### POSTER DISCUSSION 4
**Cardiovascular and Thoracic**

**Co-chairs:**
- Dr Blaine Kent, Department of Anesthesia, Dalhousie University, Halifax, NS
- Dr Jason Taam, Department of Anesthesiology and Pain Medicine, University of Alberta, Edmonton, AB

**Sunday June 23**
14:15 – 16:00
Chinook 4

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ISOLATED LUNG COLLAPSE IN TWO STAGES WITH BRONCHIAL BLOCKER: EQUIVALENT TO DOUBLE-LUMEN TUBE?

José Luis Carrasco del Castillo¹, Jérôme Lemieux¹, Jacques Somma¹, Nathalie Gagné², Jean S. Bussières¹

1. Anesthesiology, Institut universitaire de cardiologie et de pneumologie de Québec, Quebec, QC, Canada
2. Research center, Institut universitaire de cardiologie et de pneumologie de Québec, Quebec, QC, Canada

Introduction: Double-lumen tube (DLT) and bronchial blocker (BB) are commonly used for OLV which is frequently required for thoracic surgery. It is believed that DLT tend to provide quicker and better quality lung collapse than BB. In 2003, Campos (1) showed that the pulmonary collapse time of BB was longer compared to DLT (26:02 vs 17:56 min, p<0.006) during thoracotomy and video-assisted thoracoscopic surgery (VATS). In 2009, Slinger (2) observed that, in patients undergoing left thoracotomies or VATS, BB allowed surgical exposure similar to DLT, but only at 10 and 20 minutes after pleural incision. We hypothesized that apnea periods during initiation of OLV using BB would allow for similar quality and time to complete lung collapse compared to DLT. The first objective was to compare the time to obtain complete lung collapse after the initiation of OLV. The secondary objective was to assess the quality of surgical exposure. Finally, we collected the surgeon guess about which device was being used.

Methods: After IRB approval 40 patients requiring OLV for VATS were randomized in a prospective single blind (thoracic surgeons) trial. We compared left-side DLT (20 patients) Bronchocath® from Mallinckrodt Medical, Ireland to BB (20 patients) Uni-blocker® from Systems Fuji Corporation, Tokyo, Japan with the internal lumen occluded. In both groups OLV began once the patient was in lateral decubitus position (LDP). In the BB group, two 30 seconds periods of apnea were performed : immediately after FOB verification of the BB position in LDP and just after incision of the pleura. Time from the start of OLV until complete lung collapse was recorded. The quality of the collapsed lung graded by the surgeon on a scale from 1 to 4 was also collected at 0, 5, 10 and 20 minutes (T0, T5, T10 and T20) after pleural incision. Surgeon’s guess on which device was used for LI was recorded at the end of data collection.

Results: Of the 40 patients randomized, 38 were analyzed. Fisher’s exact test showed no difference in the demographics of our patients, for FEV1 or FEV1/FVC ratio. Mean time to complete lung collapse was 32.5 +/-11.8 min and 47.8 +/-35.9 min for BB and DLT groups respectively (p=0.1 with Folded F). There was better lung collapse in BB-group at T0 (p=0.04 with Fisher’s exact test), with a trend of better quality of lung collapse in the BB-group at T5, T10 and T20. Surgeon’s guess about the device used was incorrect in 68% for the BB-Group and 50% in TDL-Group.

Discussion: Overall the hypothesis of similar collapse time and quality of lung collapse for BB and DLT was confirmed except at T0 where a statistically significant difference showed a better quality of lung collapse in the BB group compared to the DLT group. This later result as well as an overall trend favoring the BB group was unexpected since there is a general belief that DLT tend to provide quicker and better quality lung collapse than BB. The surgeons were unable to correctly guess the device used 68% and 50% of the time when BB and DLT were used respectively. In conclusion, BB induces lung collapse equivalent if not better than the DLT and surgeons are unable to guess which device is in place.

