E-015

FAILURE MECHANISMS OF CURRENT THROMBECTOMY DEVICES IDENTIFIED IN A HUMAN BRAIN MODEL: IATROGENIC EMBOLIZATION, RESIDUAL AND RECURRENT LARGE VESSEL OCCLUSION, PERSISTENT PERFORATING ARTERY OCCLUSION, AND ARTERIAL COLLAPSE, TRACTION AND AVULSION

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Introduction Complete recanalization in large vessel occlusion (LVO) strokes with suction catheters and stent retrievers has remained at 50% despite improved technologies and accumulating operator experience. About 40% of patients experience poor neurological outcomes and many cannot be recanalized at the first attempt. In this experimental study, we aimed to analyze the interaction between the arteries/emboli/devices in human brains and to provide mechanistic explanations of failures and complications of current interventions in a human brain LVO model.

Method Elastic, fragment-prone and stiff embolus analogs were fabricated using a multilinear regression model derived from analysis of LVO emboli. Then, 105 LVO were generated in 12 fresh human brains pressurized by a pulsatile pump and recanalization attempted in 61 cases using aspiration thrombectomy (ACE™ 68; Penumbra) and in 44 cases using stent/aspiration technique (Solitaire™ Platinum, Medtronic and ACE™ 68, Penumbra).

Results First pass complete (34%), successful (71%) and complete (60%) recanalization rates in this model were consistent with the literature. Devices loaded the emboli with tensile forces leading to elongation and intravascular fragmentation with downstream embolization to the microcirculation causing recurrent (15%) and residual (73%) occlusions, or both (12%). Moreover: a) residual emboli remained in small branching and perforating arteries in alleged complete recanalization (28%); b) vacuum caused arterial collapse at physiological pressures (43%); c) device withdrawal caused arterial traction (41%); and d) severe arterial traction provoked avulsion of perforating arteries.

Conclusion Stents and suction catheters load emboli with tensile forces leading to fragmentation, embolization and residual occlusion and cause significant arterial deformation, collapse and traction.

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E-016

NOVEL COMPLICATION GRADING SCALE AND SEVERITY REPORTING SCALE: A DETAILED PROPOSAL AND FEASIBILITY STUDY

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Introduction/Purpose A morbidity and mortality conference is an integral part of the progressing landscape of quality-driven healthcare. However, in neuroendovascular surgery the

experience is far from universal in format. Lack of uniformity in classification and grading of severity of complications makes universal reporting challenging and difficult to compare across institutions. Furthermore, complications are often specialty specific, making generalization of a multispecialty standardized complication grading scale infeasible. To enable standardization of reporting, we seek to test feasibility of a neuroendovascular surgery specific complication classification and severity scale by enrolling physicians to review 4 case vignettes and score the complications using the standardized tool.

Materials and Method This schema has evolved over several iterations, seeking to account for all complications that have been evaluated over the past 5 years, into a concise and uniform reporting system. We have created a system to classify complications within two categories, Peripheral and Cranial/Spinal Complication Grades. Aligning with other complication scales vetted in the literature, we created a uniform scoring system from 1–5 to capture the severity of the complication. Grades three or higher are reportable complications. Four cases with complications were used to test feasibility of this classification and grading scale. With little to no introduction to the tool, eleven physicians trained in either neurological surgery, neuroradiology, neurocritical care or neuroendovascular surgery at various stages of training (resident, fellow) and careers (private practice, academic) were asked to review the vignettes and grade the complications using the standardized tool. We analyzed their ability to accurately identify the correct grade and severity of the complication, as well as sub-analyzed the accuracy of providers trained in neuroendovascular surgery.

Results When reporting the accurate complication grade and severity we found a 66% accuracy of all responders. The accuracy improved to 86% when considering only the severity of the complications, which is the only score that determines reportability of a complication. Neuroendovascular trained providers in the survey were able to identify the correct complication grade and severity accuracy at a rate of 70%, while the accuracy in identifying the correct severity improved to 90%.

Conclusion The creation of a universal complication reporting and grading scale has been used in other sub-specialties to improve both local and global assessment of complications in the literature. The acceptance of a standardized surgical grading scales within neuroendovascular surgery will miss complications unique to this subspecialty. We propose a grading scale which would standardize the reporting and evaluation of complications. This will provide a more universal experience within institutions, which is critical for quality-driven healthcare and allow for more generalized reporting within the literature. This initial feasibility assessment confirms neuroendovascular trained physicians can be in agreement to the severity of a complication with a high degree of accuracy. The greatest limitation to the study was the lack of familiarity of the reviewers to the complication grade. In a larger validation study, utilizing training to the scale, as well as reducing risk of reviewer fatigue by decreasing the number of cases per reviewer would likely improve accuracy.

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