

Poster section II. Carotis

Association of Bovine Aortic Arch Anatomy with Increased Carotid Stenosis in the Left Carotid Artery

Samuel Kalina¹, Negin Mahmoudi Hamidabad¹, John C. Benson¹, Kai Nogami¹, Elham Mahmoudi¹, Luca Saba², Giuseppe Lanzino¹, Valentina Nardi¹, Amir Lerman¹

1: Mayo Clinic, Rochester, MN, USA

2: Azienda Ospedaliero Universitaria (A.O.U.), Cagliari, Italy

BackgroundThe bovine aortic arch is the most common vascular variant, where the left common carotid artery originates from the brachiocephalic trunk, potentially altering blood flow and increasing stroke risk. Its association with carotid stenosis severity remains unclear.
ObjectiveThis study examines the impact of bovine aortic arch anatomy on carotid atherosclerosis. We hypothesized that bovine anatomy contributes to increased atherosclerosis, leading to higher risk of severe left carotid stenosis.
MethodsThis retrospective study included patients with carotid artery disease undergoing carotid endarterectomy (CEA) and pre-surgical computed tomography angiography (CTA). CTAs were reviewed to assess carotid stenosis severity and aortic arch anatomy, classified as normal or bovine. Propensity score matching (1:2) was applied based on demographics and risk factors. The Mann-Whitney U test compared carotid stenosis between groups.
ResultsA total of 203 patients (bovine: 23, normal: 180) were enrolled. After matching, 20 bovine cases were paired with 45 normal controls. Among the 65 patients, 47 (74.6%) were male, with a median age of 70 [IQR: 65.0-76.0] years. Bovine anatomy was associated with more left-sided CEA cases (66.7% vs. 36.4%; $p=0.030$). Carotid stenosis severity was higher in bovine arch patients (82.5% [76.2-88.7] vs. 70.0% [50.0-95.0]; $p=0.030$).
ConclusionsThe bovine aortic arch may influence local atherosclerosis, leading to different vascular outcomes. These findings suggest altered hemodynamics in bovine anatomy may predispose individuals to more severe atherosclerosis, particularly on the left side

Brain infacts correlate with exulcerated plaques and severe incompleteness of the circle of Willis – retrospective analysis of a large cohort of carotid endarterectomy patients

Milán Vecsy-Nagy¹, Péter Csongor², Péter Banga³, Prof. Sótónyi Péter³

1: Semmelweis Egyetem VSZÉK, Radiológia; Department of Radiology and Radiological Science, Medical University of South Carolina

2: Semmelweis Egyetem VSZÉK, Radiológia,

3: Semmelweis Egyetem VSZÉK, Vascularis és Endovascularis Részleg

AimsTo detect, describe and correlate cerebral infarcts shown by CT to demographic data, co morbidities, carotid plaque features, and anatomy of the circle of Willis (CW) in subjects undergoing carotid endarterectomy (CEA).
Materials and methodsAfter ethical approval and informed consent from all study subjects, we retrospectively analyzed the carotid CT angiography (CTA) and brain CT of patients who underwent CEA in our institution between January 2013-May 2018. The number and localisation (territorial or watershed) of ipsilateral hypodensities corresponding to brain infarcts were recorded. Carotid bifurcation plaques were analyzed qualitatively (calcified, fibrotic, lipid, exulcerated) after measuring/averaging plaque densities in three consecutive slices at the largest plaque thickness. The anterior and ipsilateral posterior CW segments were evaluated considering the presence/number of hypoplastic (diameter of <0.8 mm) and non-visualized segments. The most severe constellation was incompleteness of both the anterior and ipsilateral posterior parts feeding the middle cerebral artery of the operated side. Uni- and multivariable Cox proportional hazards models were used to identify predictors of brain infarcts and to compare predictors of watershed versus territorial infarcts. The threshold for significance was defined as $p \leq 0.05$.
ResultsData of 1163 subjects was analysed (age 68.7 ± 8.1 , female 38.6%). We found no difference in demographics, co morbidities or CW anatomy comparing those with or without cerebral infarcts, except for the symptomatic status ($p < 0.001$). The only significant predictor when comparing territorial versus watershed infarcts was smoking. With multivariable analysis significant determinants of ipsilateral brain infarcts were symptomatic status ($p < 0.001$), multiple incompleteness of the CW ($p = 0.02$) and exulcerated plaque morphology ($p < 0.001$).
ConclusionThere is a significant association between the higher rates of ipsilateral brain infarcts and severe incompleteness of the CW and exulcerated plaques in our large CEA cohort.

