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Editorial

Looking into a Whole Picture: Ventricular Vascular Coupling-Refining Cardiovascular Risk Stratification in Patients with Obstructive Sleep Apnea

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Previous article by Chung et al.[1] described correlation between decreased coronary flow reserve (CFR) and impaired ventricular vascular coupling in patients with obstructive sleep apnea (OSA). Among many cardiovascular disease, many epidemiological and retrospective studies suggested that OSA contribute to development and progression of heart failure (HF). From HF perspectives, association between coronary flow reserve and impaired ventricular coupling index supports role of microvascular dysfunction in OSA patients provides mechanism insight of development of HF.

From the previous article,[1] OSA patients with reduced CFR group showed similar systolic and diastolic function to those with normal CFR. Only difference was a decreased Ees (left ventricular end systolic elastance) value, which resulted in higher ventricular vascular coupling index (VVI). It is interesting that Ees showed significant difference while global longitudinal strain parameters of left ventricle and left atrium, which are thought to be very sensitive parameters to characterize cardiac dysfunction, failed to show difference between normal and decreased CFR group. This may suggest that since OSA affects not only heart but also vascular function, ventricular vascular coupling index may be the earliest parameter to describe pathologic changes of cardiovascular system.[2] A concept of ventricular vascular coupling encompasses a whole cardiovascular system including heart, aorta and peripheral artery, under the principle of interdependence, which provides a "whole picture" of disease. The association between CFR and Ees in previous study[1] implicate possibility of refined risk stratification in OSA patients.

Although cardiac catheterization provides more accurate measurement of ventricular vascular coupling index than non-invasive methods, non-invasive assessments are more applicable for daily practice and assessment for patients with risk factors. In previous article by Chung et al.[1] End systolic pressure/stroke volume (Ea)/end systolic pressure/end systolic volume (Ees) was used as a non-invasively measured parameter to assess ventricular vascular coupling. This is the most commonly used parameter developed by Chen et al.,[3] however, limitations of this single beat method should be considered. Ea/Ees does not account for left ventricular loading sequence. Also, when derived by a simplified formula, Ea/Ees equals end systolic volume/stroke volume, which is equal to 1/(EF-1). Therefore, Ea/Ees by a simplified formula may not convey

substantial information beyond ejection fraction. Another limitation is that in condition with increased arterial and ventricular stiffness, both Ea and Ees could be impaired but a ratio of Ea/Ees would still remain in normal range. Due to such limitations, current consensus documents from European Cardiology Society recommend a simultaneous measurement of arterial and myocardial function parameters to assess disease process and treatment responses.[2] With increasing needs to non-invasively and accurately assess ventricular vascular coupling, novel parameters has been suggested, including time-resolved wall stress curve[4] (using non-invasively measured central pressure waveform and time-resolved left ventricular geometric information from echocardiography or cardiac magnetic resonance imaging) and myocardial work index[5] derived from a new echocardiography software. Further studies using new indices for ventricular vascular coupling may improve early detection of maladaptive structural and function changes of heart in patients with OSA.

Accurate assessment of ventricular vascular coupling could provide a new therapeutic target in OSA and ventricular vascular coupling guided treatment may ultimately improve prognosis of OSA by refining risk stratification to prevent possible cardiovascular events. From therapeutic perspective, it would be very interesting to assess response to therapeutic intervention such as a continuous positive airway pressure therapy, by assessing serial changes of ventricular vascular coupling index. Previous study by Chung et al.[1] suggests needs for more mechanistic assessment cardiovascular system in patients with OSA.

REFERENCES

1. Chung H, Kim SW, Kim HO, et al. Reduced coronary flow reserve is associated with impaired ventricular-vascular interaction in patients with obstructive sleep apnea. Int J Heart Fail 2020;2:195-203.
CROSSREF
2. Ikonomidis I, Aboyans V, Blacher J, et al. The role of ventricular-arterial coupling in cardiac disease and heart failure: assessment, clinical implications and therapeutic interventions. A consensus document of the European Society of Cardiology Working Group on Aorta & Peripheral Vascular Diseases, European Association of Cardiovascular Imaging, and Heart Failure Association. Eur J Heart Fail 2019;21:402-24.
PUBMED | CROSSREF
3. Chen CH, Fetics B, Nevo E, et al. Noninvasive single-beat determination of left ventricular end-systolic elastance in humans. J Am Coll Cardiol 2001;38:2028-34.
PUBMED | CROSSREF
4. Chirinos JA. Ventricular-arterial coupling: Invasive and non-invasive assessment. Artery Res 2013;7:2-14.
PUBMED | CROSSREF
5. Boe E, Russell K, Eek C, et al. Non-invasive myocardial work index identifies acute coronary occlusion in patients with non-ST-segment elevation-acute coronary syndrome. Eur Heart J Cardiovasc Imaging 2015;16:1247-55.
PUBMED | CROSSREF