Stent Thrombosis: A Clinical Perspective

Bimmer E. Claessen, José P.S. Henriques, Farouc A. Jaffer, Roxana Mehran, Jan J. Piek, George D. Dangas

Together with the use of stents in percutaneous coronary intervention, stent thrombosis has emerged as an important entity to understand and prevent. Adjunct pharmacological therapy, stent design, and deployment technique have been adjusted ever since the introduction of stents to reduce the incidence of stent thrombosis. The current clinical overview of stent thrombosis ranges from its pathophysiology to current state-of-the-art technical and pharmacological recommendations to avoid this complication.

Correlates and Outcomes of Late and Very Late Drug-Eluting Stent Thrombosis: Results From DESERT (International Drug-Eluting Stent Event Registry of Thrombosis)

Ron Waksman, Ajay J. Kirtane, Rebecca Torguson, David J. Cohen, Thomas Ryan, Lorenz Räber, Robert Applegate, Sergio Waxman, Paul Gordon, Kimberly Kaneshige, Martin B. Leon, on behalf of the DESERT Investigators

Late/very late drug-eluting stent (DES) thrombosis is poorly studied. The DESERT (International Drug-Eluting Stent Event Registry of Thrombosis), a retrospective, multicenter, international, case-control registry of 492 cases of late/very late definite DES thrombosis, demonstrated independent clinical correlates of late/very late stent thrombosis (ST) as being younger age, African-American race, current smoking, multivessel disease, longer stented length, overlapping stents, and percutaneous coronary intervention in vein grafts. Independent angiographic correlates for late/very late ST were lesions within the left anterior descending artery or a bypass graft, thrombus, and a larger residual diameter stenosis after the initial DES implantation. The majority of ST events occurred after 1 year and continued to occur as long as 7.3 years.

EDITORIAL COMMENT

Late Stent Thrombosis: Can it Be Prevented?

Laura Mauri, Benjamin Z. Galper
Predictors and Outcomes of Recurrent Stent Thrombosis: Results From a Multicenter Registry
Ehrin J. Armstrong, Shiv Sab, Gagan D. Singh, Wayland Lim, Khung-Keong Yeo, Stephen W. Waldo, Mitul Patel, Ryan Reeves, John S. MacGregor, Reginald I. Low, Kendrick A. Shunk, Ehtisham Mahmud, Jason H. Rogers

Patients who had an initial stent thrombosis (ST) development may be at high risk of recurrent ST (rST). In a multicenter registry of 221 patients with ST, the cumulative hazard ratio of definite or probable rST was 16% at 1 year and 24% at 5 years. The 3-year rate of major adverse cardiovascular events was 50% for patients with rST compared with 22% for patients with a single ST (p = 0.01). After multivariable adjustment, independent predictors of definite/probable rST were age, bifurcation ST, and proximal vessel diameter.

EDITORIAL COMMENT
Shifting the Focus to Recurrences: So Good We Can Afford it or Too Bad We Cannot Avoid it?
Marco Valgimigli

Impact of Gene Polymorphisms, Platelet Reactivity, and the SYNTAX Score on 1-Year Clinical Outcomes in Patients With Non–ST-Segment Elevation Acute Coronary Syndrome Undergoing Percutaneous Coronary Intervention: The GEPRESS Study
Tullio Palmerini, Paolo Calabrò, Federico Piscione, Stefano De Servi, Marco Cattaneo, Diego Maffeo, Anna Toso, Antonio Bartorelli, Cataldo Palmieri, Marco De Carlo, Davide Capodanno, Chiara Barozzi, Luciana Tomasi, Diego Della Riva, Andrea Mariani, Nevio Taglieri, Letizia Bacchi Reggiani, Renatormaria Bianchi, Roberta De Rosa, Matteo Mariani, GianMarco Podda, Philippe Généreux, Gregg W. Stone, Dominick J. Angiolillo