Carotid Body Tumor; A Pandora's box for Vascular Surgeons

Dr. Ashish R. Bhiwapurkar¹, Dr. Suraj Wasudeo Nagre¹

1: GRANT GOVERNMENT MEDICAL COLLEGE AND SIR JJ GROUP OF HOSPITALS, MUMBAI, INDIA

Background: Carotid Body Tumors (CBT) are rare hypervascular Neuroendocrine tumor found at bifurcations of Common Carotid artery. Its evaluation and treatment require a multidisciplinary approach. Early detection and meticulous dissections are necessities for successful management as there is a high rate of neurovascular complications. The objective of this study is to share the experience of a tertiary care Hospital in managing patients diagnosed with CBT without practicing preoperative embolization. **Design Method:** A cross sectional study done over 10 patients that underwent excision of CBT from January 2023 to June 2024. Data were collected from Hospital records. The tumor were classified according to Shamblin Classification. Patients were followed up for 6 months. **Results:** Out of 10 patients, 3 were male and 7 were female. 6 patients had right sided tumor and 4 had left sided. 8 patients complained of neck mass and 2 patients presented with positive medical history. Tumor diameter ranged from 3 to 7 cm. 7 patients had Shamblin Type III tumor, 2 had Type II and 1 had Type I tumor. Average operating time was of 200 mins. Blood transfusions were required in 2 cases, one from Type III and one from Type II; whereas none from Type I ($p=0.001$). Arterial reconstruction of Internal Carotid artery was done by interposition Great Saphenous Vein graft in one patient. Average Blood loss was 120 ml. Temporary nerve dysfunctions was found in 2 patients which recovered by steroids and physiotherapy. Stroke was found in one patient of Type III who underwent arterial reconstruction. Lymph nodes excised in 6 patients turned out to be benign. Tumor in one patient mimicked like CBT but histopathology report showed Nerve Sheath Tumor. **Conclusion:** Excision of CBT without preoperative embolization feasible with acceptable outcome. Comprehensive workups and multidisciplinary approaches are required for optimally managing this Pandora's Box.

Clinical Predictors of Mortality in Patients with Acute Ischemic Stroke Treated with Mechanical Thrombectomy: A Nonlinear, Internally Validated Model

Henriette Mészáros¹, Péter Orosz², Zoltán Kővári², Klaudia Vivien Nagy¹, Béla Merkely¹, Istvan Hizoh¹, Sandor Nardai²

1: Heart and Vascular Centre of Semmelweis University

2: Semmelweis University Center of Neurosurgery and Neurointervention

Background: Mechanical thrombectomy (MT) has been proved to be a safe and effective technique for treating acute ischemic stroke. Yet, predictors of mortality following the intervention are poorly elucidated. Therefore, we developed and internally validated a nonlinear model using a single-center registry. **Methods:** We analyzed data of 1227 patients who underwent MT in a high-volume center. Median follow-up was 1487 days with 627 deaths (51.1%). Candidate predictors included demographics, medical history, clinical presentation, laboratory results, and medical treatment. Following a bootstrap-based predictor selection, a Cox regression model was constructed which was validated internally using bootstrap resampling. Discrimination and calibration were characterized by the c-statistic and calibration slope, respectively. **Results:** The following 14 clinical variables proved to be predictors: age, sex, known atrial fibrillation (AF), NIHSS score at admission, preoperative thrombolysis, hemoglobin concentration, INR and GGT at admission, final TIC1 flow, hemorrhagic transformation, pre- and postoperative antiplatelet therapy, postoperative oral anticoagulation (OAC) and statin treatment. Moreover, the effect of postoperative OAC therapy on mortality may be a function of the presence of AF, i.e., OAC treatment exerts its beneficial effect only in patients without AF. After internal validation, our model demonstrated acceptable discrimination and good calibration (c-statistic=0.74, slope=0.95). **Conclusion:** We present a novel, internally validated model for predicting mortality following MT. It may help to identify patients at higher risk, allowing for targeted preventive measures and potentially improving clinical outcomes. Further external validation studies are warranted to refine the model and validate its performance in diverse populations.

