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James I. Fann, MD, Stanford, Calif

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We intended to provide the basis for a safe, standardized approach to minimally invasive aortic valve replacement via upper hemisternotomy or right anterior thoracotomy. In addition, a stepwise learning program to achieve proficiency is outlined for surgeons who are interested in performing minimally invasive aortic valve replacement.

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The characteristics of good thoracic surgical training
John W. Hammon, MD, Fred A. Crawford, MD, and Members of the Senior Tour, Winston-Salem, NC, and Charleston, SC

Simulation in cardiothoracic surgical training: Where do we stand?
Kanika Trehan, MS, Clinton D. Kemp, MD, and Stephen C. Yang, MD, Baltimore, Md

Surgical simulation is becoming an increasingly important educational tool in training cardiothoracic surgeons. Here, we review the current status of simulation in cardiothoracic surgical training and provide an overview of all simulation models applicable to cardiothoracic surgery that have been published to date.

(continued on page 16A)
One-year follow-up period after transumbilical thoracic sympathectomy for hyperhidrosis: Outcomes and consequences

Li-Huan Zhu, MD, Quan Du, MD, Long Chen, MD, Shengsheng Yang, MD, Yuanrong Tu, MD, Shengping Chen, MD, and Weisheng Chen, MD, PhD, Fuzhou, People’s Republic of China

Thoracoscopic sympathectomy is the preferred treatment for patients with hyperhidrosis, but this procedure can be associated with chronic pain and visible scars. We developed a new procedure: transumbilical thoracic sympathectomy. The 1-year follow-up results confirmed that this method is effective and has a high level of satisfaction.

Minimal-dose computed tomography is superior to chest x-ray for the follow-up and treatment of patients with resected lung cancer

Wael C. Hanna, MBA, MD, Narinder S. Paul, MD, Gail E. Darling, MD, Hadas Moshonov, PhD, Frances Allison, MSc, Thomas K. Waddell, MD, PhD, Marcelo Cypel, MD, Marc E. de Perrot, MD, Kazuhiro Yasufuku, MD, PhD, Shaf Keshavjee, MSc, MD, and Andrew F. Pierre, MSc, MD, Toronto, Ontario, Canada

A minimal-dose computed tomography scan is superior to chest radiography for follow-up evaluation after curative resection of lung cancer. The majority (78%) of recurrences are diagnosed at the asymptomatic stage. Those patients are eligible for further curative treatment and have prolonged survival.

Neoadjuvant chemoradiotherapy for locally advanced thymic tumors: A phase II, multi-institutional clinical trial

Robert J. Korst, MD, Andrea Bezjak, MD, Shanda Blackmon, MD, Noah Choi, MD, Panos Fidias, MD, Geoffrey Liu, MD, Alexander Marx, MD, Cameron Wright, MD, Susan Mock, RN, John R. Rutledge, MAS, and Shaf Keshavjee, MD, Paramus and Ridgewood, NJ; Ardsley, NY; Toronto, Ontario, Canada; Houston, Tex; Boston, Mass; and Mannheim, Germany

Induction chemoradiotherapy administered to patients with locally advanced thymic tumors was tolerable and resulted in a high rate of complete surgical resection. Specific CT and PET criteria are helpful in selecting patients with Masaoka stage III tumors and those with B3 thymoma and thymic carcinoma.

Invasive mechanical ventilation in patients with fibrosing interstitial pneumonia

Stephane Gaudry, MD, François Vincent, MD, Antoine Rabbat, MD, Hilario Nunes, MD, PhD, Bruno Crestani, MD, PhD, Jean Marc Naccache, MD, Michel Wolff, MD, PhD, Gabriel Thabut, MD, PhD, Dominique Valeyre, MD, PhD, Yves Cohen, MD, PhD, and Hervé Mal, MD, PhD, Paris and Bobigny, France

In this retrospective work, we included 27 patients with idiopathic pulmonary fibrosis or fibrosing idiopathic nonspecific interstitial pneumonia who required invasive mechanical ventilation. A subset of patients were discharged alive from the ICU and hospital, thus providing the opportunity to consider lung transplant.
Tumor invasiveness as defined by the newly proposed IASLC/ATS/ERS classification has prognostic significance for pathologic stage IA lung adenocarcinoma and can be predicted by radiologic parameters

Mamoru Takahashi, MD, Yoshiki Shigematsu, MD, PhD, Makoto Ohta, MD, Hironobu Tokumasu, MD, MPH, Tadashi Matsukura, MD, PhD, and Takashi Hirai, MD, PhD, Fukui and Kyoto, Japan

We evaluated the prognostic significance and radiologic findings of pathologic stage IA lung adenocarcinoma classified according to the newly proposed International Association for the Study of Lung Cancer, American Thoracic Society, and European Respiratory Society classification. Tumor invasiveness as defined by this classification had prognostic significance and could be predicted by evaluating radiologic parameters on thin-section computed tomography.

Unilateral versus bilateral antegrade cerebral protection during circulatory arrest in aortic surgery: A meta-analysis of 5100 patients

Emiliano Angeloni, MD, Umberto Benedetto, PhD, Johanna J. M. Takkenberg, PhD, Ivan Stigliano, MD, Antonino Roscitano, MD, Giovanni Melina, PhD, and Riccardo Sinatra, MD, Rome, Italy, and Rotterdam, The Netherlands

In complex aortic surgery, the use of unilateral or bilateral cannulation in administering ACP is still debated. Meta-analysis of available data was performed, and bilateral and unilateral ACP showed similar postoperative mortality. In addition, both permanent and temporary neurologic dysfunction rates were similar.

A prospective study of growth and rupture risk of small-to-moderate size ascending aortic aneurysms

Sarah Geisbüs, MD, Angelina Stefanovic, Deborah Schray, Irina Oyfe, Hung-Mo Lin, ScD, Gabriele Di Luozzo, MD, and Randall B. Griep, MD, New York, NY

Computed tomography volume measurements of the aorta provide a precise, reproducible method for monitoring aortic size. Patients with small-to-moderate ascending aortic aneurysms have slow aneurysm growth and a small risk of rupture or dissection. Less frequent than annual computed tomography screening may be indicated, and elective resection may not be necessary.

