response shapes from the 20 to 500 ms post-stimulation period. This allowed us to group stimulation sites that evoked similar responses. We then related each group to high frequency, broadband, changes in spectral power as a reflection of local neuronal activity. RESULTS/ANTICIPATED RESULTS: We found that the VTC receives strong inputs specifically from the amygdala and hippocampus, both in terms of amplitude and broadband spectral power change. However, inputs from the hippocampus produced a different canonical shape than those from the amygdala. We also observed that VTC responses to inputs from the insula clustered in shape with those from the amygdala. These clustering patterns were consistent across subjects, although the actual shapes of the clusters showed variability. We further observed that some shapes were more associated with increases in overall neuronal activity than others, as reflected by broadband spectral power change. DISCUSSION/SIGNIFICANCE OF FINDINGS: Stimulation of connected sites may drive excitability at the target region in ways that are described by sets of full-time-course responses. By capturing their shapes, we can begin to decipher canonical input types at the circuit level. This approach might identify how stimulation inputs can be tailored to therapy while mitigating adverse effects.

86057

High Screening Efficacy Using Wearable Seismocardiography to Identify Aortic Valve Disease Patients, Potential to Tailor MRI Exams to Patient Needs*

Ethan M I Johnson[1], Alex J Barker[2] and Michael Markl[1]
[1]Northwestern University, [2]University of Colorado, Anschutz Medical Campus and [3]Northwestern University

ABSTRACT IMPACT: A single seismocardiography (SCG) parameter has been shown to accurately classify aortic valve disease (AVD) status in healthy controls and AVD patients. This could support development of SCG as a quick, inexpensive screening tool to better tailor MRI examination to patients' needs. OBJECTIVES/GOALS: MRI is used commonly for monitoring of aortic valve disease (AVD), but it has high costs. We hypothesize that energy in seismocardiograms (SCG)"signals from chest surface vibrations"is different between healthy controls and AVD patients, and we evaluate potential efficacy of using SCG to recommend MRI only for patients with flow abnormalities. METHODS/STUDY POPULATION: With IRB approval, 45 healthy control subjects (47 ±18years, 18 female) and 9 patients (63 ±16years, 2 female) with aortic valve disease history and known flow abnormalities were recruited. SCG signals were acquired supine, immediately prior to MRI of thoracic aortic blood flow at 1.5T with a time-resolved phase contrast (4D Flow) sequence. The SCG was processed to calculate late-systole high-frequency (120-240Hz) RMS energy. MR velocity images were analyzed to measure peak velocity and trace pathlines of flow.
Screening efficacy of the SCG energy metric was assessed, with hypothesis testing for differences in energy level distributions between controls and patients, and receiver-operator characteristic (ROC) analysis was used to calculate rates of correct/incorrect classification of disease. RESULTS/ANTICIPATED RESULTS: Healthy subjects had coherent flow pathlines through the aortic arch and mid-ascending aorta peak velocities of 106 ±21cm/s (cohort mean ±standard deviation). All valve disease subjects had flow abnormalities, such as jetting flow near the valve or swirling through the arch, as visualized by pathlines. Patients' peak mid-ascending aorta velocities were 167 ±69cm/s. The SCG energy for healthy controls was significantly different than that of valve patients (-5.6 ±0.3dBmm/s/s vs. -4.0 ±1.2dBmm/s/s respectively; $p<0.001$). Thresholding SCG energy to distinguish patients from controls correctly classifies subjects with a high true-positive rate and low false-positive rate. The ROC for this classification has area-under-curve 0.956. DISCUSSION/SIGNIFICANCE OF FINDINGS: A high potential screening efficacy was observed using a single, linear SCG metric to identify AVD patients with flow abnormalities. If used to complement MRI surveillance protocols for AVD, this method has potential to serve as a quick, inexpensive tool for better tailoring MRI exams to patient needs.