The aim of this study was to investigate the association between high on-treatment platelet reactivity (HPR) and the SYNTAX (Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery) score (SS) for risk prediction of major adverse cardiovascular events (MACE) in patients with non-ST-segment elevation acute coronary syndrome undergoing percutaneous coronary intervention. Between 1 month and 1 year, HPR at 1 month was an independent predictor of MACE in patients with an SS $\geq$15, but not in those with an SS <15, displaying a 5-fold increase in event rates (10.4% vs. 2.5%; p < 0.0001). CYP2C19*2 was the only single nucleotide polymorphism associated with HPR, but it was not associated with MACE.
Validation and Comparison of the Long-Term Prognostic Capability of the SYNTAX Score-II Among 1,528 Consecutive Patients Who Underwent Left Main Percutaneous Coronary Intervention

Bo Xu, Philippe Généreux, Yuejin Yang, Martin B. Leon, Liang Xu, Shubin Qiao, Yongjian Wu, Hongbing Yan, Jilin Chen, Yelin Zhao, Yanyan Zhao, Tullio Palmerini, Gregg W. Stone, Runlin Gao

The SYNTAX (Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery) score-II (SS-II) was recently developed in an attempt to better individualize and help the decision-making process between percutaneous coronary intervention (PCI) and coronary artery bypass graft surgery. From 1,528 consecutive patients undergoing unprotected left main PCI only, the authors validated its predictive capability for long-term mortality and compared it with other anatomic or clinical scoring algorithms. At a mean follow-up of 4.4 years, the SS-II and other scores combining clinical and angiographic variables showed a superior capacity in terms of long-term prognostication compared with purely anatomic SS.

SEE ADDITIONAL CONTENT ONLINE

Cerebrovascular Events Post-Transcatheter Aortic Valve Replacement in a Large Cohort of Patients: A FRANCE-2 Registry Substudy

Didier Tchetche, Bruno Farah, Leonardo Misuraca, Adele Pierri, Olivier Vahdat, Corinne Lereun, Nicolas Dumonteil, Thomas Modine, Marc Laskar, Helene Eltchaninoff, Dominique Himbert, Bernard Iung, Emmanuel Teiger, Karine Chevreul, Michel Lievre, Thierry Lefevre, Patrick Donzeau-Gouge, Martine Gilard, Jean Fajadet

Tchetche and colleagues analyzed the incidence, impact, and predictors of cerebrovascular events (CVEs) after transcatheter aortic valve replacement (TAVR) in the FRANCE (French Aortic National CoreValve and Edwards)-2 registry. A total of 3,191 patients were included. Six-month follow-up events were adjudicated according to Valve Academic Research Consortium 1. Of the cohort, 3.98% had a CVE with a mean delay of 2 days (interquartile range: 0 to 7 days). CVE occurrence was associated with an increased unadjusted mortality rate ($p = 0.002$). Age and having 2 valves replaced were predictors of CVEs. CVEs after TAVR mainly occur within 48 h. Advanced age and multiple valves replaced during the same procedure are predictors of CVE.

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Feasibility and Exploratory Efficacy Evaluation of the Embrella Embolic Deflector System for the Prevention of Cerebral Emboli in Patients Undergoing Transcatheter Aortic Valve Replacement: The PROTAVI-C Pilot Study


This study determined the feasibility, safety, and exploratory efficacy of the Embrella Embolic Deflector (EED) system (Edwards Lifesciences, Irvine, California) in 52 patients undergoing transfemoral transcatheter aortic valve implantation (TAVR). A total of 41 patients received the EED system and 11 patients underwent TAVR without embolic protection (control group). The EED system was successfully deployed at the level of the aortic arch in all patients with no complications. Cerebral diffusion-weighted magnetic resonance imaging (DW-MRI) performed within 7 days after TAVR showed the presence of new ischemic lesions in all patients in both groups (median: 7 [interquartile range: 3 to 13] lesions/patient). The use of the EED system was associated with a lower lesion volume ($p = 0.003$ vs. control group). All new cerebral lesions had disappeared at the DW-MRI performed at 30 days after TAVR.

SEE ADDITIONAL CONTENT ONLINE

EDITORIAL COMMENT

How Embolism Proof Is the Embrella Embolic Deflector System?