Arterial grafts balance survival between incomplete and complete revascularization: A series of 1000 consecutive coronary artery bypass graft patients with 98% arterial grafts

Teresa M. Kieser, MD, Helen J. Curran, MD, M. Sarah Rose, PhD, Colleen M. Norris, PhD, and Michelle M. Graham, MD, Calgary and Edmonton, Alberta, Canada; and Halifax, Nova Scotia, Canada

In 1000 patients who had undergone coronary artery bypass grafting (98% arterial grafts), no evidence shows incomplete revascularization decreased survival perioperatively or at midterm in patients younger than age 80 years. Reduced midterm survival occurred in 53 of 70 patients with incomplete revascularization aged ≥80 years. Beneficaility of complete revascularization cannot be tested with a randomized controlled trial, but only with retrospective/observational studies. This study eliminates the venous-graft variable.
The Ross procedure: Outcomes at 20 years
Tirone E. David, MD, Carolyn David, BN, Anna Woo, MD, and Cedric Manlhiot, BSc, Toronto, Ontario, Canada

In this cohort of 212 patients who had undergone the Ross procedure, survival at 20 years was similar to the general population, 77.9% were free from any reoperation, 81.8% were free from reoperation on the pulmonary autograft, and 92.7% in the pulmonary homograft. Dilated aortic annulus and aortic insufficiency were associated with risk of failure.

Off-pump transapical implantation of artificial chordae to correct mitral regurgitation: Early results of a single-center experience
Kestutis Rucinskas, MD, Vilius Janusauskas, MD, Diana Zakarkaite, MD, Sigita Aidietiene, MD, Robertas Samalavicius, MD, Giovanni Speziali, MD, and Audrius Aidietis, MD, Vilnius, Lithuania, and Pittsburgh, Pa

Transapical implantation of artificial chordae (NeoChords) under beating-heart conditions was feasible, could be performed safely, and resulted in a relatively short procedure time. Larger studies and longer follow-up are warranted.

Expanding relevance of aortic valve repair—is earlier operation indicated?
Vikas Sharma, MBBS, Rakesh M. Suri, MD, DPhil, Joseph A. Dearani, MD, Harold M. Burkhart, MD, Soon J. Park, MD, Lyle D. Joyce, MD, Zhao Li, MSc, and Hartzell V. Schaff, MD, Rochester, Minn

Repair of the aortic valve has emerged as a more standardized and reproducible discipline during the past decade. We examined our 20-year experience with AVRop to determine the long-term predictors of survival and reoperation, with particular emphasis on the timing of surgery.

Understanding variability in hospital-specific costs of coronary artery bypass grafting represents an opportunity for standardizing care and improving resource use
Arman Kilic, MD, Ashish S. Shah, MD, John V. Conte, MD, Kaushik Mandal, MBBS, William A. Baumgartner, MD, Duke E. Cameron, MD, and Glenn J. R. Whitman, MD, Baltimore, Md

This study evaluated interhospital variability in CABG costs in the United States. The principal finding was that, after accounting for multiple patient, operative, complication, and hospital-related variables, there persisted significant variability in costs between institutions. Identifying the causes of cost discrepancies in CABG is prudent to improving nationwide resource use.

Mechanical versus bioprosthetic mitral valve replacement in patients <65 years old
Tsuyoshi Kaneko, MD, Sary Aranki, MD, Quratulain Javed, MD, Siobhan McGurk, BS, Prem Shekar, MD, Michael Davidson, MD, and Lawrence Cohn, MD, Boston, Mass

For patients <65 years, MVR with bioprosthetic valves resulted in a greater reoperation rate and decreased survival compared with MVR with mechanical valves. The rate of bleeding and embolic events was similar. These findings have confirmed the safety of MVR with mechanical valves in this population.

(continued on page 19A)
Outcomes of surgical aortic valve replacement in moderate risk patients: Implications for determination of equipoise in the transcatheter era
Sebastian A. Iturra, MD, Rakesh M. Suri, MD, DPhil, Kevin L. Greason, MD, John M. Stulak, MD, Harold M. Burkhart, MD, Joseph A. Dearani, MD, and Hartzell V. Schaff, MD, Rochester, Minn

We studied 502 moderate-risk patients who had undergone SAVR. The early mortality was 2.8%. The predictors of mid-term death were atrial fibrillation and chronic pulmonary and peripheral vascular disease. SAVR in moderate-risk patients can be performed with very low morbidity and mortality.

The second best arterial graft: A propensity analysis of the radial artery versus the free right internal thoracic artery to bypass the circumflex coronary artery
Robert F. Tranbaugh, MD, Kameilla R. Dimitrova, MD, David J. Lucido, PhD, Darryl M. Hoffman, MD, Gabriela R. Dincheva, BS, Charles M. Geller, MD, Sandhya K. Balaram, MD, PhD, Wilson Ko, MD, and Daniel G. Swistel, MD, New York, NY

Either the radial artery or the free right internal thoracic artery may be used as the second arterial graft to gain the survival benefit of multiple arterial bypass grafting. Radial artery conduits appear better in diabetic, chronic obstructive pulmonary disease, and elderly patients undergoing coronary artery bypass grafting. Patient profiles and surgeon preference should guide the choice of the second arterial conduit.

Parameters for successful nonoperative management of traumatic aortic injury
Joseph Rabin, MD, Joe DuBose, MD, Clint W. Sliker, MD, James V. O’Connor, MD, Thomas M. Scalea, MD, and Bartley P. Griffith, MD, Baltimore, Md

The management of blunt traumatic aortic injury has evolved. Treatment options include medical management, TEVAR, and open surgical repair. This study seeks to define a grading system to assign patients for repair or medical management.

Repair of retrograde ascending dissection after descending stent grafting
Jahanzaib Idrees, MD, Amr Arafat, MD, Douglas R. Johnston, MD, Lars G. Svensson, MD, PhD, and Eric E. Roselli, MD, Cleveland, Ohio

RAD can present as an early or a late complication after descending stent grafting because of aortic instability or disease progression and has usually been associated with descending dissection or intramural hematoma. It is a life-threatening complication that can be managed safely with early recognition and rapid delivery of open or hybrid repair.