Complex Functional Transcranial Doppler Ultrasound Examinations in Patients with Significant Internal Carotid Artery Stenosis

Rita Magyar-Stang¹, Borbála Csányi², Anna Gaál¹, Zsuzsanna Mihály³, Zsófia Czinege³, Péter Sótónyi³, Tamás Horváth⁴, Balázs Dobi⁵, Dániel Bereczki⁶, Akos Koller⁷, Róbert Debreczeni¹

1: Department of Neurology, Semmelweis University, Budapest, Hungary

2: János Szentágothai Neurosciences School of PhD Studies, Semmelweis University, Budapest, Hungary

3: Department of Vascular and Endovascular Surgery, Semmelweis University, Budapest, Hungary

4: Research Center for Sport Physiology, Hungarian University of Sports Science, Budapest, Hungary

5: HUN-REN Neuroepidemiological Research Group, Budapest, Hungary

6: Department of Neurology, Semmelweis University, HUN-REN Neuroepidemiological Research Group, Budapest, Hungary

7: Research Center for Sport Physiology, Hungarian University of Sports Science, Budapest, Hungary, Translational Medicine Institute, Faculty of Medicine, and ELKH-SE, Cerebrovascular and Neurocognitive Disorders Research Group, Semmelweis University, Budapest, Hungary, Department of Physiology, New York Medical College, Valhalla, NY, USA

Introduction: In cases of 48 patients with significant Internal Carotid Artery (ICA) stenosis (ICAS-70%<) a multimodal Transcranial Doppler US examination was performed before undergoing vascular surgery. **Methods:** 48 patients were recruited. The applied four vasoactive stimuli were the Valsalva Maneuver (VM), Common Carotid artery Compression test (CCC), Hyperventilation (HV) and Breath Holding (BH) tests. The blood flow velocity changes of both MCA were registered by TCD. The patients' systemic hemodynamic parameters were also simultaneously recorded: ECG, continuous non invasive arterial blood pressure measurement and capnography. A number of time and amplitude variables were defined that took into account arterial blood pressure changes in addition to BFV changes. The Wilcoxon Matched Pair Test was used for the statistical analysis of the variables of the stenotic and contralateral side. **Results:** Due to technical reasons VM of 34, HV-BH test of 31 and CCC test of 26 patients were evaluated. In the case of HV-BH tests the BHI did not show a significant difference regarding the stenotic and contralateral side (BHIICAop (mean(SD)): $2,34 \pm 21,87$, BHIICAnonop (mean (SD)): $2,63 \pm 2,60$ Wilcoxon Matched Pair Test $p=0,29$), while in the dynamic tests (CCC and VM) both time and amplitude variables proved to be sensitive for detecting hemodynamic disturbances. **Conclusion:** In cases of carotid stenosis requiring surgical treatment, we recommend the use of stimuli that induce pressure-flow changes for preoperative ischemic risk assessment.

Elevated Autoimmune Inflammatory Markers and Perioperative Risks Required Element Number

Calculation: Insight Into a New Carotid Biobank

Mark Matus¹, Sára Varga¹, Vivien Kriskó¹, Leonie Driessen¹, Melissa Pawin-On Brinning¹, Gergő Gyurok², Ágnes Szappanos², Péter Sótónyi², Zsuzsanna Mihály²

1: Semmelweis University, Heart and Vascular Centre, Budapest Hungary

2: Department of Vascular and Endovascular Surgery Semmelweis University, Budapest, Hungary

Introduction: Patients with inflammatory conditions have an increased risk of cardiovascular diseases, including carotid artery stenosis. However, data on systemic inflammation's role in stenosis progression and perioperative risks during carotid reconstruction remain limited. To address this, a biobank was established to collect biological samples from patients undergoing open carotid artery reconstruction. **Aim:** This study investigates the prevalence of autoimmune inflammatory markers to determine their potential role in carotid stenosis and estimate the sample size for a future prospective study on perioperative risks. **Methods:** The carotid plaque biobank was initiated on January 1, 2024. Blood and plaque samples from patients undergoing open carotid reconstruction are stored and analyzed. Preoperative immunoserological parameters and relevant clinical data are recorded prospectively. **Results:** By April 15, 2024, 29 patient samples had been collected (mean age: 69.9 ± 9.7 years). Four patients experienced neurological events within six months preoperatively. Perioperative complications included one death due to respiratory insufficiency, one neurological event, and one case of hyperperfusion syndrome. Antibody positivity (AB) was detected in 19 of 29 patients (65.5%), with antinuclear (38%), anti-chromatin (24%), anti-dsDNA (21%), and anti-cytoplasmic (10%) antibodies being the most common. Only one patient had a known autoimmune disease (Hashimoto's thyroiditis). For the Fischer exact test and the Chi-square test, 785 ($d=0.1$) and 31 ($d=0.5$) optimal sample sizes are required to be achieved by power analysis. For correlation analysis, the required sample sizes range from 1571 ($d=0.1$) to 64 ($d=0.5$). **Conclusion:** Autoimmune markers are frequently present in patients with carotid stenosis. Collecting at least 64 additional samples is necessary to achieve statistical power for evaluating their impact on perioperative outcomes.