Eric H. Wong¹, Janet Martin¹, Jie-Yu Fang², Daniel Bainbridge¹, Davy C. Cheng ¹

1. Department of Anesthesia & Perioperative Medicine, London Health Sciences Centre-University Hospital, University of Western Ontario, London, ON, Canada
2. Department of Anesthesia, The First Affiliated Hospital, Sun Yat-sen University, Guangzhou, Guangdong, China

Introduction: Conventional inotropes have long been associated with hemodynamic benefit, but not survival benefit (1-5). Levosimendan is a novel inotrope that functions as a calcium sensitizer. It enhances myocardial contractility but also produces both coronary and peripheral vasodilation (6). Recent meta-analyses have suggested that levosimendan may have long-term survival benefits in various patient populations (7-10). Our meta-analysis seeks to determine the effect of levosimendan on mortality in two specific patient populations: cardiac surgery patients and non-surgical inpatients with heart failure.

Methods: The primary outcome of interest was mortality at maximum follow-up available. Secondary outcomes included atrial fibrillation, hypotension, length of stay, NYHA class, and ejection fraction. A comprehensive search was undertaken to identify all randomized control trials of levosimendan use in post-operative cardiac surgery patients (“CS”) and non-surgical inpatients with heart failure (“HF”). MEDLINE, Cochrane CENTRAL, EMBASE, and ClinicalTrials.gov were comprehensively searched until August 2012. All randomized control trials comparing levosimendan to a control and reporting at least one outcome of interest were included. Odds ratios (OR, 95% confidence intervals [CI]) and weighted mean differences (WMD, 95% CI) were calculated for discrete and continuous outcomes, respectively. All of the studies included in this review had approval from their local ethics board.

Results: A total of 48 trials with 4946 patients was included. When compared to placebo, levosimendan is associated with a non-significant reduction in mortality for both HF patients (OR 0.71, 95% CI 0.48 - 1.05, P value for effect 0.09) and CS patients (OR 0.98, 95% CI 0.44 - 2.18, P value for effect 0.96). When compared to dobutamine/dopamine, levosimendan is associated with significant reduction in mortality for both HF (OR 0.53, 95% CI 0.31 - 0.89, P value for effect 0.02) and CS patients (OR 0.33, 95% CI 0.13 - 0.84, P value for effect 0.02). However, for HF patients, there is strong evidence of unpublished negative studies within both our placebo and dobutamine/dopamine subgroups.

Discussion: In either HF or CS patients, there is no definitive proof that levosimendan has a survival benefit relative to placebo. This is especially true for HF patients, due to the high likelihood of unpublished negative studies. When compared to dobutamine/dopamine, while we cannot rule out a survival benefit, the significant reduction in mortality with levosimendan in HF patients needs to be tempered by suspected publication bias. However, levosimendan may be associated with a survival benefit relative to dobutamine/dopamine in CS patients.

2. Eur J Heart Fail 2002; 4:515–529
5. Intensive Care Med 2011; 37:290–301
1630731 - EARLY MORBIDITY AND MORTALITY ASSOCIATED WITH THORACIC ENDOVASCULAR AORTIC REPAIR (TEVAR) AT A TERTIARY CARE CENTRE

Graeme Bishop¹, Ashraf Fayad¹

1. University of Ottawa, Ottawa, ON, Canada.

Introduction: Thoracic endovascular aortic repair (TEVAR) has been accepted as a minimally invasive approach with a lower incidence of morbidity and mortality compare to the traditional open approach.¹ This reduced risk results in TEVAR being performed on patients with advanced co-morbidities who were once declined intervention. Our study aims to monitor early morbidity and mortality to ensure patient selection remains appropriate.

