REPLY

Response to Latest British Society of Echocardiography recommendations for left ventricular ejection fraction categorisation: potential implications and relevance to contemporary heart failure management

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We thank Dr Kanagala and Professor Squire for their keen interest in our paper (1) and their insight into the challenge of grading left ventricular ejection fraction (LVEF) (2). We must emphasise that our paper's remit was not to be a clinical guide on heart failure nor on its treatment.

The cut-off for what is regarded as a severely impaired LVEF has changed over the last half-century and vary from society to society (3). Previous BSE guidelines recommended that severe LVEF was ≤35%, therefore, the BSE has chosen to remain consistent with reporting standards used throughout the UK. Every BSE accredited sonographer and department has issued a report stating severe LVEF was ≤35% for almost a decade. We have also been consistent in recommending measuring (and reporting) the LVEF as accurately as possible.

The American Society of Echocardiography and European Association of Cardiovascular Imaging have also remained consistent in their definition of severe LVEF as <30% in their 2015 chamber definitions paper (4), unchanged from their 2005 paper (5). This is despite the ACCF/AHA defining HFrEF as ≤ 40% in 2013 (6). Our paper outlines why we chose to adhere to ≤ 35%.

In the 2012 European Society of Cardiology (ESC) paper on heart failure (7), the authors pointed out that 'The major trials in patients with HF and a reduced EF (HF-REF), or "systolic HF", mainly enrolled patients with an EF ≤ 35%, and it is only in these patients that effective therapies have been demonstrated to date'. In 2016, the ESC brought in the term 'Heart Failure with mid-range Ejection Fraction' (HFmrEF) and almost (but not quite) aligned with the ACCF/AHA by defining HFrEF as an LVEF < 40% (8).

Since 2012, the cut-off LVEF used in trials of heart failure medications has varied; it is this value that then determines a drug's license. None of the imaging or clinical American, European or British society guideline provides a cut-off for severe LVEF or HFrEF that universally determines prescribing across all drug classes. The numerical value of the ejection fraction is essential to determine if a particular drug is indicated, which is why we insist on it being quoted; the only exception being cases where image quality is so poor it would be inaccurate to do so. We also recommend that when management plans are determined by LVEF, but routine trans-thoracic echo images are of poor quality, contrast echocardiography or alternative modalities are considered.

For this reason, we must disagree with Dr Kanagala and Professor Squire in claiming that the MRAs and the ARNIs have 'a well established and evidence-based

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extended survival benefit' across the entire HFrEF population. We would urge readers to refer to the *British National Formulary* and the NICE guidelines as well as the landmark trial papers for the actual LVEF and specific clinical criteria required for prescribing within license (9, 10, 11, 12, 13, 14, 15).

Similarly, we also disagree with Dr Kanagala and Professor Squire that there is a clear benefit for device therapy in patients with HFrEF when defined as an LVEF ≤ 40%. The NICE guidelines (16) and thus clinical commissioning groups insist on an LVEF ≤35%. The results of a study of patients who had a conventional indication for pacing (17) does not open up the utility of complex device therapy to all the heart failure patients with an LVEF up to 50% but rather highlights the potential detriment of the conventional RV pacing on heart function in this group.

We note Dr Kanagala and Professor Squire's criticism that we have simplified the relationship between prognosis and LVEF. However, we stated that 'a lower ejection fraction is associated with a poorer prognosis' only in the context of considering and rejecting the use of 30% or lower as a useful cut-off for severe LVEF as opposed to 35%.

Reducing systolic dysfunction categories from three groups to two will not adversely affect future heart failure research nor will it overwhelm community heart failure services. The BSE has not changed its severe cut-off from its previous guidelines used throughout the UK for almost a decade and we do not define HFrEF in our paper. We have merely removed the arbitrary 'mild' and 'moderate' terms and replaced them with the quoting of an ejection fraction. This emphasis on quoting LVEF% for this group was also highlighted in our poster to accompany the paper.

The scenarios that Dr Kanagala and Professor Squire describe where they envisage that our guidelines would cause patient harm do not stand scrutiny when a report contains a numeric LVEF%. We make no recommendation that would lead to patients with impaired LVEF being offered inappropriate therapy, nor would they be denied treatment, let alone have it withdrawn if their LVEF has improved. In fact, we concur with the ESC clinical guidelines that patients with impaired LVEF should be *considered* for therapy whilst accepting that, for many patient groups, further research is required. By quoting the LVEF, those specific patients who may benefit from a particular therapy in certain circumstances can be selected by the clinician.

Measurement and reporting of LVEF are recommended in our BSE normal reference interval guideline and are the key take home message we would like to put to Dr Kanagala and Professor Squire. Most of the treatments mentioned in their letter require an ejection fraction to be measured to ensure prudent, safe, and evidence-based care. While categorisation of systolic dysfunction has useful but limited benefits (mainly to non-specialists), we agree that the numerical reporting of ejection fraction is important for all prescribing clinicians and especially heart failure specialists (3). It is recommended as standard practice by the BSE.

Declaration of interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the article.

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