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Right ventricular septal pacing in patients with right bundle branch block☆

Michael C. Giudici, MD,[a,*] Basil Abu-El-Haija, MD,[a] Phillip E. Schrumpf, RN,[a] Prashant D. Bhave, MD,[a] Belal Al Khiami, MD,[a] Serge S. Barold, MD[b]

[a] *Division of Cardiology, University of Iowa Hospitals, Iowa City, Iowa*
[b] *Florida Arrhythmia Institute, Tampa, Florida*

Abstract

Background: Cardiac resynchronization therapy (CRT) has been shown to improve left ventricular (LV) function and exercise performance in patients with left bundle branch block. Patients with right bundle branch block (RBBB) do not have a similar positive response to standard CRT. We hypothesized that single site pacing of the right ventricular septum (RVS) near the proximal right bundle could restore more normal activation of the LV in RBBB patients.

Methods: 78 consecutive patients (56 M, 22 F) with baseline RBBB underwent pacemaker or ICD implantation. Leads were placed in the right atrium and RVS.

Results: Baseline QRS duration was 120–220 ms (mean QRSd = 147 ms). At the optimal AV delay, the fused QRSd was 56–160 ms (mean QRSd = 112 ms). The mean decrease in QRSd was 34 ± 20.4 ms ($p < 0.001$).

Conclusion: RVS pacing in patients with RBBB resulted in a marked decrease in QRS duration and often normalized the ECG.

Keywords: Cardiac resynchronization; Right bundle branch block; Right ventricular septal pacing

Introduction

Cardiac resynchronization therapy (CRT) with a pacing lead on the lateral left ventricle (LV) and a right ventricular lead has been shown to improve cardiac output, quality of life, and exercise performance in patients with ejection fraction (EF) ≤ 35%, left bundle branch block (QRS duration >130 ms), and symptomatic congestive heart failure [1–4]. Results with this therapy in patients with right bundle branch block (RBBB) have not shown the same degree of response, and have in fact trended toward a deleterious effect [5–7].

The rationale for placing a pacing lead into a lateral vein of the coronary venous system to pace the territory normally activated by the left bundle branch is straightforward in a patient with a left bundle branch block (LBBB). It is also reasonable to assume that in a patient with an intact left bundle, pacing that area would have little effect. In early studies with temporary pacing systems, patients with a narrow QRS or RBBB did not significantly benefit from bi-ventricular pacing, but those with LBBB and a very wide QRS derived great benefit [8]. A more recent study of CRT in RBBB by Rickard et al. [6] suggested a lack of benefit in these patients. Likewise, Bilchick et al. [7] found that RBBB was a "powerful predictor of poor outcome after CRT". Patients whose LV wall-motion abnormality derives from a RBBB could potentially see an improvement with pacing near the area of the LV served by the right bundle — the septum.

Our studies over the years with right ventricular septal (RVS) pacing have suggested that the benefit of RVS pacing is due to the recruitment of the conduction system by pacing near to the right bundle branch [9] (Figs. 1 and 2). This led us to attempt to normalize conduction in patients with a baseline

Fig. 1. Autopsy specimen from a patient with right ventricular outflow septal pacing demonstrating lead position near the course of the right bundle.

☆ Conflicts of interest: none.

* Corresponding author at: University of Iowa Hospitals, 200 Hawkins Drive, 4426JCP, Iowa City, Iowa 52242.
E-mail address: michael-c-giudici@uiowa.edu

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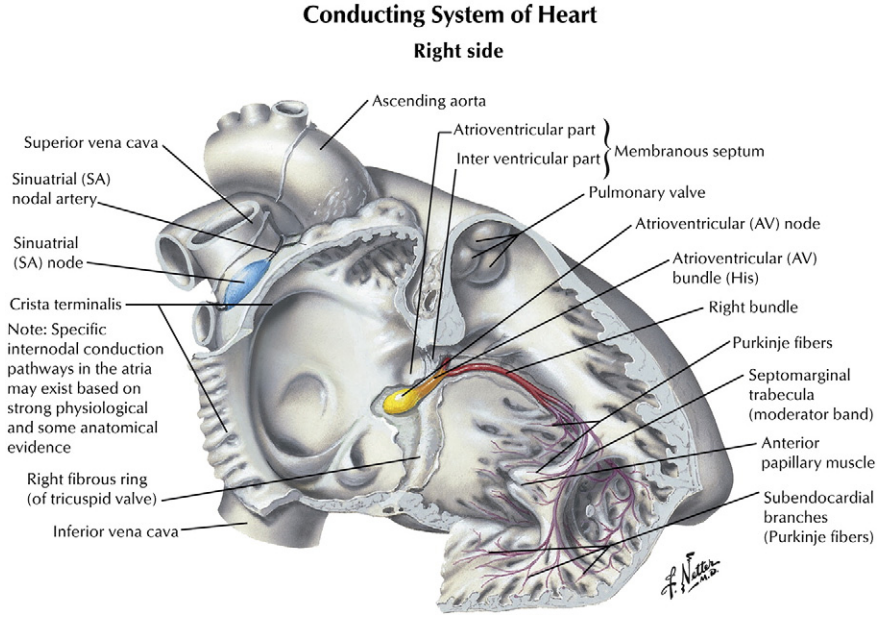