Methods: Local REB approval was obtained for our historical cohort study. All patients who underwent TEVAR at our institution from July 2007-12 were identified using a surgical procedure database. The electronic record was then used to identify the 30-day mortality and major morbidity secondary to TEVAR, including myocardial infarction (MI), spinal cord ischemia (SCI), renal failure, stroke and complications related to CSF drainage. Baseline demographic data, surgical and anesthetic details was also extracted. Our electronic record did not provide accurate data on respiratory events or ICU length of stay.

Results: A total of 82 patients were identified with an average age of 66 +/- 15 years. 56 were male and 26 were female. Emergency procedures represented 37% of our cohort. The indication was aneurysm in 61%, type B dissection in 21%, trauma in 9% and aortic ulcer in 7%. Repeat aortic surgery accounted for 41% of patients and 20% underwent hybrid procedures. The proximal coverage zone included the aortic arch in 39% of cases but only 21% of patients had coverage of a non-revascularized left subclavian artery. More than half of the descending thoracic aorta was covered in 52% of cases. 95% underwent a general anesthetic, 66% had TEE during the procedure, and 71% had preoperative CSF drains placed. 3 patients had CSF drains placed post operatively for symptomatic SCI, of which 1 was successful in reversing paraplegia. There were no major complications secondary to CSF drains, although one placement was unsuccessful. 48% of patients underwent rapid RV pacing to induce hypotension during proximal stent deployment and no major complications were noted. There were no acute surgical conversions. 95% of procedures were noted to be successful at the time of discharge. Early mortality and major morbidity are displayed in Table 1. ST-elevation MI occurred in only 1 patient.

Discussion: Our in-hospital rates of major morbidity and mortality are largely in-line with other academic centres. Notably, our rate of MI was higher than most published rates. The reason is unclear, but differing definitions of MI, variances in post operative investigations, and patient selection may contribute. All but 2 of our cases of MI occurred urgent/emergent or hybrid/repeat procedures. This may indicate a need for enhanced perioperative cardiac care of this high risk group.

2 Circulation 2011;123:2938-2945
3 Vasc and Endovasc Surg. 2007;41(3):186–91

Table 1. Early Morbidity and Mortality

<table>
<thead>
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<th>Outcome</th>
<th>Incidence (%)</th>
<th>Incidence from Literature (2%) [2,3,4]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>7.3</td>
<td>6-13</td>
</tr>
<tr>
<td>MI</td>
<td>17.1</td>
<td>2-6</td>
</tr>
<tr>
<td>Permanent SCI</td>
<td>8.5</td>
<td>0-13</td>
</tr>
<tr>
<td>Transient SCI</td>
<td>2.4</td>
<td>0-5</td>
</tr>
<tr>
<td>Stroke</td>
<td>6.1</td>
<td>2-8</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>2.4</td>
<td>3-4</td>
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</table>
Thoracic epidural analgesia (TEA) is frequently used in patients undergoing open abdominal aortic surgery (OAAS). While TEA provides superior analgesia as compared with the alternatives, no clear reduction in serious peri-operative complications has ever been demonstrated. Beta-blockers, agents that reduce peri-operative myocardial ischemia, have recently (1) been associated with increased mortality in the OAAS population when the patients have significant blood loss (BL). The purpose of this analysis was to determine if a similar relationship existed between TEA, BL and peri-operative complications.

Methods: Following institutional approval a retrospective study of all patients who underwent non-emergent OAAS between January 2002 and December 2007 was completed. Factors that might moderate the incidence of peri-operative myocardial infarction (MI) and death were recorded. Patients in whom the thoracic epidural catheter was inserted pre-operatively and was being used as the primary analgesic at 24 hours post-operatively were considered to have had TEA. Statistical analysis and modeling, including interactions, were performed to identify determinants of adverse outcomes.

