



Canadian Journal of  
Cardiology

Journal canadien  
de cardiologie

www.onlinecjc.ca

*Journal of the  
Journal de la*



Canadian  
Cardiovascular  
Society

Société  
canadienne  
de cardiologie

For Issue Highlights with article summaries, go to [www.onlinecjc.ca](http://www.onlinecjc.ca).

## Editorial

### **I 496** The Peripheral Arterial Disease Pandemic: No Let-up in Sight

*Daniel G. Hackam, BSc, MD, PhD, FRCPC*

### **I 498** Mild Valvular Regurgitation: A Culprit in Cardiovascular Mortality or a Summons to Find the Culprit?

*Blase A. Carabello, MD*

### **I 500** Improving Outcomes Following Catastrophic Cardiac Events During Transcatheter Aortic Valve Replacement

*Harold L. Lazar, MD*

Publication Mail Agreement 41536048  
Return undeliverable Canadian addresses to:  
Elsevier  
Periodicals Order  
Fulfillment Department  
1799 Highway 50 East  
Linn, MO 65051

Printed in Canada

**On the Cover:** *Estimation of diastolic mitral regurgitation, a major determinant of heart failure in patients with complete AV block. Image is continuous-wave Doppler showing multiple atrial contractions with multiple episodes of diastolic mitral regurgitation (Dias MR). Diastolic MR immediately follows the A wave. From the article by Viskin et al., pages 1562-1568 of this issue.*

### **I 502** The Indirect Impact of COVID-19 on Cardiac Care and Outcomes: Lessons From a Stretched System

*Michelle M. Graham, MD, and Christopher S. Simpson, MD*

### **I 504** Rise of the Machines: Where Virtual Processing Meets Percutaneous Coronary Intervention

*Michael G. Nanna, MD, and W. Schuyler Jones, MD*

## Brief Rapid Report

### **I 507** Temporal Trends in Hospitalization for Lower Extremity Peripheral Artery Disease in Ontario: The Importance of Diabetes

*Jean Jacob-Brassard, MD, Mohammed Al-Omran, MD, MSc, FRCSC, Mobamad A. Hussain, MD, PhD, FRCSC, Muhammad Mamdani, PharmD, MA, MPH, Thérèse A. Stukel, PhD, Douglas S. Lee, MD, PhD, and Charles de Mestral, MDCM, PhD, FRCSC*

Continued

## Table of Contents

### Clinical Research - Valvular Heart Disease

- I 513** Survival of Patients With Mild Secondary Mitral Regurgitation With and Without Mild Tricuspid Regurgitation

*Makoto Mori, MD, Gabe Weininger, BS, Ritu Agarwal, MD, MS, Michael Shang, BS, Andrea Amabile, MD, Arianna Kahler-Quesada, BS, Sameh Yousef, MD, Matthew Pichert, MD, Prashanth Vallabhajosyula, MD, MS, Yawei Zhang, MD, MPH, PhD, Lissa Sugeng, MD, MPH, and Arnar Geirsson, MD*

### Clinical Research - Interventional Cardiology

- I 522** Catastrophic Cardiac Events During Transcatheter Aortic Valve Replacement

*Yafen Liang, MD, Abhijeet Dhoble, MD, Adarsh Pakanati, MD, Yelin Zhao, MS, Felix Kork, MD, Wei Ruan, MD, PhD, Travis Markham, MD, Richard Smalling, MD, PhD, Prakash Balan, MD, Anthony Estrera, MD, Tom C. Nguyen, MD, Igor Gregoric, MD, Biswajit Kar, MD, and Holger Eltzhig, MD, PhD*

- I 530** The Impact of Virtual Fractional Flow Reserve and Virtual Coronary Intervention on Treatment Decisions in the Cardiac Catheter Laboratory

*Rebecca C. Gosling, MRCP, PhD, Zulfiqar Adam, FRCP, PhD, David S. Barmby, FRCP, PhD, Javaid Iqbal, FRCP, PhD, Kenneth P. Morgan, FRCP, PhD, James D. Richardson, FRCP, PhD, Alexander M.K. Rothman, MRCP, PhD, Patricia V. Lawford, BSc, PhD, D. Rodney Hose, BSc, PhD, Julian P. Gunn, MRCP, MD, and Paul D. Morris, MRCP, PhD*

- I 539** A Novel Fenestrating Device: Quick Fenestrator for Reconstructing Supra-aortic Arteries In Situ During Thoracic Endovascular Aortic Repair

*Jun Bai, MD, Chao Wang, MD, Yandong Liu, MD, Jie Jin, MS, Jianjin Wu, MD, Xiangguo Ji, BA, and Lefeng Qu, MD, PhD*