Dissemination and Implementation

30143

Asymptomatic Thoracic Aortic Aneurysm Growth Rates and Predicting Factors: A Systematic Review and Meta-Analysis

Matthew Henry, Pieter Van Bakel, Mark MacEachern, Marion Hoffman Bowman, Kim Eagle; Himanshu Patel and Nicholas Burris
University of Michigan

ABSTRACT IMPACT: Through conducting this systematic review and meta-analysis, we will elucidate which factors influence thoracic aortic aneurysm growth, which will further help clinicians to properly stratify and manage their patients with TAAs. OBJECTIVES/GOALS: Thoracic aortic aneurysms (TAA) are an indolent but fatal disease, and the patient characteristics that predict both overall growth and growth rate are still not well characterized. Our goal is to conduct a systematic review and meta-analysis in other to better describe different patient characteristics that predict TAA growth. METHODS/STUDY POPULATION: M.M. conducted a search of Ovid MEDLINE, Embase, and Scopus to identify articles. Inclusion criteria were any longitudinal study reporting asymptomatic TAA growth, growth rates, or clinical proxies for growth such as dissection, rupture, emergency surgery, and death. M.H and P.B. independently applied the criteria to the results of the search. Conflicts were resolved by N.B. Data was extracted and risk of bias assessed independently by M.H. and P.B. Summary estimates of the outcome variables are combined across studies using standard meta-analysis methods. Heterogeneity is assessed via forest plots, chi2 test (Q test), and I2 statistic. Sensitivity analysis is conducted to assess robustness of the findings. RESULTS/ANTICIPATED RESULTS: The literature search resulted in 3,419 abstracts, of which 176 were included and thus require a full text review. Cohen's Kappa coefficient was 0.64, indicating substantial agreement and high inter-rater reliability. We describe four categories of patient characteristics influencing the growth of asymptomatic TAAs: demographics, genetic or inheritable conditions, hemodynamic or biomechanical factors, and serum biomarkers. We describe the measure of effect for all variables. We anticipate there is a significant level of heterogeneity between studies, and potentially moderate risk of bias for many of the included studies as they are retrospective and observational in nature. Furthermore, we anticipate publication bias and evaluate

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it with funnel plots. DISCUSSION/SIGNIFICANCE OF FINDINGS: Understanding the factors that influence the growth of asymptomatic thoracic aortic aneurysms (TAA) is paramount, as the size and growth rate of TAAs dictates the clinical course. Little is understood about the degree to which different characteristics influence growth. This meta-analysis will help elucidate factors that promote TAA growth.

Evaluation

85965

Biomechanical analysis of vertebral body polymethylmethacrylate cement augmentation performed using two different techniques

Kabir Torres[1], BA, Brandon B. Carlson[2], MD, MPH, Douglas C. Burton[1], MD, Jacob Birlingmair[1], MD, R. Sean Jackson[1], MD, Joshua T. Bunch[1], MD, Terrence McIff[1], PhD and Stephanie Robinson[1]
[1]University of Kansas - School of Medicine and [2]Department of Orthopedics - University of Kansas Medical Center

