What's New in Cardiac Surgery?

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Perioperative aminoglycoside treatment is associated with a higher incidence of post-operative dialysis in adult cardiac surgery patients

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Background: Aminoglycoside treatment has been associated with nephrotoxic effects. However, the effect of perioperative aminoglycoside treatment on the risk of acute kidney injury requiring dialysis among patients undergoing cardiac surgery remains uncertain.

Methods: We performed a register study based on prospectively collected data from population-based health care databases of 3625 consecutive patients undergoing cardiac surgery at the Aarhus University Hospital, Skejby, Denmark. Patients requiring preoperative dialysis were excluded, leaving a total of 3587 patients (99% of original patient cohort), of whom 89 received perioperative aminoglycosides.

Results: The cumulative risk of in-hospital dialysis-dependent acute kidney injury was 3.2% (n = 115). Perioperative use of aminoglycosides was associated with an increased risk of postoperative dialysis (adjusted odds ratio [OR], 4.41; 95% confidence interval [CI], 1.83–10.59). Other predictors included reoperation because of bleeding (adjusted OR, 2.80; 95% CI, 1.63–4.80), use of inotropic support during anesthesia (adjusted OR, 2.10; 95% confidence interval, 1.49–2.95), and cardiopulmonary bypass lasting longer than 120 minutes (adjusted OR, 1.95; 95% CI, 1.19–3.20) along with EuroSCORE variables. Postoperative dialysis was associated with higher 30-day mortality (10.9% vs 2.5%, P < .0001, $\chi 2$ test), but use of aminoglycosides was not independently associated with mortality.

Conclusions: Perioperative use of aminoglycosides in adults undergoing cardiac surgery was associated with increased risk of postoperative dialysis.

Hypoglycemia with intensive insulin therapy after cardiac surgery: Predisposing factors and association with mortality

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Background: Intensive insulin therapy has become a major therapeutic target in cardiac surgery patients. It has been associated, however, with an increased risk of hypoglycemia compared with conventional insulin therapy. Our study sought to identify the factors predisposing to hypoglycemia with intensive insulin therapy and investigate its effect on early clinical outcomes after cardiac surgery.

Methods: A concurrent cohort study of 2,538 consecutive patients undergoing cardiac surgery (coronary artery bypass grafting, valve, or bypass grafting and valve surgery) from January 2005 to March 2010 was carried out. Multivariable logistic regression analysis and propensity score matching were used (1) to identify the risk factors for developing hypoglycemia (blood glucose < 60 mg/dL) after cardiac surgery and (2) to compare major morbidity, operative mortality, and actuarial survival between patients in whom hypoglycemia developed (n = 77) and those in whom it did not (n = 2461). The propensity score–adjusted sample included 61 patients in whom hypoglycemia developed and 305 patients in whom it did not (1 to 5 matching).

Results: Risk factors for hypoglycemia included female gender (odds ratio [OR] = 2.3, 95% confidence intervals [CI] = 1.4–3.7; P < .001), diabetes (OR = 2.8, CI = 1.7–4.5; P < .001), hemodialysis (OR = 3.0, CI = 1.3–6.8; P = .009), intraoperative blood product transfusion (OR = 2.0, CI = 1.2–3.4; P = .010), and earlier date of surgery (years of surgery, 2005–2007; OR = 2.1, CI = 1.2–3.7; P = .007) . Hypoglycemia increased the risk for operative mortality in

univariate (hypoglycemic 10% vs normoglycemic patients 2%; P < .001) but not in propensity score– adjusted analysis (OR= 2.5, 0.9–6.7; P = .11). The propensity score–adjusted analysis demonstrated a significant increase in hemorrhage-related reexploration (P = .048), pneumonia (P < .001), reintubation (P < .001), prolonged ventilatory support (P < .001), hospital length of stay (P < .001), and intensive care unit length of stay (P < .001) for the hypoglycemic compared with normoglycemic patients. Five-year actuarial survival was similar in the compared patient groups (hypoglycemic 75% vs normoglycemic 75%; P = .22).

Conclusions: Hypoglycemia with intensive insulin therapy is independently associated with increased risk for respiratory complications and prolonged hospital and intensive care unit lengths of stay after cardiac surgery. In our study, hypoglycemia was not independently associated with increased risk of death.

Beneficial effect of exogenous surfactant in infants suffering acute respiratory distress syndrome after cardiac surgery

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Objectives: The efficiency of exogenous pulmonary surfactant for pediatric patients suffering acute respiratory distress syndrome after cardiac surgery remains indeterminate. This study explored (1) whether use of exogenous surfactant improved recovery for patients suffering postoperative acute respiratory distress syndrome and (2) whether kinetic analysis of pulmonary functional change was helpful to indicate an appropriate dosing scheme.