### Clinical Research - Epidemiology

- I 547** The Impact of the COVID-19 Pandemic on Cardiac Procedure Wait List Mortality in Ontario, Canada

*Derrick Y. Tam, MD, PhD, Feng Qiu, MSc, Ragavie Manoragavan, BSc, Stephen E. Fremes, MD, MSc, Ansar Hassan, MD, PhD, Dennis T. Ko, MD, MSc, Sandra B. Lauck, PhD, David Naimark, MD, MSc, Maral Ouzounian, MD, PhD, Beate Sander, PhD, Louise Sun, MD, MSc, and Harindra C. Wijeyesundera, MD, PhD*

- I 555** Clinical Presentation and Outcome of Patients Experiencing Homelessness Presenting With ST-Segment Elevation Myocardial Infarction

*Samantha S.L. Liauw, MD, Linh Luong, MPH, Shuangbo Liu, MD, Mohamed Atcha, MD, Yvonne Kwok, MPH, Rosane Nisenbaum, PhD, Neil Fam, MD, MSc, Stephen W. Hwang, MD, MPH, and Asim N. Cheema, MD, PhD*

### Clinical Research - Electrophysiology and Arrhythmias

- I 562** Heart Failure Due to High-Degree Atrioventricular Block: How Frequent Is It and What Is the Cause?

*Dana Viskin, MD, Amir Halkin, MD, Jack Sherez, Ricki Megidish, BSc, Dana Fourey, MD, Gad Keren, MD, and Yan Topilsky, MD*

## Table of Contents

### **I 569** RAFF-3 Trial: A Stepped-Wedge Cluster Randomised Trial to Improve Care of Acute Atrial Fibrillation and Flutter in the Emergency Department

*Ian G. Stiell, MD, Patrick M. Archambault, MD, Judy Morris, MD, Eric Mercier, MD, Debra Eagles, MD, Jeffrey J. Perry, MD, Frank Scheuermeyer, MD, Greg Clark, MD, Sophie Gosselin, MD, Alain Vadeboncoeur, MD, Ratika Parkash, MD, Kerstin de Wit, MD, Andrea M. Patey, PhD, Venkatesh Thiruganasambandamoorthy, MBBS, and Monica Taljaard, PhD; for the RAFF-3 Study Investigators*

### **Clinical Research - Heart Failure and Cardiomyopathy**

### **I 578** The Effect of Artificial Pulsatility on the Peripheral Vasculature in Patients With Continuous-Flow Ventricular Assist Devices

*Peter Ivak, MD, PhD, Ivan Netuka, MD, PhD, Zuzana Tucanova, MD, Peter Wohlfahrt, MD, PhD, Miroslav Konarik, MD, Ondrej Szarszoi, MD, PhD, Sarka Novakova, Milos Kubanek, MD, PhD, Vera Lanska, DSc, and Jan Pitha, MD*

### **Clinical Research - Clinical Genetics**

### **I 586** Development and Evaluation of Decision Aids to Guide Families' Predictive Testing Choices for Children at Risk for Arrhythmia or Cardiomyopathy

*Susan Christian, MSc, PhD, Alicia Welsh, BA, BEd, Jeremy Yetman, Patrician Birch, PhD, Kirsten Bartels, MSc, Lindsay Burnell, MSc, Fiona Curtis, MSc, Cathleen Huculak, MSc, Laura Zahavich, MSc, Laura Arbour, MD, Julien Marcadier, MD, and Joseph Atallah, MD, MPH*

### **Basic Research**

### **I 593** A Novel Role of Claudin-5 in Prevention of Mitochondrial Fission Against Ischemic/Hypoxic Stress in Cardiomyocytes

*Tao Luo, MD, PhD, Haiqiong Liu, MSc, Baihe Chen, MSc, Han Liu, MSc, Ahmed Abdel-Latif, MD, PhD, Masafumi Kitakaze, MD, PhD, Xianbao Wang, MD, PhD, Yuanzhou Wu, MD, Dylan Chou, PhD, and Jin Kyung Kim, MD, PhD*

### **Review**

### **I 607** Management of Atrial Fibrillation in 2021: An Updated Comparison of the Current CCS/CHRS, ESC, and AHA/ACC/HRS Guidelines

*Christopher C. Cheung, MD, MPH, Stanley Nattel, MD, FHRS, Laurent Macle, MD, FHRS, and Jason G. Andrade, MD, FHRS*

### **Systematic Review/Meta-analysis**

### **I 619** Kawasaki Disease Shock Syndrome vs Classical Kawasaki Disease: A Meta-analysis and Comparison With SARS-CoV-2 Multisystem Inflammatory Syndrome