ABSTRACT IMPACT: This study will answer key questions that spine surgeons have regarding techniques used in cement augmentation of vertebral compression fractures and will ultimately advance patient care for such injuries. OBJECTIVES/GOALS: The objective of this study is to determine if a difference exists in load-bearing characteristics and load-to-fracture between injecting cement anteriorly prior to screw placement versus cement augmentation via fenestrated pedicle screws. We also expect differences in load-to-failure characteristics between different cement volumes. METHODS/STUDY POPULATION: This study will be performed in a bioengineering laboratory that has access to a Materials Testing System (MTS). Eight cadaveric specimens will be selected from our stock after pre-screening via CT for inclusion and exclusion criteria. The levels T8-L1 will be dissected from the vertebral column along with any soft tissue structures. The vertebral bodies will be potted in an epoxy mold. From each spine, there are 2 groups of three. One vertebral body from each spine will serve as an internal control, one will be augmented with cement via a cannula and then instrumented with a non-fenestrated screw and the third will be instrumented will a fenestrated screw and then augmented with cement. After appropriate curing time, repeat CT imaging will be completed. The specimens will then be loaded to failure and the results analyzed. RESULTS/ANTICIPATED RESULTS: We hypothesize that we will see a better anterior spread with the cannula/non-fenestrated screw method as compared to the fenestrated screw. The reason being is that we would expect the fenestrated screw to experience more cement extruding from the fenestration rather than being directed anteriorly. We believe a better anterior spread of the cement will lead to a greater load-bearing capacity for the vertebral body. We also believe that a difference will exist in load-to-failure testing with the two volumes being tested, though we cannot predict to what a degree this difference will be impactful as there have been few studies prior looking at this. DISCUSSION/SIGNIFICANCE OF FINDINGS: This study is significant because it will aid in determining the optimal technique to implement in the setting of vertebral compression fractures. This will lead to improved patient care as well as a greater understanding of the instrumentation used in such procedures. The results will lay the groundwork for future research on this procedure.

Precision Medicine

15564

Going with the Flow: Engineering Vascularized Urothelial Flaps for Female-to-Male Phalloplasty in Transgender Patients

Jason Harris[1], Xue Dong[1], Ryan Bender[2], Sarah Caughey[1], Nabih Berri[1] and Jason Spector[1]
[1]Weill Cornell Medicine and [2]Downstate Medical Center

ABSTRACT IMPACT: This project uses rapid prototyping, 3D printing, and cell seeding to solve the most common post-operative complications that arise from the current methods of urethral elongation during phalloplasty. OBJECTIVES/GOALS: Post-op fistula and stricture formation occur in up to 50% of phalloplasty patients. These complications arise from the mismatch between skin and uroepithelium, or from scarring secondary to ischemia. Here we describe the fabrication of a novel vascularized urothelial flap for phalloplasty that contains discrete urothelial and vascular channels. METHODS/STUDY POPULATION: A custom designed 3D negative mold, with a urethral channel and a vascular inlet and outlet channel was prototyped in Adobe Fusion 360 and printed on a Prusa i3 MK3S printer in PLA. A 2mm diameter pluronic sacrificial macrofiber was used to connect the channels to form a vascular loop, and 1% type-I collagen was extruded over the mold. After solidifying, the scaffold was demolded and seeded with grade I urothelial carcinoma (SW780 cells, at 5-10 x 106 cells/mL) in the urethral channel, and adenovirus-infected E4 endothelial cells (at 3x106 cells/mL) in the vascular channel. The scaffolds were cultured up to 14 days and then fixed for histologic analysis. RESULTS/ANTICIPATED RESULTS: Collagen scaffolds were fabricated reliably using the custom 3D negative molds. After both seven and fourteen days of culture, the urothelial channel contained a robust, stable urothelial monolayer lining throughout the channel. By 14 days urothelial multilayer formation was seen, providing definitive evidence of a more mature urothelial layer. Grooves within the collagen allowed for nests of urothelial cells to develop, leading to increased multilayer formation. In addition, the vascular channels supported a healthy endothelial lining at both seven and fourteen days. There were no significant histological differences between constructs seeded with 5x106 urothelial cells/mL and 107 cells/mL. We anticipate that multilayer formation will increase with time, and that constructs will survive beyond 28 days. DISCUSSION/SIGNIFICANCE OF FINDINGS: We have developed a novel strategy to engineer vascularized urethral tissue. These constructs can be kept for at least 14 days and form stable monolayers and multilayers consistent with native urothelial architecture. Using 3D printing and autologous cell seeding promises to create patient-specific vascularized urethral flaps for phalloplasty.

22732

Impact of Type-I Interferon Manipulation During Embryo Implantation and Placentation

Michael K. Simoni, Sydnie Swanson, Monica Mainigi and Kellie Jurado
University of Pennsylvania

ABSTRACT IMPACT: This research will promote understanding the role of the Type-I Interferon signaling pathway during embryo

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