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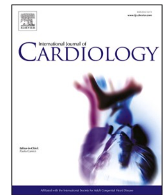

Editorial

Atrial fibrillation burden and cognitive function; a new horizon in the digital health era?

Atrial fibrillation (AF) is the most prevalent clinical arrhythmia, is a major risk factor for stroke, and is associated with cardiovascular and total mortality. On the other hand, we have increasing evidence today on the association between AF and dementia which is another huge disease burden in the aging society. Numerous retrospective and prospective studies in recent years have reported a strong association between AF, cognitive decline, and dementia [1,2]. Such an association, however, need not be a causal relationship, because all these conditions very likely have a multifactorial interaction with other cardiovascular risk factors involved (e.g., hypertension, dyslipidemia, obesity, renal function changes, etc). Potential mechanisms underlying AF-associated cognitive impairment can also be linked to a prothrombotic state, inflammation, reduced cerebral blood flow, beat-to-beat variability in cardiac cycle length, and silent or overt stroke as well [3]. However, as AF and dementia also share important risk factors, this association is probably more than an epiphenomenon.

Regardless of the mechanism the high prevalence of AF, and dementia and the association of both entities urge us to early detection of high-risk patients. This should also prompt us to search for possible prevention measures preferentially at the population level in the upcoming digital health era.

In this issue of the ICJ, Tang and colleagues [4] reported an interesting study on the association of cognitive decline and AF. They enrolled 253 patients with non-valvular AF and evaluated AF burden with a 14-day patch-based electrocardiography. Cognitive function was assessed using the Montreal Cognitive Assessment (MoCA). Patients with higher AF burden were significantly older and had larger left atrium size, a worse ejection fraction, and a lower MoCA score than those with lower AF burden. Predictors of MoCA score included age, CHA2DS2-VASc score, AF burden, and Center for Epidemiologic Studies Depression Scale scores. The association between MoCA scores and AF burden remained significant after adjustment for demographic characteristics, underlying diseases, and echocardiographic parameters.

Several findings and implications in this study deserve further comment.

Firstly, this is a study using innovative diagnostic technology. Tang et al. [4] have used long-lasting ECG patches to demonstrate the association between cognitive function and AF burden in patients with AF. The findings in registries or clinical studies derive from the information in hospital records, from patients' history, the clinical symptoms, or from intermittent ECG monitoring as the presence or absence of AF. However clinically determined AF patterns do not correspond well to the AF burden measured by long-term ECG monitoring and increased AF burden is also associated with increased mortality [5]. Similarly, Singh-Manoux et al. [2] have reported that the risk of dementia was strongly associated with the duration of exposure to AF in the younger participants but not in the elderly, in a population-based study. Hence AF burden could be a better marker for plausible mechanisms leading to cognitive decline (hypoperfusion, inflammation, beat-by-beat variability in cerebral circulation or micro embolism, etc) that the brain is exposed to. Using such long-lasting patches or wearables to study the association of AF burden and cognitive decline, especially in longitudinal studies, we might reach more robust findings in the near future. If the AF burden would come to be a key element for cognitive decline, then what approaches and when might be considered to be necessary to decrease this burden? We have already, yet indirect evidence that anticoagulation or catheter ablation of AF might reduce the risk of cognitive decline or dementia [6,7].

Secondly, the effects of AF burden on cognitive function appear to become more evident as the CHA2DS2-VASc score increases. This finding is also in parallel with studies pointing out that AF duration together with CHA_2DS_2-VASc score could enhance risk prediction. Recent studies have reported an interaction between AF duration and CHA_2DS_2-VASc score that can further risk-stratify patients with AF for systemic thromboembolism [8]. Similar interaction might exist for cognitive decline or dementia however we need longitudinal studies in order to clarify the issue.

Thirdly, combining AF burden and CHA2DS2-VASc score together with emerging parameters such as blood pressure variability indexes might further strengthen these findings. There is evidence that higher blood pressure variability is associated with cognitive decline or probable dementia [9,10]. Wearable technology today enables us to track beat-by-beat blood pressure variation; we can simultaneously monitor cardiac rhythm, evaluate AF burden, beat-by-beat blood pressure variability, and assess the risk together with CHA2DS2-VASc score. Yet we need refining and standardization in BPV measurements.

Finally, a few limitations should be considered. The study population is relatively small. Patients with stroke were not included in the study however; silent stroke or small vessel disease cannot be excluded as brain imaging was not performed. This is especially important in an Asian population in whom small vessel disease is more prominent, as stated by the authors themselves [4].

Dr. Tang and colleagues should be complimented on their innovative study demonstrating that AF burden is associated with cognitive function in patients with AF. They have used long-lasting patches and assessed the duration rather than a dichotomy of AF as suggested in the

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newer AF guidelines and have shown that the duration of AF is associated with a lower MoCA score. Their study could pave the way to population-based prospective studies with wearable devices to increase our knowledge on the association between AF and dementia.

In the digital era, we will be using wearable devices more and more in clinical trials and daily practice thus will be able to access real-life data. Combining those data with already existing risk stratification models we might be able to identify high-risk patients more preciously likely to benefit from preventive measures.

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