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Editorial

QRS change in heart failure: When is the right time for cardiac resynchronization therapy?

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Approximately one third of patients with reduced left ventricular ejection fraction (LVEF) also have electrical mechanical dyssynchrony manifested as widened QRS durations on surface electrocardiogram [1]. The dyssynchronous contraction of the ventricle results in reduced efficiency of cardiac output, functional diastolic mitral regurgitation, and unfavorable progressive remodeling of both the left and right ventricles [2–4]. Furthermore, QRS prolongation is a significant predictor of clinical deterioration, with increased prevalence of severe mitral regurgitation and increase risk for ventricular tachyarrhythmias, sudden cardiac death, and all-cause mortality [5]. Cardiac resynchronization therapy (CRT) aims to restore the timing of ventricular contraction to correct these pathophysiologic changes. Accordingly, current guidelines recommend that patients with QRS duration ≥130 msec, reduced LVEF, and symptomatic HF should be considered for CRT with a defibrillator (CRT-D) [6]. Overall, the accumulate data for clinical benefit from CRT is strongest in patients with QRS duration ≥150 msec and left bundle branch block (LBBB), intermediate in patients with QRS duration ≥150 msec without LBBB or those with QRS duration <150 msec with LBBB, and weakest in patients with QRS duration of 130 msec to <150 msec without LBBB (Fig. 1) [7]. In contrast, recent data suggest that CRT may be associated with increased cardiovascular and total mortality in patients with QRS duration <130 msec [8]. These findings suggest the need for appropriate selection of patients for cardiac resynchronization therapy that is based on both QRS duration and morphology.

In this issue of the *International Journal of Cardiology*, Rav-Acha et al. report on the incidence of the development of new pathological QRS widening among patients with reduced LVEF during long-term follow-up [9]. The authors also identified factors associated with the development of QRS >130 msec in this population. The study comprised 178 patients with reduced LVEF and a narrow QRS (<120 msec) who were followed over a median period of 30 months. During this time-period, participating patients had a median of 11 eletrocardiograms performed. The study provides novel and clinically important data on long-term dynamic changes in QRS duration in patients with low LVEF that may affect decision on device therapy in this population. Importantly, QRS prolongation to >130 ms was identified in 16% of the patients during a median follow-up of 30 months. However, only half of these patients had LBBB pattern, suggesting that approximately 10% of patients with an initial narrow QRS may benefit from an upgrade to a cardiac resynchronization therapy during follow-up.

Increased age (<70 yrs), a wider baseline QRS (>100 msec), and a larger left atrial diameter (>4.75 cm) were identified as significant possible predictors of future QRS prolongation. Notably, multivariable analysis identified baseline QRS > 100 ms as the strongest predictor for QRS prolongation to >130 msec during long-term follow-up, and showed that QRS prolongation over time was independently associated with >7-fold increased risk for subsequent mortality or heart failure hospitalizations.

What are the clinical implications of these findings? Based on the study's results the authors suggest two possible management strategies in patients with a narrow QRS who have increased risk for QRS widening. Their first option is an initial strategy of CRT-D implantation, as opposed to the current practice of ICD implantation in this population. However, implantation of a full CRT-D device in patients with QRS < 130 msec (even if they have factors associated with QRS prolongation over time) was shown to be associated with increased mortality and is therefore not recommended per current guidelines [6]. The second proposed management strategy is implantation of a "CRT-D with plug" (i.e. a CRT-D device without the LV lead). This option should also be viewed with caution since the results of the study suggest that only a relatively small minority (10% or less) of patients with an initial narrow QRS will develop LBBB over an average period of >2 years. This low event rate may not justify the risks and financial implications of implanting a CRT-plug device in patients with a narrow

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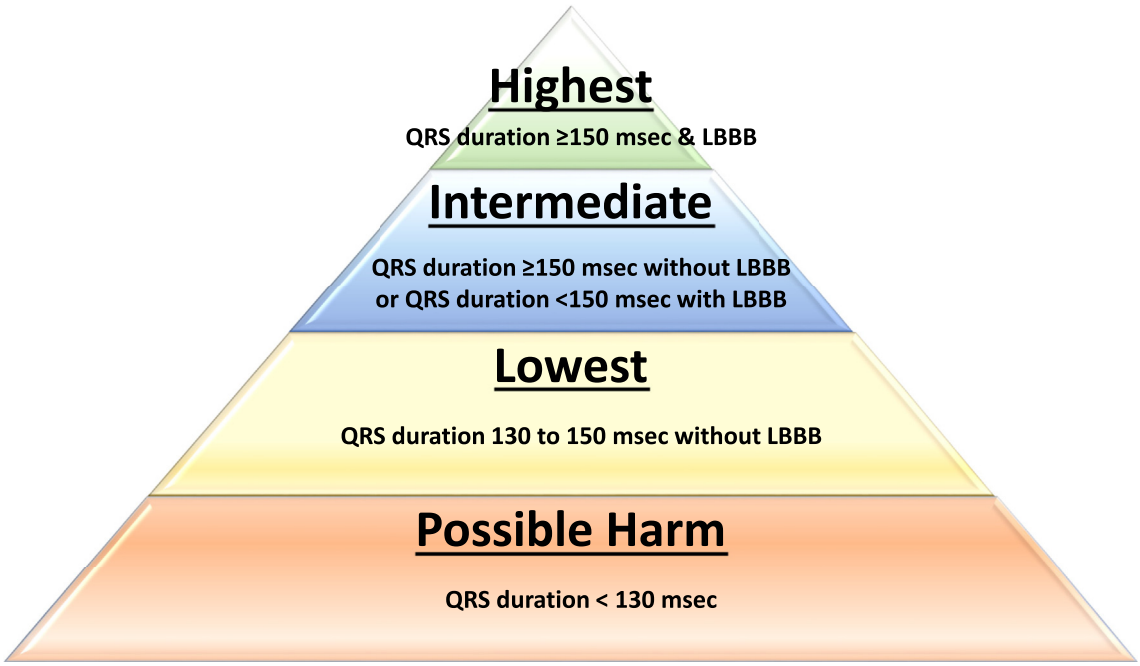

Fig. 1. QRS and response to CRT.

QRS, even if they have factors associated with QRS prolongation over time.

We therefore believe that the main "take-home" message of this study is that patients with a low LVEF and a narrow QRS who receive an ICD should be continuously followed-up for dynamic changes in QRS duration since the morbidity and mortality associated with QRS increase over time may be obviated by an upgrade to a CRT-D device when indicated.

Declaration of competing interest

The authors report no relationships that could be construed as a conflict of interest.

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