

Journal of Vascular Surgery Venous and Lymphatic Disorders

The Premier International Journal of Medical, Endovascular, and
Surgical Care of Venous and Lymphatic Disorders

CONTENTS

Volume 9, Number 6, November 2021

PRESIDENTIAL ADDRESS

1353 Virtues of the American Venous Forum: Quality, morality, and collegiality

Harold J. Welch, MD, *Hyannis, Mass*

COVID-19 AND VENOUS DISEASE

1361 Deep vein thrombosis and pulmonary embolism among hospitalized coronavirus disease 2019—positive patients predicted for higher mortality and prolonged intensive care unit and hospital stays in a multisite healthcare system

Young Erben, MD, Camila Franco-Mesa, MD, Peter Gloviczki, MD, William Stone, MD, Alfredo Quinones-Hinojoas, MD, Andrew J. Meltzer, MD, Michelle Lin, MD, Melanie R. F. Greenway, MD, Osman Hamid, MD, Zlatko Devcic, MD, Beau Toskich, MD, Charles Ritchie, MD, Christopher J. Lamb, MD, Randall R. De Martino, MD, Jason Siegel, MD, Houssan Farres, MD, Albert G. Hakaim, MD, Devang K. Sanghavi, MD, Yupeng Li, PhD, Candido Rivera, MD, Pablo Moreno-Franco, MD, Nancy L. O'Keefe, BA, Neethu Gopal, MD, Christopher P. Marquez, MD, Josephine F. Huang, MD, Manju Kalra, MD, Raymond Shields, MD, Mercedes Prudencio, PhD, Tania Gendron, PhD, Robert McBane, MD, Myung Park, MD, MS, Jonathan B. Hoyne, PhD, Leonard Petrucelli, PhD, John C. O'Horo, MD, and James F. Meschia, MD, *Jacksonville, Fla; Rochester, Minn; Scottsdale, Ariz; and Glassboro, NJ*

In the present retrospective multisite health care system review of 915 hospitalized patients with coronavirus disease 2019 (COVID-19), the incidence of deep vein thrombosis (DVT) and pulmonary embolism (PE) was 9.0%, greater than that for patients hospitalized for other reasons. The occurrence of DVT and PE in COVID-19 patients was associated with greater mortality and prolonged intensive care unit and hospital stays compared with hospitalized COVID-19 patients without DVT/PE.

1371 The original and modified Caprini score equally predicts venous thromboembolism in COVID-19 patients

Sergey Tsaplin, PhD, Ilya Schastlivtsev, PhD, Sergey Zhuravlev, LOH, Victor Barinov, PhD, Kirill Lobastov, PhD, and Joseph A. Caprini, PhD, *Moscow, Russian Federation; and Chicago, Ill*

This retrospective analysis of prospectively collected data demonstrates a significant association between the original and modified Caprini score and symptomatic venous thromboembolism in 168 patients with COVID-19. The original Caprini score identified individuals at the highest risk among patients with COVID-19 admitted to the hospital.

Cover Image: See Clinical Research Studies, page 1504

CLINICAL RESEARCH STUDIES

ACUTE VENOUS THROMBOEMBOLISM

1382 Catheter-based interventions versus medical and surgical approaches in acute pulmonary embolism

Rafael S. Cires-Drouet, MD, Khanjan Nagarsheth, MD, David J. Kaczorowski, MD, Shahab Toursavadkahi, MD, Kristopher Deatrck, MD, Ronson J. Madathil, MD, Kevin M. Jones, MD, Steven Liskov, MD, Jeffrey Fitch, MD, Michelle Sayad, MD, Chetan Pasrija, MD, Minerva Mayorga-Carlin, MPH, Daniel Herr, MD, John D. Sorkin, MD, Bartley Griffith, MD, Brajesh K. Lal, MD, and James S. Gammie, MD, *Baltimore, Md*

Catheter-based interventions (n = 30) for acute pulmonary embolism were associated with fewer recurrent events (0% vs 6.4%) but increased mortality (0% vs 16.6%) compared with medical (n = 62) and surgical (n=16) treatment, respectively.