Methods: Pediatric patients receiving an exogenous surfactant due to acute respiratory distress syndrome after cardiac surgery for congenital heart defects were reviewed from chart records. They were compared with patients without its use despite the same postoperative complication. Oxygenation index and ventilation index were calculated and fitted with a monoexponential function before and after its use. Other outcomes including chest radiography, duration of mechanical ventilation, and intensive care unit and hospital stay were also analyzed.

Results: All patients developing postoperative acute respiratory distress syndrome were infants. Among them, 19 infants received surfactant administration (Curosurf, 100 mg kg–1, treatment group). Twenty-four infants without its administration served as control, though also suffering from the same complication. All infants receiving surfactant survived, whereas three infants in the control group died. The duration of mechanical ventilation or hospital stay was significantly shorter after surfactant administration. The infants received either one (n = 13, one-dose subgroup) or two doses (n = 6, two-dose subgroup) before successful weaning from the ventilator. After the first dose was administered, the maximal rates of oxygen index and ventilation index change were significantly higher for infants in the one-dose subgroup (oxygen index: 2.3 ± 0.9 vs 0.8 ± 0.7, p = 0.009, ventilation index: 12.9 ± 3.8 vs 3.9 ± 2.5, p = 0.007). Shortly thereafter (<12 h), both parameters in the two-dose subgroup deteriorated and a second dose was administered 24 h later.

Conclusions: Exogenous pulmonary surfactant is an efficient medication for infants suffering acute respiratory distress syndrome after cardiac surgery. Kinetics analysis of functional change after initial surfactant use may be referred for early determination of an optimal dosing scheme.

Key Words: Acute respiratory distress syndrome • Pulmonary surfactant • Congenital heart defects • Mechanical ventilation

Outcomes and associated risk factors for mitral valve replacement in children

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Objectives: We aim to report time-related outcomes following mitral valve replacement (MVR) in children and to identify factors affecting outcomes.

Methods: Clinical records from 307 children who underwent MVR between 1985 and 2004 were reviewed. Competing-risks methodology determined time-related

prevalence of three mutually exclusive end-states: death, mitral reoperation and survival without subsequent MVR, and their associated risk factors.

Results: Mean age was 11.4 ± 5.6 years including 36 (12%) patients <2 years old. There were 154 (50%) males. Underlying pathology was rheumatic fever (n = 195, 64%), congenital (n = 83, 27%) and other (n = 29, 9%) with congenital pathology predominant in younger children while rheumatic fever predominant in older children. Hemodynamic manifestation was regurgitation (83%), stenosis (5%), or mixed disease (12%). One hundred and twenty-six patients (41%) had undergone a prior cardiac surgery including mitral surgery (n = 96, 31%). Initial mitral prosthesis was mechanical (n = 229, 75%), tissue (n = 71, 23%), or homograft (n = 7, 2%). Concomitant cardiac surgery was required in 141 patients (46%). Competing-risks analysis predicted that 20 years following MVR, approximately 17% of patients have died, 51% have undergone mitral reoperation and only 33% were alive and free from mitral reoperation. Risk factors for death without mitral reoperation included younger age <3 years [PE (parameter estimates): +1.66 ± 0.31, p < 0.001], longer cross-clamp time (PE: +0.11 ± 0.04/10 min, p = 0.005), postoperative complications (PE: +1.58 ± 0.31, p < 0.001), and higher prosthesis size/body surface area (BSA)-predicted mitral annulus ratio (PE: +0.48 ± 0.10, p < 0.001). Risk factors for mitral reoperation included implantation of homograft or tissue prosthesis (PE: +1.12 ± 0.23, p < 0.001) and smaller prosthesis size (PE: +0.06 ± 0.03/1 mm, p = 0.05). Fifteen-year freedom from pacemaker implantation, endocarditis, bleeding, and thromboembolism was 92%, 96%, 82%, and 92%, respectively.

Conclusions: Mortality and mitral reoperation are common after MVR in children and outcomes can be predicted based on patient's age, prosthesis size, and other associated factors. Some modifiable factors such as avoiding oversized prostheses may improve outcomes especially in the smallest children.

Key Words: Mitral valve replacement • Rheumatic fever • Mitral regurgitation • Congenital heart disease

Efficacy and Safety of Aprotinin in Neonatal Congenital Heart Operations

Ann Thorac Surg 2011;92:958-963. doi:10.1016/j.athoracsur.2011.04.094

Background: Aprotinin has been associated with significant morbidity and mortality in adults, leading to its withdrawal from the market and clinical substitution with the lysine analogs, tranexamic acid and ε-aminocaproic acid. Neonates undergoing cardiopulmonary bypass are especially at risk for perioperative bleeding, yet little data exist comparing lysine analogs with aprotinin.

