proximal common carotid artery to the distal IJV using polytetrafluoroethylene (6 mm in diameter, 6-7 cm in length). Pigs were observed for 1 week, 2 weeks, or 3 weeks. Select pigs underwent ultrasound measurements of flow and ultrasound and caliper measurements of vessel diameters before graft placement. Vessels were harvested from two additional pigs that had undergone procedures unrelated to the IJV for control measurements. Grafts and vessels were excised and analyzed with histologic evaluation.

Results: At baseline, there was no significant difference in peak systolic or end-diastolic velocities between the left and right IJVs. The left and right IJVs also did not demonstrate any difference in caliper-measured diameters or ultrasound-measured luminal diameters. Histologic analysis of preoperative bilateral IJVs showed no difference in wall thickness or intima-media surface area. There were 10 left-sided and 8 right-sided polytetrafluoroethylene grafts placed; 4 of 10 (40%) were patent on the left and 7 of 8 (88%) were patent on the right ($P = .03996$, χ^2 test). Postoperatively, the right IJV showed an increase in wall thickness (0.15 to 0.35 mm; $P < .0001$) and intima-media surface area (0.17 to 0.35 mm^2; $P = .0024$) compared with baseline, but significant thickening was not seen on the left side. Left-sided grafts had increased luminal macrophages at the arterial anastomosis compared with right-sided grafts, but there was no significant difference in macrophage number at the venous anastomosis.

Conclusions: Left-sided jugular veins do not thicken to the degree that right-sided veins thicken on exposure to the AVG environment. Lack of left jugular venous remodeling was associated with reduced graft patency in this preclinical model. These data suggest anatomic differences in different venous beds, emphasizing the need to understand the biology of venous remodeling to optimize graft patency.

Author Disclosures: S. Liu: Nothing to disclose; **T. Wang:** Nothing to disclose; **J. Wang:** Nothing to disclose; **T. Isaji:** Nothing to disclose; **L. Niklason:** stock options Humacyte; **A. Dardik:** Nothing to disclose.

AMERICAN VENOUS FORUM ANNUAL MEETING ABSTRACTS

Venous Thromboembolism Prophylaxis and Its Association With Postoperative Venous Thromboembolism, Morbidity, and Mortality in a Modern Postsurgical Cohort

Danielle Sutzko,[1] Andrea Obi,[2] Monita Karmakar,[1] Nicholas Osborne,[1] Peter Henke[2]. [1]Surgery, Section of Vascular Surgery, University of Michigan; [2]Surgery, Section of Vascular Surgery, University of Michigan Health System

Objective: Evidence-based recommendations for venous thromboembolism (VTE) prevention include assessment of risk and application of mechanical or pharmacologic prophylaxis. Trials and patient cohort series have suggested benefit compared with no prophylaxis. However, whether this translates into real-world benefit is less clear. We hypothesized that prescription of VTE prophylaxis is high and that it confers a decreased VTE incidence and mortality benefit using a multihospital quality consortium.

Methods: This statewide, retrospective cohort study analyzed the primary outcomes of VTE incidence, morbidity, and mortality among postsurgical patients with and without VTE prophylaxis between April 2013 and September 2017 from 73 hospitals. All inpatient surgical procedures (>24-hour admission) with complete variables regarding VTE prophylaxis were included. Logistic regressions with cluster robust standard errors were then used to evaluate independent risk factors for postoperative VTE despite appropriate VTE prophylaxis adjusting for patients' demographics, premorbid conditions, family and personal history of deep venous thrombosis (DVT), intraoperative risk factors, and case complexity.

