

The uncertain/questionable prognostic value of exercise hypertension

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Arterial hypertension (AH) is a widespread disease that has a prevalence of 30-45 % in the general population (1). It is the most important cause of stroke, heart failure, myocardial infarction and other cardiovascular (CV) disorders (2). It is also considered one of the most important risk factors for the mortality and morbidity in the general population (3, 4). In epidemiological studies, the clinical evidence for arterial hypertension is mainly based on blood pressure (BP) measurement at rest. Exercise stress testing is routinely used for the assessment of cardiovascular (CV) risk and BP is measured at baseline and at incremental stages of the test (5). Normally, systolic BP increases but diastolic BP either drops or remains unchanged with increasing exercise intensity. The increased systolic BP is due to increased cardiac output as a response to the increased demand for the oxygenated blood in active muscular beds. There is no widely accepted normal BP response to exercise, and the cut-off values for exertional hypertension is more inconsistent and arbitrarily

defined. Some studies have used absolute numbers, with systolic BP values ≥ 210 mmHg in men and ≥ 190 mmHg in women, and others used the values exceeding 90th to 95th percentile of study population, as the cut-off to discriminate the exaggerated exercise/stress hypertension (6, 7, 8). Moreover, the cut-off values used in these studies are not adjusted for age and sex, the factors known to influence peak exercise systolic BP (9).

In healthy normotensive adults, exercise hypertension has been shown to be associated with higher risk of developing hypertension at rest (10,11) and increased incidence of left ventricular hypertrophy (11). The extent of increase of systolic BP has also been shown to have a significant clinical role. Failure of patients with known or suspected heart disease to achieve at least a modest increase in systolic BP (up to 140 mmHg or Δ increase of 10 to 40 mmHg) are known to have untoward prognosis, which is worse in those in whom SBP drops at peak exercise (12, 13). Conflicting evidence exists with regards to the clinical prognosis, adverse cardiac remodeling, future development hypertension and CV events, of patients with 'exaggerated exercise systolic BP response', occurring at moderate exercise, including the apparently healthy (14, 15). This controversy is supported by the current guidelines

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which states that 'results on the prognostic significance of exercise BP are not consistent. which may be due to the fact that the two hemodynamic components of BP change in opposite directions during dynamic exercise: systemic vascular resistance decreases whereas cardiac output increases. It is likely that the decisive prognostic factor is a blunted reduction of systemic vascular resistance during exercise, compatible with structural pathophysiological changes in arteries and arterioles. Whether or not the impaired arterial dilatation is translated into an excessive rise of BP may at least partly depend on cardiac output'.

Despite that the guidelines acknowledge the role of the exaggerated BP response to exercise in predicting long term outcome in normotensives and those with only mild hypertension. Another controversial findings is the good prognosis a high BP during exercise carries in patients with heart failure and in subjects over 75 years of age, in whom a higher exercise BP is considered as a surrogate of preserved systolic cardiac function (12, 15, 17). In fact, a meta-analysis (18) published in 2013, which pooled data from 12 longitudinal studies showed that hypertensive response to moderate exercise (HRE) intensity is an independent prognosticator for CV events and mortality.

The pathophysiological mechanisms of exercise-induced hypertension are not well understood, and this highlights the need for better determination of possible contributing factors and responsible mechanisms. Proposed pathophysiological mechanisms of exaggerated stress-induced arterial hypertension, include excessively high sympathetic tone during exercise, increased LV mass, endothelial dysfunction and decreased aortic distensibility, due to aging and aortic atherosclerosis (19,20). This is an important issue, as it is known that the increased systolic BP is associated with worsening cardiac function in patients with hypertrophic LV disease, who constitute 60-90% of patients with heart failure and preserved ejection fraction (HFpEF) (21, 22). Also, those complaining of breathlessness, may have normal cardiac function and normal BP at rest, but develop significantly increased BP with exercise, which results in raised left ventricular wall stress and subendocardial ischaemia, even in the absence of epicardial coronary artery disease, with its known consequences, cavity remodeling (23). It should be realized that BP response is not only during exercise testing but with all other forms of movement, exercise and stress, thus putting the myocardium under a significant state

of prolonged ischaemic dysfunction with its known subsequent CV events. Furthermore, those with stiff leftventricle but maintained systolic function, i.e. with reduced diastolic reserve, are likely to develop significantly raised left atrial pressure with exercise/stress as a potential cause for their breathlessness (24).

In view of the above, the call is out for hypertension and cardiology specialists to provide more evidence for the normal physiological, abnormal and seriously risky blood pressure response to exercise/stress. In the same way hypertension diagnosis and management have moved from one off reading to average 24 hour monitoring, individuals and patients might need to be stratified according to their exercise BP response which could have significant implication on their optimum management strategies in order to secure best clinical outcome.

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