Methods: Neonates undergoing cardiopulmonary bypass (January 2006 to December 2009) were included in this single-institution, retrospective cohort study. Preoperative, intraoperative, and postoperative data were analyzed. The relationship between demographic, surgical risk data, and outcomes were analyzed. Markers of effectiveness included transfusion requirement, duration of operation, duration of ventilation, and intensive care unit length of stay. Markers of safety included reexploration, renal dysfunction, neurologic complications, and death.

Results: Of 423 included neonates, 271 (64%) received aprotinin and 152 (36%) a lysine analog. Infants who received aprotinin had a higher baseline creatinine and lower weight and gestational age. The aprotinin group experienced shorter time to surgical closure, lower blood product use, and lower rates of reexploration and postoperative renal dysfunction compared with the lysine-analog group. There was no difference in duration of ventilation or intensive care unit stay, neurologic outcomes, or death.

Conclusions: Neonates who received aprotinin had significantly lower intraoperative transfusion requirements and shorter surgical closure times. The aprotinin group was less likely to require surgical reexploration and had a lower rate of renal injury. These data illustrate the need for further research regarding safety and efficacy of aprotinin in a larger sample of children undergoing cardiac operations.

Atrioventricular valve repair in patients with functional single-ventricle physiology: Impact of ventricular and valve function and morphology on survival and reintervention

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Objective: This study was to determine whether atrioventricular valve repair modifies natural history of single-ventricle patients with atrioventricular valve insufficiency and to identify factors predicting survival and reintervention.

Methods: Fifty-seven (13.5%) of 422 single-ventricle patients underwent atrioventricular valve repair. Valve morphology, regurgitation mechanism, and ventricular morphology and function were analyzed for effect on survival, transplant, and reintervention with multivariate logistic and Cox regression models. Comparative analysis used case-matched controls.

Results: Atrioventricular valve was tricuspid in 67% and common in 28%. Ventricular morphology was right in 83%. Regurgitation mechanisms were prolapse (n = 24, 46%), dysplasia (n = 18, 35%), annular dilatation (n = 8, 15%), and restriction or cleft (n = 2, 4%). Postrepair insufficiency was none or trivial in 14 (26%), mild in 33 (61%), and moderate in 7 (13%). Survival in repair group was lower than in matched controls (78.9% vs 92.7% at 1 year, 68.7% vs 90.6% at 3 years, P = .015). Patients with successful repair and normal ventricular function had equivalent survival to matched controls (P = .36). Independent predictors for death or transplant included increased indexed annular size (P = .05), increased cardiopulmonary bypass time (P = .04), and decreased postrepair ventricular function (P = .01). Ventricular dilation was a time-related factor for all events, including failed repair.

Conclusions: Survival was lower in single-ventricle patients operated on for atrioventricular valve insufficiency than in case-matched controls. Patients with little postoperative residual regurgitation and preserved ventricular function had equivalent survival to controls. Lower grade ventricular function and ventricular dilation correlated with death and repair failure, suggesting that timing of intervention may affect outcome.

Single-center 50 years' experience with surgical management of tetralogy of Fallot

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Objective: The aim of this study was to evaluate the long-term outcome of total repair for tetralogy of Fallot. We aimed to characterize late survival and the time-related risk of late reoperation.

Methods: Operative protocols, patient records, and the database of the department were evaluated from 1951 until 2008. The official death registry of Norway was used for follow-up. Of the patients identified, the follow-up was 99.6% complete.

Results: A total of 627 patients were studied. Of these, 570 could be identified for follow-up. There were a total of 41 early and 30 late deaths. The total early (including palliative procedures) mortality was 7.2% and total late mortality was 7.9%. However, during the last 10 years, no early mortality has been observed following repair. A total of 264 patients underwent some form of palliative procedure as their first treatment, and 541 patients had a reparative procedure performed, with an early mortality of 31 (5.7%). In patients subjected to a reparative procedure, there was no difference in freedom from death or reoperation following primary repair versus primary palliation. The use of transannular patch was associated with a highly significant risk of reoperation.

Conclusions: Surgical treatment of the tetralogy of Fallot and related congenital cardiac malformations has good long-term prognosis. In this cohort of patients, more than one-third required additional procedures later on, and, in some cases, as many as four additional surgeries. Palliative procedures followed by repair do not influence survival or reoperation-free survival. There are no differences between transatrial versus transventricular repair on survival or re-repair. Any transannular incision increases the risk of re-repair, but does not influence long-time survival. There is an almost linear decrease in reoperation-free survival following any type of repair of tetralogy of Fallot, even for as long as 50 years since the first procedure.

