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621  Historical perspectives of The American Association for Thoracic Surgery: Thomas H. Burford (1907-1977)  
*Shoichi Okada, MD, and Marc R. Moon, MD, St Louis, Mo*

### Expert Review

626  Isolation of persistent air leaks and placement of intrabronchial valves  
*Amit K. Mahajan, MD, Diana C. Doeing, MD, and Douglas K. Hogarth, MD, Chicago, Ill*

The present review describes the methods used for the placement of Spiration IBVs in patients with PALs secondary to APFs. The placement process of IBVs is a collection of steps aimed at identifying and occluding the lung segments contributing to PALs. These steps include air leak isolation, airway sizing, and valve deployment. Additionally, the methods for removal and the possible complications from IBV placement are described.

### Congenital Heart Disease (CHD)

631  Prioritizing quality improvement in pediatric cardiac surgery  
*Pirooz Eghtesady, MD, PhD, Anoop K. Brar, PhD, and Matthew Hall, PhD, St Louis, Mo, and Overland Park, Kan*

We analyzed data related to commonly performed procedures in pediatric cardiac surgery according to mortality, intensive care unit/total hospital lengths of stay (excess days and coefficient of variation), adverse events, and readmission rates. We developed a prioritization scheme for targeting quality improvement on the basis of these measures.

641  Contemporary outcomes of surgical ventricular septal defect closure  
*Brett R. Anderson, MD, MBA, Kristen N. Stevens, PhD, Susan C. Nicolson, MD, Stephen B. Gruber, MD, PhD, Thomas L. Spray, MD, Gil Wernovsky, MD, and Peter J. Gruber, MD, PhD, Philadelphia, Pa, and Ann Arbor, Mich*

This retrospective study examined a consecutive series of 369 simple ventricular septal defect closures at a single institution. The results of the analyses argue that, even in the current era, weight remains an important factor in reducing risk in young infants, and is a strong predictor of shorter length of stay.

648  Arrhythmia surgery for atrial fibrillation associated with atrial septal defect: Right-sided maze versus biatrial maze  
*Yu-Mi Im, MS, Joon Bum Kim, MD, Sung-Cheol Yun, PhD, Jae Won Lee, MD, Cheol Hyan Chung, MD, Jeong-Jun Park, MD, and Tae-Jin Yen, MD, PhD, Seoul, Republic of Korea*

The electrophysiological outcome of a biatrial maze procedure for atrial fibrillation associated with atrial septal defect was compared with that of limited right-sided ablation. By using the Cox survival model, the right-sided ablation group showed a significantly decreased time to recurrence of atrial fibrillation in comparison with the biatrial maze procedure group (hazard ratio, 5.11; 95% confidence interval, 1.59-16.44; \( P = .006 \)).

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656  Complete but not partial thymectomy in early infancy reduces T-cell–mediated immune response: Three-year tracing study after pediatric cardiac surgery  
Hirotsugu Karobe, MD, PhD, Takashi Tominaga, MD, PhD, Mikio Sugano, MD, Yasunobu Hayabuchi, MD, PhD, Yoshiyasu Egawa, MD, PhD, Yousuke Takahama, PhD, and Tetsuya Kitagawa, MD, PhD, Tokushima, Kagawa, and Ehime, Japan

How neonatal thymectomy affects the subsequent development of the immune system in humans remains unclear. We monitored thymectomized infants for 3 years. Patients with complete thymectomy exhibited a reduction in T-cell number, attenuated vaccination-induced immunoglobulin-G responses, and an increase in hospitalization frequency. The thymus should be at least partially conserved.

663  Simulating hemodynamics of the Fontan Y-graft based on patient-specific in vivo connections  
Christopher M. Haggerty, BS, Kirk R. Kanter, MD, Maria Restrepo, BS, Diane A. de Zélicourt, PhD, W. James Parks, MD, Jarek Rossignac, PhD, Mark A. Fogel, MD, and Ajit P. Yoganathan, PhD, Atlanta, Ga, and Philadelphia, Pa

The hemodynamics of the Fontan Y-graft taken from patient-specific connections are characterized. Compared with virtually modeled total cavopulmonary connection controls, the first-generation in vivo Y-grafts demonstrated similar efficiency characteristics with improved stability of inferior caval flow distributions. Important considerations of surgical implementation are proposed to improve hemodynamic performance.