Fig. 2. Illustration of conduction system in the same view as Fig. 1. Note how the right bundle courses along the septum in relation to where pacing leads are placed.

RBBB by pacing with a single ventricular lead placed in the vicinity of the proximal right bundle and then optimizing atrio-ventricular (AV) timing to achieve optimal fusion with the patients' intact left bundle branch.

Methods

78 consecutive patients, 56 male and 22 female, mean age 74 years (range 46–93 years) with RBBB underwent dual chamber pacemaker or ICD implantation for standard indications such as sick sinus syndrome and intermittent AV block for pacemakers and those diagnoses plus primary or secondary prevention of life-threatening arrhythmias for ICDs. Active-fixation leads were placed in the right atrium in as anteromedial a position as possible. The right ventricular lead was placed in the septum just below the moderator band using standard techniques. Septal placement was confirmed with fluoroscopy in the 45° left anterior oblique view at implant. After implantation, patients underwent bedside optimization with the AV delay tested over a range of settings to try and achieve the narrowest QRS duration and most normal

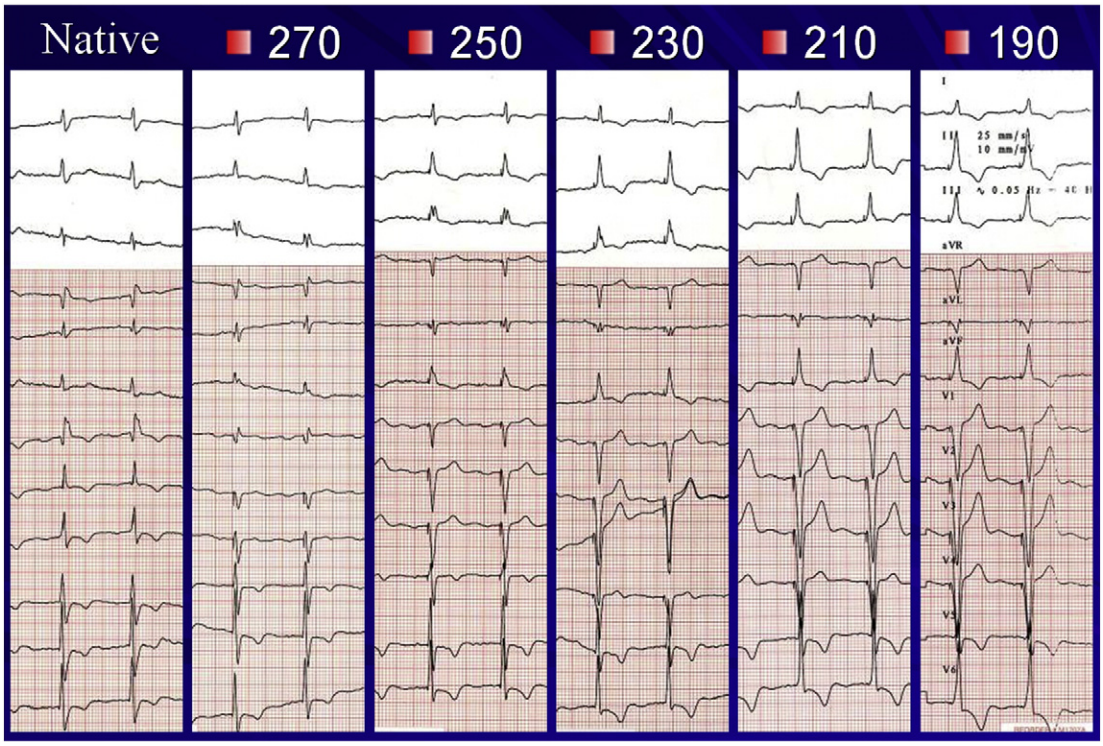

Fig. 3. Pacing at shorter AV delays to show the continuum from RBBB to normal QRS to RV paced pattern in the same patient.