Key Words: Congenital heart disease • Tetralogy of Fallot • Pulmonary insufficiency

Repair of persistent truncus arteriosus without a conduit: sleeve resection of the pulmonary trunk from the aorta and direct right ventricle-pulmonary artery anastomosis

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Objective: Establishing a new continuity between the right ventricle and the pulmonary artery is the mainstay of repair for persistent truncus arteriosus. We used the Tran Viet–Neveux technique without a Lecomte maneuver to construct the connection without a conduit. Here, we retrospectively review the mid-term surgical results to examine the effectiveness of this approach.

Methods: A cylindrical segment incorporating both pulmonary artery branches was sleeve-resected from the truncal artery. The cylindrical segment was cut in the middle and two truncal arterial flaps were combined to form the posterior floor of the new pulmonary arterial trunk. The edge of the floor was attached directly to the superior margin of an oblique incision made in the left-anterior wall of the right ventricle. A polytetrafluoroethylene monocusp was attached to the lower half margin of the right ventricular incision. A large glutaraldehyde-treated pericardial patch was used to form the anterior hood of the new right ventricular outflow tract. Both great arteries were located in a normal spiral configuration.

Results: Ten babies (range: 3 days to 9 months of age) underwent this procedure. The Collett–Edwards classification of persistent truncus arteriosus was type I in five cases and type II in five others. There was one hospital death due to severe respiratory distress. During follow-up (36–60 months, median 54 months), only one re-operation was required to enlarge a left branch pulmonary artery stenosis. Follow-up echocardiography showed pulmonary regurgitation (mild two, moderate seven, and severe one) and mild flow acceleration in the left pulmonary artery branch and right ventricle–pulmonary artery connection in one case.

Conclusion: This simple modification for surgical correction of persistent truncus arteriosus may be an effective alternative that overcomes conduit-related problems.

Key Words: Persistent truncus arteriosus • Repair without conduit • Right ventricle–pulmonary artery direct anastomosis • Surgical results • Pulmonary hypertension.

Thirty-Year Experience with the Arterial Switch Operation

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Background: We evaluated the results of the arterial switch operation (ASO) being performed at our institution for more than 30 years and identified risk factors for mortality and reoperation.

Methods: Clinical outcome of 332 consecutive patients with transposition of the great arteries undergoing ASO was retrospectively analyzed, using surgical reports, medical charts, and latest follow-up echocardiography. Statistical analysis was performed using the Kaplan-Meier method and univariable and multivariable binary logistic and Cox regression analyses.

Results: In-hospital mortality was 11.4%. At 15 years, estimated overall survival was 85.2%, and estimated freedom from reoperation was 74.0%. Cross-clamp time ($p = 0.001$) and absence of the Lecompte maneuver ($p = 0.001$) were identified as independent risk factors for in-hospital mortality, whereas coronary problems during surgery ($p = 0.009$) and postoperative pacemaker implantation ($p < 0.001$) were independent risk factors for late mortality. Independent risk factors for reoperation were higher age at the time of the ASO ($p = 0.002$), presence of arch abnormalities ($p < 0.001$), coronary problems during surgery ($p = 0.005$), and duration of ventilation ($p < 0.001$). At latest echocardiography, moderate or severe neoaortic regurgitation was present in 3.4% of the patients.

Conclusions: Overall, 30 years of experience with the ASO shows good survival and event-free survival rates. Coronary transfer problems during surgery were found to be an important risk factor for late mortality and reoperation. However, coronary anatomy other than 1LCx-2R and an intramural course of the left coronary artery or left anterior descending artery were not risk factors for mortality or reoperation. Neoaortic regurgitation does not seem to form a major problem.

Anemia Before Coronary Artery Bypass Surgery as Additional Risk Factor Increases the Perioperative Risk

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Background: A negative relationship between anemia before coronary artery bypass graft (CABG) surgery and the perioperative mortality has been shown. We tried to clarify whether anemia only expresses an increased perioperative risk or is a risk factor per se in a two-institution database.

Methods: In the years 2005 and 2006, 185 of 3,311 patients undergoing isolated first-time CABG surgery had anemia defined as hematocrit less than 33% or Hb ≤11 g/dL. Preoperative and postoperative data of patients having anemia and patients having normal hematocrit were compared using χ2-tests or Fisher's exact tests regarding structural group differences. To determine factors influencing perioperative mortality, methods of logistic regression were used.

Results: The 30-day mortality of anemic patients (12.9%) was significantly higher ($p < 0.001$) than the mortality of nonanemic patients (2.2%). Patients having anemia, though, had a worse risk profile before surgery: high European System for Cardiac Operative Risk Evaluation values (median, 7 in anemic patients versus 4 in nonanemic patients), acute myocardial infarction (9.7% in anemic versus 2% in nonanemic patients), diabetes mellitus (45.4% in anemic versus 33.3% in nonanemic patients), and cardiogenic shock (5.4% in anemic versus 0.8% in nonanemic patients) were significantly more frequent in the anemic group. However, taking these risks in account, the logistic regression revealed preoperative anemia still to be a mortality-increasing factor in patients undergoing CABG surgery (odds ratio 3.727, confidence interval: 2.196 to 6.324). Furthermore, anemia was a risk factor for perioperative morbidity (major adverse cardiovascular events) after CABG surgery (odds ratio 2.199, confidence interval: 1.423 to 3.397).