671  Unplanned reinterventions are associated with postoperative mortality in neonates with critical congenital heart disease  
Mjaye L. Mazwi, MD, David W. Brown, MD, Audrey C. Marshall, MD, Frank A. Pigula, MD, Peter C. Laussen, MBBS, Angelo Polito, MD, MPH, David Wypij, PhD, and John M. Costello, MD, MPH, Boston, Mass

Of 943 neonates who underwent cardiac surgery, 11% required an unplanned cardiac reintervention during the same hospitalization. Patients who were smaller, had a greater RACHS-1 category, or less-experienced surgeons were at greater risk. The need for an unplanned reintervention was strongly associated with increased in-hospital mortality.

678  Intra/extracardiac fenestrated modification leads to lower incidence of arrhythmias after the Fontan operation  
Pranava Sinha, MD, David Zurakowski, PhD, Dingchao He, MD, Can Yerebakan, MD, Vicki Friedenberg, RN, Jeffrey P. Moak, MD, and Richard A. Jonas, MD, Washington, DC, and Boston, Mass

In this retrospective review of patients who underwent the Fontan operation, 3 technical modifications were compared. The intra/extracardiac modification was found to have the lowest incidence of abnormal rhythm at short- and intermediate-term follow-up, especially when compared with the lateral tunnel modification. Other predictors of abnormal rhythm were more than moderate atrioventricular valve regurgitation preoperatively (arrhythmias in the first 2 postoperative weeks), and older age at Fontan and preoperative higher mean pulmonary artery pressures (at longer follow-up).

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Surgical treatment of metachronous second primary lung cancer after complete resection of non–small cell lung cancer
Masatsugu Hamaji, MD, Mark S. Allen, MD, Stephen D. Cassivi, MD, Claude Deschamps, MD, Francis C. Nichols, MD, Dennis A. Wigle, MD, PhD, and K. Robert Shen, MD, Rochester, Minn

Outcomes of surgical treatment of a second metachronous NSCLC were investigated. Tumor size 2 cm or smaller is a significant favorable factor for survival and lower rate of progression following resection. Expected morbidity and mortality are comparable to primary surgery.

Treatment of stage I lung cancer in high-risk and inoperable patients: Comparison of prospective clinical trials using stereotactic body radiotherapy (RTOG 0236), sublobar resection (ACOSOG Z4032), and radiofrequency ablation (ACOSOG Z4033)
Traves Crabtree, MD, Varun Puri, MD, Robert Timmerman, MD, Hiran Fernando, MD, Jeffrey Bradley, MD, Paul A. Decker, MS, Rebecca Paulus, PhD, Joe B. Putnum, Jr, MD, Damian E. Dupuy, MD, and Bryan Meyers, MD, MPH, St. Louis, Mo, Dallas, Tex, Boston, Mass, Rochester, Minn, Philadelphia, Pa, Nashville, Tenn, and Providence, RI

The selection criteria and short-term outcomes were compared among 3 prospective clinical trials using SBRT (RTOG 0236), sublobar resection (ACOSOG Z4032), and RFA (ACOSOG Z4033). The pretreatment DLCO% was 61.6% ± 30.2% for RTOG 0236, 46.4% ± 15.6% for ACOSOG Z4032, and 43.7% ± 18.0% for ACOSOG Z4033 (P = .001). A propensity-matched comparison showed no difference between SBRT and surgery for 30-day grade 3+ AEs (odds ratio, 2.37; 95% confidence interval, 0.75-9.90; P = .18). These results underscore the need for a randomized trial to delineate the relative survival benefit of each modality and to help stratify patients considered high risk.

The best that surgery has to offer
Thomas A. D’Amico, MD, Durham, NC

Lung cancer lymph node micrometastasis detection using real-time polymerase chain reaction: Correlation with vascular endothelial growth factor expression
Chukwumere E. Nwogu, MD, Sai Yendamuri, MD, Wei Tan, MS, Eric Kannisto, MS, Paul Bogner, MD, Carl Morrison, MD, DVM, Richard Cheney, MD, Elisabeth Dexter, MD, Anthony Picone, PhD, Mark Hennon, MD, Alan Hutson, PhD, Mary Reid, PhD, Alex Adjei, MD, PhD, and Todd L. Demmy, MD, Buffalo, NY

A handheld gamma probe facilitated the detection of micrometastases in lymph nodes by quantitative real-time polymerase chain reaction after pulmonary resection for lung cancer. This correlated positively with vascular endothelial growth factors A, C, and D and VEGF receptor-3 expression in lymph nodes.

