COMMENT

Ambulatory blood pressure monitoring with atrial fibrillation detection algorithm: two birds with one stone

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Blood pressure (BP) measurement in the presence of atrial fibrillation (AF) is considered as difficult and uncertain due to the increased beat-to-beat BP variability (BPV) which renders even the gold standard manual auscultatory method problematic [1]. There is a lack of validated automated electronic devices specifically in the presence of AF, and no agreed standard on how to test the device accuracy in these patients [1]. The 2023 European Society of Hypertension guidelines recommend taking at least triplicate manual auscultatory BP measurements in patients with AF, but automated oscillometric devices may also be used [2]. Another problem is that as automated BP measuring devices are increasingly used in the office or clinic, asymptomatic AF may be missed during a routine visit since pulse auscultation/palpation may not be performed. This is highly important because AF is highly prevalent in the elderly people with hypertension [1].

In this issue of the Hypertension Research journal, Lundwall et al. presented a subanalysis from the telemonitoring TEMPLAR project, aiming to perform intra-individual comparisons of ambulatory BP (ABP) measurements during both indicated AF and sinus rhythm (SR) [3]. From 4,398 individuals referred by general practitioners for ABP monitoring in community pharmacies in Italy, data from 430 selected elderly, mostly hypertensive participants (mean age 78 years, 77% hypertensives) were analyzed. Patients were fitted with a sophisticated ABP monitoring device with an embedded AF-specific algorithm that allowed AF detection during each BP measurement. The participants included in the final analysis

fulfilled two criteria: (i) > 30% of their ABP measurements indicated AF, and (ii) ≥ 3 consecutive ABP measurements in each rhythm were required. Using these criteria, the researchers aimed to include patients with paroxysmal AF with episodes longer than 30 min. Their main study findings were: (i) about 10% of screened patients were categorized as having paroxysmal AF, most of them being undiagnosed, (ii) daytime and nighttime systolic BP values during AF were similar to the respective ones during SR, whereas only nighttime diastolic BP was higher in AF compared to SR, (iii) diastolic but not systolic BPV was higher in AF, and (iv) the results were not largely influenced by heart rate.

The issue of optimal AF screening in selected populations is very challenging and to this aim the implementation of AF detection algorithms in different types of automated BP monitors can be a game changer. The 2020 European Society of Cardiology AF management guidelines recommend screening for AF in hypertensive and elderly patients, and BP monitors with specific AF detection algorithms are listed among the recommended screening tools [4]. Especially, ambulatory and home BP monitoring with devices equipped with such diagnostic algorithms may allow opportunistic AF screening in many snapshots, which is crucial for detecting paroxysmal AF. Meta-analyses of studies comparing the detection accuracy of such devices vs simultaneous reference electrocardiography (ECG) have indicated considerable diagnostic potential with a pooled sensitivity and specificity of 95% and 94%, respectively [1]. In 2018, Kollias et al. published the first study using an ABP device with AF specific algorithm (same device as in the study by Lundwall et al.) vs reference 24-h Holter ECG monitoring and performed a receiver operating characteristics curve analysis to define the percentage of AF-positive readings required to safely settle the diagnosis of paroxysmal or permanent AF (approximately > 30%) [5]. Two additional studies with ABP devices have been published [6, 7], one with the same device as in the study by

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Table 1 Studies implementing atrial fibrillation detection during automated ambulatory blood pressure monitoring [data presented as mean ± SD or n (%)]

Study	Setting	N	Age (years)	Males	Hypertension	Blood pressure device	Reference method (simultaneous)	Sensitivity (95% CI)	Specificity (95% CI)	Accuracy (95% CI)
Watanabe 2022 (Japan) [7]	Hospital	90	63 ± 10	60 (67)	85 (94)	A&D TM-2441	Holter	1.00 (0.98, 1.00)	0.79 (0.78, 0.81)	0.81 (0.79, 0.82)
Huppertz 2019 (Denmark) [6]	Cardiology Clinic	48	72 ± 11	28 (58)	32 (67)	Microlife WatchBP O3 Afib	Pacemaker	0.76 (0.55, 0.91)	0.81 (0.79, 0.83)	0.81 (0.79, 0.83)
Kollias 2018 (Greece) [5]	Hypertension Clinic	100	71 ± 8	53 (53)	85 (85)	Microlife WatchBP O3 Afib	Holter	0.93 (0.91, 0.94)	0.87 (0.86, 0.88)	0.88 (0.87, 0.89)