Reoperative aortic valve replacement in the octogenarians—minimally invasive technique in the era of transcatheter valve replacement
Tsuyoshi Kaneko, MD, Dan Loberman, MD, Igor Gosev, MD, Fadi Rassam, BS, Siobhan McGurk, BS, Marzia Leacche, MD, and Lawrence Cohn, MD, Boston, Mass

Re-AVR in octogenarians can be performed with acceptable mortality and morbidity. A minimally invasive approach might improve survival in this high-risk population.
163 Preoperative percutaneous coronary intervention in patients undergoing open thoracoabdominal and descending thoracic aneurysm repair
Leonard N. Girardi, MD, Yury Rabotnikov, MD, and Dimitrios V. Avgerinos, MD, New York, NY

The ACC/AHA guidelines have not recommended coronary revascularization before elective noncardiac surgery. A total of 592 patients underwent TA repair. Of those, 7.4% had significant CAD and underwent PCI. The perioperative mortality and incidence of MI in the PCI group was 0. Our findings have shown that PCI before TA repair is safe and efficacious.

169 Incidence and progression of mild aortic regurgitation after Tirone David reimplantation valve-sparing aortic root replacement
Elizabeth H. Stephens, MD, PhD, David H. Liang, MD, PhD, John-Peder Escobar Kvitting, MD, PhD, Fabian A. Kari, MD, Michael P. Fischbein, MD, PhD, R. Scott Mitchell, MD, and D. Craig Miller, MD, Stanford, Calif

The incidence and progression of AR after valve-sparing aortic root replacement were analyzed in 96 patients with early and mid-term echocardiograms. Forty-one patients (43%) had mild AR at 1 year, which progressed to moderate AR in 5 patients who subsequently remained stable and to severe AR in 1 patient who ultimately required reoperation.

179 Early clinical and angiographic outcomes after robotic-assisted coronary artery bypass surgery
Michael E. Halkos, MD, MSc, Henry A. Liberman, MD, Chandan Devireddy, MD, Patrick Walker, BA, Alok V. Finn, MD, Wissam Jaber, MD, Robert A. Guyton, MD, and John D. Puskas, MD, MSc, Atlanta, Ga

Robotic-assisted coronary artery bypass grafting provides a minimally invasive alternative to coronary artery bypass grafting via sternotomy or percutaneous intervention for patients with coronary disease. This procedure can be performed for patients with isolated left anterior descending disease or as part of a hybrid revascularization procedure for multivessel disease.

186 Frailty and risk in proximal aortic surgery
Asvin M. Ganapathi, MD, Brian R. Englum, MD, Jennifer M. Hanna, MD, Matthew A. Schechter, MD, Jeffrey G. Gaca, MD, Lynne M. Hurwitz, MD, and G. Chad Hughes, MD, Durham, NC

Although frailty has been examined in various populations, its effect on thoracic aortic surgery outcomes has not been previously studied. In proximal aortic surgery, frailty, as represented by a novel frailty score, serves as an independent risk factor for discharge disposition and as short- and long-term mortality.

192 Implantable physiologic controller for left ventricular assist devices with telemetry capability
Siavash S. Asgari, MS, and Pramod Bonde, MD, New Haven, Conn

We demonstrate a wirelessly powered implantable controller to entirely untether patients from a left ventricular assist device transcutaneous driveline. This system is capable of driving a left ventricular assist device pulsatile mode gated with electrocardiography and of communicating wirelessly with a smart platform.

(continued on page 21A)
203  Results of the minimally invasive coronary artery bypass grafting angiographic patency study
Marc Ruel, MD, MPH, Masood A. Shariff, MD, Harry Lapierre, MD, Nikhil Goyal, MD, Carole Dennie, MD, Scott M. Sadel, MD, Benjamin Sohmer, MD, and Joseph T. McGinn, Jr, MD, Ottawa, Ontario, Canada; and Staten Island, NY

In this dual-center study, 91 patients were prospectively enrolled to undergo MICS CABG via a small left thoracotomy approach. The study primary outcome was graft patency at 6 months, using CTA. There was no mortality or major adverse cardiac events, and 6-month graft patency was 92% for all grafts and 100% for LITA grafts. We conclude that MICS CABG is safe, feasible, and associated with excellent outcomes and graft patency at 6 months post-surgery.

210  Pushing the limits—further evolutions of transcatheter valve procedures in the mitral position, including valve-in-valve, valve-in-ring, and valve-in-native-ring
Manuel Wilbring, MD, Konstantin Alexiou, MD, Sems Malte Tugetkin, MD, Sebastian Arzt, MD, Karim Ibrahim, MD, Klaus Matschke, MD, and Utz Kappert, MD, Dresden, Germany

Transcatheter heart valve procedures are constantly evolving and their application spectrum continuously broadening. This study looks at patients with failing mitral valve replacement or mitral valve repair and reports 3 different entities of further evolutions in transcatheter heart valve procedures: valve-in-valve, valve-in-ring, and valve-in-native-ring.

220  Endovascular coil embolization of segmental arteries prevents paraplegia after subsequent thoracoabdominal aneurysm repair: An experimental model
Sarah Geisbüs, MD, Angelina Stefanovic, Jacob S. Koruth, MD, Hung-Mo Lin, ScD, Susan Morgello, MD, Donald J. Weisz, MD, Randall B. Griepp, MD, and Gabriele Di Luozzo, MD, New York, NY

Coiling of 2 or more segmental arteries endovascularly 1 week before simulated hybrid TAAA repair in pigs significantly reduced ischemic spinal cord damage and thereby dramatically improved functional outcome. Patients at high risk for paraplegia, who are not eligible for 2-stage surgeries, could benefit greatly from this strategy.