Positron emission tomography combined with diagnostic chest computed tomography enhances detection of regional recurrence after stereotactic body radiation therapy for early stage non–small cell lung cancer
Michael I. Ebright, MD, Gregory A. Russo, MD, Avneesh Gupta, MD, Rathana M. Subramaniam, MD, Hiran C. Fernando, MBBS, and Lisa A. Kachnic, MD, Boston, Mass

Recommendations for surveillance after SBRT for early stage NSCLC are not well defined. We performed a retrospective analysis of posttreatment imaging for 35 patients treated with SBRT for early-stage NSCLC. PET enhances detection of regional recurrence after SBRT over currently recommended practices.
“Corkscrew stenosis”: Defining and preventing a complication of percutaneous dilatational tracheostomy

Jordan V. Jacobs, MD, David A. Hill, MD, Scott R. Petersen, MD, Ross M. Bremner, MD, PhD, Richard D. Sue, MD, and Michael A. Smith, MD, Phoenix, Ariz

After reviewing a series of cases of tracheal stenosis after percutaneous dilatational tracheostomy, we have defined “corkscrew stenosis,” a lesion occurring just proximal to the stoma site, which is associated with displaced tracheal ring fractures. Recognizing and understanding this complication may help lead to its prevention in the future.

A clinical prediction rule for perioperative mortality and major morbidity after laparoscopic giant paraesophageal hernia repair

Nikiforos Ballian, MBBS, James D. Luketich, MD, Ryan M. Levy, MD, Omar Awais, DO, Dan Winger, MS, Benny Weksler, MD, Rodney J. Landreneau, MD, and Katie S. Nason, MD, MPH, Pittsburgh, Pa

When deciding to electively repair a giant paraesophageal hernia, the risk of perioperative morbidity and mortality must be weighed against symptom severity and the risk of urgent complications of an untreated hernia. We developed predictive models with good discriminatory accuracy for postoperative morbidity and mortality using pretreatment covariates.

Surgical and neurologic outcomes after robotic thymectomy in 100 consecutive patients with myasthenia gravis

Giuseppe Marulli, MD, PhD, Marco Schiavon, MD, Egle Perissinotto, MD, Antonella Bugana, MD, Francesco Di Chiara, MD, Alessandro Rebusso, MD, and Federico Rea, MD, Padua, Italy

Thymectomy is a well-defined therapeutic option for patients with myasthenia gravis. Our experience on robotic thymectomy demonstrated that this technique is safe and effective. We observed a neurologic benefit in a great number of patients.

Niche for a technology or technology for a niche?

Sudish C. Murthy, MD, PhD, Cleveland, Ohio

Drug-eluting stents versus coronary artery bypass graft surgery in left main coronary artery disease: A meta-analysis of early outcomes from randomized and nonrandomized studies

Christopher Cao, MBBS, BSc (Med), Con Manganas, MBBS, Paul Bannon, MBBS, PhD, Michael Vallety, MBBS, PhD, and Tristan D. Yan, MD, PhD, Sydney, Australia

The present meta-analysis identified 14 relevant comparative studies that examined early outcomes for drug-eluting stents versus CABG for patients with left main coronary artery disease. Included patients were highly selected. CABG had superior outcomes in major adverse cardiac and cerebrovascular events at follow-up beyond 12 months.
Minimally invasive approach provides at least equivalent results for surgical correction of mitral regurgitation: A propensity-matched comparison

Andrew B. Goldstone, MD, Pavan Atluri, MD, Wilson Y. Szeto, MD, Alen Trubelja, BS, Jessica L. Howard, BS, John W. MacArthur; Jr, MD, Craig Newcomb, MS, Joseph P. Donnelly, BS, Dale M. Kobrin, BA, Mary A. Sheridan, MPAS, PA-C, Christiana Powers, MSN, CRNP, Robert C. Gorman, MD, Joseph H. Gorman III, MD, Alberto Pochettino, MD, Joseph E. Bavaria, MD, Michael A. Acker, MD, W. Clark Hargrove III, MD, and Y. Joseph Woo, MD, Philadelphia, Pa

In what we believe is the largest propensity-matched comparison of isolated mitral valve repair via right minithoracotomy or sternotomy to date, we demonstrate in a health system–wide study that a minimally invasive approach facilitates at least equivalent mitral valve repair with fewer transfusions and lower early readmission rates.

