Coronary Jeopardy Score Predicts Ischemic Etiology in Patients With Left Ventricular Systolic Dysfunction

Holly Morgan, MBBCh[1]; Matthew Ryan, MBChB, PhD[1]; Natalia Briceno, MDRes[1]; Bhavik Modi, MA, MBBS, PhD, FHEA[2]; Haseeb Rahman, PhD[1]; Sophie Arnold, MSc; Adriana Villa, PhD[3]; Amedeo Chiribiri, MBBS, PhD, FHEA, FSCMR[1,3]; Divaka Perera, MA, MD[1,3]

Abstract

While cardiovascular magnetic resonance imaging (CMR) is the gold standard diagnostic test for heart failure etiology, it is not universally available. Our aim was to investigate whether quantifying the extent of coronary disease on angiography can predict the presence of an ischemic etiology. We included 176 patients who underwent CMR and coronary angiography for new heart failure with reduced ejection fraction. Based on CMR, 65% had an ischemic etiology and 35% were non-ischemic. A BCIS jeopardy score threshold ≥6 had 76% sensitivity and 97% specificity. In HFrEF, the extent of coronary disease on angiography can be used to rule in or out an ischemic etiology.

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Ischemic left ventricular dysfunction (ILVD) describes heart failure due to coronary artery disease and is the most common cause.[1] Distinguishing ILVD from non-ischemic cardiomyopathy (NICM) has important prognostic and management implications.[2] Cardiovascular magnetic resonance imaging (CMR) is regarded as the reference-standard test for phenotyping patients with newly-diagnosed left ventricular systolic dysfunction (LVSD), but significant variation in availability remains.[1] In practice, most patients with LVSD undergo coronary angiography as the initial test, if they are investigated at all.[3] Clinical trials have defined cohorts as having ILVD based on reduced LV ejection fraction (LVEF) and extensive coronary artery disease, but quantitative diagnostic thresholds for the latter have not been established. Angiographic scores can reproducibly quantify the burden of coronary disease in relation to volume of myocardium at risk from ischemic sequelae.

The British Cardiovascular Intervention Society Jeopardy Score (BCIS-JS) has been used to define eligibility for clinical trials of revascularization.[4] This scoring system is a modified version of the Duke JS, with additional criteria to account for dominance, left main coronary artery disease, and bypass graft disease. Points are awarded for significant disease (≥50% left mainstem stenosis or ≥70% in other vessels or bypass grafts), with the number of points dependent on the size of the subtended myocardial territory and summed to calculate overall score. The minimum score of zero indicates no significant coronary disease, the maximum score of twelve indicates proximal disease in all three vessels. The score correlates closely with ischemic burden on perfusion CMR.[4]

We aimed to determine whether quantifying the extent of coronary disease on angiography can predict the presence of an ischemic etiology in patients with LVSD.

Methods

Consecutive patients who underwent both CMR and coronary angiography at one tertiary centre within six months of diagnosis of new-onset severe LVSD (LVEF≤35%) were retrospectively included. Patients who had undergone prior revascularization or suffered a recent myocardial infarction were excluded. Heart failure etiology was classified on CMR, as ILVD or NICM, by CMR experts blinded to angiography. The extent of coronary disease was quantified using the BCIS-JS by interventional cardiologists blinded to CMR. Continuous data are presented as mean+/-SD or median (IQR) depending on normality of distribution. The area under the ROC curve (AUC) was calculated and optimum sensitivity and specificity identified, with CMR as the reference standard. The study was approved by the institutional review committee and all patients gave informed consent.

