

Porcine versus Bovine Bioprosthetic Aortic Valves: Long-term Clinical Results

Michael Persson, Natalie Glaser, Anders Franco-Cereceda, Johan Nilsson, Martin J. Holzmann, Ulrik Sartipy

Background: Previous studies have reported superior hemodynamic performance in bovine bioprosthetic aortic valves compared to porcine valves. However, the long-term effect on survival is not well known because studies have reported conflicting results. This study aimed to compare long-term survival after aortic valve replacement (AVR) in patients receiving porcine versus bovine bioprostheses. Secondary outcomes were rate of aortic valve reoperation and heart failure hospitalization.

Methods: This was a population-based cohort study including all patients who had undergone AVR from 1995-2012 in Sweden, with or without concomitant CABG. Patients were identified through the SWEDEHEART registry. Baseline and outcome data were gathered from national registries. Propensity scores and inverse probability of treatment weighting was used to control for inter-group differences. Analyses accounted for the competing risk of death when appropriate.

Results: We included 12845 patients who underwent AVR with bovine (n=8647) or porcine (n=4198) prostheses. We found a small but significant difference in survival favoring porcine prostheses; 76% vs. 78%, 43% vs. 47%, and 15% vs. 17% at 5, 10, and 15 years, respectively (HR:0.90, 95% CI: 0.85-0.96). The use of porcine prostheses was associated with an increased risk for reoperation (HR: 1.48, 95% CI: 1.11-1.98). There was no difference in the risk for heart failure hospitalization. Results were similar in patients who underwent isolated AVR.

Conclusions: Consistent with previous reports of inferior hemodynamic performance, we found that patients receiving porcine prostheses had a higher rate of reoperations. However, porcine prostheses were associated with slightly better long-term survival compared to bovine prostheses.

New-onset atrial fibrillation after coronary artery bypass grafting is associated with increased long-term morbidity and mortality: A population-based study from the SWEDEHEART-registry

Amar Taha^{1,2}, Lennart Bergfeldt^{1,2}, Leif Friberg³, Susanne J. Nielsen^{2,4}, Anders Ahlsson⁵, Staffan Björck⁶, Anders Jeppsson^{2,4}

¹ Dept of Cardiology, Sahlgrenska University Hospital, Gothenburg, Sweden

² Dept of Molecular and Clinical Medicine, Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

³ Danderyd University Hospital, Stockholm, Sweden

⁴ Dept of Cardiothoracic Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden

⁵ Karolinska University Hospital, Stockholm, Sweden

⁶ National Diabetes Register Centre, Gothenburg, Sweden

Background: New-onset postoperative atrial fibrillation (POAF) is a common complication after cardiac surgery, but the prognostic implications are not settled. In contrast to previous reports, a recent Danish study in CABG patients (Butt et al. JAMA Cardiol 2018) did not show any increased risk for thromboembolic events in POAF patients.

Purpose: To compare long-term outcome in patients with vs. without POAF after CABG in a large contemporary cohort.

Methods: All patients in Sweden undergoing first-time isolated CABG 2005-2015 without preoperative atrial fibrillation (n=32253) were included in a population-based cohort study. Data from the SWEDEHEART-registry and three other national registries were merged. POAF was defined as any new-onset atrial fibrillation (AF) episode up to the 30th postoperative day. Inverse Probability Treatment Weighting (IPTW) adjusted Cox regression models were used to compare outcome measures from the 31st postoperative day until end of follow-up (median 5 years, range 0-10). The models were adjusted for age, gender, CHA2DS2-VASc score, co-morbidity, and medications.

Results: The prevalence of POAF was 25.7% (8290/32253) and 22 % of them were treated with oral anticoagulants within 3 months after surgery. During follow-up POAF patients had a significantly higher adjusted risk for all-cause mortality [Hazard Ratio (HR) 1.11 (95 % CI 1.02-1.20)], ischemic stroke [HR 1.18 (1.06-1.30)], transient ischemic attack [HR 1.18 (1.02-1.36)], heart failure hospitalizations [HR 1.38 (1.26-1.53)], and recurrent AF [HR 4.00 (3.67-4.36)]. Treatment with oral anticoagulants was not associated with better outcome.

Conclusions After CABG, POAF is associated with significantly increased risk for long-term mortality and morbidity.

Increased particle flow rate from the airways – an early biomarker for lung injury in the intensive care unit

Martin Stenlo, MD^{1,2}, Snejana Hyllén, MD, PhD^{1,2}, Leif Pierre, PhD^{2,3}, Deniz A Bölükbas, PhD^{2,4}, Iran A. N. Silva^{2,4}, Darcy E. Wagner, PhD^{2,4}, Oskar Hallgren, PhD^{2,5}, Sandra Lindstedt, MD, PhD^{2,3}

¹ Dept. of Cardiothoracic Anesthesia and Intensive Care, Skane University Hospital, Lund University, Sweden

² Wallenberg Center for Molecular Medicine, Lund University – Lund

³ Dept. of Cardiothoracic Surgery and Transplantation, Skane University Hospital, Lund University, Sweden

⁴ Dept. of Experimental Medical Sciences, Lung Bioengineering and Regeneration, Lund University, Sweden

⁵ Dept. of Clinical Sciences, Lund University, Sweden

Background: Acute lung injury (ALI) and its most severe form, acute respiratory distress syndrome (ARDS) may occur after cardiothoracic surgery and is a common cause of death in the intensive care unit (ICU). To reduce invasive diagnostics and time consuming in-hospital transports for image diagnostics we hypothesized that particle flow rate (PFR) pattern from the airways could contribute to an early diagnose and for optimizing therapies.