Elective femoro-femoral cardiopulmonary bypass during transcatheater aortic valve implantation: A useful tool

Thorsten Drews, MD, Miralem Pasic, MD, PhD, Semih Bac, MD, Giuseppe D’Ancona, MD, PhD, Alexander Mladenow, MD, Roland Hetzer, MD, PhD, and Axel Unbehaun, MD, Berlin, Germany

Elective femoro-femoral normothermic cardiopulmonary bypass was used in 35 of 512 patients who underwent TAVI. The procedure increased safety and hemodynamic stability; eliminated the need for manual cardiopulmonary resuscitation if ventricular fibrillation occurred during TAVI in patients with poor LVEF, enlarged right ventricle, pulmonary hypertension, or cardiogenic shock; and allowed myocardial recovery in patients with shock.

Hemi–aortic arch debranching for hybrid aortic arch repair by sequential transposition of the left common carotid and subclavian arteries

Ludovic Canaud, MD, Frédéric Joyeux, MD, Vincent Ziza, MD, Pascal Branchereau, MD, Charles Marty-Ané, MD, PhD, and Pierre Alric, MD, PhD, Montpellier, France

The aim of this study was to assess the short-term and midterm results after hemi–aortic arch debranching for hybrid aortic arch repair by sequential transposition of the LCCA and of the LSA. Hybrid aortic arch repair by sequential transposition of the LCCA and of the LSA for zone 1 lesions provides an attractive alternative for treating hemi–aortic arch lesions in high-risk patients with acceptable primary results and encouraging midterm efficacy to prevent rupture.

Clinical efficacy of intermittent pressure augmented–retrograde cerebral perfusion

Hidehito Endo, MD, Hiroshi Kabota, MD, Hiroshi Tsuchiya, MD, Akihiro Yoshimoto, MD, Yu Takahashi, MD, Yusuke Inaba, MD, and Kenichi Sudo, MD, Tokyo, Japan

IPA-RCP was applied to aortic surgery clinically, and its effectiveness was compared with cRCP. IPA-RCP might provide more homogenous cerebral perfusion and a more effective oxygen supply to the brain with better clinical results than with cRCP.

Causes and management of aortic valve regurgitation after aortic valve reimplantation

Christian Giebels, MD, Diana Aicher, MD, Takashi Kunihara, MD, PhD, Svetlana Rodionycheva, MD, Wolfram Schmied, Dipl Psych, and Hans-Joachim Schäfers, MD, Homburg/Saar, Germany

The morphologic causes for valve failure after aortic valve reimplantation were studied and related to reoperative procedures. Early failure (<6 months) frequently involved cusp prolapse and the valve could be spared. Later (≥6 months), cusp retraction was most frequent and required valve replacement.
Gaming in risk-adjusted mortality rates: Effect of misclassification of risk factors in the benchmarking of cardiac surgery risk-adjusted mortality rates
Sabrina Siregar, MD, Rolf H. H. Groenwold, MD, PhD, Michel I. M. Versteegh, MD, Luc Noyez, MD, PhD, Willem Jan P. P. ter Burg, MSc, Michiel L. Bots, MD, PhD, Yolanda van der Graaf, MD, PhD, and Lex A. van Herwerden, MD, PhD, Utrecht, Leiden, Nijmegen, and Amsterdam, The Netherlands

Upcoding and undercoding of risk factors was simulated in a database of adult cardiac surgery in The Netherlands to assess the effect on benchmarking. Misclassification of random patients or single variables had little effect. However, limited upcoding of multiple risk factors in high-risk patients can greatly influence benchmarking.