1391 The anatomic distribution and pulmonary embolism complications of hospital-acquired lower extremity deep venous thrombosis

Tao Qiu, MD, Tao Zhang, MD, PhD, Lei Liu, MD, Wei Li, MD, PhD, Qingle Li, MD, PhD, Xuemin Zhang, MD, PhD, Yang Jiao, MD, PhD, Weihao Li, MD, PhD, Haocheng Ma, MD, and Xiaoming Zhang, MD, *Beijing and Henan, China*

This retrospective study analyzed the demographic data, ultrasound results, and pulmonary embolism (PE)-related findings of 1431 inpatients with hospital-acquired lower extremity deep venous thrombosis (HA-LEDVT). The study suggests that muscular calf vein thrombosis may be the main origin of lower extremity deep vein thrombosis. The anatomic distribution of HA-LEDVT is associated with the occurrence of PE.

ILIOFEMORAL VENOUS OBSTRUCTION

1399 Editors' Choice

Early thrombosis after iliac stenting for venous outflow occlusion is related to disease severity and type of anticoagulation  

William A. Marston, MD, Sydney E. Browder, BS, Kathleen Iles, MD, Anna Griffith, MD, and Katharine L. McGinagle, MD, MPH, *Chapel Hill, NC*

Early thrombosis occurred after venous stenting in one fourth of the 106 patients with complete occlusion of the iliofemoral venous tract in the present retrospective review. The use of low-molecular-weight heparin for >10 days after stenting before transitioning to an oral anticoagulant resulted in a significantly lower incidence of early thrombosis.

1408 Utility of the 50% stenosis criterion for patients undergoing stenting for chronic iliofemoral venous obstruction

Arjun Jayaraj, MD, Thomas Powell, MS, and Seshadri Raju, MD, *Jackson, Miss*

A single-center, retrospective analysis was performed of prospectively collected data of on 480 continuous patients (480 limbs) who had undergone initial iliofemoral venous stenting for quality of life-impairing chronic iliofemoral venous obstruction. The intravascular ultrasound-determined degree of iliofemoral venous stenosis does not appear to affect the initial clinical presentation, CEAP (clinical, etiologic, anatomic, pathophysiologic) clinical class, supine foot venous pressure, clinical improvement, quality of life improvement, stent patency, or reintervention rates after post stenting.

1416 Invited Commentary — Shaking our foundations

Ellen D. Dillavou, MD, *Durham, NC*

CONTENTS (continued)

PELVIC VENOUS DISORDERS

1417 Stratification of pelvic venous reflux in patients with pelvic varicose veins

Sergey Gavrilov, MD, PhD, Yekaterina P. Moskalenko, PhD, Nadezhda Y. Mishakina, MD, Oksana I. Efremova, PhD, Valery M. Kulikov, PhD, and Anastasiya S. Grishenkova, PhD, *Moscow, Russia*

We found an association between moderate and severe duplex ultrasound-determined reflux (ie, type II reflux [duration, 3-5 seconds] and type III reflux [duration, >5 seconds or continuous reflux in the absence of loading tests]) with the presence of severe pelvic varicose veins.

1425 **Invited Commentary** — Pelvic venous pain due to pelvic congestion syndrome is becoming a primary diagnosis

Mark S. Whiteley, MS, FRCS(Gen), *Guildford, United Kingdom*

SUPERFICIAL VENOUS DISEASE

1426 Extended Center for Vein Restoration study assessing comparative outcomes for the treatment of chronic venous insufficiency in Medicare- and non-Medicare-eligible patients

Peter J. Pappas, MD, Sanjiv Lakhanpal, MD, Khanh Q. Nguyen, DO, Eddie Fernandez, MD, and Shekeeb Sufian, MD, *Greenbelt, Md*

We performed a retrospective analysis of treatment outcomes for 15,697 Medicare-eligible patients and 35,220 non-Medicare-eligible patients. The elderly patients demonstrated treatment outcomes similar to those of the younger patients using the revised venous clinical severity scores and Chronic Venous Insufficiency Quality of Life 20-item scores, regardless of race. A comparison of thermal vs Varithena for all treatment types demonstrated equivalent results at 6 months.