Pericarotid Fat Associated with Major Adverse Cardiovascular Events after Carotid Endarterectomy

Samuel Kalina¹, Kai Nogami¹, Elham Mahmoudi¹, Negin Mahmoudi Hamidabad¹, John Benson¹, Luca Saba², Giuseppe Lanzino¹, Valentina Nardi¹, Amir Lerman¹

1: Mayo Clinic, Rochester, MN, USA

2: Azienda Ospedaliero Universitaria (A.O.U.), Cagliari, Italy

Background Pericoronary artery adipose tissue attenuation has been linked to major adverse cardiac events (MACE), but the association between pericarotid fat and prognosis remains underexplored. This study investigated the relationship between preoperative pericarotid fat characteristics and prognosis in patients undergoing carotid endarterectomy (CEA). **Methods** Patients with preoperative computed tomography angiography (CTA) followed by CEA were included. Preoperative neck CTA images were analyzed using 3D Slicer software. The common and internal carotid arteries were segmented, isolating the bifurcation region (15 mm above and 10 mm below). Pericarotid fat was defined as adipose tissue within 5 mm of the outer vessel wall, with Hounsfield units (HU) between -190 and -30. We calculated pericarotid fat HU average and volume (mm³). MACE was defined as all-cause mortality, myocardial infarction, and cerebrovascular events. **Results** Of 43 patients, one was excluded due to chronic total occlusion, leaving 42 (age 73 [67-78] years, 33 [76.7%] male). Mean ipsilateral and contralateral fat HU showed no significant difference (-60.3±11.0 vs. -60.9±11.3, p=0.437). However, median ipsilateral fat volume was higher than contralateral (528 [248, 1100] mm³ vs. 328 [184, 697] mm³, p=0.020). Patients with MACE had significantly lower ipsilateral fat density (-59.4±10.2 vs. -66.8±11.1 HU, p=0.022) and higher fat volume (468 [233, 746] vs. 845 [458, 1451] mm³, p=0.044). Kaplan-Meier analysis showed higher fat volume and lower density predicted MACE (log-rank p=0.015 and p=0.042). **Conclusions** A novel CTA analytic method identified lower ipsilateral fat density and higher fat volume as predictors of adverse outcomes in CEA patients.

Regional Analysis of Environmental Factors Influencing Out-of-Hospital Cardiac Arrest in Hungary

Dr. Nagy Bettina¹, Dr. Kiss Boldizsár¹, Dr. Csató Gábor², Dr. Pápai György², Dr. Boussousou Nora³, Prof. Dr. Merkely Béla¹, Prof. Dr. Sótonyi Péter¹, Szilágyi Brigitta⁴, Prof. Dr. Endre Zima¹

1: Heart and Vascular Centre of Semmelweis University

2: Hungarian National Ambulance Service

3: Uzsoki Street Hospital

4: Budapest University of Technology and Economics

Introduction: Out-of-hospital cardiac arrest (OHCA) continues to be a significant public health challenge, with outcomes influenced by multiple factors. Our study examined regional differences in the complex interactions between environmental factors and OHCA incidence in Hungary. **Methods:** In our research, we analyzed 148,572 OHCA cases. Through machine learning and neural networks, we modeled the complex relationships between environmental factors and socio-economic indicators with OHCA cases. **Results:** We found significant regional differences in both relative case numbers and ROSC ratios throughout the country (p<0.001). Most significant increase in case numbers during extremely cold temperatures, with higher solar radiation showing correlation with decreased cases (p<0.001), while high relative humidity was associated with increased incidence (p<0.001). In the XGBoost modeling, the previous day's Weather Extremity Index had the highest predictive value based on feature importance. Moderate WEI values (-500 to -400) were associated with slightly increased cardiac arrest rates, while the ranges from -300 to -200 corresponded with decreased incidence rates compared to baseline. **Conclusion:** The comprehensive analysis reveals complex relationships between factors influencing OHCA outcomes. Extreme meteorological factors and regional variations result in significant differences in survival rates. Based on our results, targeted interventions are needed, taking into account environmental conditions and regional resources for strategic optimization of OHCA outcomes. This work has been implemented by the National Multidisciplinary Laboratory for Climate Change (RRF-2.3.1-21-2022-00014) project within the framework of Hungary's National Recovery and Resilience Plan supported by the Recovery and Resilience Facility of the European Union.