Comprehensive surgical approach to treat atrial fibrillation in patients with variant pulmonary venous anatomy
William Wang, MD, Donald Buehler, MD, Ali Hamzei, MD, XueNing Wang, MD, and XinHui Yuan, MD, San Diego, Calif; and Taiyuan and Changzhi, China

We report a comprehensive surgical approach to treat atrial fibrillation with anatomically variant pulmonary vein with a modified full maze procedure. Multiple pulmonary vein isolation and epicardial–endocardial longitudinal pulmonary vein ablations along with the standard maze are essential to success. Early referral for surgical ablation allows higher success rates.

Blood product conservation is associated with improved outcomes and reduced costs after cardiac surgery
Damien J. LaPar, MD, MSc, Ivan K. Crosby, MD, Gorav Ailawadi, MD, Niv Ad, MD, Elmer Choi, MD, Bruce D. Spiess, MD, Jeffery B. Rich, MD, Vigneshwar Kasirajan, MD, Edwin Fonner, Jr, DrPH, Irving L. Kron, MD, and Alan M. Speir, MD, Investigators for the Virginia Cardiac Surgery Quality Initiative, Charlottesville, Falls Church, Richmond, and Norfolk, Va

The purpose of this investigation was to determine the efficacy of a multi-institutional effort to reduce blood product use after cardiac surgical operations. Implementation of a coordinated blood use initiative significantly improved postoperative morbidity, mortality, and resource utilization.

The influence of preoperative serum anticholinergic activity and other risk factors for the development of postoperative cognitive dysfunction after cardiac surgery
Konstanze Plaschke, MD, PhD, Steffen Hauth, PhD, Claudia Jansen, PhD, Thomas Bruckner, PhD, Christoph Schramm, MD, Matthias Karck, MD, and Jurgen Kopitz, PhD, Heidelberg, Germany

Serum anticholinergic activity was investigated as a potential preoperative risk factor for postoperative cognitive dysfunction among patients undergoing cardiac surgery. In contrast to intraoperatively increased levels of S100 calcium binding protein B, preoperative serum anticholinergic activity was not associated with postoperative cognitive dysfunction following adjustment for covariates and therefore did not predict postoperative cognitive dysfunction 3 months after cardiac surgery.

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812 Adenosine instead of supranormal potassium in cardioplegia: It is safe, efficient, and reduces the incidence of postoperative atrial fibrillation. A randomized clinical trial
Øyvind Jakobsen, MD, PhD, Torvind Næsheim, MD, Katherine Nergård Aas, MD, Dog Sørlie, MD, PhD, and Tor Steensrud, MD, PhD, Tromsø, Norway

We replaced hyperkalemia with 1.2 mmol/L adenosine in cold crystalloid cardioplegia in low-risk patients having elective CABG. This led to a more rapid cardiac arrest and similar cardioprotection and postoperative hemodynamics. A lower incidence of new onset atrial fibrillation was observed.

819 Inspiratory muscle training for diaphragm dysfunction after cardiac surgery
Metka Kodric, MD, Roberto Trevisan, MD, Chiara Torregiani, MD, Rossella Cifaldi, MD, Cinzia Longo, MD, Fabiana Cantarutti, RT, and Marco Confalonieri, MD, Trieste, Italy

Diaphragm dysfunction is a complication of cardiac surgery. Surgical diaphragm plication represents the only option. Because training improves functional nerve recovery after a nerve lesion, we hypothesized that early diaphragm muscle training may be beneficial. Inspiratory muscle training may improve inspiratory muscle strength and increases paralyzed diaphragm mobility.

824 Optimized ventricular restraint therapy: Adjustable restraint is superior to standard restraint in an ovine model of ischemic cardiomyopathy
Lawrence S. Lee, MD, Ravi K. Ghanta, MD, Suyog A. Mokashi, MD, Otavio Coelho-Filho, MD, Raymond Y. Kwong, MD, Michael Kwon, MD, Jian Guan, MS, Ronglih Liao, PhD, and Frederick Y. Chen, MD, PhD, Boston, Mass

We investigated the effects of restraint level on left ventricular reverse remodeling in an ovine model of dilated cardiomyopathy. Restraint level clearly affects the rate and degree of reverse remodeling, and restraint applied in an adjustable manner is superior to restraint applied in a standard, nonadjustable manner in promoting reverse remodeling.