*Loubna Lamrani, DCS Health Science, Cedric Manlhiot, PhD, Matthew D. Elias, MD, Nadine F. Choueiter, MD, Audrey Dionne, MD, Ashraf S. Harahsheh, MD, Michael A. Portman, MD, Brian W. McCrindle, MD, MPH, and Nagib Dahdah, MD, MBA*

## Table of Contents

### Training/Practice: Practical Clinical Practice Update

#### I 629 Myocarditis and Pericarditis After COVID-19 mRNA Vaccination: Practical Considerations for Care Providers

*Adriana Luk, MD, FRCPC, MSc, Brian Clarke, MD, FRCPC, FACC, Nagib Dahdah, MD, MBA, FRCPC, FACC, Anique Ducharme, MD, FRCPC, Andrew Krahn, MD, Brian McCrindle, MD, MPH, Trent Mizzi, BSc, MD, FRCPC, Monika Naus, MHS, MD, FRCPC, FACPM, Jacob A. Udell, MD, MPH, FRCPC, Sean Virani, MD, MSc, MPH, FRCPC, FCCS, Shelley Zieroth, MD, and Michael McDonald, MD, FRCPC*

### Training/Practice: Health Policy and Promotion

#### I 635 Development of Quality Indicators for the Management of Acute Type A Aortic Dissection

*Ansar Hassan, MD, PhD, Maral Ouzounian, MD, PhD, Francois Dagenais, MD, Ismail El-Hamamsy, MD, PhD, Michael C. Moon, MD, Zlatko Pozeg, MD, R. Scott McClure, MD, Michael Yamashita, MDCM, MPH, Mark D. Peterson, MD, PhD, Roderick MacArthur, MD, Jehangir J. Appoo, MDCM, and Michael W.A. Chu, MD, Med, on behalf of the Canadian Thoracic Aortic Collaborative (CTAC)*

### Training/Practice: Training in Cardiovascular Medicine and Research

#### I 639 Current Status of Simulation Use in Canadian Cardiac Surgery Training Programs

*Abigail White, MD, Gurmeet Singh, MD, MSc, FRCSC, Michael C. Moon, MD, FRCSC, Bin Zhen, MD, PhD, and Simon R. Turner, MD, MEd, FRCSC*

#### I 644 Improving Online ECG Interpretation Through Self-Generation of Diagnoses During Practice: A Randomized Study

*Pavel Antiperovitch, MD, FRCPC, B(H)Sc, Lorne Gula, MD, MS, FRCPC, and Sarah Blissett, MD, MHPE, FRCPC*

### Training/Practice: Contemporary Issues in Cardiology Practice

#### I 648 Cardiac Implantable Devices Management in Medical Assistance in Dying (MAiD): Review and Recommendations for Cardiac Device Clinics

*Santabhanu Chakrabarti, MD, FRCPC, FCCS, Jennifer A. Gibson, RN, PhD, Matthew T. Bennett, MD, FRCPC, FCCS, Mustafa Toma, MD, FRCPC, Ankush T. Verma, MD, FRCPC, Rudy Chow, MD, FRCPC, Laurel Plewes, MSN, RN, CNS, Calum J. Redpath, MD, PhD, FRCPC, Blandine Mondésert, MD, FRCPC, Lawrence Sterns, MD, FRCPC, FCCS, and Andrew D. Krahn, MD, FRCPC, FCCS*

### Case Report

#### I 651 Is Occult Genetic Substrate the Missing Link Between Arrhythmic Mitral Annular Disjunction Syndrome and Sudden Cardiac Death?

*Marianna Appignani, MD, Mohammed Y. Khanji, MBChB, MRCP, PhD, Eloisa Arbustini, MD, Liborio Stuppia, MD, Laura Ceriello, MD, Enrico Di Girolamo, MD, Cesare Mantini, MD, PhD, Sabina Gallina, MD, C. Anwar A. Chahal, MD, MRCP, PhD, and Fabrizio Ricci, MD, PhD, MSc*

## Table of Contents

### **I 654** Immune Checkpoint Inhibitor Myocarditis With Normal Cardiac Magnetic Resonance Imaging: Importance of Cardiac Biopsy and Early Diagnosis

*Stephane Ederhy, MD, Charlotte Fenioux, MD, Clement Cholet, MD, Philippe Rouvier, MD, Alban Redbeuil, MD, PhD, Ariel Cohen, MD, PhD, and Joe-Elie Salem, MD, PhD*

### **I 657** A Case of Lymphocytic Myocarditis With Complete Heart Block Requiring Permanent Pacemaker Implantation

*Hirmand Nouraei, MD, MSc, Avi Ostry, MD, Jonathon A. Leipsic, MD, and Zachary Laksman, MD, MSc*