1437 Great saphenous vein occlusion rates after combined treatment with laser and foam sclerotherapy

Jorge H. Ulloa, MD, Anthony Comerota, MD, FACS, Valentin Figueroa, MD, and Sebastian Cifuentes, MD, *Bogota, Colombia; and Falls Church, Va*

In this retrospective, single-arm cohort study, combined treatment of incompetent great saphenous veins (GSVs) with endovenous laser ablation and polidocanol foam sclerotherapy provided an overall GSV occlusion success rate of 97.57% at 1 year with no associated severe adverse events.

1443 Correlation between great saphenous length of treatment zone and diameter with improvement in symptoms after ablation

Robert R. Attaran, MBChB, Aneil Bhalla, MD, Carlos I. Mena-Hurtado, MD, and Cassius I. Ochoa Charar, MD, *New Haven, Conn*

Data from a multicenter randomized control prospective study of 242 patients undergoing radiofrequency ablation (RFA) or cyanoacrylate closure (CAC) of the great saphenous vein (GSV) were analyzed. Venous Clinical Severity Score (VCSS) was measured at baseline and at 1, 3, 6, 12, 24, and 36 months postablation. A comparison of postablation VCSS was made between GSVs <5.5 mm versus \geq 5.5 mm. Using the median treatment length value of 34 cm, patients were divided into group I (\geq 34 cm) versus group II (<34 cm) for analysis. Improvement in VCSS based on length of segment ablated was evaluated. The diameter of the GSV (<5.5 mm vs \geq 5.5 mm) did not affect baseline symptoms or improvement postablation. Longer segments of reflux were associated with more severe disease and correlated with improved clinical outcomes, postablation.

POST-THROMBOTIC SYNDROME

1451 Predictors for the risk and severity of post-thrombotic syndrome in vascular Behçet's disease

Aysun Aksoy, MD, Seda Colak, MD, Burcu Yagiz, MD, Belkis Nihan Coskun, MD, Ahmet Omma, MD, Yasin Yildiz, MD, Alper Sari, MD, Nuh Atas, MD, Can Ilgin, MD, Ömer Karadag, MD, Abdülsamet Erden, MD, Ediz Dalkilic, MD, Naile Bolca, MD, Rabia Ergelen, MD, Mehmet Ruhi Onur, MD, Haner Direskeneli, MD, and Fatma Alibaz-Oner, MD, *Istanbul, Ankara, and Bursa, Turkey*

In the present multicenter cross-sectional study, immunosuppressive treatment decreased the risk of severe post-thrombotic syndrome (PTS) in patients with Behçet disease and a history of deep vein thrombosis. Anticoagulant usage with immunosuppressive treatment provided no additional benefit for preventing the development of PTS.

CONTENTS (continued)

VENOUS LABORATORY

1460 **Improving follow-up of incomplete lower extremity venous duplex ultrasound examinations performed for deep and superficial vein thromboses**

Shelby M. Van Leuven, BS, Megan L. Mertz, BS, Shirin Ferdosian, BS, Rikki J. Samuel, BS, Gregory J. Landry, MD, Timothy K. Liem, MD, Gregory L. Moneta, MD, and Khanh P. Nguyen, MD, *Portland, Ore*

For patients with incomplete and negative (I/N) lower extremity venous duplex examinations, appending a reminder statement for a follow-up examination to the report of the I/N study increased the rate of follow-up examinations by 43%, with 23% of the follow-up studies demonstrating deep vein thrombosis (DVT) or superficial vein thrombosis (SVT) and 50% definitively excluding DVT or SVT.