Kollias et al. and Lundwall et al. [6] (Table 1). ABP devices taking multiple BP measurements during a monitoring day could indeed serve as a useful tool for the detection of asymptomatic paroxysmal AF during the routine use of ABP monitoring in the elderly for its classic indications in hypertension. The study by Lundwall et al. reported that among 4,398 individuals, 456 had permanent or paroxysmal AF (> 30% of their ABP measurements with AF) and of them 430 had paroxysmal AF (> 30% of their ABP measurements with AF and ≥ 3 consecutive ABP measurements in each rhythm). This means that using this indirect but relatively accurate method, the prevalence of both permanent and paroxysmal AF in this sample of elderly hypertensives was approximately 10% but impressively the majority had paroxysmal AF. It is interesting to highlight that in most of these patients this was their first AF diagnosis and, considering their age and BP status, they were candidates for anticoagulant therapy.

The most important finding in the study of Lundwall et al. is that ABP monitoring appeared to be feasible and informative in patients with AF. In a previous study the proportion of erroneous readings during 24-h ABP monitoring did not differ in patients with permanent AF vs those with SR [5]. Moreover, in the study of Lundwall et al. when BP measurements taken during AF were compared vs those during SR, similar BP values were found (only diastolic nighttime BP values were significantly higher during AF vs SR, but the difference – around 1 mmHg – was clinically minor and unimportant). This type of analysis is indirect, subject to the intra-individual BP variability, and cannot be used to officially assess the accuracy of automated BP measurements during AF. However, the findings are in line with those of a meta-analysis showing: (i) reasonable accuracy of automated BP measurement in AF vs. auscultatory reference method – especially for systolic BP –, and (ii) similar systolic BP values in AF patients pre- vs post-cardioversion [1]. To date, there are no established validation protocols for BP measuring devices in AF patients, and the International Standardisation Organisation (ISO) is currently developing such a procedure (information by ISO committee member G Stergiou). However, some devices may fulfil the requirements of the classic standard for SR people, despite the high intra-individual BPV of AF which renders the protocol criteria harder to pass [8]. In addition, routine office BP measurements in AF, either automated or auscultatory, have been found to be informative and predictive of future stroke events [9]. These findings are reassuring for the clinical relevance of the automated BP measurement in AF in reflecting cardiovascular risk and support its implementation in routine clinical practice.

Another interesting finding by Lundwall et al. is that the diastolic but not systolic BPV was higher in AF vs SR periods, which is in line with previous data [1]. Certain factors

could have a significant impact on BPV such as the number of BP measurements and activity levels per rhythm period. Another previous study also showed that intra-observer variability was significantly greater in the AF patients for diastolic BP but not for systolic BP vs SR participants [10]. Determinants of the BPV and BP measurement inaccuracies in AF are not well studied. Increased BPV may insert diagnostic and therapeutic difficulties in clinical practice. Yet, it should be noted that the elderly hypertensive patients with AF usually have isolated systolic hypertension; thus, considering the reasonable performance of the automated method for systolic BP assessment in AF, the usual diagnostic strategies should be employed. Interestingly in the study by Lundwall et al heart rate did not seem to be a determinant of BP differences between AF and SR [3].

In conclusion, automated BP measurement in AF is feasible, informative and with acceptable accuracy and clinical relevance. Objective detection of asymptomatic AF during routine automated BP measurement in the elderly is a low-cost, reasonably accurate, and widely accessible screening tool, which can have major impact on public health. The study by Lundwall et al. is another step towards high quality research in the field of BP measurement in patients with AF which is very important and has been neglected for long time.

Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

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