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New guidance for the echocardiographic assessment of aortic regurgitation: a summary

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The BSE guideline 'Echocardiographic assessment of aortic regurgitation: a practical guideline from the British Society of Echocardiography' was published in the journal Echo Research and Practice (ERP) on 27th January 2025.[1] Please visit https://echo.biomedcentral.com/ to read the full guideline. The following pages aim to provide an overview of the document emphasising important points and highlighting relevant extracts, whilst simplifying the learning.

Background

Aortic regurgitation (AR) is the third most common valve lesion[2-5]. Of adults undergoing intervention for severe valve disease, AR accounts for approximately 5%, largely due to increased prevalence with age and an aging population.[2-5] Echocardiography is key to the diagnosis and monitoring of AR and plays a vital role in clinical decision making. The last British Society of Echocardiography AR guideline was published ten years ago and as such the education committee and the author group felt it was appropriate to review current literature and evidence to ensure we remain contemporary as leaders at the echo frontier.[6] The guideline has been designed to provide a user-friendly systematic approach with practical steps to perform a comprehensive, high-quality assessment of AR.

Anatomy and mechanisms

The aortic valve structure is discussed in detail allowing the echocardiographer to appreciate the nuances of normal valve anatomy vs uni, bi and quad-cuspid valves. The guideline discourages the use of classifications in relation to bicuspid aortic valve (BAVs) 'types' and instead recommends BAVs be reported descriptively using valve orientation, noting fusion of the cusps, the presence or absence of a raphe, and the number and symmetry of the sinuses.[1] Further counsel highlights the importance of considering rates of disease progression within this population, the valuable role of monitoring aortic dimensions, and the requirement for family screening.

Not to be confused with the above, the guideline encourages the use of functional classification types in relation to AR mechanism. Defining valve insufficiency into one of three subtypes (as outlined below in table 1, figure 1) may help clinicians to systematically evaluate valve behaviour and influence the intervention of choice. However alongside this recommendation is the need to combined 'type' with a description of the mechanism, ensuring findings are effectively communicated, relatable and transferrable from the echocardiographer to the referrer and/or receiver.[1]

Table 1. Functional classification subtypes for AR mechanism.

Types	Description
Type I	Normal cusp motion within the context of aortic dilation or cusp perforation
Type II	Excessive leaflet motion such as cusp prolapse
Type III	Consequences of cusps restriction

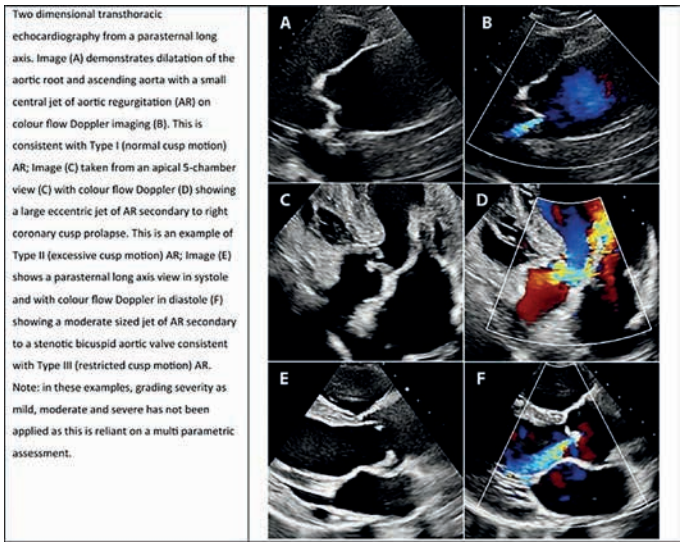

Fig 1. Examples of aortic regurgitation mechanism type according to the functional classification.[1] Reproduced with permission from Victor et al.

Echocardiographic assessment of chronic AR

One notable addition to the new guideline is the recommendation for echocardiographers to work more efficiently. Therefore, the guideline recommends: 'In some circumstances, AR is obviously mild, in which case quantitative measures are not of use, will likely be challenging to obtain, and are of questionable accuracy. In such a scenario, confirming the mild nature of regurgitation using multiple acoustic windows and planes is sufficient'.

However, the guide goes on to suggest that in all other circumstances, qualitative, quantitative and/or semi-quantitative parameters combined with corroborative findings provides the most rigorous approach to AR severity.

Qualitative parameters such as gauging the presence and size of colour flow convergence and examining the jet width / LVOT diameter ratio, albeit simple methods, provide useful information in the overall assessment of AR severity. The utility of multi-plane imaging allows for the added benefit of simultaneous interrogation from orthogonal planes reducing some of the limitations of single assessment approaches. Assessment of diastolic flow reversal within the descending thoracic aorta (DAo) and abdominal aorta remain important parameters in AR assessment. For the DAo, assessing extent (>20cm/s at end diastole) and duration (holodiastolic vs intermediate, or none) are important elements for consideration.