228  Three hundred robotic-assisted mitral valve repairs: The Cedars-Sinai experience
Danny Ramzy, MD, PhD, Alfredo Trento, MD, Wen Cheng, MD, Michele A. De Robertis, RN, BS, James Mirocha, MS, Andrea Ruzza, MD, PhD, and Robert M. Kass, MD, Los Angeles, Calif

A review of our first 300 consecutive robotic-assisted mitral valve repairs performed from June 2005 to October 2012. We compare the surgical outcomes of our previously reported initial 120 cases with the subsequent 180 procedures. The majority of complications and reoperations occurred early in our experience, especially using the first-generation da Vinci robot. The newer da Vinci Si HD system with the addition of an adjustable left atrial roof retractor together with increased experience has made robotic assisted mitral repair of all types of degenerative mitral valve pathology reproducible. The training of young surgeons in a stepwise fashion in high-volume centers will help to avoid the complications encountered during the introduction of this technology.
236 Should surgical ablation for atrial fibrillation be performed in patients with a significantly enlarged left atrium?
Niv Ad, MD, Linda Henry, PhD, Sharon Hunt, MBA, and Sari D. Holmes, PhD, Falls Church, Va

A large left atrium (>5.5 cm) conveys a decreased probability of SR restoration at 1 year. However, this group still experiences a high rate of SR restoration with or without antiarrhythmic medications (86%/77%). A large left atrium should not rule out surgical ablation when evaluating patients with atrial fibrillation.

242 Complete thoracoscopic ablation of the left atrium via the left chest for treatment of lone atrial fibrillation
Ju Mei, MD, PhD, Nan Ma, MD, PhD, Fangbao Ding, MD, PhD, Yin Chen, MD, Zhaolei Jiang, MD, Fengqing Hu, MD, and Haibo Xiao, MD, PhD, Shanghai, P. R. China

We developed a less invasive procedure for atrial fibrillation that allowed pulmonary vein isolation, resection of the left atrial appendage, ganglionic plexus ablation, and ablation of the left atrium all through 3 ports in the left chest wall.

247 Echocardiographic evaluation of mitral durability following valve repair in rheumatic mitral valve disease: Impact of Maze procedure
Gwan Sic Kim, Chee Hoon Lee, Joon Bum Kim, Sung-Ho Jung, Suk Jung Choo, Cheol Hyun Chung, and Jae Won Lee, MD, Seoul, Republic of Korea

In an analysis of 193 patients who underwent mitral valve repair for rheumatic valve disease, long-term clinical outcomes of rheumatic mitral repair were excellent. However, a significant number of patients experienced mitral dysfunctions postoperatively. Uncorrected atrial fibrillation without a concomitant Maze procedure increased the risks of mitral dysfunctions and adverse outcomes.

254 Impact of antimicrobial therapy on prognosis of patients requiring valve surgery during active infective endocarditis
Georges Fayad, MD, Andre Vincentelli, MD, PhD, Guillaume Leroy, MD, Patrick Devos, MD, Gilles Amr, MD, Alain Prat, MD, Mohammad Koussa, MD, and Olivier Leroy, MD, Lille and Tourcoing, France

We examined the characteristics and outcomes of patients requiring valve surgery during active infective endocarditis, focusing on impact of antimicrobial therapy. Surgery for active infective endocarditis is still associated with a high mortality rate, but its prognosis is significantly improved by adequate antimicrobial therapy.
270 Long-term patient and allograft outcomes of renal transplant recipients undergoing cardiac surgery
Rodolfo V. Rocha, MD, Diana Zaldonis, MPH, Vinay Badhwar, MD, Lawrence M. Wei, MD, Jay K. Bhama, MD, Ron Shapiro, MD, and Christian A. Bermudez, MD, Pittsburgh, Pa

Long-term outcomes and perioperative risk factors for mortality were examined in 92 patients with a functioning renal allograft who underwent cardiac surgery. Transient postoperative renal impairment increased the risk for allograft failure during long-term follow-up, but overall, outcomes after cardiac surgery were acceptable in these renal transplant recipients.

276 Long-term prognosis of ascending aortic aneurysm after aortic valve replacement for bicuspid versus tricuspid aortic valve stenosis
Evaldas Girdauskas, MD, Kushtrim Disha, MD, Michael A. Borger, MD, PhD, and Thomas Kuntze, MD, Bad Berka and Leipzig, Germany

Our study demonstrates a comparably low risk of adverse aortic events 15 years postoperatively after isolated aortic valve replacement for bicuspid versus tricuspid aortic valve stenosis and concomitant mild to moderate ascending aortic dilatation.

283 Outcomes of extracorporeal life support for low cardiac output syndrome after major cardiac surgery
Sung Jun Park, MD, Joon Bum Kim, MD, Sung-Ho Jung, MD, PhD, Suk Jung Choo, MD, PhD, Cheol Hyun Chung, MD, PhD, and Jae Won Lee, MD, PhD, Seoul, Korea

In this analysis of consecutive 93 patients who underwent extracorporeal life support (ECLS) for postoperative low cardiac output syndrome, the outcomes were determined by pre-ECLS lactate level and the use of anticoagulant nafamostat mesilate. Therefore, timely ECLS placement is required using nafamostat mesilate before the development of overt lactic acidosis.

290 Outcomes of contemporary emergency open surgery for type A acute aortic dissection in elderly patients
Akihito Matsushita, MD, Minoru Tabata, MD, MPH, Toshihiro Fukui, MD, Yasunori Sato, PhD, Shigefumi Matsuyama, MD, Tomoki Shimokawa, MD, and Shuichiro Takanashi, MD, Tokyo and Chiba, Japan

Emergency open surgery for type A acute aortic dissection in patients ≥75 years resulted in low mortality but high incidences of stroke and prolonged hospitalization.

295 Systemic effects of carbon dioxide insufflation technique for de-airing in left-sided cardiac surgery
Maya Landenhed, MD, Faleh Al-Rashidi, MD, PhD, Sten Blomqvist, MD, PhD, Peter Höglund, MD, PhD, Leif Pierre, EBCP, and Bansi Koul, MD, PhD, Lund, Sweden

This prospective randomized study reports that local insufflation of carbon dioxide into the cardiothoracic wound cavity for the purpose of de-airing during left-sided cardiac surgery can induce systemic effects with hypercapnic acidosis, increased cerebral blood flow, and local red blood cell damage.
301 A total of 404 cases of aortic valve reconstruction with glutaraldehyde-treated autologous pericardium
Shigeyuki Ozaki, MD, PhD, Isamu Kawase, MD, Hiromasa Yamashita, MD, Shin Uchida, MD, Yukinari Nozawa, MD, Mikio Takatoh, MD, and So Hagiwara, MD, Tokyo, Japan

We report the early results of our original aortic valve reconstruction using glutaraldehyde-treated autologous pericardium. Early results are excellent. This new technique is feasible as a surgical treatment for the various aortic valve diseases.