Results: Among 39,430 operations, the mean age was 60 ±15 years, and 63% (n = 24,765) were female. There were 572 (1.45%) postoperative VTEs, including 214 (0.54%) pulmonary embolisms and 404 (1.02%) DVTs. The overall mortality rate was 1.84% (n = 727). VTE events were associated with a significantly increased mortality (odds ratio [OR], 1.83; 95% confidence interval [CI], 1.18-2.83; $P = .007$) and postoperative complications (OR, 3.24; 95% CI, 2.67-3.95; $P < .001$) after adjusting for confounders. At the hospital level, there was a significant positive correlation between hospital postoperative VTE and mortality ($r = 0.27$; $P < .05$). In examining various VTE prophylaxis regimens, those receiving heparin three times a day and low-molecular-weight heparin were significantly more likely to develop a postoperative VTE event (1.71% vs 0.99%; OR, 1.39; 95% CI, 1.03-1.86; $P = .029$) compared with those who received no therapy. There was no difference in mortality between the two groups. Further analysis of patients receiving appropriate VTE chemoprophylaxis identified presence of other complications (OR, 3.21; 95% CI, 2.54-4.04; $P < .001$), having a personal history of DVT (OR, 2.34; 95% CI, 1.84-2.96; $P < .001$), receiving packed red blood cells during surgery (OR, 1.80; 95% CI, 1.32-2.44; $P < .001$), not smoking (OR, 1.37; 95% CI, 1.06-1.78; $P = .015$), not having prior history of peripheral vascular disease (OR, 1.97; 95% CI, 1.37-2.83; $P < .001$), and having high-risk procedures as independent risk factors for development of breakthrough postoperative VTE.

Conclusions: In modern day postsurgical care, VTE represents a continued source of morbidity and mortality. Contrary to our hypotheses, we found that postoperative VTE prophylaxis was broadly applied yet was associated with increased rather than decreased postoperative VTE and no effect on mortality.

Author Disclosures: D. Sutzko: Nothing to disclose; **A. Obi:** Nothing to disclose; **M. Karmakar:** Nothing to disclose; **N. Osborne:** Nothing to disclose; **P. Henke:** Nothing to disclose.

Use of the Caprini Score Integrated With a Thrombodynamics Test Reduces the Incidence of Unpredicted, Postoperative Deep Venous Thrombosis

Kirill Lobastov,[1] Galina Dementieva,[1] Natalia Soshitova,[2] Ekaterina Sautina,[1] Victor Barinov,[1] Leonid Laberko,[1] Grigoriy Rodoman[1]. [1]Department of General Surgery and Radiology, Pirogov Russian National Research Medical University; [2]GemaCore Ltd

Objective: Thrombodynamics (TD) is a global assay for hemostasis that makes it possible to follow changes in parameters such as hypercoagulation and to control an individual's response to blood thinners. The aim of this study was to compare how well the classic Caprini 2005 score and its modified version, taking into account the results of TD, predict postoperative deep venous thrombosis (DVT) in surgical patients with colorectal cancer.

Methods: This prospective observational clinical study involved 80 patients (33 men and 47 women; mean age, 73.9 ± 7.2 years) with colorectal cancer who underwent surgery. The patients were at a high risk for postoperative VTE (mean Caprini score, 9.9 ± 2.0) and received combined prophylaxis (antiembolism stockings and enoxaparin 40 mg once daily) until discharge. Enoxaparin was administered at a fixed hour according to the time of blood sampling for TD. Duplex ultrasound was performed to detect postoperative DVT before and 5 to 7 days after surgery.

Results: DVT was noted in 21 of the patients. Caprini scores significantly predicted DVT ($P < .0001$; area under the curve [AUC] = 0.839 ± 0.045). Analysis of receiver operating characteristic (ROC) curve coordinates revealed a cutoff score of 11 points, with a sensitivity of 76.2% and a specificity of 74.6%.

The results of the TD test revealed significant hypercoagulation despite administration of enoxaparin to patients with DVT. Regression analysis and ROC curves demonstrated that initial velocity of clot growth and clot size, measured 12 and 24 hours after enoxaparin administration (AUC = 0.697 ± 0.063 and AUC = 0.790 ± 0.059; AUC = 0.847 ± 0.059 and AUC = 0.803 ± 0.069, respectively), best predicted postoperative DVT. The cutoff points for DVT prediction appear to be initial velocity of clot growth >62.5 to 64.5 μm/min (normal range, 35-56 μm/min) and clot size >1351.5 to 1333.5 μm (normal range, 800-1200 μm).

The identified thresholds for the TD parameters have been integrated into the Caprini score. The total Caprini scores were recalculated for patients with at least one TD parameter that exceeded the cutoff; we also reanalyzed the ROC curves. The best predictability was found for Caprini score considering the elevation of all four TD parameters together (AUC = 0.924 ± 0.029) and increased cutoff up to 12 points with sensitivity of 85.7% and specificity of 81.4%. Using cutoffs for the original and modified scores, we calculated the number of patients whose values were under the cutoff level but who developed DVT nonetheless: 10.2% and 5.9%, respectively.

Conclusions: Integrating TD parameters into the Caprini score increases one's ability to predict postoperative DVT and to reduce the number of unpredicted complications.