Nicolas M. Van Mieghem, Aad van der Lugt

Transapical Transcatheter Aortic Valve for Severe Aortic Regurgitation: Expanding the Limits

Daniel Wendt, Philipp Kahlert, Susanne Pasa, Karim El-Chilali, Fadi Al-Rashid, Konstantinos Tsagakis, Daniel Sebastian Dohle, Raimund Erbel, Heinz Jakob, Matthias Thielmann

The present study evaluated for the first time transapical transcatheter aortic valve implantation with the use of the ACURATE TA device (Symetis SA, Ecublens, Switzerland) in a series of 8 high-risk patients presenting with pure, severe aortic regurgitation.
Initial German Experience With Transapical Implantation of a Second-Generation Transcatheter Heart Valve for the Treatment of Aortic Regurgitation

Moritz Seiffert, Ralf Bader, Utz Kappert, Ardawan Rastan, Stephan Krapf, Sabine Bleiziffer, Steffen Hofmann, Martin Arnold, Klaus Kallenbach, Lenard Conradi, Friederike Schlingloff, Manuel Wilbring, Ulrich Schäfer, Patrick Diemert, Hendrik Treede

After proof-of-principle, this multicenter analysis provides broader evidence that the JenaValve (JenaValve Technology GmbH, Munich, Germany) transcatheter heart valve is a reasonable option for the treatment of pure aortic regurgitation in patients not suitable for surgical valve replacement. Results of the initial German experience with this second-generation device in patients with noncalcified aortic regurgitation are provided and discussed.

SEE ADDITIONAL CONTENT ONLINE

EDITORIAL COMMENT

The Expansion of Transcatheter Technology to Treat Aortic Insufficiency: Everything Old Becomes New Again

Vasilis Babaliaros, Alain Cribier

Cerebral Embolic Lesions Detected With Diffusion-Weighted Magnetic Resonance Imaging Following Carotid Artery Stenting: A Meta-Analysis of 8 Studies Comparing Filter Cerebral Protection and Proximal Balloon Occlusion

Eugenio Stabile, Anna Sannino, Gabriele Giacomo Schiattarella, Giuseppe Gargiulo, Evelina Toscano, Linda Brevetti, Fernando Scudiero, Giuseppe Giugliano, Cinzia Perrino, Bruno Trimarco, Giovanni Esposito

Contrasting evidence exists about the efficacy of proximal versus distal embolic protection devices (EPDs) during neuroprotected carotid artery stenting (CAS), as assessed by the incidence of new cerebral ischemic lesions detected by diffusion-weighted magnetic resonance imaging (DW-MRI). Accordingly, Stabile et al. conducted a meta-analysis, including 8 studies and enrolling 357 patients, which showed that following CAS, the incidence of new ischemic lesions/patient detected by DW-MRI was significantly lower in the proximal EPD group. The present study suggests that the use of proximal EPDs is associated with a reduction of the amount of CAS-related brain embolization when compared with distal EPDs.

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VIEWPOINT

Methodological Standardization for the Pre-Clinical Evaluation of Renal Sympathetic Denervation

Kenichi Sakakura, Elena Ladich, Elazer R. Edelman, Peter Markham, James R.L. Stanley, John Keating, Frank D. Kolodgie, Renu Virmani, Michael Joner

Transcatheter ablation of renal autonomic nerves is a viable option for the treatment of resistant arterial hypertension; however, structured preclinical evaluation with standardization of analytical procedures remains a clear gap in this field. Sakakura et al. discuss the topics relevant for the evaluation of renal denervation devices and propose methodologies and criteria pertaining to standardization of preclinical safety and efficacy assessment, including histopathological evaluations of the renal artery, peri-arterial nerves, and associated peri-adventitial tissues. The proposed standards will help facilitate our understanding of vascular biology underlying the observed clinical effects of ablative energy in distinct vascular territories.