307 Optimal treatment strategy for type A acute aortic dissection with intramural hematoma
Mitsumasa Hata, MD, PhD, Hiroaki Hata, MD, Akira Sezai, MD, Isamu Yoshitake, MD, Shinji Wakui, MD, and Motomi Shiono, MD, Tokyo, Japan

We compared the outcome of surgical and medical treatments for patients with acute type A intramural hematoma. Early hospital mortality was 5.4% and 0% in the surgical groups for patients with complicated and uncomplicated conditions, respectively. It was 25.8% in the medical treatment group, which was significantly higher than that of the surgical groups.

312 Assessment of functional tricuspid regurgitation using 320-detector-row multislice computed tomography: Risk factor analysis for recurrent regurgitation after tricuspid annuloplasty
Masashi Kabasawa, MD, Hiroki Kohno, MD, PhD, Toru Ishizaka, MD, PhD, Keiichi Ishida, MD, PhD, Nobusada Funabashi, MD, PhD, Akihisa Kataoka, MD, PhD, and Goro Matsumiya, MD, PhD, Chiba, Japan

Tricuspid valve annular diameters, tethering angles, and tethering height correlated significantly with the severity of functional tricuspid regurgitation. Tethering of the tricuspid valve showed strong correlation with tricuspid regurgitation after tricuspid annuloplasty.

321 Simple interrupted suturing increases valve performance after aortic valve replacement with a small supra-annular bioprosthesis
Minoru Tabata, MD, MPH, Kentaro Shibayama, MD, Hiroyuki Watanabe, MD, Yasunori Sato, PhD, Toshihiro Fukui, MD, and Shuichiro Takanashi, MD, Tokyo and Chiba, Japan

Compared with noneverting mattress sutures, simple interrupted sutures provide larger effective orifice areas and reduce the incidence of prosthesis–patient mismatch after aortic valve replacement with a small supra-annular bioprosthesis.

326 Prognostic value of sustained elevated C-reactive protein levels in patients with acute aortic intramural hematoma
Takeshi Kitai, MD, Shuichiro Kaji, MD, Kitae Kim, MD, Natsuhiko Ehara, MD, Tomoko Tani, MD, Makoto Kinoshita, MD, and Yutaka Furukawa, MD, Kobe, Japan

The data from a total of 180 patients with IMH were retrospectively reviewed to determine the prognostic significance of serial CRP measurements. Patients with elevated CRP had significantly greater rates of adverse events, and an elevated CRP level had incremental value over the development of an ULP. CRP was a simple and useful marker for the prediction of patients with IMH at high risk of adverse events.

(continued on page 25A)
332  Thoracic aortic surgery: An overview of 40 years clinical practice
Jos A. Bekkers, MD, PhD, Roderick J. L. M. te Riele, Johanna J. M. Takkenberg, MD, PhD, Goris Bol Raap, MD, PhD, Jan Hofland, MD, PhD, Jolien W. Roos-Hesselink, MD, PhD, and Ad J. J. C. Bogers, MD, PhD, Rotterdam, The Netherlands

Surgery of the thoracic aorta was performed increasingly during a 40-year time period. Both early mortality and late survival improved impressively over time. In particular, patients with inherited aortic disease may require multiple operations.

344  Durability of central aortic valve closure in patients with continuous flow left ventricular assist devices
Stephen H. McKellar, MD, MSc, Salil Deo, MBBS, Richard C. Daly, MD, Lucian A. Durham III, MD, PhD, Lyle D. Joyce, MD, PhD, John M. Stulak, MD, and Soon J. Park, MD, MSc, Salt Lake City, Utah, and Rochester, Minn

A competent aortic valve is necessary for effective LVAD therapy. One method of correcting native aortic valve regurgitation is a central coaptation stitch placed at device implantation. We report on the long-term durability of this repair.

349  Outcomes of surgery in the treatment of isolated nonnative mitral valve infective endocarditis
Kevin L. Greason, MD, Mathew Thomas, MD, James M. Steckelberg, MD, Richard C. Daly, MD, Hartzell V. Schaff, MD, Zhuo Li, MS, and Joseph A. Dearani, MD, Rochester, Minn

Isolated nonnative mitral valve infective endocarditis is a life-threatening problem. We reviewed our experience with the surgical management of such patients. We report a treatment-related mortality of 21%, but surviving patients obtain a cure rate of 96% and a 5-year survival of 48%.

355  Should less-invasive aortic valve replacement be avoided in patients with pulmonary dysfunction?
Turki B. Albacker, MD, MSc, Eugene H. Blackstone, MD, Sarah J. Williams, MS, A. Marc Gillinov, MD, Jose L. Navia, MD, Eric E. Roselli, MD, Suresh Keshavamurthy, MBBS, MS, Gösta B. Pettersson, MD, PhD, Tomislav Mihaljevic, MD, Douglas R. Johnston, MD, Joseph F. Sabik III, MD, Bruce W. Lyle, MD, and Lars G. Svensson, MD, PhD, Cleveland, Ohio

In patients with preoperative respiratory dysfunction, a partial upper J-incision for aortic valve replacement can lead to more favorable outcomes than a full sternotomy, including shorter intensive care unit and postoperative lengths of stay and better early survival, which are amplified with decreasing pulmonary function.