Results: The charts from the 462 patients who underwent OAAS were reviewed, of which all adverse outcomes were documented in 461. TEA was used in 388 patients. With the exception of a history of ischemic heart disease (IHD) which was increased in the no TEA group, there were no statistical differences in age, sex, ASA status, Detsky score, RCRI, use of beta-blockers (BB), blood loss, or volume of blood transfused between the patients who had TEA and the no TEA group (Table 1). The interaction between no TEA versus TEA and blood loss is given by $-1.119 + 0.00032 \times BL$. Replacing BL by the group average (2560.44) results in $-0.2890$, suggesting patients without TEA are less likely to have a peri-operative MI ($p=0.038$).

Discussion: TEA can provide excellent post-operative analgesia and was used in 84% of the patients who underwent OAAS. The odds of a peri-operative MI is a function of blood loss and was increased through the use of TEA, in spite of a lower incidence of ischemic heart disease in these patients. These results suggest that the routine use of TEA in patients undergoing OAAS should be reconsidered.

References: 1. Le Manach, Y. Anes 2012, 117(6); 1203-11

Table 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>No TEA (n=68)</th>
<th>TEA (n=388)</th>
<th>p</th>
</tr>
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<tbody>
<tr>
<td>IHD</td>
<td>36</td>
<td>139</td>
<td>0.024</td>
</tr>
<tr>
<td>BB</td>
<td>52</td>
<td>294</td>
<td>0.866</td>
</tr>
<tr>
<td>BL</td>
<td>2709 (2162)</td>
<td>2541 (2187)</td>
<td>0.559</td>
</tr>
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</table>

p <0.05 considered significant. Mean (SD).
Proximal Aortic Compliance Based on Speckle Tracking Imaging and Its Effect on Aortic Impedance.

Alexander J. Gregory\(^1\), Randy D. Moore\(^2\), Neal Maher\(^3\), Marelise Kruger\(^3\), Gary Dobson\(^3\)

1. Department of Anesthesia and Critical Care, University of Pennsylvania, Philadelphia, PA, United States
2. Department of Vascular Surgery, University of Calgary, Calgary, AB, Canada
3. Department of Anesthesiology, University of Calgary, Calgary, AB, Canada

Introduction: Arterial stiffening is a risk factor for cardiovascular disease, impaired coronary blood flow, diastolic dysfunction and mortality.\(^1\)\(^-\)\(^3\) Aortic impedance (Z\(_o\)), determined by pressure and flow, is used as a measure of aortic function and LV afterload. Speckle tracking imaging (STI) allows quantification of tissue wall velocity, strain and strain rates from echocardiographic images.\(^4\) We used an STI-based measurement of proximal aortic compliance (C\(_{\text{prox-Ao}}\)) in early systole and determined its effect on LV afterload by simultaneously measuring Z\(_o\).

Methods: This study received local ethics committee approval. Data was acquired during general anesthesia for endovascular abdominal aortic repair. TEE was performed and the volume change of the aortic root and proximal ascending aorta were calculated using STI-based radial velocities and longitudinal strain rates from the mid-esophageal aortic valve long axis view. Aortic flow was calculated with LVOT diameter and pulsed-wave Doppler from the transgastric long axis view. Aortic pressure was derived by recording radial artery pressure and using a validated transfer function.\(^5\) C\(_{\text{prox-Ao}}\) and Z\(_o\) were calculated in early systole and their relationship analyzed by linear regression.

Results: Ten data sets were acquired. We calculated aortic pressure and flow as well as the rates of aortic volume (dV/dt) and pressure change (dP/dt) during the cardiac cycle (figure 1A). We also generated a pressure-volume loop for the proximal aorta (figure 1B). The mean value for early systolic C\(_{\text{prox-Ao}}\) was 4.885 \(\times\) 10\(^{-5}\) \(\pm\) 3.055 \(\times\) 10\(^{-5}\) mL mmHg\(^{-1}\) and for Z\(_o\) it was 74.3 \(\pm\) 37.0 dynes s cm\(^{-5}\). Linear regression analysis showed a correlation between decreased C\(_{\text{prox-Ao}}\) and increased Z\(_o\) during early systole, though it did not meet statistical significance (R\(^2\) = 0.32, p=0.08).

