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CLINICAL RESEARCH

Prospective assessment of the frequency of low gradient severe aortic stenosis with preserved left ventricular ejection fraction: Critical impact of aortic flow misalignment and pressure recovery phenomenon

Évaluation prospective de la fréquence du rétrécissement aortique sévère à bas gradient et fraction d'éjection ventriculaire gauche préservée : impact critique du mauvais alignement du flux aortique et du phénomène de restitution de pression

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Abbreviations: 2D, two-dimensional; Ap, obtained using the 2D apical view approach; AS, aortic stenosis; AT, acceleration time; AVA, aortic valve area; ELI, energy loss index; ET, ejection time; HG, high-gradient; LF, low flow; LG, low gradient; LV, left ventricular; LVEF, left ventricular ejection fraction; LVOT, left ventricular outflow tract; MPG, mean pressure gradient; Multi, obtained using the multiview approach; NF, normal-flow; SVi, indexed stroke volume; Vmax, peak aortic jet velocity; VTI, velocity time integral.

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KEYWORDS

Aortic stenosis;
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Low gradient;
Pressure recovery

Summary

Background. – The frequency of paradoxical low-gradient severe aortic stenosis (AS) varies widely across studies. The impact of misalignment of aortic flow and pressure recovery phenomenon on the frequency of low-gradient severe AS with preserved left ventricular ejection fraction (LVEF) has not been evaluated in prospective studies.

Aims. – To investigate prospectively the impact of aortic flow misalignment by Doppler and lack of pressure recovery phenomenon correction on the frequency of low-gradient (LG) severe aortic stenosis (AS) with preserved LVEF.

Methods. – Aortic jet velocities and mean pressure gradient (MPG) were obtained by interrogating all windows in 68 consecutive patients with normal LVEF and severe AS (aortic valve area [AVA] $\leq 1 \text{ cm}^2$) on the basis of the apical imaging window alone (two-dimensional [2D] apical approach). Patients were classified as having LG or high-gradient (HG) AS according to MPG $< 40 \text{ mmHg}$ or $\geq 40 \text{ mmHg}$, and normal flow (NF) or low flow (LF) according to stroke volume index $> 35 \text{ mL/m}^2$ or $\leq 35 \text{ mL/m}^2$, on the basis of the 2D apical approach, the multiview approach (multiple windows evaluation) and AVA corrected for pressure recovery.

Results. – The proportion of LG severe AS was 57% using the 2D apical approach alone. After the multiview approach and correction for pressure recovery, the proportion of LG severe AS decreased from 57% to 13% (LF-LG severe AS decreased from 23% to 3%; NF-LG severe AS decreased from 34% to 10%). As a result, 25% of patients were reclassified as having HG severe AS (AVA $\leq 1 \text{ cm}^2$ and MPG $\geq 40 \text{ mmHg}$) and 19% as having moderate AS. Hence, 77% of patients initially diagnosed with LG severe AS did not have “true” LG severe AS when the multiview approach and the pressure recovery phenomenon correction were used.

Conclusions. – Aortic flow misvaluation, resulting from lack of use of multiple windows evaluation and pressure recovery phenomenon correction, accounts for a large proportion of incorrectly graded AS and considerable overestimation of the frequency of LG severe AS with preserved LVEF.

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MOTS CLÉS

Rétrécissement
aortique ;
Échocardiographie
Doppler ;
Bas gradient ;
Restitution de
pression

Résumé

Contexte. – La fréquence du rétrécissement aortique (RAO) à bas gradient paradoxal varie largement selon les études. L'impact du défaut d'alignement du flux Doppler et de la restitution de pression sur la fréquence du rétrécissement aortique paradoxal n'a pas été évalué dans des études prospectives.

Buts. – Évaluer prospectivement l'impact du défaut d'alignement du flux en Doppler et de l'absence de correction par le phénomène de restitution de pression sur la fréquence du rétrécissement aortique paradoxal, serré à bas gradient malgré une fraction d'éjection ventriculaire gauche (FEVG) préservée.

Méthodes. – Les vitesses et le gradient moyen transaortique étaient obtenus en interrogeant toutes les fenêtres acoustiques/échographiques chez 68 patients consécutifs porteurs d'un RAO serré (surface fonctionnelle $\leq 1 \text{ cm}^2$) et une FE VG préservée. Les patients étaient classifiés en sous-groupes selon le gradient moyen transvalvulaire (haut ou bas gradient) et le niveau de flux transvalvulaire (débit normal ou bas débit). Les quatre groupes étaient constitués successivement : à partir des données de l'approche apicale 2D seule, à partir des données de l'approche multivues obtenues par les sondes 2D et Pedoff et en tenant compte de la surface aortique corrigée à la restitution de pression.

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