Quantitative parameters such as vena contracta width (VC) and effective regurgitant orifice area (EROA) are considered vital for comprehensive assessment. Again the usefulness of multiplane imaging is highlighted, with 3D vena contracta a consideration where 3D imaging quality allows. EROA, a direct estimation of the size of the orifice area and a useful marker of prognosis, is recommended for use with calculation using the proximal isovelocity surface area (PISA) method preferential. The guideline provides a step by step approach to EROA by PISA. Of note, the published example intentionally shows an incorrect PISA radius measurement (red line), with guidance outlining the correct approach (white line). It is important to remember that the PISA radius should be measured coaxial with the ultrasound beam as opposed to in the direction of the regurgitation flow. The value of regurgitant volume (RVol) and regurgitant fraction (RF) are outlined but so too are their limitations. Figure 2 shows an example image from the guideline demonstrating the calculation of RVol and RF. RVol and stroke volume calculated using the MV annulus is appropriate in the absence of mitral regurgitation. However, in the presence of pseudo functional mitral stenosis (secondary to eccentric AR), stroke volume should be calculated using the right ventricular outflow tract (RVOT). Although simply a regurgitant volume derived percentage of stroke volume, RF has been shown to be useful in the context of LV systolic dysfunction and/or reduced cardiac output, where small RVol are proportionally more significant owing to reduced forward stroke volume.[1]

Importantly, in light of their inherent limitations, the use of continuous wave Doppler intensity and pressure half time (PHT) in the assessment of AR severity should only be considered alongside other more robust parameters.[1, 7]

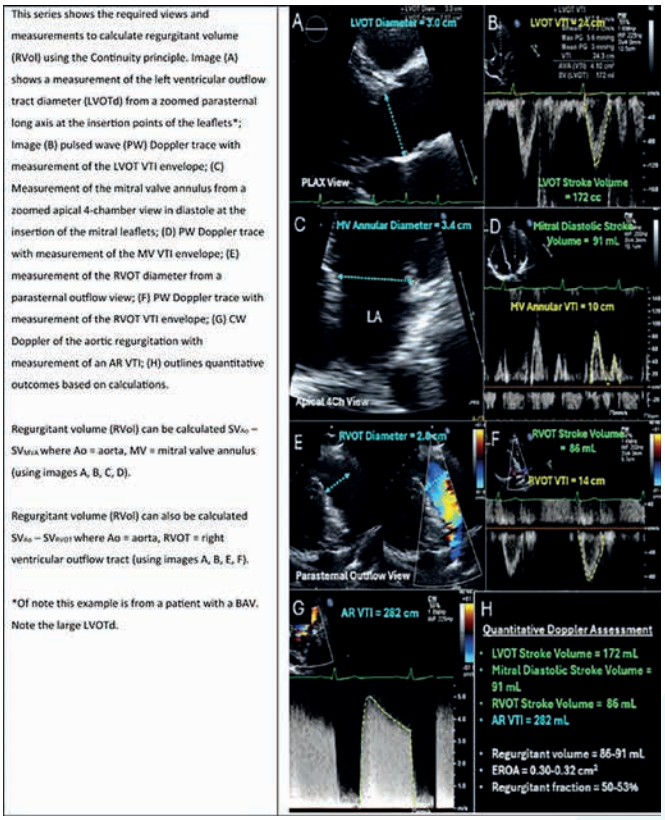

Fig 2. Calculating the regurgitant volume using the continuity principle.[1] Reproduced with permission from Victor et al.

Additional key parameters in the assessment of chronic AR

In the setting of AR, a normal indexed LV volume in and of itself almost always rules out severe AR. It is therefore recommended that LV size be assessed using Simpson's biplane methods. This additionally provides an estimate of ejection fraction (EF), equally as important given the added pressures and maladaptive changes resulting in LV systolic impairment. It is also recommended that non-indexed and indexed linear dimensions of the LV are reported. The use of global longitudinal strain (GLS), an indicator of early LV systolic dysfunction is recommended. With lower maximal values demonstrating an association with poor outcomes in patients with severe chronic AR, there is growing evidence regarding the value of GLS. In the absence of widely accepted thresholds, progressive reductions in GLS should be stressed as this may prompt closer clinical or echocardiographic surveillance. A comprehensive assessment of the aorta is essential in the setting of AR; not only because it may be the potential mechanism for the insufficiency but also because of the association between variant anatomy and aortic enlargement. The guideline recommends that the aortic root (sinus of Valsalva, sino-tubular junction) and the ascending aorta are reported using the absolute values and those indexed to height.

The guide highlights several high-risk echocardiographic features prompting referral for intervention. These include a left ventricular end systolic dimension (LVESd) of >50mm (LVESd indexed >25mm/m^2), a left ventricular ejection fraction of <55% or rapid dilation of a left ventricle approaching surgical thresholds. Additionally, an ascending aorta diameter of >55mm, or >45mm within special populations, is noted as a red flag.