Method: Seven pigs with a mean weight of 65 ± 1.3 kg were mechanically ventilated. PFR was measured using a customized PExA 2.0. Lipopolysaccharides (LPS) was given as endotracheal (ET) installation (0,33mg/kg) and as infusion (2µg/kg/min) in the pulmonary artery. ARDS was defined according to the Berlin definition.

Results: All animals developed ARDS in 90 ± 11 minutes. The PFR peaked after 60 minutes with PFR of 1511 ± 638 (compared to baseline 60 ± 28 ($p = 0.0012$)). i.e. approximately 30 minutes before any ARDS stage was reached ($p = 0.0226$). A multiplex immunoassay for cytokines (plasma and bronchoalveolar lavage) showed a significant increase in IL-8 and TNF-alfa after 180 minutes. Severe lung injury was confirmed histologically.

Conclusions: The present results imply that PFR could be used as an early biomarker for ARDS. A significant increase in PFR was seen before changes in traditional parameters such as hypoxemia, increased inspiratory pressure and lower tidal volumes occur but also before any change in cytokine response could be detected.

Moderate hypothermia with remote ischemic preconditioning improves cerebral protection compared to deep hypothermia: a study using a surviving porcine model

Caius Mustonen¹, Hannu-Pekka Honkanen¹, Siri Lehtonen², Hannu Tuominen³, Tuomas Mäkelä¹, Timo Kaakinen¹, Kai Kiviluoma¹, Vesa Anttila⁴, Tatu Juvonen⁵

¹ Research Unit of Surgery, Anaesthesia and Intensive Care, University of Oulu and Medical Research Center, Oulu, Finland

² Department of Obstetrics and Gynecology, Oulu University Hospital, Oulu, Finland

³ Department of pathology, Oulu University Hospital, Oulu, Finland

⁴ Heart Center, University of Turku and Turku University Hospital, Turku, Finland

⁵ Department of Cardiac Surgery, Heart and Lung Center, Helsinki University Central Hospital, Helsinki University Hospital, Helsinki, Finland

Objectives. The optimal temperature management of hypothermic circulatory arrest (HCA) is still controversial. Moderate hypothermia preserves cerebral autoregulation and shortens cardiopulmonary bypass (CPB) duration. However, moderate hypothermia alone has inferior organ protection to deep hypothermia, so adjuncts that increase the ischemic tolerance are needed. Thus, we hypothesized that a combination of remote ischemic preconditioning (RIPC) and moderate hypothermia would be superior to deep hypothermia alone.

Methods. Sixteen pigs were randomized to either RIPC or control groups (8+8). The RIPC group underwent four cycles of transient hind limb ischemia. The RIPC group underwent cooling with CPB to 24°C and the control group to 18°C, followed by a 30-minute arrest period and subsequent rewarming to 36°C. Measurements of cerebral metabolism were made from sagittal sinus blood samples and common carotid artery blood flow. The permissible periods of HCA were calculated based on these measurements. Neurological recovery was evaluated daily during a 7-day follow-up and the brain was harvested for histopathological analysis.

Results. Six pigs in the RIPC group reached normal neurological function but none in the control group (P=0.007). The composite neurological score of all postoperative days was higher in the RIPC group than in the control group (55 (52 – 58) vs. (45 (39 -51) (P = 0.026)(Figure 1.). At 24°C the estimated permissible periods of HCA were 21 (17 – 25) minutes in the RIPC group and 11 (9 – 13) minutes in the control group (P=0.007)(Figure 2.).

Conclusions. RIPC combined with moderate hypothermia provides superior cerebral protection.

Bioreactance and FloTrac show imprecision and poor trending ability in monitoring cardiac index in comparison with intermittent pulmonary artery thermodilution during off-pump coronary artery bypass surgery

Laura Ylikauma¹, Pasi Ohtonen¹, Tiina Erkinaro¹, Merja Vakkala¹, Janne Liisanantti¹, Jari Satta¹, Tatu Juvonen², Timo Kaakinen¹

¹ Research Unit of Surgery, Anesthesia and Intensive Care, University of Oulu and Medical Research Center, Oulu, Finland

² Department of Cardiac Surgery, Heart and Lung Center, Helsinki University Central Hospital, Helsinki Finland

Pulmonary artery catheter (PAC) is the golden standard of cardiac index monitoring but recently new, less invasive methods to assess cardiac performance have been developed.