832 Prediction of the critical thermal zone during pulmonary cryoablation on computed tomography from correlated experimental and clinical findings
Kohei Hashimoto, MD, Yotaro Izumi, MD, PhD, Yoshikane Yamauchi, MD, Hideki Yashiro, MD, Masanori Inoue, MD, Seishi Nakatsuka, MD, PhD, and Hiroaki Nomori, MD, PhD, Tokyo, Japan

The results of the present study have demonstrated that the less than −20°C zone corresponds to the central solid zone on CT. Local cancer control was better in nodules contained within this zone. Therefore, pulmonary cryoablation should target tumors contained within the central solid zone on CT, which represents the less than −20°C zone.

839 Immunohistochemical studies of pulmonary large cell neuroendocrine carcinoma: A possible association between staining patterns with neuroendocrine markers and tumor response to chemotherapy
Yugo Tanaka, MD, Hiroyuki Ogawa, MD, Kazuya Uchino, MD, Chiho Ohbayashi, MD, Yoshimasa Maniwa, MD, Wataru Nishio, MD, Atsunori Nakao, MD, and Masahiro Yoshinura, MD, Akashi City, Hyogo, and Kobe, Japan; and Pittsburgh, Pa

Perioperative chemotherapy might play an important role in pulmonary LCNEC treatment. Immunohistochemical analyses revealed that patients with tumors that were negative for at least 1 of the markers, synaptophysin, chromogranin A, and neural cell adhesion molecule, might benefit more from chemotherapy than those with immunoreactivity for all 3 neuroendocrine markers.

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847 **Healing process after total cricoidectomy and laryngotracheal reconstruction: Endoscopic and histologic evaluation in a canine model**

Kazumichi Yamamoto, MD, Michitaka Honda, MD, Tetsurou Yamamoto, MD, and Tatsuo Nakamura, MD, PhD, Kyoto, Japan

The healing process after total cricoidectomy and laryngotracheal reconstruction was evaluated in a canine model, according to the postoperative period. Six months of T-tube placement is probably sufficient; however, 3 months of placement might not be. No difference was found between the dogs with and without a bone graft.

854 **Inhibiting CXCL12 blocks fibrocyte migration and differentiation and attenuates bronchiolitis obliterans in a murine heterotopic tracheal transplant model**

David A. Harris, BS, Yunge Zhao, MD, PhD, Damien J. LaPar, MD, MSc, Abbas Emaminia, MD, John F. Steidle, BA, Mark Stoler, MD, Joel Linden, MD, Irving L. Kron, MD, and Christine L. Lau, MD, Charlottesville, Va, and La Jolla, Calif

Fibrocytes are bone marrow–derived mesenchymal stem cells that play an integral role in fibrotic lung pathology. We have shown that an antibody against CXCL12 attenuates airway fibrosis in a mouse model of obliterative bronchiolitis. Therapies directed at the CXCR4/CXCL12 axis might mitigate donor airway fibrosis after lung transplantation.

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862 **Extracorporeal membrane oxygenation as a bridge to pulmonary transplantation**

Charles W. Hoopes, MD, Jasleen Kukreja, MD, Jeffery Golden, MD, Daniel L. Davenport, PhD, Enrique Diaz-Guzman, MD, and Joseph B. Zwischenberger, MD, Lexington, Ky, and San Francisco, Calif

Acute clinical deterioration preceding death is a common observation in patients with advanced lung disease. Deployment of extracorporeal gas exchange technologies can provide an effective clinical bridge to definitive therapy with pulmonary transplantation.

869 **Primary graft dysfunction does not lead to increased cardiac allograft vasculopathy in surviving patients**

Murray H. Kwon, MD, Samantha Y. Wong, MD, Abbas Ardehali, MD, Hillel Laks, MD, Zili K. Zhang, PhD, Mario C. Deng, MD, and Richard J. Shemin, MD, Los Angeles, Calif

Myocardial injury may lead to the long-term development of cardiac allograft vasculopathy after transplantation. Primary graft dysfunction is often a manifestation of donor heart injury during the transplantation process. Although it increases early mortality, it does not lead to increased cardiac allograft vasculopathy in surviving patients.

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874 **Have you seen an atrium bigger than this?**

Khaled E. Al-Ebrahim, MBBCh, FRCSC, Jeddah, Saudi Arabia

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