VENOUS IMAGING

1467 **Imaging of vascular malformations with a high-intensity focused ultrasound probe for treatment planning**

James Danahey, BA, Ralf Seip, PhD, Brian Lee, AAS, Nima Nassiri, MD, Alan Dardik, MD, PhD, Raul Guzman, MD, and Naiem Nassiri, MD, *New Haven, Conn; Charlotte, NC; and Los Angeles, Calif*

The treating surgeon was able to identify and outline all vascular malformations in the present pilot study of 10 patients with superficial venous and/or lymphatic malformations of the trunk and extremities using a commercially available high-intensity focused ultrasound probe with minimal difficulty and stable acoustic coupling.

VENOUS THORACIC OUTLET SYNDROME

1473 **Thoracic outlet decompression for subclavian venous stenosis after ipsilateral hemodialysis access creation**

Sungho Lim, MD, Abdul Q. Alarhayem, MD, Jarrad W. Rowse, MD, Francis J. Caputo, MD, Christopher J. Smolock, MD, Sean P. Lyden, MD, Lee Kirksey, MD, and David M. Hardy, MD, *Cleveland, Ohio*

Transaxillary thoracic outlet decompression for patients with ipsilateral hemodialysis (HD) access was found to be technically feasible and safe operation in the present retrospective study. Patients with threatened HD access due to subclavian vein stenosis should be carefully evaluated for possible extrinsic compression at the costoclavicular junction and might benefit from decompression.

MESENTERIC VENOUS THROMBOSIS

1479 **Venous mesenteric ischemia carries high procedural burden and elevated mortality in patients with severe presentation**

Zach M. Feldman, MD, MSc, Linda J. Wang, MD, MBA, Elizabeth L. Chou, MD, Christopher A. Latz, MD, MPH, Brandon J. Sumpio, MD, Matthew J. Eagleton, MD, and Mark F. Conrad, MD, MMSc, *Boston, Mass; and Cerritos, Calif*

Venous mesenteric ischemia demonstrates a variable course in this retrospective cohort study of 103 patients at a quaternary care center, with inferior outcomes in patients with subacute symptoms, those requiring intervention, and those with delayed intervention. The findings suggest that early risk stratification may improve outcomes of those requiring intervention.

VENOUS AND LYMPHATIC MALFORMATIONS

1488 **Effects of sirolimus in the treatment of unresectable infantile hemangioma and vascular malformations in children: A single-center experience**

Yu Jeong Cho, MD, Hyunhee Kwon, MD, Yong Jae Kwon, MD, Seong Chul Kim, MD, PhD, Dae Yeon Kim, MD, PhD, and Jung-Man Namgoong, MD, PhD, *Seoul, Korea*

In the present retrospective review of six patients with unresectable infantile hemangioma and vascular malformations, sirolimus treatment promoted reduction of lesion volume and, thus, could be used as a bridge to surgical resection. Appropriate early intervention using sirolimus could be a promising treatment modality for unresectable vascular anomalies.

CONTENTS (continued)

1495 **Clinical presentation and outcomes after endovascular management in a mixed pediatric and adult Klippel-Trenaunay syndrome population**

Kari J. Nelson, MD, Rebecca Bennett, MD, Alexander Lam, MD, Hanna Javan, MD, Laura Findeiss, MD, Kristen M. Kelly, MD, J. Stuart Nelson, MD, PhD, and Nadine Abi-Jaoudeh, MD, *Laguna Hills, Orange, San Francisco, and Irvine, Calif; and Atlanta, Ga*

In the present retrospective study of 20 Klippel-Trenaunay syndrome (KTS) patients, endovascular intervention for refractory symptoms related to venous pathology of KTS resulted in 97.8% technical success, 100% clinical success, and 6.7% complication rates. Endovascular intervention is safe and effective for KTS patients for whom conservative management has failed.