362  Ventricular hypertrophy and left atrial dilatation persist and are associated with reduced survival after valve replacement for aortic stenosis
Jocelyn M. Beach, BS, Tomislav Mihaljevic, MD, Jeevanantham Rajeswaran, MSc, Thomas Marwick, MD, PhD, Samuel T. Edwards, MD, Edward R. Nowicki, MD, MS, James Thomas, MD, Lars G. Svensson, MD, PhD, FACC, Brian Griffin, MD, A. Marc Gillinov, MD, FACC, and Eugene H. Blackstone, MD, FACC, Cleveland, Ohio, and Abu Dhabi, United Arab Emirates

Severe LV hypertrophy with LA dilatation can develop from severe aortic stenosis, even without symptoms. These changes can persist, are associated with decreased long-term survival even after successful AVR, and could be indications for early AVR if supported by findings from an appropriate prospective study.

(continued on page 26A)
370 Early single-center experience in sutureless aortic valve implantation in 120 patients
Harald C. Eichstaedt, MD, Jerry Easo, MD, Tobias Härle, MD, and Otto E. Dapunt, MD, PhD, Oldenburg, Germany

A large single-center experience with a sutureless bioprosthesis in the aortic position reveals improved surgical key times and excellent hemodynamic results in the midterm follow-up for both isolated aortic valve replacement and in combination with other cardiovascular procedures. Minimally invasive access seems to be facilitated by this method.

376 Interference of propofol with signal transducer and activator of transcription 5 activation and cardioprotection by remote ischemic preconditioning during coronary artery bypass grafting
Eva Kottenberg, MD, Judith Masioliik, PhD, Matthias Thielmann, MD, Heinz Jakob, MD, Jürgen Peters, MD, and Gerd Heusch, MD, PhD, Essen, Germany

Remote ischemic preconditioning during propofol anesthesia did not evoke either STAT5 activation or cardioprotection, in contrast to remote ischemic preconditioning during isoflurane anesthesia. This might imply interaction of propofol with the cardioprotective signaling upstream of STAT5.

383 The Ross procedure in patients aged less than 18 years: The midterm results
Gianluca Brancaccio, MD, PhD, Angelo Polito, MD, MPH, Stiljan Hoxha, MD, Fabrizio Gandolfo, MD, Salvatore Giannico, MD, Antonio Amodeo, MD, and Adriano Carotti, MD, Rome, Italy

The optimal operative management for aortic valve disease in children and young adults remains controversial. The Ross procedure is an attractive option for the management of aortic valve disease and complex left ventricular outflow tract obstruction in pediatric population. However, a high mortality rate might have to be considered when performing this procedure in infants and the high rate of reoperation for right-sided conduit in childhood and adolescence should favor alternative surgical options.

389 Technical Performance Scores are strongly associated with early mortality, postoperative adverse events, and intensive care unit length of stay—analysis of consecutive discharges for 2 years
Meena Nathan, MD, John Karamichalis, MD, Hua Liu, MS, Kimberley Gauvreau, ScD, Steven Colan, MD, Matthew Saia, BS, Frank Pigula, MD, Francis Fynn-Thompson, MD, Sitaaram Emani, MD, Christopher Baird, MD, John E. Mayer, MD, and Pedro J. del Nido, MD, Boston, Mass

The TPS is strongly associated with early mortality, adverse events, and increased resource usage after congenital cardiac surgery after adjusting for age and disease complexity and can be used as a tool for self-assessment and quality improvement.

397 Modified Blalock-Taussig shunt versus ductal stenting for palliation of cardiac lesions with inadequate pulmonary blood flow
David Michael McMullan, MD, Lester Cal Permut, MD, Thomas Kenny Jones, MD, Troy Alan Johnston, MD, and Agustin Eduardo Rubio, MD, Seattle, Wash

Percutaneous stenting of the ductus arteriosus has been introduced as an alternative to the mBTS for palliation of ductal-dependent cardiac lesions. mBTS and stented patients experienced similar rates of reintervention to provide appropriate pulmonary blood flow, supporting the use of ductal stenting in selected patients.

(continued on page 27A)
404 Left thoracoscopic sympathectomy for cardiac denervation in patients with life-threatening ventricular arrhythmias
Sophie C. Hofferberth, MBBS, BSc, Frank Cecchin, MD, Dan Loberman, MD, and Francis Fynn-Thompson, MD, Boston, Mass

We conducted a retrospective review of all patients who underwent video-assisted thoracoscopic left cardiac sympathetic denervation for treatment of life-threatening ventricular arrhythmias. This minimally invasive adjunctive therapy achieves a beneficial response in most symptomatic patients and should be considered amongst the treatment armamentarium in all patients with refractive ventricular arrhythmias.

412 Management of tricuspid regurgitation in congenital heart disease: Is survival better with valve repair?
Sameh M. Said, MD, Joseph A. Dearani, MD, Harold M. Burkhart, MD, Heidi M. Connolly, MD, Ben Eidem, MD, Paul E. Stensrud, MD, and Hartzell V. Schaff, MD, Rochester, Minn

A total of 553 patients underwent TV surgery for congenital TR from January 1993 to December 2010. TV repair was performed in 442 (80%) and valve replacement in 111 (20%). TV repair was associated with significantly better survival than was valve replacement.

420 Paracorporeal lung assist devices as a bridge to recovery or lung transplantation in neonates and young children
David M. Hoganson, MD, Avihu Z. Gazit, MD, Umar S. Boston, MD, Stuart C. Sweet, MD, R. Mark Grady, MD, Charles B. Huddleston, MD, and Pirooz Eghtesady, MD, PhD, St Louis, Mo

A pumpless paracorporeal lung assist device with inflow from the pulmonary artery and return to the LA supported 1 neonate and 3 small children with decompensated respiratory failure as a bridge to LT, recovery, or past the average wait time for donor lungs.

428 A composite outcome for neonatal cardiac surgery research
Ryan J. Butts, MD, Mark A. Scheurer, MD, Sinai C. Zyblewski, MD, Amy E. Wahlquist, MS, Paul J. Nietert, PhD, Scott M. Bradley, MD, Andrew M. Atz, MD, and Eric M. Graham, MD, Charleston, SC

A composite outcome including death, mechanical circulatory support, cardiac arrest, hepatic or renal injury, and lactic acidosis was studied in neonates undergoing cardiac operations. The composite outcome was highly associated with duration of mechanical ventilation, intensive care unit stay, and hospital stay. This composite outcome may be useful in future trials.