Systematic Shunting Under General Anesthesia For Carotid Endarterectomy : A prospective study

Ass. Prof. Julien Sfeir¹

1: Lebanese American University Medical Center Rizk Hospital

Introduction Routine shunting is still controversial in CEA, some surgeons are using shunting systematically, some use it only when there is signs of poor perfusion during the procedure. In our study, we are going to show that systematic shunting under general anesthesia is safe and can give similar outcome compared to CEA done under cerebral monitoring and selective shunting. **Methods** 178 CEA were included. The primary and secondary endpoints were to evaluate the risk of stroke and mortality respectively and to evaluate the incidence of complications related to the shunt insertion. 25% symptomatic, 75% asymptomatic. Stenosis > 70 % confirmed on dual imaging US and CTAngio/MRA. Same perioperative protocol was implemented: Patients with normal kidney function underwent coronary angiography, in whom 6.7% had coronary angioplasty and 2 had CABG. Nuclear cardiac imaging in patients with moderate renal disease except in 7 patients (operated for repetitive TIA within 48

hours). All patients had brain MRI. All symptomatic patients who had recent coronary stenting were on dual antiplatelets. All patients were operated under general anesthesia with the insertion of shunt type ARGYLE and dacron patch angioplasty. Results: No Stroke seen, No shunt related per operative complication. Transient dysarthria and weakness in 1.12% and was related to intra operative hypotension documented on diffusion MRI, 5.5% had elevation of troponin and were in the symptomatic group, 3 patients had coronary angioplasty and stenting post operatively. 4 had moderate hematomas with spontaneous resolution. Mortality was 0.05%. At 3 months, no dissection was seen or any anatomical issues related to shunting. When comparing these results with all meta analysis we found that our results were similar in terms of mortality, procedure related complications and prevention of stroke. Conclusion: When optimal peri operative assessment of patients is done, carotid endarterectomy under general anesthesia with systematic shunting is safe and can produce good outcome with low rate of perioperative stroke and death.

The impact of contralateral carotid occlusion on circle of Willis completeness

Péter Banga1

1: Semmelweis University Városmajor Heart and Vascular Centre

Introduction: Patients undergoing carotid reconstruction (CEA) with contralateral internal carotid artery occlusion (CCO) may face a heightened risk of perioperative stroke, although this risk is debated. Circle of Willis (CoW) deficiencies have been implicated in perioperative stroke rates, particularly when multiple segments are absent. Despite the rarity of a complete CoW, patients with CCO might exhibit a more robust cerebral arterial collateral system. **Methods:** This retrospective study included patients undergoing CEA between January 2013 and May 2018. A total of 1,481 patients were included, divided into two groups: those with CCO (N=110) and those with a patent bilateral internal carotid artery (PBC) (N=1,371). CoW morphology was assessed using CTA scans, and demographic and clinical data were collected prospectively. **Results:** Patients with CCO were older (median age: 69 years) compared to those with a PBC (median age: 68 years) ($P=.041$) and exhibited a higher prevalence of chronic obstructive pulmonary disease (COPD) ($P=.024$). However, there were no significant differences in other comorbidities between the two groups. Regarding CoW morphology, patients with CCO had a significantly higher prevalence of a complete CoW (19.1%) compared to those with a PBC (4.9%) ($P<.001$). Notably, the anterior semicircle was more complete in the CCO group, with a higher proportion of normal anterior communicating arteries (ACoA) and complete anterior and posterior semicircles. Moreover, patients with CCO exhibited a significantly lower prevalence of absent posterior communicating arteries (PCoA) compared to those with a PBC ($P<.001$). **Conclusion:** Patients with CCO undergoing CEA had a significantly greater, nearly four times higher incidence of a complete CoW compared to those with a PBC. These findings underscore the importance of tailored surgical care for patients with CCO. Future research is sufficient to clarify the underlying mechanisms driving CoW adaptation in response to CCO and its implications for surgical decision-making.