CEREBRAL HYPOPERFUSIONS AND HYPERTENSIVE EVENTS DURING ATRIAL FIBRILLATION: A MECHANISM FOR COGNITIVE IMPAIRMENT?

M.Anselmino[a], A.Saglietto[a], S.Scarsoglio[b], L.Ridolfi[c], F.Gaita[a]

a Hospital 'Città della Salute e della Scienza di Torino', Division of Cardiology, Department of Medical Sciences, Turin, Italy
b Politecnico di Torino, Department of Mechanical and Aerospace Engineering, Turin, Italy
c Politecnico di Torino, Department of Environmental, Land and Infrastructure Engineering, Turin, Italy

PURPOSE

Atrial fibrillation (AF) is associated with an **increased risk of dementia and cognitive decline**, independent of clinical strokes/TIAs.
Aim of the present study was to study AF impact on the whole cerebral circulation through a **computational hemodynamic analysis**.

METHODS

Two coupled lumped-parameter models (systemic and cerebrovascular circulations) were used to simulate sinus rhythm (SR) and AF.
For each simulation **5,000 cardiac cycles** were analyzed, computing main statistics (mean and standard deviation) for **different cerebral hemodynamic parameters**.

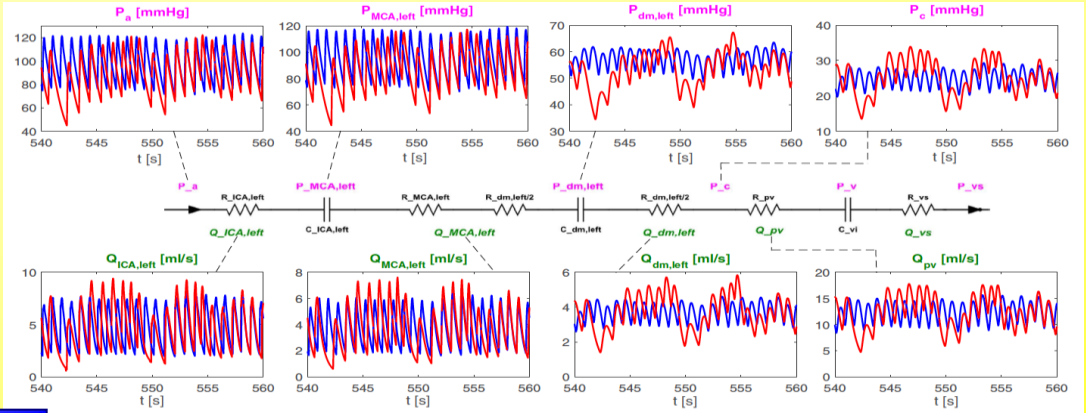
RESULTS

AF triggered a **greater variability** (represented by the standard deviation) of the parameters, especially in the deepest circulation (**cerebral arterioles and capillaries**; see Figure 1).

During AF **303 hypoperfusions** (maximum duration: **2 beats**) occurred at the arteriolar level, while **387 hypertensive events** (maximum duration: **5 beats**) occurred at the capillary level (see Figure 2). By contrast, neither hypoperfusions nor hypertensive events occurred during SR.

Figure 1

Pressure and flow time series at different levels of the cerebral circulation during SR (blue) and AF (red).
P(a): systemic arterial pressure; P(MCA,left): left middle cerebral artery pressure;
P(dm,left): left middle distal pressure;
P(c): cerebral capillary pressure; Q(ICA,left): left internal carotid flow rate;
Q(MCA,left): left middle cerebral artery flow rate;
Q(dm,left): left middle distal flow rate;
Q(pv): proximal venous flow rate.



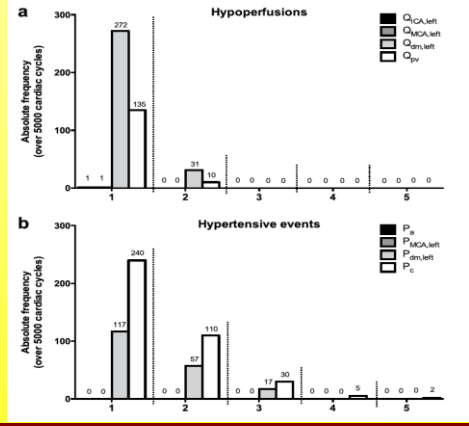


Figure 2

Absolute frequency of hypoperfusions (a) and hypertensive events (b) during AF along the ICA-MCA pathway; the abscissa indicates the number of consecutive beats characterizing the events.

CONCLUSIONS

During AF, the irregular heartbeat leads to **transient periods of excessive capillary pressure or reduced arteriolar blood flow** in the cerebral circulation.
Therefore, **AF *per se*** candidates as a relevant mechanism into the genesis of AF-related **cognitive impairment/dementia**.

Declaration of interest: NONE

Correspondance: matteo.anselmino@unito.it