SEE ADDITIONAL CONTENT ONLINE

IMAGES IN INTERVENTION

Immediate, Acute, and Subacute Thrombosis Due to Incomplete Expansion of Bioresorbable Scaffolds

Tommaso Gori, Eberhard Schulz, Thomas Münzel

Neointimal Hemorrhage After Drug-Eluting Stent Implantation: Possible Role for Development of Neoatherosclerosis

Hiroyuki Hao, Kenichi Fujii, Takahiro Imanaka, Rika Kawakami, Taro Kawano, Tadateru Takayama, Atsushi Hirayama, Hatsue Ishibashi-Ueda, Tohru Masuyama, Seiichi Hirota

- ONLINE FEATURE Solitary Coronary Artery: A Rare Coronary Anomaly
  Suresh Sharma, Rashmi Thapa, Buddhadeb Dawn, Deepak Parashara

- ONLINE FEATURE Coronary Embolism and Thrombosis of Prosthetic Mitral Valve
  Francisco Javier Lacunza-Ruiz, Carmen Muñoz-Esparza, Juan García-de-Lara

- ONLINE FEATURE Myocardial Bridging in All Major Epicardial Vessels
  Mohit D. Gupta, Meenahalli Palleda Girish, Vijay Trehan, Sanjay Tyagi

- ONLINE FEATURE Transcatheter Valve-in-Valve Replacement in Complex Cyanotic Congenital Heart Disease With a Single Ventricle
  Gonzalo J. Martinez, Bernard H. Ng, Michael K. Wilson, Sanjeevan Pasupati, David A. Robinson, Bruce L. Cartwright, Mark R. Adams, David S. Celermajer, Martin K. Ng

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ONLINE FEATURE  Crushed Stent With Acute Occlusion in Superficial Femoral Artery After Enhanced External Counterpulsation
Yongsung Suh, Young-Guk Ko, Seung Hyun Lee, Man-Deuk Kim, Donghoon Choi

ONLINE FEATURE  Tracheal Compression Following Hybrid Procedure in an Infant With Hypoplastic Left Heart Syndrome
Federica Sidoti, John Hibbeln, Michel Ilbawi, Damien Kenny

ONLINE FEATURE  An Unusual Presentation of Giant Right Coronary Artery Pseudoaneurysm as a Late Complication of Stent Fracture Treated by Hybrid Procedure: Unusual Presentation of Stent Rupture
Gianluca Pontone, Laura Cavallotti, Erika Bertella, Daniele Andreini, Alessandro Lualdi, Francesco Alamanni

ONLINE FEATURE  Anomalous Origin of the Common Left Coronary Artery From the Right Coronary Sinus: An Unusual Anatomical Variation
Pankaj Jariwala, Sunitha Lingareddy, Sarat Koduganti

ONLINE FEATURE  Percutaneous Pulmonary Valve Implantation in a Native Outflow Tract: 3-Dimensional DynaCT Rotational Angiographic Reconstruction and 3-Dimensional Printed Model
Joseph T. Poterucha, Thomas A. Foley, Nathaniel W. Taggart

ONLINE FEATURE  Gastroepiploic Graft Dysfunction Caused by Celiac Artery Stenosis: Diagnostic Approach for an Unusual Cause of Angina
Kunal Bhatt, Wassim Odeh, Sarah Rinehart, James Lee, Zhen Qian, Bhagat Reddy, Anna Kalynych

ONLINE FEATURE  One-Year Follow-Up Optical Coherence Tomography After Implantation of Biodegradable Vascular Scaffolds for a Chronic Coronary Total Occlusion
Toru Naganuma, Azeem Latib, Vasileios F. Panoulas, Katsumasa Sato, Tadashi Miyazaki, Sunao Nakamura, Antonio Colombo

ONLINE FEATURE  All at Once: Multivessel Spontaneous Coronary Artery Dissection With Right Coronary Artery ST-Segment Elevation Myocardial Infarction
Muhammad Rizwan Sardar, Lauren M. Pieczynski, Wajeeha Saeed, Steven M. Domsky, Timothy A. Shapiro, Paul Coady

ONLINE FEATURE  Multimodality Visualization With 3-Dimensional Reconstruction of Neointimal Plaque Rupture After Bare-Metal Stent Implantation
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LETTERS TO
THE EDITOR

Do Advances in Technology in the Catheterization Laboratory for Percutaneous Coronary Interventions Negatively Influence an Operator's Technique, Decision Making, and Judgment?
John A. Ambrose

A Risk Score for Prediction of Hyperglycemia at Coronary Angiography
Binita Shah, Joseph Burdowski, Iryna Lobach, Eugenia Gianos, Steven P. Sedlis

EDITOR'S PAGE

"They've Gone About as Far as They Can Go"
Spencer B. King III

CORRECTION