NUTCRACKER SYNDROME

1504 **Current results of left gonadal vein transposition to treat nutcracker syndrome**

Anaïs Debucquois, MD, Lucie Salomon du Mont, MD, PhD, Wilfried Bertho, MD, Adrien Kaladji, MD, PhD, Olivier Hartung, MD, PhD, and Simon Rinckenbach, MD, PhD, *Besançon, Rennes, and Marseille-Nord, France*

We have presented the results from a multicenter retrospective study of 11 patients treated by transposition of the left gonadal vein for nutcracker syndrome, with pain relief, total resolution of hematuria, reduction of pelvic varicose veins, and a low complication rate.

VENOUS ULCERS

1510 **The need for perforator treatment after VenaSeal and ClosureFast endovenous saphenous vein closure in CEAP 6 patients**

Misaki M. Kiguchi, MD, MBA, FACS, Kyle B. Reynolds, MD, Bianca Cutler, MSN, FNP-C, Eshetu Tefera, MS, Mariya Kochubey, MD, Rachel Dirks, PhD, Steven D. Abramowitz, MD, Edward Y. Woo, MD, and Leigh Ann O'Banion, MD, RPVI, *Washington, DC; and Fresno, Calif*

A larger percentage of radiofrequency ablation (RFA)-treated saphenous veins required secondary perforator vein RFA compared with VenaSeal-treated saphenous veins (48.7% vs 26.7%; $P = .003$) to heal their wounds in this multicenter retrospective study of 119 CEAP 6 patients. The authors suggest that in CEAP 6 patients, VenaSeal closure may treat a longer segment of refluxing saphenous veins, eliminating more venous hypertension, and thus, requiring significantly less perforator procedures to heal wounds.

1517 **Outcomes of endovenous laser ablation with additional iliac vein stenting of nonthrombotic lesions in patients presenting with active venous ulcers**

Xinrui Yang, MD, Xiaoyu Wu, MD, PhD, Zhiyou Peng, MD, PhD, Minyi Yin, MD, PhD, Xinwu Lu, MD, PhD, and Kaichuang Ye, MD, PhD, *Shanghai, China*

Endovenous laser ablation with the addition of iliac venous stenting for nonthrombotic iliac vein lesions improved venous leg ulcer healing in our single-center retrospective study of 157 patients with venous ulcers and nonthrombotic iliac vein lesions.

COMPRESSION THERAPY

1526 **Intermittent pneumatic compression after varicose vein surgery**

Korina Kappa-Markovi, Houman Jalaie, MD, Hilal Özhan-Hasan, Monika Deges, and Knuth Rass, MD, *Simmerath and Aachen, Germany*

The present randomized controlled trial was designed to evaluate the decongestive effects of a single session of postoperative intermittent pneumatic compression (IPC) and its effects on quality of life, pain, and ecchymosis formation after varicose vein surgery. Because of the increased risk of ecchymosis formation without detectable positive effects in the present study, IPC cannot be recommended as a standard postoperative treatment.

CONTENTS (continued)

FROM BENCH TO BEDSIDE

- 1535 Transforming growth factor- β 1 and inducible nitric oxide synthase signaling were involved in effects of prostaglandin E₂ on progression of lower limb varicose veins**
Ji-Chang Wang, MD, Jingtao Gu, MD, Yan Li, MD, Qiang Ma, MD, Jun Feng, MD, and Shaoying Lu, MD, Xi'an, Shaanxi, People's Republic of China