Discussion: Our approach of using transesophageal echocardiographic STI analysis along with radial artery monitoring appears to be a minimally invasive method of deriving proximal aortic compliance. Our resulting pressure-volume loop (figure 1B) is similar to that produced by invasive measurements in an animal model.\(^6\) Furthermore, our early results suggest that a portion of left ventricular afterload, as defined by aortic characteristic impedance, may be due in part to the compliance of the proximal aorta. Larger studies must be completed in order to definitively measure both the size and significance of this contribution.

References:
1. Hypertension 2001;37:1236-41
2. J Am Coll Cardiol 1994;24:1406-14
3. Heart 2005;91:1551-6

a) aortic pressure (red), flow (magenta), dV/dt (green) and dP/dt (blue). b) pressure-volume loop in systole (red) and diastole (blue).
A RAPID RECOVERY PATHWAY FOR CABG SURGERY: ONE INSTITUTIONAL EXPERIENCE

Harman Parhar, Jocelyn Reimer-Kent, Richard N. Merchant

1. Anesthesiology and Perioperative Medicine, Royal Columbian Hospital, New Westminster, BC, Canada
2. Cardiac Services, Royal Columbian Hospital, New Westminster, BC, Canada

Introduction: In 1996 our Cardiac Surgery Program developed a rapid recovery pathway based on a “wellness” model. This pathway established aggressive daily goals and was devised to enhance recovery and hasten hospital discharge by preventing and/or minimizing pain, nausea, constipation, immobility and respiratory depression. Use of the pathway is not mandatory and anesthesiologists can customize care as they wish.

Administering non-opioid analgesics [acetaminophen and non steroidal anti-inflammatory drugs (NSAIDs)] regularly has been considered the main contributor to achieving rapid recovery. With recent concerns over NSAID complications and a perceived increase in patient comorbidities it has been unclear whether the positive outcomes, initially achieved, have been maintained. Hence we conducted a chart review of coronary artery bypass graft (CABG) patients to document the success of achieving pathway goals and assess whether there appeared to be a relationship between NSAID use and patient outcomes.

Methods: Local Ethics Committee approval was obtained. Consecutive hospital paper charts of patients undergoing exclusively CABG procedures in 2008 were manually scanned for a variety of demographic, surgical, physiological, pharmacological, and care parameters. We compare, using descriptive statistics, various outcome measures between groups where NSAIDS vs non-NSAIDS were the main adjunct analgesic therapy.

Results: We examined 120 charts. 110 had complete data accessible, but two patients died immediately postoperatively, leaving 108 subjects in this study. 60% of cases were electively booked, 33% in-hospital urgent (35% NSAID, 29% non-NSAID), and 6% emergency (4% NSAID, 9% non-NSAID). Seventy-three patients (68%) received perioperative NSAIDS and all but 2 patients received acetaminophen.

Discussion: This descriptive retrospective chart review revealed that using NSAIDs as an adjunct in postoperative pain management for our group of CABG patients appeared to be associated with quicker recovery characteristics, including diminished opioid consumption, reduced delirium, and a shorter LOS. Due to the limitations of this study a causal link for the role of NSAIDs in these findings cannot be made.