Journal of Vascular Surgery: Venous and Lymphatic Disorders
March 2019

Author Disclosures: K. Lobastov: Nothing to disclose; **G. Dementieva:** Nothing to disclose; **N. Soshitova:** Nothing to disclose; **E. Sautina:** Nothing to disclose; **V. Barinov:** Nothing to disclose; **L. Laberko:** Nothing to disclose; **G. Rodoman:** Nothing to disclose.

E-Selectin Inhibition: A New Way to Treat Proximal Deep Venous Thrombosis

Daniel Myers,[1] Patrick Lester,[1] Raymond Adili,[1] Angela Hawley,[1] Laura Durham,[1] Veronica Dunivant,[1] Garrett Reynolds,[1] Suman Sood,[1] William Fogler,[2] John Magnani,[2] Mike Holinstat,[1] **Thomas Wakefield**[1]. [1]University of Michigan Medical School; [2]GlycoMimetics, Inc

Objective: There is a close inter-relationship between thrombosis and inflammation. In previous studies, we have shown the importance of P-selectin in thrombogenesis and thrombus resolution in many preclinical animal models. The role of E-selectin has been explored in rodent models and in a small pilot study of clinical calf vein deep venous thrombosis. The purpose of this study was to determine the role of E-selectin in thrombosis in a primate model of proximal iliac vein thrombosis, a model close to the human condition.

Methods: Iliac vein thrombosis was induced with a well-characterized primate model. Through a transplant incision, the hypogastric vein and iliac vein branches were ligated. Thrombus was induced by balloon occlusion of the proximal and distal iliac vein for 6 hours. The balloons were then deflated, and the primates recovered. Starting on postocclusion day 2, animals were treated with the E-selectin inhibitor GMI-1271, 25 mg/kg subcutaneously once daily (n = 4). Nontreated control (CTR) animals received no treatment (n = 5). All animals were evaluated by magnetic resonance venography (MRV), hematology (complete blood count), coagulation tests (bleeding time, partial thromboplastin time, activated partial thromboplastin time, fibrinogen, and thromboelastography) at baseline, day 2, day 7, day14, and day 21 with euthanasia. In addition, platelet function and CD44 expression on leukocytes were determined.

Results: E-selectin inhibition by GMI-1271 significantly increased vein recanalization by MRV vs CTR animals on day 14 ($P < .05$) and day 21 ($P < .0001$; Fig, *A*). GMI-1271 significantly decreased vein wall inflammation by MRV with gadolinium vein wall enhancement vs CTR also on day 14 ($P < .0001$) and day 21 ($P < .0001$; Fig, *B*). The thromboelastographic measure of clot strength showed significant decreases in animals treated with GMI-1271 vs CTRs at day 2 ($P < .05$) and day 7 ($P < .05$). Importantly, no significant differences in hematology or coagulation test results were noted between all groups, suggesting that E-selectin inhibition carries no bleeding potential. GMI-1271 did not affect platelet function or aggregation or CD44 expression on leukocytes. In addition, no episodes of bleeding were noted in either group.

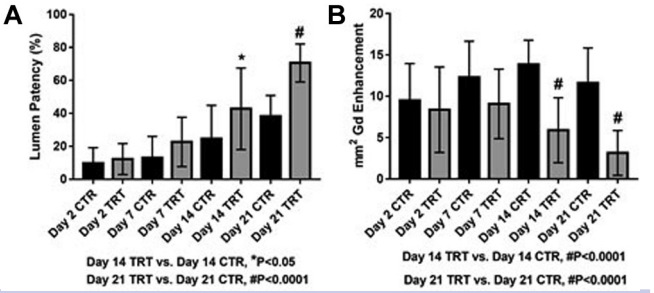

Fig. A, Percentage of vein recanalization. **B,** Vein wall inflammation. *CTR,* control; *TRT,* treated.

Conclusions: The study suggests that E-selectin modulates venous thrombus progression and that its inhibition will increase thrombus recanalization and decrease vein wall inflammation, without affecting coagulation. The use of an E-selectin inhibitor such as GMI-1271 could potentially change how we treat deep venous thrombosis.