REVIEW ARTICLES

- 1545 Comparison of intravascular ultrasound and multidimensional contrast imaging modalities for characterization of chronic occlusive iliofemoral venous disease: A systematic review**
Taimur Saleem, MBBS, and Seshadri Raju, MD, FACS, Jackson, Miss
- 1557 A narrative review on the epidemiology, prevention, and treatment of venous thromboembolic events in the context of chronic venous disease**
Michael T. Kemp, MD, Andrea T. Obi, MD, Peter K. Henke, MD, and Thomas W. Wakefield, MD, Ann Arbor, Mich
- 1568 Efficacy of rivaroxaban in prevention of post-thrombotic syndrome: A systematic review and meta-analysis**
Christos Karathanos, MD, MSc, PhD, Petroula Nana, MD, MSc, Konstantinos Spanos, MD, MSc, PhD, George Kouvelos, MD, MSc, PhD, Alexandros Brotis, MD, PhD, Miltiadis Matsagas, MD, PhD, and Athanasios Giannoukas, MD, MSc, PhD, Larissa, Greece
- 1577 Use of covered stent grafts as treatment of traumatic venous injury to the inferior vena cava and iliac veins: A systematic review**
Reinier R. Smeets, MD, Diba Demir, MD, Jorinde van Laanen, MD, Geert Willem H. Schurink, MD, PhD, and Barend M. E. Mees, MD, PhD, Maastricht, The Netherlands
- 1588 Treatment strategies for inferior vena cava aneurysms**
Mian Wang, MD, Hui Wang, MD, Bingye Liao, MD, Guiyan Peng, MD, and Guangqi Chang, MD, Guangzhou, China

VENOUS VANTAGE POINT

- 1597 Review and commentary of key non-JVS-VL articles**

LETTERS TO THE EDITOR

- 1599 Efficacy of iliac venous stenting for proximal venous occlusive disease**
Mehmet Senel Bademci, MD, Cemal Kocaaslan, MD, Fatih Avni Bayraktar, MD, Ahmet Oztekin, MD, Omer Arda Uslu, MD, and Ebuzer Aydin, MD, Istanbul, Turkey
- 1599 Reply**
Huimin Xu, MM, Yu Tian, MM, and Bin Hao, BD, Taiyuan, China
- 1600 Deep vein insufficiency, not the method choice, determines the outcome of endovascular treatment in CEAP 6 patients**
Cezary Szary, MD, Justyna Wilczko, MD, and Tomasz Grzela, MD, PhD, Warsaw, Poland
- 1600 Reply**
Leigh Ann O'Banion, MD, and Misaki M. Kiguchi, MD, MBA, Fresno, Calif. and Washington, DC

CONTENTS (continued)

1601 High colloid osmotic pressure as a proposed mechanism of acute renal injury after pharmacomechanical thrombectomy

Kerbi Alejandro Guevara-Noriega, MD, MSc, MTM, PhD, Trixie Yap, MD, and Uvanys Guevara-Noriega, MD, Sabadell and Pamplona, Spain; and London, United Kingdom

1602 When migration is not migration

Mitchell D. Eggers, PhD, MBA, Steven Y. Huang, MD, and Joseph R. Steele, MD, Pearland and Houston, Texas

JOURNAL OF VASCULAR SURGERY: VENOUS AND LYMPHATIC DISORDERS – NOVEMBER 2021 AUDIOVISUAL SUMMARY

e25 **Journal of Vascular Surgery: Venous and Lymphatic Disorders – November 2021 Audiovisual Summary** 

READERS SERVICES

- **Information for readers**
- **Information for authors and Editorial Policies:** See www.jvsvenous.org, Journal Information, Editorial Policies and Procedures
- **Events of interest**

CME CREDIT AVAILABLE TO JVS-VL READERS

Readers can obtain CME credit by reading a selected article and correctly answering four multiple choice questions on the Journal Web site (www.jvsvenous.org). The CME article is identified in the Table of Contents of each issue. After correctly answering the questions and completing the evaluation, readers will be awarded one *AMA PRA Category 1 Credit*[™].

ICON KEY



Audio Discussion

Listen from the online version of the article



Continuing Medical Education

Test available online at www.jvsvenous.org



Editor's Choice

This article has been given "Editor's Choice" distinction.



Online-only Articles

Available online at www.jvsvenous.org