<table>
<thead>
<tr>
<th></th>
<th>NSAIDs given</th>
<th>NSAIDs not given</th>
</tr>
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<tbody>
<tr>
<td>Number of grafts</td>
<td>3.7±1.1</td>
<td>3.7±1</td>
</tr>
<tr>
<td>Age</td>
<td>65±10</td>
<td>69±10</td>
</tr>
<tr>
<td>Number of comorbidities</td>
<td>1.9±1</td>
<td>2.9±2</td>
</tr>
<tr>
<td>Preoperative ejection-fraction</td>
<td>51%</td>
<td>49%</td>
</tr>
<tr>
<td>Preoperative creatinine</td>
<td>80(49–125)</td>
<td>111(65–217)</td>
</tr>
<tr>
<td>Cardiopulmonary-bypass minutes</td>
<td>105±3.5</td>
<td>121±8</td>
</tr>
<tr>
<td>Aortic cross-clamp minutes</td>
<td>80.1±3.2</td>
<td>89.6±6.0</td>
</tr>
<tr>
<td>New dialysis</td>
<td>0</td>
<td>6(17%)</td>
</tr>
<tr>
<td>Morphine equivalents (ME)</td>
<td>108±11.5</td>
<td>434±153</td>
</tr>
<tr>
<td>ME/LOS</td>
<td>18±2</td>
<td>30.8±6.7</td>
</tr>
<tr>
<td>Delirium</td>
<td>12%</td>
<td>26.5%</td>
</tr>
<tr>
<td>Day of first defecation</td>
<td>2.9</td>
<td>3.8</td>
</tr>
<tr>
<td>Day of first stair climbing</td>
<td>4.3</td>
<td>7.3</td>
</tr>
<tr>
<td>Median postop length-of-stay (LOS)</td>
<td>5±5.8(3–49)</td>
<td>6.5±6.7(4-24)</td>
</tr>
</tbody>
</table>
1653704 - DYNAMIC ANNULAR GEOMETRY OF RIGID VS. SELECTIVELY FLEXIBLE MITRAL ANNULOPLASTY RINGS

Han Kim¹, Remco Bergman³, Kamal Khabbaz⁴, Feroze Mahmood⁵

1. Anesthesia, St. Michael’s Hospital, Toronto, ON, Canada
2. Anesthesia, Beth Israel Deaconess Medical Center, Boston, MA, United States
3. Anesthesia, University Medical Center Groningen, Groningen, Netherlands
4. Cardiac Surgery, Beth Israel Deaconess Medical Center, Boston, MA, United States

Introduction: The principles of mitral valve (MV) repair includes the addition of a mitral annuloplasty ring to preserve dynamic motion of the mitral annulus and facilitate remodeling of the left ventricle(1). Despite this being standard practice, the surgical choice of the actual type of ring is often an inconsistent process. Short and long-term outcome differences between rigid and selectively flexible rings have been studied, but they have not been compared against each other real-time in vivo after implantation. With 3-dimensional Transesophageal Echocardiography (3D TEE), the dynamic motion through the cardiac cycle was assessed for rigid and selectively flexible rings and analyzed for comparison.

Methods: As part of a prospective IRB-approved protocol, patients undergoing routine 3D TEE examinations for mitral valve repair were included. 33 selectively flexible rings (Colwin Galloway Future and Carpentier-Edwards Physio II MV annuloplasty rings) were compared to 10 rigid rings through systole to assess their changes in dynamic geometry. Measurements were made offline with Image Arena® (TomTec® GmbH, Munich, Germany) and its MV Assessment 2.1 package. Measured MV annular variables included anterio-posterior (AP) diameter, anterolateral-posteromedial (ALPM) diameter, commissural diameter, sphericity, non-planarity angle, aortomitral angle, circumference, 2D and 3D area, and tenting height and volume.

Results: Both ring types showed individual increases in AP and ALPM diameter, circumference, and 2D and 3D area. However, when rigid rings were compared against the selectively flexible rings, the percentage changes were not significantly different for any measured variable between the two groups.

Discussion: Although both rigid and selectively flexible rings exhibit dynamic expansion through systole after implantation, the proportion of these changes were identical when compared to each other. This suggests that these rings behave identically after implantation as assessed by 3D TEE, despite their qualitative differences of described behavior. This may be important for surgical selection, short-term hemodynamic performance, and long-term implications for remodeling and durability.


3-Dimensional dynamic analysis of the mitral annulus in the Image Arena software package. The annulus is tracked through the cardiac cycle and geometric dimensions measured.