In this study a comparison of 579 simultaneous intra- and postoperative cardiac index measurements obtained with Starling SV (non-invasive monitor utilizing bioreactance), EV1000 (FloTrac, mini-invasive monitor) and PAC with intermittent thermodilution (TD) technique was done in 20 patients undergoing off-pump coronary artery bypass surgery (OPCAB). The agreement of compared data was investigated by Bland–Altman plots trending ability was assessed by four-quadrant plots with clinical concordance.

In comparison with PAC TD, Starling SV was associated with a bias of 0.13 L/min/m² (95% CI 0.07;0.18), wide limits of agreement (LOA, -1.45 to 1.29 [95% CI -1.23;-1.01 and 1.51;1.73]), a percentage error of 60.7 %, and a poor trending ability with a clinical concordance of 29.0 % in zone 1. In comparison with PAC TD, EV1000 was associated with a bias of 0.01 L/min/m² (95% CI -0.05;0.06), wide LOA (-1.56 to 1.0 [95% CI -1.27;-0.98 and 1.29;1.58]), a percentage error of 56.8% and a poor trending ability of 39.3% in zone 1.

Starling SV and EV1000 showed acceptable mean bias, but imprecision due to wide LOAs and large percentage errors in addition to poor trending abilities when compared to PAC limiting their reliability in monitoring cardiac index in patients undergoing OPCAB.

Surgical Repair of Acute Type A Aortic Dissection Complicated with Stroke: Results from The Nordic Consortium for Acute Type A Aortic Dissection (NORCAAD) database

Raphaëlle Chemtob¹, Simon Fuglsang², Arnar Geirsson³, Anders Ahlsson⁴, Christian Olsson⁴, Jarmo Gunn⁵, Khalil Ahmad², Emma Hansson⁶, Emily Pan⁵, Linda Arnadóttir⁷, Ari Mennander⁹, Shahab Nozohoor¹¹, Anders Wickbom¹⁰, Igor Zindovic¹¹, Aldina Pivodic¹², Anders Jeppsson⁶, Vibeke Hjortdal², Tomas Gudbjartsson⁷

¹ Department of Thoracic and Cardiovascular Surgery, Heart and Vascular Institute, Cleveland Clinic, Cleveland, Ohio, USA

² Department of Cardiothoracic and Vascular Surgery, Aarhus University Hospital, Aarhus, Denmark

³ Section of Cardiac Surgery, Department of Surgery, Yale University School of Medicine, New Haven, Connecticut, USA

⁴ Heart and Vascular Theme, Karolinska University Hospital, Stockholm, Sweden

⁵ Department of Surgery, Heart Center, Turku University Hospital, University of Turku, Turku, Finland

⁶ Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden

⁷ Department of Cardiothoracic Surgery, Landspítali University Hospital, Hringbraut, Reykjavik, Iceland

⁸ Faculty of Medicine, Reykjavik, Iceland

⁹ Department of Cardiothoracic Surgery, Heart Center Tampere University Hospital and University of Tampere, Tampere, Finland

¹⁰ Department of Cardiothoracic and Vascular Surgery, Orebro University Hospital, Orebro, Sweden

¹¹ Lund University, Skåne University Hospital, Department of Clinical Sciences, Lund, Department of Cardiothoracic Surgery, Lund, Sweden

¹² Statistiska konsultgruppen, Gothenburg, Sweden

Objectives: Perioperative stroke remains a serious complication in patients with acute type A aortic dissection (ATAAD). Previous studies investigating stroke in ATAAD patients have been limited by small cohorts and show diverging results. We sought to identify risk factors associated with stroke and its effect on outcome in a large cohort of surgically treated ATAAD patients.

Materials and methods: The Nordic Consortium for Acute Type A Aortic Dissection (NORCAAD) database included patients who underwent surgical repair for ATAAD at eight Nordic University Hospitals between 2005 and 2014.

Results: Perioperative stroke was detected in 177 out of 1128 patients (15.7%). Patients with stroke presented more often with cerebral malperfusion (20.6% vs. 6.3%, $p < 0.001$), syncope (30.6% vs. 17.6%, $p < 0.001$), cardiogenic shock (33.1% vs. 20.7%, $p < 0.001$), pericardial tamponade (25.9% vs. 14.7%, $p < 0.001$), and more frequently underwent total aortic arch replacement (10.7% vs. 4.7%, $p = 0.016$), compared to patients without stroke. In the 86 patients presenting with cerebral malperfusion, 38.4% developed perioperative stroke. Unadjusted 30-day and 5-year mortality was 0.28 vs. 0.14 and 0.43 vs. 0.26 in patients with and without stroke. Perioperative stroke was an independent predictor of early (OR: 2.02 (95% CI: 1.34-3.05) $p < 0.001$) and mid-term mortality (HR: 1.68 (95% CI: 1.27-2.23) $p < 0.001$).

Conclusions: Signs of cerebral malperfusion and impaired hemodynamics, as well as extensive surgical repair was associated with increased risk of perioperative stroke, subsequently increasing mortality. Nevertheless, a large proportion of patients presenting with cerebral malperfusion did not develop stroke, underscoring the importance of prompt surgery to avoid permanent stroke.