Conclusions: In our patient group undergoing CABG surgery, preoperative anemia increased the mortality risk by 3.4, even when taking the higher perioperative risk of anemic patients into consideration.

Absence of deterioration of vascular function of the donor limb at late follow-up after radial artery harvesting

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Objective: Radial artery harvesting has been questioned because of purported long-term circulatory consequences. Previous midterm Doppler ultrasonographic results are inconsistent regarding ulnar arterial effects. Flow-mediated vasodilatation more sensitively measures response to shear stress as index of arterial reactivity and function.

Methods: We contacted 231 patients who had undergone radial artery harvesting at least 10 years previously (mean follow-up, 12.9 ± 0.8 years). Subcohort of 25 volunteers (mean age, 69.2 ± 8.4 years) underwent ultrasonographic evaluation of ipsilateral (harvest) and contralateral (control) ulnar arteries. Flow-mediated vasodilatation compared changes in ulnar arterial diameters before and after occlusion.

Results: In subcohort, peak systolic velocity of harvest ulnar artery was 0.82 ± 0.15 m/s, versus 0.63 ± 0.23 m/s on control side ($P < .001$), with no differences in intimomedial thickness ($P = .763$) or presence of atherosclerotic plaques ($P = .364$). Baseline diameter of harvest ulnar artery was 3.0 ± 0.5 mm, versus 2.7 ± 0.6 mm on control side ($P = .007$). Postocclusion diameter of harvest ulnar artery was 3.2 ± 0.5 mm, versus 2.9 ± 0.6 mm on control side ($P = .001$). No differences were seen in preocclusion and postocclusion absolute and percentage changes in ulnar arterial diameter.

Conclusions: Despite increased shear stress, no deterioration in either ulnar arterial structure or functional reactivity was measured by flow-mediated vasodilatation more than 10 years after radial artery harvesting. With appropriate preoperative evaluation, radial arterial grafting for coronary artery bypass grafting is not associated with long-term donor limb vascular insufficiency.

Influence of patient gender on mortality after aortic valve replacement for aortic stenosis

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Objective: To assess the influence of gender on mortality after aortic valve replacement for aortic stenosis.

Methods: A retrospective analysis was performed on data prospectively collected from all patients undergoing aortic valve replacement for aortic stenosis. Multivariate regression analysis was performed to evaluate the effect of 22 preoperative and operative variables on early, late, and overall mortality.

Results: Aortic valve replacement was performed in 3343 patients with aortic stenosis between 1982 and 2003. The female patients were older, with a smaller body mass index. The women were less likely to have diabetes, chronic obstructive pulmonary disease, previous myocardial infarction, or left ventricular ejection fraction <35% but were more likely to have hypertension or a New York Heart Association III-IV classification. The female patients received a smaller prosthetic valve, with a smaller effective orifice area index (EOAI). The mean follow-up period was 6.18 ± 4.96 years, with a total of 2066.142 years of follow-up. The independent predictors of early mortality for the male patients included age, concomitant surgical revascularization, congestive heart failure, and valve size of ≤21 mm. The independent predictors of late mortality for the male patients included age, concomitant surgical revascularization, diabetes, renal failure, chronic obstructive pulmonary disease, congestive heart failure, and a bioprosthetic valve. The independent predictors of overall mortality for the male patients included age, concomitant surgical revascularization, diabetes, renal failure, heart failure, and valve size of ≤21 mm. For the female patients, the risk factors for early mortality included body mass index <25 kg/m2; for late mortality included age, concomitant surgical revascularization, New York Heart Association class III-IV, and diabetes; and for overall mortality included age, concomitant surgical revascularization, New York Heart Association class III-IV, and renal failure. Furthermore, male gender was an independent predictor of late (but not early or overall) mortality.

Conclusions: The independent predictors of mortality after aortic valve replacement for aortic stenosis differed between the male and female patients. Male gender increased the risk of late mortality, and a valve size of ≤21 mm increased the risk of early and overall mortality among the male patients only. These differences need to be taken into consideration preoperatively and require consideration during operative management.