434 Residual lesions in postoperative pediatric cardiac surgery patients receiving extracorporeal membrane oxygenation support
Hemant S. Agarwal, MBBS, FAAP, Daphne C. Hardison, VPNPP, Benjamin R. Saville, PhD, Brian S. Donahue, MD, PhD, Fred S. Lamb, MD, PhD, David P. Bichell, MD, and Zena L. Harris, MD, Nashville, Tenn

Hemodynamically significant residual lesions requiring reintervention to wean from ECMO support are present in 28% of postoperative pediatric cardiac surgery patients placed on ECMO. Earlier recognition and intervention of residual lesions on ECMO is associated with improved clinical outcomes.

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### 442 The effect of preoperative nutritional status on postoperative outcomes in children undergoing surgery for congenital heart defects in San Francisco (UCSF) and Guatemala City (UNICAR)

Monique Radman, MD, Ricardo Mack, MD, Joaquin Barnoya, MD, MPH, Aldo Castañeda, MD, PhD, Monica Rosales, MD, Anthony Azakie, MD, Nilesh Mehta, MD, Roberta Keller, MD, Sanjeev Datar, MD, PhD, Peter Oishi, MD, and Jeffrey Fineman, MD, San Francisco, Calif, Guatemala City, Guatemala; St. Louis, Mo, and Boston, Mass

Lower total body fat mass and acute/chronic malnourishment are associated with worse clinical outcomes in children undergoing surgery for congenital heart disease in a resource-abundant institution. Duration of inotropic support and plasma BNP levels increase concomitantly as measures of nutritional status decrease, supporting the hypothesis that malnourishment is associated with decreased myocardial function.

### 451 Long-term follow-up evaluation of renal function in patients treated with peritoneal dialysis after cardiac surgery for correction of congenital anomalies

Eran Mel, MD, Miriam Davidovits, MD, and Ovdi Dagan, MD, Petach Tikva and Tel Aviv, Israel

A single-center cohort study was conducted to assess the long-term renal outcome of patients who underwent correction of congenital heart anomalies at Schneider’s Children’s Medical Center Israel, and developed AKI requiring peritoneal dialysis. Of 76 patients included in our study, 26 were alive at time of follow-up. Of these, 25 had normal renal function. Despite the development of AKI requiring dialysis after correction of congenital cardiac anomalies, the long-term renal prognosis in survivors is good.

## Cardiothoracic Transplantation (TX)

### 456 Combined heart-kidney transplant improves post-transplant survival compared with isolated heart transplant in recipients with reduced glomerular filtration rate: Analysis of 593 combined heart-kidney transplants from the United Network Organ Sharing Database

Tara Karamlou, MD, Karl F. Welke, MD, D. Michael McMullan, MD, Gordon A. Cohen, MD, Jill Gelow, MD, Frederick A. Tibayan, MD, James M. Mudd, MD, Matthew S. Slater, MD, and Howard K. Song, MD, San Francisco, Calif, Seattle, Wash, and Portland, Ore

Criteria for performing simultaneous heart-kidney transplants are unclear. We investigated if a threshold estimated glomerular filtration rate could be identified that justified combined heart-kidney transplant. Isolated heart transplant recipients in the lowest estimated glomerular filtration rate quintile had worse survival than combined kidney-heart transplant recipients, suggesting a benefit from a combined transplant strategy in this subgroup.

### 462 Risk factors for mortality or delisting of patients from the pediatric heart transplant waiting list

Aamir Jeewa, MD, Cedric Manlhiot, BS, Paul F. Kantor, MBBC, Seema Mital, MD, Brian W. McCrindle, MD, MPH, and Anne I. Dipchand, MD, Toronto, Ontario, Canada

This retrospective study between 1999 and 2008 to determine risk factors for children awaiting heart transplant showed higher probability of transplant or delisting for patients receiving mechanical circulatory support and higher mortality for younger patients and those with complex congenital heart disease. Knowledge of risk factors can assist transplant listing.
Analgesia in patients undergoing thoracotomy: Epidural versus paravertebral technique. A randomized, double-blind, prospective study
Federico Raveglia, MD, Alessandro Rizzi, MD, Andrea Leporati, MD, Piero Di Mauro, MD, Ugo Cioffi, PhD, and Alessandro Baisi, MD, Milan, Italy

Pain must always be controlled after thoracotomy. The aim of our study was to compare the gold standard epidural catheter with a technique that involves placement of a catheter in the paravertebral space. Data we collected show that paravertebral catheters are safe and effective and must always be considered as an alternative.

Dexamethasone levels predict cortisol response after infant cardiopulmonary bypass
Sheri S. Crow, MD, William C. Oliver, Jr, MD, Jamie A. Kiefer, PA, Melissa R. Snyder, PhD, Joseph A. Dearani, MD, Zhuo Li, MS, and Harold M. Burkhart, MD, Rochester, Minn

A 1 mg/kg dose of dexamethasone given to infants before cardiopulmonary bypass generates significantly different blood levels of dexamethasone at intensive care unit arrival. These levels are highly correlated with the postoperative cortisol response. Higher dexamethasone levels are associated with lower postoperative cortisol levels and this suppression persists even after dexamethasone levels decrease.

Duration and magnitude of blood pressure below cerebral autoregulation threshold during cardiopulmonary bypass is associated with major morbidity and operative mortality
Masahiro Ono, MD, PhD, Kenneth Brady, MD, R. Blaine Easley, MD, Charles Brown, MD, Michael Kraut, MD, PhD, Rebecca F. Gottesman, MD, PhD, and Charles W. Hogue, Jr, MD, Baltimore, Md, and Houston, Tex

The duration and magnitude of blood pressure below the lower limit of autoregulation during cardiopulmonary bypass has been associated with major morbidity and operative mortality. Real-time monitoring of cerebral blood flow autoregulation might provide optimal blood pressure targets and the lower limit of autoregulation during cardiopulmonary bypass.