### **I 659** Recurrent Stent Thrombosis Secondary to Immunoglobulin G4-Related Disease

*Chieh Yang Koo, MBBS, Anita Yee Nah Lim, MBChB, and Koo Hui Chan, BM*

### **I 661** Rubidium-82 Positron Emission Tomography With Intravenous Ergonovine to Diagnose Vasospastic Angina

*E. Marc Jolicur, MD, MSc, MHS, and Matthieu Pelletier-Galarneau, MD, MSc*

### **I 665** Myocarditis After SARS-CoV-2 Vaccination: A Vaccine-Induced Reaction?

*Tommaso D'Angelo, MD, Antonino Cattafi, MD, Maria Ludovica Carerj, MD, Christian Booz, MD, Giorgio Ascenti, MD, Giuseppe Cicero, MD, Alfredo Blandino, MD, and Silvio Mazziotti, MD*

### **I 668** Shock, Thrombus, TAVR: A Challenging TAVR With Large Left-Ventricular Thrombus

*David Blusztajn, MD, Peter Teng, MD, Tobias Deuse, MD, and Vaikom S. Mahadevan, MD*

### **I 671** Acute Severe Renal Artery Stenosis Presenting as Acute Kidney Injury With Severe Hypertension and Active Urine Sediment

*Januvi Jegatheswaran, MD, FRCPC, Adnan Hadziomerovic, MD, FRCPC, and Marcel Ruzicka, MD, PhD, FRCPC*

## Images in Cardiology

### **I 674** Interatrial Septal Aneurysm Mimicking an Atrial Myxoma on Multiparametric Cardiovascular Magnetic Resonance Imaging

*Chen Chuan Fang, MBBS, MRCS, Ven Gee Lim, MBChB (Hons), MRCP, MSc, Massimiliano Codispoti, MBChB (Hons), MD (Hons), FRCSEd, FRCPSGlas, FRCS C-Th, PgDip MedEd, MCh (Hons), and Jamal N. Khan, PhD, MBChB (Hons), BMedSci (Hons), FRCP, FESC*

## Letters to the Editor

### **I 677** The Time Has Come for Vascular Medicine in Canada

*Sonia S. Anand, MD, PhD, FRCPC(C), Alan D. Bell, MD, CCFP, FCFP, and David Szalay, MD, MEd, FRCSC*

### **I 678** Exercise Targets in the 2020 CCS Guidelines for the Management of Patients With Atrial Fibrillation

*Jennifer L. Reed, RKin, PhD, Tasuku Terada, CEP, PhD, Kimberley L. Way, AEP, PhD, Sol Vidal-Almela, MSc, Andrew L. Pipe, CM, MD, and Signe Stelling Risom, RN, PhD*

---

## Table of Contents

---

**I 680** Reply to Reed et al.—Exercise Targets in the 2020 CCS Guidelines for the Management of Patients With Atrial Fibrillation

*Jason G. Andrade, MD, Laurent Macle, MD*

---

**I 681** More Evidence of Cardiac Rehabilitation: Need to Consider Patient Quality of Life

*Rod S. Taylor, MSc, PhD, Grace Dibben, PhD, James Faulkner, PhD, and Hasnain Dalal, MBChB, MD*

---

**I 683** Patients With Postural Orthostatic Tachycardia Syndrome Have Different Experiences in Health Care in Canada and the United States

*Juliette Hall, Kate M. Bourne, BSc, Lauren E. Stiles, JD, Robert S. Sheldon, MD, PhD, Cyndya A. Shibao, MD, MSCI, Luis E. Okamoto, MD, Emily M. Garland, PhD, Alfredo C. Gamboa, MD, MSCI, Andre Diedrich, MD, PhD, Italo Biaggioni, MD, David Robertson, MD, and Satish R. Raj, MD, MSCI*

---

**I 685** Exercise-Based Cardiopulmonary Rehabilitation for Pulmonary Arterial Hypertension as a Therapeutic Option in Low- and Middle-Income Countries

*Akhila Satyamurthy, MPT, Ramachandran Padmakumar, MD, DM, and Abraham Samuel Babu, PhD*

**I 687** Clarifying Transcatheter Aortic Valve Implantation Training Requirement Recommendations for Physicians Currently in Practice

*Anita W. Asgar, MD, MSc, Maral Ouzounian, MD, PhD, Corey Adams, MD, Jonathan Afilalo, MD, MSc, Stephen Fremes, MD, Sandra Lauck, PhD, Jonathan Leipsic, MD, Nico Piazza, MD, PhD, Josep Rodes-Cabau, MD, Robert Welsh, MD, Harindra C. Wijeyesundera, MD, PhD, and John G. Webb, MD; on behalf of the 2019 CCS TAVI Position Statement Committee*

## Departments

---

**I 493** President's Page

---

**A 10** Information for Readers