CardioPulse

Mobile health technology facilitates population screening and integrated care management in patients with atrial fibrillation：

Observations from the Huawei Heart Study and mAFA II randomized trial.

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Atrial fibrillation (AF) is the commonest heart rhythm disorder, which increases the risk of stroke, death, dementia, heart failure and hospitalisation. The main AF-related complications could be prevented if AF was diagnosed early and appropriate interventions initiated in a timely manner.

Current management of patients with AF is limited by the low detection rate of AF, non-adherence to guidelines and lack of consideration of patient's preferences in relation to treatment and management options, thus highlighting the need for a more holistic and integrated approach to AF care. New approaches to AF management, including the use of novel technologies, are proposed to optimize the patient care pathway.

AF detection can sometimes be problematic as it is often asymptomatic. The first presentation of a patient with AF can often be with an AF-related complication. Photoplethysmography (PPG)-based smartwear and wearables may be an option for population screening for AF, which could provide the possibility of continuous monitoring. Following AF detection, an integrated care approach is advocated, combining a multidisciplinary team bridging primary and secondary care, with patient involvement, and new technology tools may help to facilitate this.

Various proposals for integrated care AF management have been suggested. A major challenge is how to operationalize the concept of integrated AF care in busy 'real-world' clinical practice. Such a holistic approach to AF care can be simplified into a practical, simple ABC (Atrial Fibrillation Better Care) pathway (Figure), as follows[1]:

- **'A' Anticoagulation to Avoid stroke** – Anticoagulation with non-vitamin K antagonist oral anticoagulant (NOAC) or well-managed warfarin;
- **'B' Better symptom management** with patient-centred symptom-directed shared decisions for rate or rhythm control;
- **'C' Cardiovascular risk and comorbidity management** (blood pressure, sleep apnoea, diabetes etc.) plus lifestyle changes (weight reduction, regular exercise, reducing alcohol/stimulants, psychological morbidity, smoking cessation, etc.).[1, 2]

The use of mobile health (mHealth) technology may provide an innovative solution to operationalize the ABC pathway. Indeed, mHealth tools have been studied as an aid to support shared decision making for anticoagulation, to achieve telemonitoring-based feedback, and to improve medication adherence.[3] The **M**obile Health (mHealth) technology to improve optimization of integrated care in patients with **A**trial **F**ibrillation **A**pp programme[4] was designed to investigate mHealth technology for

improved screening and optimised integrated care in AF. The programme included pre-MAFA phase of AF screening, using HUAWEI smart devices (the 'Huawei Heart Study').[5] This phase investigated the incidence of AF identified with a PPG-based screening strategy in the general population, and then those with identified AF were considered for entry into the mAFA II randomized trial[6], whose aim was to validate an integrated care approach based on the ABC pathway. The primary endpoint of mAFA II trial was the composite of stroke/thromboembolism, all-cause death, and rehospitalization.

The Huawei Heart Study (pre-mAFA study**)**

The PPG algorithm and smart devices used for the Huawei Heart Study were validated with over total 29,485 PPG signals before commencement of the mAFA II trial.[7, 8] In the pre-mAFA study, more than 246,000 people downloaded the PPG screening app, with about 187,000 individuals using a smart device to monitor their pulse rhythm between October 26, 2018 and May 20, 2019. Of these, 424 (0.23%) participants had "suspected" AF and 262 (62%) were followed up by the mAFA Telecare team and mAFA doctors. Of those followed up, 262 (87.0%) were confirmed as having AF and almost all (216, 95%) were enrolled into mAFA II, receiving AF integrated care or usual care.

The mean (standard, deviation, SD) age of the overall cohort was 35 (11) years. The majority 132,365 (71%) of AF episodes were detected within the first 14 days of wearing the device, although nearly one third of AF episodes were recorded after two weeks. Automatic periodical measurements were more likely to detect "suspected" AF episodes. The highest proportion of AF episodes were among those aged 65 years and over; 2.78% (95% confidential interval, CI 2.28-3.38%) had 'suspected AF', and 1.70% (95% CI 1.31-2.19%) with 'identified' AF. There was a consistent increase in incident 'suspected AF' and 'identified' AF as age rose. After entering the AF patient care pathway, 80% of patients at high-risk of stroke were anticoagulated.

In summary, continuous home-monitoring with smart device-based PPG technology was a feasible approach for the screening and early detection of AF in a large population. This could help efforts aimed at screening and detection of AF, as well as early interventions to reduce stroke and other AF-related complications.

The mAFA II trial

The mAFA II trial was a two-arm, prospective, cluster-randomised controlled trial, which enrolled adult patients with AF from 40 hospitals across China. Patients allocated to usual care received the standard treatment provided by doctors according to their

local clinical practice.

Suitable patients were enrolled into the mAFA II trial from two sources: (i) the initial AF screening programme (pre-mAFA); and (ii) out-patient and in-patient departments of participating centres. Participating centres were randomized to the mAFA intervention arm or usual care. All patients were followed up for 12 months for adverse events.

In the mAFA intervention group, doctors used the mAFA platform to manage AF patients. The mAFA platform provided clinical decision support tools (CHA_2DS_2-VASc, HAS-BLED, SAMe-TT_2R_2 scores) to facilitate treatment recommendations, plus educational materials and patient involvement strategies with self-care protocols and structured follow-up. The mAF App supported implementation of the ABC pathway for integrated or holistic AF management. The primary composite outcome was a combination of stroke/thromboembolism, all-cause death, and rehospitalization.

There were 1646 patients allocated to mAFA intervention (mean, SD, age 67.0, 15 years, 625, 38.0%, female) with mean (SD) follow-up of 262 (141) days, while 1678 patients were allocated to usual care (mean (SD) age 70.0 (12) years, 637(38.0%) female) with mean (SD) follow-up of 291 (114) days. Rates of the composite outcome of 'ischaemic stroke/systemic thromboembolism, death, and rehospitalization' were lower with the mAFA intervention compared to usual care (1.9% vs. 6.0%, hazard ratio, HR 0.39, 95% CI: 0.22-0.67; $p<0.001$). Rates of rehospitalization were lower with the mAFA intervention (1.2% vs 4.5%, HR 0.32, 95% CI: 0.17-0.60; $p < 0.001$). Subgroup analyses by gender, age, AF type, risk score and comorbidities, demonstrated consistently lower HRs for the composite outcome for patients receiving the mAFA intervention compared to usual care (all $p<0.05$). Thus, an integrated care approach to AF care, supported by mobile health technology, reduced the risks of rehospitalization and clinical adverse events.

Quo vadis?

In the present study, mHealth technology provided not only a screening and clinical decision support tool, and also facilitated holistic or integrated care management of patients with AF, according to the ABC pathway. mHealth technology has the potential to improve diagnostic pathways (especially with the evolution of machine learning and sophisticated data-driven risk prediction and diagnostic algorithms), as well as streamline and simplify management and as demonstrated by the mAFA-II trial, this can lead to improved clinical outcomes.

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