the reduced model with important predictors included, diagnosis of cancer, and history of previous chronic pain were observed to be significantly predictive of PPTP development (table 1).

**Conclusion:** Our study indicates that persistent pain at 6 months has an incidence of 35% with VATS, compared to 54% with OTS. The persistent pain has a higher chance of being neuropathic with OTS, compared to VATS. The results support the finding that a diagnosis of cancer, and history of previous pain are highly predictive; however, the actual procedure, gender, and the use of epidural do not affect the development of PPTP. A prospective randomized study of appropriate sample size is necessary to confirm the above findings.

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