13-Saddle-shaped mitral valve annuloplasty rings improve leaflet coaptation geometry

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Objectives: The mitral valve annulus naturally conforms to a saddle shape in systole. This configuration is believed to put the leaflets into a lower-energy equilibrium with the annulus and subvalvular apparatus. Conventional flat annuloplasty rings restrict posterior leaflet motion, which may result in a "monocusp" valve, affecting valvular stress distribution. It is hypothesized that saddle-shaped annuloplasty rings cause less distortion of the physiologic leaflet geometry than do flat rings.

Methods: Twelve pigs were studied in an acute setting with 3-dimensional echocardiography and sonomicrometry before and after implantation of rigid flat (n = 5) and saddle-shaped (n = 7) annuloplasty rings. The rings were true sized to the annulus with equal anterior–posterior and commissure–commissure circumferential dimensions. The saddle-shaped rings had an annular height to commissural width ratio of 15%.

Results: Saddle-shaped rings maintained both leaflets operational (P < .01). Flat rings made the posterior leaflet immobile and the anterior leaflet aligned flat along the annulus in systole, effectively resulting in monoleaflet function. The average distance from the papillary muscle tips to the posterior annulus decreased by 2.4 ± 0.4 mm after flat ring implantation (P < .01).

Conclusions: Saddle-shaped annuloplasty rings provide better leaflet coaptation geometry than do flat rings by not hoisting the papillary muscles toward the posterior annulus through the commissural chordae, allowing greater leaflet mobility. This entails a potentially beneficial impact on valvular stress distribution that could affect durability of the repaired valve.

Long-Term Survival and Quality of Life Justify Cardiac Surgery in the Very Elderly Patient

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Background: Elderly patients are often discouraged from undergoing cardiac surgery procedures owing to the perception of high mortality and poor functional outcomes. This study evaluates long-term survival and quality of life after cardiac surgery in octogenarian and nonagenarian patients.

Methods: We identified a 459 patient cohort greater than 80 years of age who underwent elective cardiac surgery at our institution from 1994 to 1999. Survival was assessed with Kaplan-Meier analysis and compared with an age-matched and sex-matched population cohort. Among survivors, quality of life was assessed 8 years postoperatively using the Medical Outcomes Study Short Form 12 Health Survey, version 2. Risk factors for mortality were identified with Cox regression.

Results: Operative mortality was 4.1%. Actuarial postoperative 5-year and 10-year survival was 53% and 27%, respectively. When compared with age- and sex-matched general population data, relative survival (excluding operative deaths) was 90.4% at 5 years and 78.7% at 10 years. Risk factors for late mortality included age greater than 85, male sex, low body mass index, renal failure, and postoperative respiratory failure. Survivors' median quality of life mental health score was higher (55.2 versus 48.9; $p < 0.05$) and physical health score was equivalent (39.3 versus 39.8; $p = 0.66$) to the general elderly population.

Conclusions: Cardiac surgery in the very elderly patient can be performed with low operative mortality, excellent long-term survival, and postoperative quality of life exceeding that of the general elderly population.

Bicuspid aortic valve surgery with proactive ascending aorta repair

J Thorac Cardiovasc Surg 2011;142:622-629.e3

Objectives: Bicuspid aortic valves are associated with aortic catastrophes, particularly dissection. We examined whether proactive repair of associated dilatation would reduce risk of subsequent aortic dissection or reoperation and whether more aggressive resection is needed in patients undergoing bicuspid aortic valve surgery alone.

Methods: From January 1993 to June 2003, 1989 patients (of our total experience of 4316) underwent bicuspid aortic valve surgery. Long-term outcomes of 1810 were analyzed according to aortic size and whether bicuspid aortic valve surgery was performed alone or with aortic repair.

Results: In-hospital 30-day survival was similar (98.8% valve alone vs 98.9% with aortic repair), with no penalty incurred for concomitant aortic repair. Bicuspid aortic valve–alone patients had worse late survival (75% vs 85% at 10 years, P = .0001), but in the matched cohort survival was nearly identical (85% vs 86%; P = .7). With this strategy, freedom from late aortic events was high in both groups (99% valve alone vs 97% with aortic repair at 10 years; P[log-rank] = .06) and similar in the matched cohort (95% vs 97%; P = .2). Approximately 95% of patients undergoing valve-alone surgery had aortic diameters smaller than 4.6 cm or cross-sectional area/height ratios less than 9.4 cm2/m; 80% undergoing valve surgery plus aortic repair had diameters larger than 4.1 cm or ratios greater than 7.3 cm2/m. Only 0.2% of events occurred at an aortic diameter size of less than 4.5 cm.