Approach to the patient with chronic AR

The guideline recommends that AR is graded as either mild, moderate or severe, and a summary of severity thresholds is provided within the document. Figure 3 outlines and summarises the echocardiographic approach when faced with a patient with chronic AR.

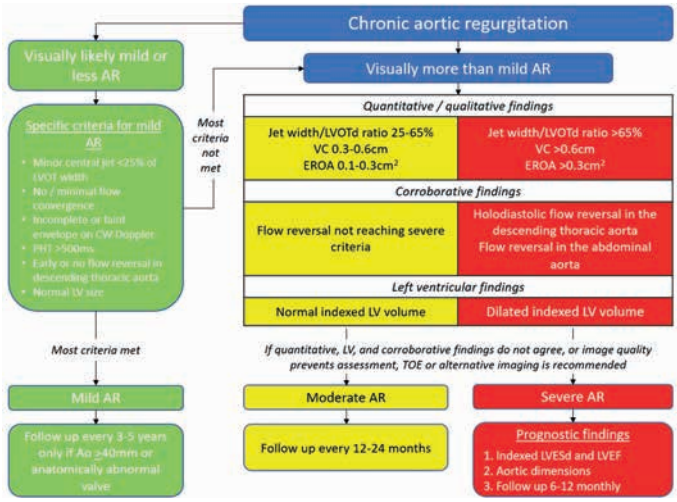

Fig 3. Decision aid to guide assessment of aortic regurgitation severity. If AR visually appears mild or less in severity, this should be clarified using a selection of the specific criteria as listed in the green box. If confirmed, there is no need to attempt further assessment. In those patients where AR appears more than mild, further detailed evaluation is required. In this scenario, the severity of AR can be confirmed if at least one quantitative / qualitative characteristic, one corroborative characteristic, and indexed left ventricular volumes are all in agreement. For example: a patient with a VC of 0.7cm, holodiastolic flow reversal in the descending thoracic aorta, and dilated indexed LV volumes, clearly has severe AR. In this situation the focus should then be on key prognostic features including the indexed LVESd, LV function, and aortic dimensions. If quantitative/qualitative characteristics, corroborative characteristics, and indexed LV volumes are not in agreement, further imaging such as TOE is recommended to clarify severity and ensure optimal management of the patient. In a significant minority of cases, quantitative assessment will not be possible, either because image quality is insufficient, or other factors such as valve calcification impedes detailed quantification. In such cases, the BSE recommend that further imaging (such as TOE) is advised within the report. This ensures appropriate classification of AR severity, optimal timing of follow-up and promotes good clinical management. (AR=aortic regurgitation; LVOT=left ventricular outflow tract; Ao=aorta; CW=continuous wave; PHT=pressure half time; LV=left ventricular; LVOTd=left ventricular outflow tract diameter; VC=vena contract; EROA=effective regurgitation orifice area; LVESd=left ventricular end systolic dimension; LVEF=left ventricular ejection fraction; TOE=transoesophageal echocardiography)

Additional imaging

The value of transoesophageal echocardiography, cardiac magnetic resonance imaging and cardiac computed tomography is outlined. Of note, exercise stress echo (ESE) is not supported in the evaluation of AR severity. As heart rate increases the duration of diastole decreases. Therefore, at peak stress AR is less obvious and may be underestimated. However ESE can still play a role in the assessment of contractile reserve, the unmasking of symptoms, the precipitation of arrhythmia and overall functional capacity.[8] Additionally, ESE may reveal other causes for symptoms such as ischaemia.

Acute AR

Acute AR is very different from chronic AR for several reasons. Firstly, the aetiology is often different; the most frequent being infective endocarditis and aortic dissection for acute severe AR. Secondly, as opposed to chronic AR, in acute AR there is no time for the LV to adapt to the added overload and as such the LV filling pressures and left atrial pressures become significantly elevated. Typically, in acute severe AR the LV will not necessarily be dilated and there will often be normal or even hyperdynamic LV systolic function. Other echo parameters suggestive of acute severe AR are outline in the guideline. A useful semi-quantitative approach which can be used in this setting is to compare the forward stroke volume with the degree of holodiastolic flow reversal in the descending aorta however this is not foolproof as elevated left ventricular diastolic pressures can curtail diastolic flow. Acute severe AR patients often present in extremis making high quality echo images challenging. With this in mind a high index of suspicion is required as urgent escalation may be required.

Conclusion

As the prevalence of AR within the population continues to increase, the role of transthoracic echocardiography becomes increasingly vital to ensure timely patient care. This guideline aims to support echocardiographers to accurately determine AR severity and escalate, refer, or follow up, as required.

Finally, whilst I have the opportunity, I wanted to say an enormous thank you to my co-authors, Liam Ring, Vasiliki Tsampasian, David Oxborough, Sanjeev Bhattacharyya and Rebecca T. Hahn. It was a pleasure to work with you on this important piece of work.

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