Cardio-embolic Diseases

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The brain and heart have been shown to be closely inter-related. Twenty percent of ischaemic stroke patients have a history of cardio-embolic disease. Congestive heart failure, atrial fibrillation, valvular heart disease, acute myocardial infarction, endocarditis (infectious, non-bacterial thrombotic), and atrial myxoma are main cardiac causes of cerebral embolism. Patent foramen ovale, atrial septal aneurysm, mitral valve prolapse, mitral annular calcification, calcific aortic stenosis, and mitral valve strands are all conditions with a potential risk of cerebral embolism (1).
In this setting, transcranial Doppler sonography has become a widely used method for detecting cerebral circulating microemboli arising from the carotid arteries or the heart.
Many researchers have performed transcranial Doppler monitoring of high-intensity transient signals (HITS) as a possible diagnostic tool for detecting cerebral embolism (2). Patients with potential cardiac sources of embolism are at higher risk of cerebrovascular disease. HITS are commonly detected in these subjects.
Recent trials have provided new insights. Paroxysmal and stable atrial fibrillation should be included among the possible causes of cardio-embolic stroke. Cardiogenic cerebral embolisation is common among patients with any cause of atrial fibrillation (AF), but particularly in those with AF caused by rheumatic and arteriosclerotic heart disease. Patients suffering severe ventricular dysfunction and left atrial enlargement (3) have an increased risk of ischaemic stroke. Higher levels of emboli were found in these patients versus subjects without AF (3-5). Acute coronary disease, especially associated with reduced ejection fraction, may become a cardiogenic embolic source. A Canadian study published in 1999 (6) assessed HITS detection in patients affected by acute myocardial infarction. Higher HITS frequency was found in patients with impaired systolic function and anterior infarction. These patients also showed a higher prevalence of stroke in spite of adequate antithrombotic therapy.
Atherosclerotic disease of the aortic arch has more recently been identified as a risk factor for ischaemic stroke. This clinical diagnosis has to be suspected in patients affected by cryptogenetic transient ischaemic attack or ischaemic stroke. Transoesophageal echocardiography (7) has been considered the diagnostic "gold standard" for evaluating the presence of aortic arch atheromas.
In a novel approach, HITS were assessed in elderly stroke patients by monitoring of both middle cerebral arteries (8). Higher concentrations were found to be significantly associated with large aortic arch atheromas (AAs), versus no or small AAs. This observational finding may support a causal role of large AAs in cerebral embolism.

Cardiosurgical procedures and cerebral microembolisation

Many authors report that there is a role for transcranial Doppler ultrasonography in the detection of microemboli during left heart catheterisation (LHC). LHC is a procedure well known to carry a risk for cerebral complications (9). Lund et al. (9) observed a higher microembolic load when the procedure was performed by transradial as opposed to transfemoral access. Transradial access, furthermore, was associated with a higher concentration of solid microemboli.
A new, recent study (10) investigated microembolic signals (MES), detected by transcranial Doppler, during carotid angioplasty with stenting and during carotid endarterectomy (CEA). The authors concluded that patients undergoing carotid angioplasty with stenting suffered more solid and gaseous embolism compared with those undergoing CEA.
Cardiac valve replacement is a procedure associated with a risk of cerebral microembolisation (11). A British study, using multifrequency transcranial Doppler ultrasound, compared the nature and concentration of microemboli in patients who had undergone valve replacement. A higher solid microemboli concentration was detected in patients with mechanical as opposed to biologic prostheses.
A French study (12) published in 2001, assessed the timing of occurrence and potential significance of MES

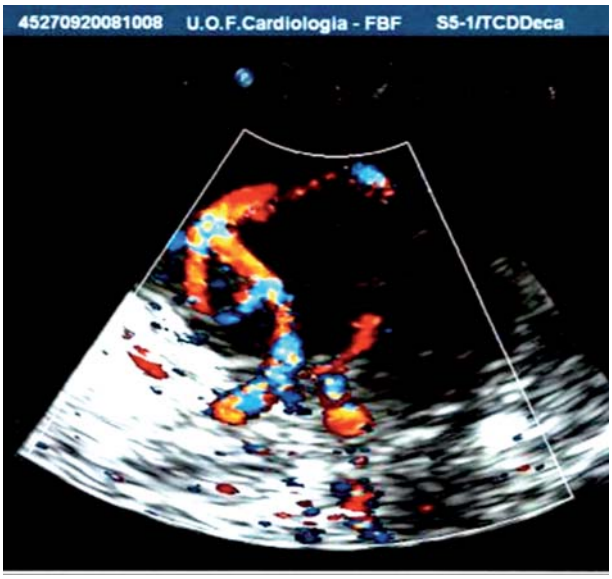

Fig. 1 - TCCD: Right MCA M2 embolic occlusion.

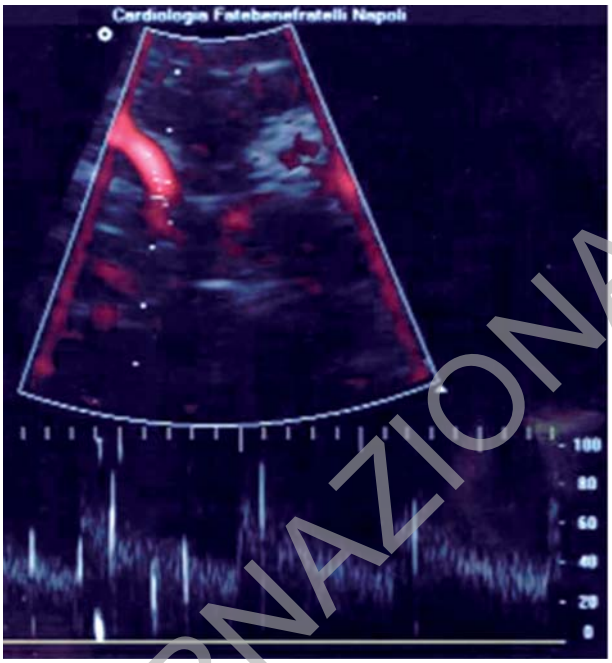

Fig. 2 - Microembolic signals.

during femoral left heart catheterisation. Surprisingly, the authors, did not find a significant association between MES concentration and coronary artery disease. The assumption, since majority of MES were gaseous, was that they might occur during contrast media injection, and not be related to cardiovascular disease or catheterisation.

In conclusion, transcranial colour-coded Doppler is a reliable, non-invasive diagnostic method, allowing real-time detection and monitoring of cerebral embolism.

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