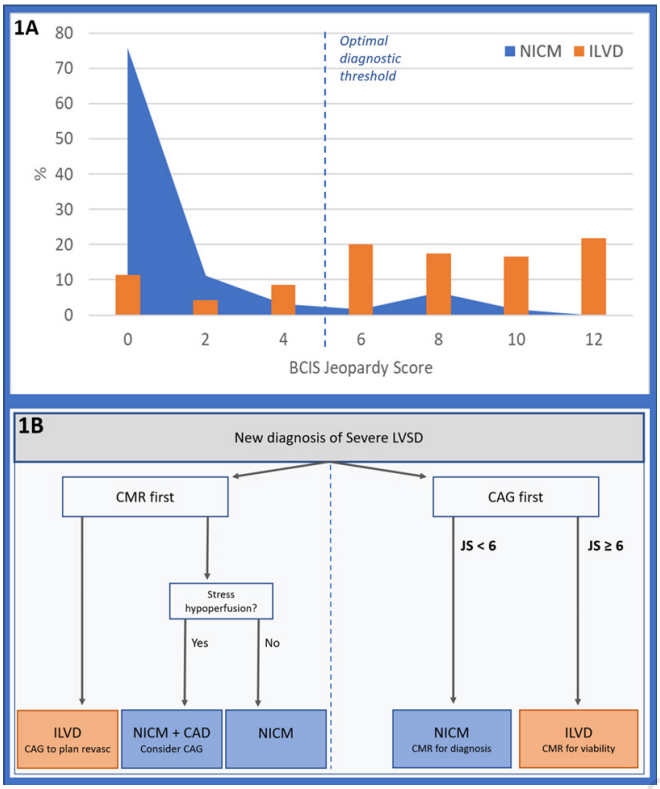

FIGURE 1. Use of the BCIS Jeopardy Score in the diagnosis of left ventricular dysfunction. Percentage distribution of BCIS-JS by cardiac magnetic resonance imaging diagnosis. (B) Suggested flow chart to guide investigation of new severe LVSD. CAD = coronary artery disease; CAG = coronary angiogram; LVSD = left ventricular dysfunction; ILSD = ischemic left ventricular dysfunction; JS = jeopardy score.

Results

One hundred and seventy-six patients were included; mean age was 66 years (range 34-88) and LVEF on CMR was 27 ± 8%. The CMR etiology was ILVD in 114 (65%) and NICM in 62 (35%). There were no significant differences in hypertension (63% vs 53%; *P*=.12), diabetes (33% vs 24%; *P*=.21) or smoking (47% vs 35%; *P*=.13), but higher rates of hypercholesterolemia in the ILVD cohort (65% vs 39%; *P*<.01). The BCIS-JS was 7.3 ± 3.8 in patients with ILVD and 1.1 ± 2.5 in NICM (*P*<.001) (**Figure 1A**). The AUC for the BCIS-JS for diagnosing ILVD was 0.89 (95% CI, 0.84-0.94). A BCIS-JS threshold ≥4 had 84% sensitivity and 87% specificity. A threshold of ≥6 had 76% sensitivity and 97% specificity; positive predictive value 94%, negative predictive value 67%. In the NICM group, only 6 patients had a score ≥6. In 18 patients diagnosed as ILVD, the BCIS-JS was ≤2.

Discussion

This study identified that in patients with LVSD, a BCIS-JS ≥6 reliably identifies an ischemic etiology. Conversely, a proportion of patients with little or no obstructive coronary disease (BCIS-JS ≤2) have CMR features suggestive of ILVD, raising the possibility of dual etiology or "smart heart" hibernation (where remote ischemia triggers adaptation of normally perfused territories).[5] An alternative explanation is that the BCIS-JS identifies significant coronary disease by the presence of a lesion of >70% diameter stenosis, and, hence, may misclassify some hemodynamically important lesions with lesser degrees of stenosis. Coronary physiology testing at the time of angiography to calculate a functional JS may further improve accuracy.[6]

Study limitations. The limitations of this study include its retrospective and observational nature as well as the modest sample size. Prospective validation of these findings would be valuable.

Conclusion

These results add to the body of evidence supporting the use of coronary angiography early in the diagnostic pathway of LVSD[3] (**Figure 1B**). The use of this technique may allow the diagnosis of ILVD to be made using echocardiography and angiography alone. If angiography reveals an equivocal burden of coronary disease, either invasive physiology or functional imaging should be considered. If revascularization is considered, functional imaging could also provide information about viability, and hence, where available, the modalities are complementary in diagnosing and managing patients with LVSD.

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From the [1]School of Cardiovascular Medicine and Sciences, King's College London, London, United Kingdom; [2]Glenfield Hospital, University of Leicester, United Kingdom; and [3]Cardiology Department, Guys and St Thomas' Hospital, Westminster Bridge Road, London, United Kingdom.

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Address for correspondence: Divaka Perera, MD, Cardiology Department, Guys and St Thomas' Hospital, Westminster Bridge Road, London, SE1 7EH. Email: divaka.perera@kcl.ac.uk