Session cardiovasculaire

Wall shear stress during the cardiac cycle and endothelial cells planar cell polarityin mouse carotid artery

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Blood flow produces fluid shear stress (SS), a frictional force parallel to the blood flow, on the endothelial cell (EC) layer of the lumen of the vessels. ECs themselves are sensitive to this SS in terms of directionality and intensity. This study aimed to determine the physiological SS value during the cardiac cycle and EC polarity and orientation from blood flow in healthy male and female mouse carotid arteries. Experimentation is done on anesthetized 8 male and 8 female 8-week-old C5BL/6J mice. In vivo, measurements of maximum blood velocity and vessel diameter in diastole and systole were performed on the right common carotid artery by Doppler ultrasound imaging. Blood viscosity (total andplasmatic) and hematocrit were determined on blood samples. Diastolic and systolic SS values were calculated applying a newly developed method (F-method) assuming heterogeneous blood flow, i.e., a red cell central plug flow surrounded by a peripheral plasma sheath flow, and compared with the classical method (N-method) assuming a homogenous blood flow with constant apparent total blood viscosity. EC polarity and orientation were determined ex vivo on the carotid endothelium by confocal imaging after labeling the EC nucleus and Golgi apparatus. Diastolic and systolic SS, calculated by the F-method, were 6±2.5 Pa and 30±6.5 Pa, respectively. Diastolic and systolic SS, calculated by the N- method, were 6% and 14% higher, respectively, than by F-method. Total blood and plasmatic viscosity were 4±0.5 cP and 1.27 cP, respectively. ECs were polarized and significantly oriented against blood flow. No sex difference was identified.

Long-term impact of postnatal nutritional programming on glucose metabolismand on cardiac sensitivity to ischemia-reperfusion injury in vivo in mice

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Introduction: Postnatal overfeeding (PNOF) in rodents induces long-lasting effects on health, including increased body weight, altered cardiac function, and disrupted glucose metabolism. However, these effects are predominantly studied in young animals, leaving a gap in understanding for older subjects. We aimed to assess the impact of PNOF on cardiac function, cardiac sensitivity to ischemia-reperfusion (I-R) injury, glucose metabolism, and pericardial adipose tissue (PAT) in young (4 months), adult (6 months) and old (12 months) male mice.

Material and methods: PNOF was induced by reducing litter size in C57/BL6 mice, leading to increased body weight persisting into adulthood. Echocardiography and glucose tolerance tests were conducted at various ages. Ischemia-reperfusion injury was induced in vivo, and PAT was analyzed for inflammatory markers.

Results: PNOF led to early and persistent increases in body weight, impaired left ventricular function, glucose intolerance, and insulin resistance across all age groups. Moreover, PNOF mice exhibited increased PAT mass with heightened inflammation and altered activin A expression. Notably, PNOF also increased infarct size following cardiac surgery at all ages.

Conclusion: Short-term PNOF induces lasting metabolic and cardiac alterations across different life stages in mice. These findings underscore the importance of early-life nutritional interventions in mitigating long-term health risks. Further elucidation of the underlying cellular mechanisms is warranted to understand the full implications of PNOF-induced programming on metabolic syndromedevelopment in humans.

Screening for postural orthostatic tachycardia syndrome using 24-hour ECGrecording in patients with long COVID

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Purpose: Cardiovascular autonomic dysfunction (CVAD) is a major complication in a large proportion of long COVID patients. One of the most typical phenotypes of CVAD, postural orthostatic tachycardia syndrome (POTS), is commonly observed as a sequalae of COVID infection. The purpose of the study was to develop and test 24h-ECG recording in order to direct the clinical suspicion towards the diagnosisof POTS.

Methods: Consecutive patients referred to the multidisciplinary long COVID unit at Karolinska University Hospital in Stockholm, from April 2021 to April 2022 were included. Patients with POTS were compared with long COVID patients without POTS (verified by active standing test/head-up tilt testing) and control healthy subjects according to 3 specific analyses based on 24-h ECG recording: (1) heart rate (HR) spikes>30 bpm; (2) awakening HR increase; and (3) HR variability parameters. Control group consisted of healthy subjects from database of the University Hospital of Saint-Etienne.

Results: A total of 100 long-COVID patients (mean age: 42.54±10.45y, 92% women) and 100 healthysubjects (mean age: 41.40±7.21y, 96% women) were included. Long-COVID POTS (n=45) was associated with (1) higher number of HR spikes/h (1.47±0.84 vs. 0.40±0.28/h, p<0.01), (2) abrupt andsustained increase in HR after awakening (p<0.05), and (3) reduction of HRV (mean SDNN: 90.61±23.73 vs. 97.33±29.90 ms, p=0.04; mean RMSSD: 34.90±12.48 vs. 43.35±21.10 ms, p=0.04) compared with healthy subjects.

Conclusion: A triple analysis of 24-h ECG recordings could reveal a characteristic POTS signature in long COVID patients. This novel analysis may strengthen screening and therapy monitoring of these patients.