The influence of preoperative weight loss on the postoperative course after esophageal cancer resection
Maartje K. van der Schaaf, MD, Hugo W. Tilanus, MD, PhD, Jan J. B. van Lanschot, MD, PhD, Asif M. Johar, BSc, MSc, Permina Lagergren, PhD, Jesper Lagergren, MD, PhD, and Bas P. L. Wijnhoven, MD, PhD, Stockholm, Sweden, Rotterdam, The Netherlands, and London, United Kingdom

Preoperative weight loss might increase the risk of postoperative morbidity and mortality after esophagectomy for cancer. The risk of complications was estimated using multivariate logistic regression models. HRs were used to calculate survival. The results showed decreased 5-year survival but no increased risk of complications with >10% weight loss.

Minimally invasive papillary muscle sling placement during mitral valve repair in patients with functional mitral regurgitation
Orlando Santana, MD, Natalia V. Solenkova, MD, Andres M. Pineda, MD, Christos G. Mihos, DO, and Joseph Lamelas, MD, Miami Beach, Fla

In patients with severe functional mitral regurgitation, minimally invasive mitral repair with papillary muscle sling placement for severe functional mitral regurgitation is safe and effective in the short-term.
Dexmedetomidine, an α-2a adrenergic agonist, promotes ischemic tolerance in a murine model of spinal cord ischemia-reperfusion

Paraplegia is a complication of aortic surgery. Pharmacologic agents that increase neurons’ ischemic tolerance would serve as ideal adjuncts to reduce the risk of this complication. Pretreatment with dexmedetomidine increased cyclic AMP response-element binding protein-mediated neuroprotective proteins attenuating neuronal injury and cytoarchitectural decay in a murine model of spinal cord ischemia-reperfusion.

Targeting of the Hedgehog signal transduction pathway suppresses survival of malignant pleural mesothelioma cells in vitro

The Hh pathway is active in MPM cells. Attenuation of pathway signaling by genetic or pharmacologic approaches suppressed tumor cell proliferation. Repurposing of pharmaceutical agents Food and Drug Administration–approved for other clinical indications but recently found to have Hh inhibitory activity might facilitate clinical development of this class of targeted molecular therapeutic agents.

Vascularity of human atrioventricular valves: A myth or fact?

The present study examined the type, location, and number of vessels in the atrioventricular valve apparatus using a light microscope. There were 60 normal formalin-fixed human hearts with ages ranging from 10 to 70 years. The vessels were observed in 12 tricuspid (20%) and 14 mitral (23.33%) valves. When performing procedures involving in situ tissue engineering and valve repair, the physician needs to be aware of presence of these vessels in human heart valves.

A case of subaortic stenosis

Simultaneous relief of acute visceral and limb ischemia in complicated type B aortic dissection by axillobifemoral bypass

Transaortic repair for the moderate functional mitral regurgitation

An alternative technique for surgical repair of pulmonary dissection

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A simplified technique for pulmonary autograft stabilization with the Valsalva prosthesis
Joel Price, MD, MPH, Saadallah Tamer, MD, Laurent de Kerchove, MD, and Gebrine El Khoury, MD, Baltimore, Md, and Brussels, Belgium

Two-stage hybrid repair for a Kommerell diverticulum in a right-sided aortic arch associated with multivessel coronary disease and atrial septal defect
Hidetake Kawajiri, MD, Katsuhiko Oka, MD, Keiichi Kanda, MD, PhD, and Hitoshi Yaku, MD, PhD, Kyoto, Japan

Ross operation after failed valve-sparing reimplantation: Pulmonary autograft inclusion into the previously implanted Valsalva graft
Saadallah Tamer, MD, Laurent de Kerchove, MD, Norman Colina Manzano, MD, and Gebrine Elkhoury, MD, Brussels, Belgium

Right ventricular local longitudinal curvature as a marker and predictor for pulmonary valve replacement surgery outcome: An initial study based on preoperative and postoperative cardiac magnetic resonance data from patients with repaired tetralogy of Fallot
Dalin Tang, PhD, Chun Yang, MS, Tal Geva, MD, and Pedro J. del Nido, MD, Worcester and Boston, Mass; and Nanjing and Beijing, China

Sequela-free long-term survival of a 65-year-old woman after 8 hours and 40 minutes of cardiac arrest from deep accidental hypothermia
Marie Meyer, MD, Nathalie Pelurson, MD, Ebrahim Khabiri, MD, Nils Siegenthaler, MD, and Beat H. Walpoth, MD, Geneva, Switzerland, and Embrun, France

Transient right ventricular dysfunction caused by retractor during lower hemisternotomy mitral valve repair in a patient with pectus excavatum
Homare Okamura, MD, Jon Parmet, MD, and Robert S. Farivar, MD, PhD, Philadelphia, Pa

Delayed esophageal diverticulum formation after stent-based treatment of perforation
Meghana R. Kunkala, MD, and Claude Deschamps, MD, Rochester, Minn

Acute inferior wall myocardial infarction secondary to ruptured sinus of Valsalva aneurysm in a 22-year-old man
Hui-Ping Sun, MD, Xiang Ma, PhD, Xue Bao, MD, Karmacharya Ujit, MD, and Yi-Tong Ma, PhD, Ürümqi, China

Early structural valve deterioration of the Trifecta aortic valve biological prosthesis: A word of caution
Pankaj Saxena, FRACS, PhD, Kevin L. Greason, MD, and Hartzell V. Schaff, MD, Rochester, Minn

Sternal closure technique for bilateral transverse thoracosternotomy after bilateral sequential lung transplantation
Suresh Keshavamurthy, MD, Sudish C. Murthy, MD, PhD, and David P. Mason, MD, Cleveland, Ohio

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541 B-type natriuretic peptide in children undergoing pediatric cardiac surgery: Just a marker of disease severity strongly related to age or much more?
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541 TAVI without surgical standby: Is history repeating itself? A word of caution
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543 Reply to the Editor
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Notices of Correction


544 Correction of article by Hussain ST, Idrees J, Brozzi NA, Blackstone EH, Pettersson GB. entitled Reply to the Editor (2013;146:1301).

544 Correction of article by Hussain ST, Blackstone EH, Pettersson GB. entitled Reply to the Editor (2013;146:1557-8).

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