Conclusions: Aortic size larger than 4.5 cm or aortic cross-sectional area/height ratio greater than 8 to 10 should be considered triggers for concurrent aortic repair, because there is no added risk, and late survival is better; however, more aggressive resection is unwarranted

16-Warm-blood cardioplegia with low or high magnesium for coronary bypass surgery: a randomised controlled trial

Eur J Cardiothorac Surg 2011;40:722-729. doi:10.1016/j.ejcts.2010.09.049

Objective: Magnesium (Mg2+) is cardioprotective and has been routinely used to supplement cardioplegic solutions during coronary artery bypass graft (CABG) surgery. However, there is no consensus about the Mg2+ concentration that should be used. The aim of this study was to compare the effects of intermittent antegrade warm-blood cardioplegia supplemented with either low- or high-concentration Mg2+.

Methods: This study was a randomised controlled trial carried out in two cardiac surgery centres, Bristol, UK and Cuneo, Italy. Patients undergoing isolated CABG with cardiopulmonary bypass were eligible. Patients were randomised to receive warm-blood cardioplegia supplemented with 5 or 16 mmol l–1 Mg2+. The primary outcome was postoperative atrial fibrillation. Secondary outcomes were serum biochemical markers (troponin I, Mg2+, potassium, lactate and creatinine) and time- -plegia arrest. Intra-operative and postoperative clinical outcomes were also recorded.

Results: Data from two centres for 691 patients (342 low and 349 high Mg2+) were analysed. Baseline characteristics were similar for both groups. There was no significant difference in the frequency of postoperative atrial fibrillation in the high (32.8%) and low (32.0%) groups (risk ratio 1.03, 95% confidence interval, CI, 0.82–1.28). However, compared with the low group, troponin I release was 28% less (95% CI 55–94%, p = 0.02) in the high-Mg2+ group. The 30-day mortality was 0.72% (n = 5); all deaths occurred in the high-Mg2+ group but there was no significant difference between the groups (p = 0.06). Frequencies of other major complications were similar in the two groups.

Conclusions: Warm-blood cardioplegia supplemented with 16 mmol l–1 Mg2+, compared with 5 mmol l–1 Mg2+, does not reduce the frequency of postoperative atrial fibrillation in patients undergoing CABG but may reduce cardiac injury. (This trial was registered as ISRCTN95530505.)

Key Words: Myocardial protection • Cardioplegia • CABG • Surgery • Atrial fibrillation • Flutter

17-Effect of remote ischemic preconditioning on renal dysfunction after complex valvular heart surgery: A randomized controlled trial

J Thorac Cardiovasc Surg 2011;142:148-154

Objective: Acute kidney injury after cardiac surgery with cardiopulmonary bypass is closely related to systemic inflammatory reactions and oxidative stresses. Remote ischemic preconditioning is a systemic protective strategy whereby brief limb ischemia confers systemic protection against prolonged ischemia and inflammatory reactions in distant organs. This study investigated whether remote ischemic preconditioning provides systemic protective effect on kidneys that are not directly exposed to ischemia–reperfusion injury during complex valvular heart surgery.

Methods: Seventy-six adult patients undergoing complex valvular heart surgery were randomly assigned to either remote ischemic preconditioning group (n = 38) or control group (n = 38). Remote ischemic preconditioning consisted of 3 10-minute cycles of lower limb ischemia and reperfusion with an automated cuff inflator. Primary end points were comparisons of biomarkers of renal injury including serum creatinine, cystatin C and neutrophil gelatinase–associated lipocalin, and incidence of acute kidney injury. Secondary end points were comparisons of myocardial enzyme release and pulmonary parameters.

Results: There were no significant differences in serum levels of biomarkers of renal injury between groups throughout the study period. The incidence of acute kidney injury did not differ between groups. Creatine kinase isoenzyme MB at 24 hours after surgery was lower, and intensive care unit stay was shorter in the remote ischemic preconditioning group than in the control group.

Conclusions: In patients undergoing complex valvular heart surgery, remote ischemic preconditioning did not reduce degree of renal injury or incidence of acute kidney injury whereas it did reduce myocardial injury and intensive care unit stay.

Should Heart Transplant Recipients With Early Graft Failure Be Considered for Re-transplantation?

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Background: The purpose of this study was to determine if orthotopic heart transplantation performed within 90 days of an initial heart transplant (re-Tx) should be a contraindication to retransplantation based on inferior outcomes when compared with primary orthotopic heart transplantation recipients (control).

Methods: De-identified data were obtained from the United Network for Organ Sharing. The study population included all adult heart transplant recipients greater than 18 years old from 1995 to 2008 (n = 26,804). Multivariable regression was performed in order to assess the simultaneous effect of multiple risk factors on posttransplant graft failure (PTGF) at 90 days. Secondary outcomes of interest included infection, stroke, and dialysis during the transplant hospitalization as well as primary nonfunction of the graft at 90 days.

