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Short Communication

Arterial Stiffness as a Superior Predictor of Cardiovascular Risk: Comparative Analysis in Osteoporotic, Rheumatoid Arthritis, and Chronic Kidney Disease Populations

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Aging is an inevitable process, bringing with it numerous health challenges. Among the most pressing are cardiovascular diseases (CVD), which remain the leading cause of mortality worldwide [1]. While traditional risk factors such as hypertension, high cholesterol, smoking, and diabetes have long dominated clinical attention, emerging research suggests a stronger, yet often overlooked predictor: arterial stiffness [1,2]. Compared to other conditions like osteoporosis, characterized by reduced bone mineral density (BMD), vascular rigidity, measured by pulse wave velocity (PWV), is showing greater importance in predicting cardiovascular mortality [3,4].

Osteoporosis and increased arterial stiffness have been individually linked to heightened cardiovascular events in the general population (GP) [5]. However, the question remains: which condition has a more significant impact on cardiovascular outcomes? Our recent study involving 558 patients from the GP, followed over 36 months, aimed to answer this [5]. The results were compelling. While both BMD (as measured at the femoral neck and lumbar spine) and PWV were associated with cardiovascular events, PWV emerged as the more robust predictor of cardiovascular mortality [5,6].

Bone health has traditionally been a key concern in older populations, especially with regard to the risk of fractures. Dual-energy X-ray absorptiometry (DXA) assessments of BMD are commonly used to evaluate osteoporosis risk, and low BMD has been linked to poor cardiovascular outcomes. However, our study shows that arterial stiffness, expressed by higher PWV, presents a greater threat [5]. Patients with a PWV above 9 m/s had significantly higher cardiovascular event rates than those with lower values, irrespective of their BMD. This crucial finding underscores the need for clinicians to shift their focus toward vascular health when assessing cardiovascular risk in aging populations [6,7].

Aging, by itself, is a profound risk factor for cardiovascular disease, independent of traditional markers. Arterial stiffness and hypertension are inherently linked to the aging process, and the premature stiffening of the arteries — accelerated by conditions such as diabetes and chronic hypertension — further compounds cardiovascular risk. In fact, the American Heart Association (AHA) and European expert consensus documents recommend using PWV as a key measure of arterial stiffness [7,8]. PWV is non-invasive and provides a reliable estimate of the true age of the arteries, offering insight into the risk of future cardiovascular events [8,9].

In the elderly, vascular stiffness is a more significant predictor of mortality than osteoporosis. Despite BMD's role in predicting fractures, our study shows that PWV — a measure of arterial stiffness — correlates more strongly with cardiovascular outcomes [5]. The presence of comorbidities such as diabetes and chronic kidney disease only exacerbates the stiffening of the arteries [10,11]. As a result, PWV has become an invaluable tool for clinicians seeking to better understand a patient's cardiovascular risk.

As the population continues to age, the burden of cardiovascular disease will only grow. Addressing this issue requires a more nuanced approach to risk assessment, one that incorporates vascular health alongside traditional markers such as BMD [5,6,12]. It is clear from our findings that arterial stiffness should take precedence in clinical evaluations of cardiovascular risk, especially in older adults [2]. Measuring PWV offers a simple, non-invasive method to predict cardiovascular outcomes and guide early intervention strategies [10,11].

Osteoporosis, while important in the context of bone health and fracture prevention, is not the most critical determinant of cardiovascular mortality [11]. As healthcare providers, we must prioritize arterial stiffness as a key predictor of cardiovascular events. The aging process may be inevitable, but by focusing on vascular health — particularly by using PWV measurements — we can better manage and potentially reduce the risk of cardiovascular disease in our aging populations [12].

In addition to the general population, the impact of PWV on specific high-risk groups further emphasizes its importance. For instance, studies in patients with rheumatoid arthritis (RA) reveal a heightened level of arterial stiffness compared to the general population. A study involving 80 RA patients and 71 control subjects demonstrated that the mean PWV values were significantly higher in the RA group (7.687 ± 1.03 vs. 7.253 ± 0.97 m/s in the control group) [13]. This increased arterial stiffness in RA patients was strongly associated with inflammatory markers such as C-reactive protein and disease duration, underlining the role of chronic inflammation in accelerating arterial aging. Moreover, RA patients showed additional risk factors like low levels of high-density lipoprotein cholesterol (HDL-C), which also contributed to higher PWV [13].

Similarly, in chronic hemodialysis patients (CHP), arterial stiffness progresses at an alarming rate compared to the general population. In a 36-month follow-up study, PWV increased from 11.18 ± 2.29 to 11.82 ± 2.34 m/s in CHP patients, while in the control group, the progression was much slower (from 9.02 ± 1.89 to 9.29 ± 1.93 m/s) [6]. Factors such as hemoglobin, albumin, and C-reactive protein levels were significant determinants of PWV progression in CHP patients. The burden of arterial stiffness in these patients is further compounded by the presence of uremia-related factors, which exacerbate vascular rigidity and heighten cardiovascular risk [6,14].

Chronic hemodialysis patients (CHP) experience not only accelerated arterial stiffness but also a more rapid loss of bone mass compared to the general population [6]. This is particularly concerning, as these patients frequently exhibit secondary hyperparathyroidism, leading to increased bone turnover and mineral loss. Chronic kidney disease mineral and bone disorder (CKD-MBD) plays a central role in the reduction of the BMD, contributing to accelerated osteoporosis. The interplay between renal dysfunction, calcium-phosphate metabolism, and elevated parathyroid hormone levels exacerbates bone resorption. Consequently, bone loss in CHPs is often more pronounced, particularly at the femoral neck and lumbar spine, as shown by the significant BMD decline in these regions [6,13,14]. Additionally, long-term hemodialysis and associated uremic toxins further impair bone remodeling, increasing fracture risk among this vulnerable population [13,15].

The results of these studies reinforce the idea that arterial stiffness is a critical marker of cardiovascular health, not just in the general aging population but also in patients with chronic conditions like RA and chronic kidney disease. As such, the use of PWV as a routine measure of arterial stiffness could provide valuable insights into the cardiovascular risk profiles of these vulnerable groups.

Given the overwhelming evidence, it is imperative that clinicians incorporate PWV into their standard cardiovascular risk assessments. This non-invasive measure provides a direct estimate of vascular health and can serve as an early warning system for cardiovascular events, allowing for timely interventions aimed at reducing mortality [4,14]. While osteoporosis remains a key consideration in aging populations, it is clear that arterial stiffness is a more pressing concern when it comes to predicting cardiovascular outcomes.

In conclusion, while osteoporosis and reduced BMD continue to be major concerns for older adults, arterial stiffness is emerging as the more crucial factor in determining cardiovascular outcomes. As the evidence mounts, it is time for clinicians to incorporate PWV into routine cardiovascular screenings, shifting the focus

away from BMD as the sole indicator of risk. By doing so, we can better predict and prevent the cardiovascular events that remain the leading cause of death in aging populations. In high-risk groups such as patients with RA and CHP, the routine measurement of PWV can provide critical insights into disease progression and improve overall management strategies aimed at reducing cardiovascular mortality.

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