Author Disclosures: D. Myers: Nothing to disclose; **P. Lester:** Nothing to disclose; **R. Adili:** Nothing to disclose; **A. Hawley:** Nothing to disclose; **L. Durham:** Nothing to disclose; **V. Dunivant:** Nothing to disclose; **G. Reynolds:** Nothing to disclose; **S. Soo:** Nothing to disclose; **W. Fogler:** salary, stock options GlycoMimetics, Inc; **J. Magnani:** salary, stock options GlycoMimetics, Inc; **M. Holinstat:** Nothing to disclose; **T. Wakefield:** Nothing to disclose.

Association of Inflammatory and Hemostatic Biomarkers with Inflammasomes in Septic Patients at Risk for Development of Coagulopathy

Evi Kalodiki,[1,2] Debra Hoppensteadt,[1] Richard Green,[1] Amanda Walborn,[1] Grace Wegryzn,[1] Jawed Fareed[1]. [1]Thrombosis Hemostasis, Loyola University Medical Centre; [2]Vascular Surgery, Josef Pflug Vascular Laboratory, Ealing Hospital, and Imperial College and West London Vascular and Interventional Centre

Objective: Sepsis is a catastrophic complication of infection that results in systemic inflammatory responses. Inflammasomes initiate the inflammatory cascade that results in the activation of caspase 1, leading to the upregulation of inflammatory cytokines such as interleukins B and 18. The NRLP-3 inflammasome contributes to the innate immune response identification of pattern recognition receptors on pathogens including bacteria and viruses. Whereas the role of inflammasome in the inflammatory response is known, it is not clear how inflammasome contributes to the hemostatic dysregulation observed in sepsis-associated coagulopathy. The purpose of this study was to quantitate inflammasome levels in defined sepsis-associated patients and to determine its potential relevance to various biomarkers of hemostatic dysregulation.

Methods: Plasma samples from 52 adults with sepsis and suspected coagulopathy were analyzed. Samples were collected from intensive care unit patients on day 0, under an Institution Review Board-approved protocol. Samples were stored at −80°C before analysis. Platelet count was determined as part of standard clinical practice. Healthy control samples were purchased from George King Bio-Medical (Overland, Kan). Prothrombin time and international normalized ratio were measured using recombiplastin reagent. Fibrinogen was measured using a clot-based method on ACL ELITE (Instrumentation Laboratory, Bedford, Mass) coagulation analyzer. Cortisol, D-dimer, plasminogen activator inhibitor 1 (PAI-1), NLRP-3 inflammasomes, microparticle-associated tissue factor, fibronectin, and CD40L were measured using commercially available enzyme-linked immunosorbent assays.

Results: In comparing patients with sepsis and suspected disseminated intravascular coagulation (DIC) with the normal plasma samples, there was a significant elevation in NLRP-3 inflammasome levels in the sepsis cohort ($P < .0001$). The Fig shows that the NLRP-3 inflammasome concentration in the sepsis cohort did not correlate with other biomarkers. An elevated level of NLRP-3 inflammasomes was significantly

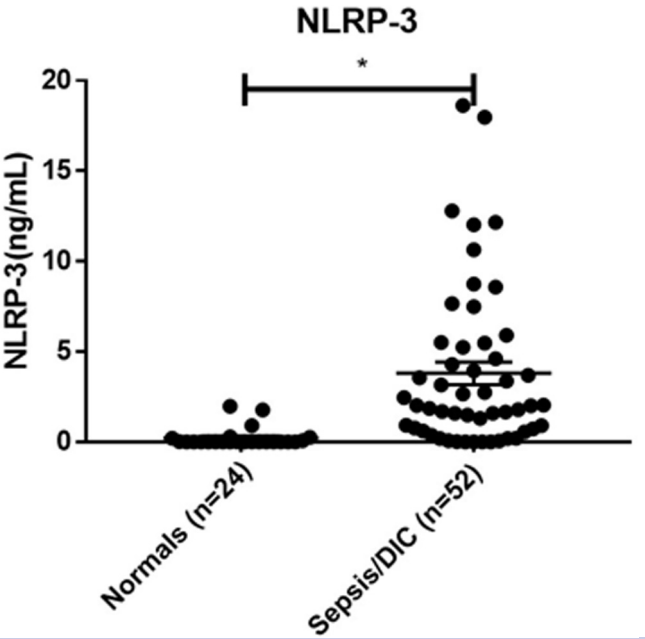

Fig. NLRP-3 inflammasomes in patients with sepsis and suspected disseminated intravascular coagulation (*DIC*) on day 0 (N = 52) compared with normal healthy controls (N = 24).