Results: Among the study cohort, there were 90 (0.34%) re-Tx patients. Median survival in this group was 1.6 years compared with 10.5 years for controls. Unadjusted PTGF, infection, dialysis, and primary nonfunction were significantly higher ($p < 0.001$) in the re-Tx group. After risk adjustment, however, PTGF ($p = 0.545$), infection ($p = 0.696$), dialysis ($p = 0.664$), stroke ($p = 0.115$), and primary nonfunction ($p = 0.531$), did not differ significantly between the 2 groups.

Conclusions: When controlling for pretransplant recipient characteristics, retransplantation within 90 days of a previous transplant is not associated with increased morbidity or mortality. However, unadjusted overall survival was significantly worse in the re-Tx group. This suggests that although retransplantation at 90 days alone is not a risk factor for inferior outcomes, given the significant comorbidities of these patients, the indications for retransplantation within 90 days are rare and must be critically examined.

On-pump versus off-pump surgical revascularization in patients with acute coronary syndromes: Analysis from the Acute Catheterization and Urgent Intervention Triage Strategy trial

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Objective: Early invasive strategy, defined as early coronary angiography and subsequent revascularization, when appropriate, is recommended by current guidelines for the management of patients with moderate- to high-risk acute coronary syndromes. We sought to compare the outcomes of patients with acute coronary syndromes undergoing surgical revascularization with an on-pump versus off-pump approach.

Methods: Among a total of 13,819 patients with moderate- to high-risk acute coronary syndromes enrolled in the Acute Catheterization and Urgent Intervention Triage Strategy trial, 1375 patients were triaged to isolated coronary artery bypass grafting. One thousand one hundred fifty-four patients underwent operations with cardiopulmonary bypass (the coronary artery bypass grafting group), and 221 patients underwent off-pump coronary artery bypass grafting (the off-pump coronary artery bypass grafting group). Propensity score matching (1:3) was applied to adjust for differences in baseline clinical and angiographic characteristics, yielding a total of 880 matched patients with acute coronary syndromes (220 managed with off-pump coronary artery bypass grafting and 660 managed with coronary artery bypass grafting).

Results: At 30 days, patients undergoing off-pump coronary artery bypass grafting had fewer events of bleeding (43.7% vs 56.3%, $P = .0005$) and myocardial infarction (7.3% vs 12.1%, $P = .055$) but higher rates of reintervention (3.7% vs 1.2%, $P = .02$). At 1 year, there was no difference between groups in death, total myocardial infarctions, reinterventions, strokes, or major adverse cardiac events, but

there was a lower rate of non–Q-wave myocardial infarctions in the off-pump coronary artery bypass grafting group (4.6% vs 9.2%, P = .03).

Conclusions: In this large-scale study evaluating the outcomes of patients with acute coronary syndromes, off-pump coronary artery bypass grafting was associated with lower rates of bleeding and non–Q-wave myocardial infarction but more reinterventions early after the procedure. At 1 year, there was no major outcome difference between the 2 surgical strategies.

In patients with an enlarged left atrium does left atrial size reduction improve maze surgery success?

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A best evidence topic in cardiothoracic surgery was written according to a structured protocol. The question addressed was: In [adults undergoing a maze procedure for atrial fibrillation (AF)], [does left atrial size reduction] compared to [maze surgery alone] improve [maze surgery success]? A total of 58 papers were found using the reported search, of which eight represented the best evidence to answer the clinical question. The authors, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers are tabulated. Four out of eight papers compared a volume reduction technique as an adjunct to the maze procedure to a maze procedure alone - all four papers reported that atrial volume reduction significantly increased restoration of sinus rhythm: 89.3% vs. 67.2%, P<0.001; 85% vs. 68%, P<0.05; 84% vs. 68%, P<0.05; 90% vs. 69%, P<0.05. Three out of eight papers had no control group but reported good rates of sinus rhythm restoration at last follow-up -90%, 92% and 89%, respectively - despite the study population including atrial enlargement, a risk factor for failure of a maze procedure. One paper reported no benefit of an atrial reduction plasty in patients with a left atrium (LA) >70 mm. An enlarged LA is a risk factor for failure of a maze procedure, and various models of AF suggest that reducing atrial mass and/or diameter may help to abolish the re-entry circuits underlying AF. Furthermore, AF is uncommon when left atrial diameter is <40 mm, so there is at least some physiological basis for atrial reduction surgery in aiding the success of a maze procedure. The evidence suggests that patients with an enlarged (≥55 mm) or giant (≥75 mm) LA who are at risk of failing to obtain sinus conversion after a standard maze procedure may derive benefit from concomitant atrial reduction surgery using either a tissue excision or a tissue plication technique. However, the evidence is not strong since the papers available are not readily comparable owing to substantial variations in the populations and procedures involved. We therefore, emphasise the need for prospective randomised studies in this area. Keywords: Atrial fibrillation; Cox maze; Left atrial size reduction; maze, Mini-maze; Recurrence of atrial fibrillation