STUDY PROTOCOL

The Effect of Atrioventricular Delay Optimization on Ventricular Functions in Patients Undergoing Conduction System Pacing

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Background

Conduction system pacing (CSP), including His bundle pacing and left bundle branch area pacing, has emerged as a physiological pacing strategy that preserves native ventricular activation and reduces electrical and mechanical dyssynchrony associated with conventional right ventricular pacing. Although CSP improves ventricular synchrony, the role of atrioventricular (AV) delay optimization in patients undergoing CSP remains insufficiently investigated.

AV delay programming has a direct impact on ventricular filling, atrial contribution to cardiac output, and overall hemodynamic performance. Previous studies in dual-chamber pacing and cardiac resynchronization therapy have demonstrated beneficial effects of AV delay optimization on ventricular function and hemodynamic parameters. However, data regarding the effects of AV delay optimization in patients treated with CSP are limited.

Study Objective

The primary objective of this study is to evaluate the effects of individualized AV delay optimization on ventricular function in patients undergoing conduction system pacing.

Study Design

This study was designed as a single-center, prospective, observational clinical study conducted at the Department of Cardiology, University of Health Sciences Bursa Yuksek Ihtisas Training and Research Hospital, Bursa, Türkiye.

Study Population

Inclusion Criteria

- Age ≥18 years
- Permanent conduction system pacing implantation for atrioventricular block
- Sinus rhythm
- Ability to undergo transthoracic echocardiographic assessment
- Provision of written informed consent

Exclusion Criteria

- Persistent or permanent atrial fibrillation
- Significant valvular heart disease
- Inadequate echocardiographic image quality
- Congenital heart disease
- Inability to complete follow-up evaluations

Study Procedures

All participants underwent standard clinical evaluation and transthoracic echocardiography.

Baseline echocardiographic measurements were obtained before AV delay optimization. AV delay optimization was subsequently performed using echocardiographic transmitral inflow and left ventricular outflow tract velocity-time integral (LVOT VTI)-guided methods.

Following optimization, echocardiographic assessment was repeated using identical imaging protocols.

Echocardiographic Assessment

The following parameters were evaluated:

- Left ventricular ejection fraction (LVEF)
- Global longitudinal strain (GLS)
- Left ventricular outflow tract velocity-time integral (LVOT VTI)
- Cardiac output (CO)
- Left atrial diameter
- Systolic pulmonary artery pressure (sPAP)
- Diastolic function parameters

All measurements were performed according to contemporary echocardiographic recommendations.

AV Delay Optimization

AV delay optimization was performed using Doppler echocardiographic methods based on:

- Transmitral inflow assessment
- LVOT VTI maximization

The optimal AV delay was determined individually for each participant.

Outcome Measures

Primary Outcome

Change in Global Longitudinal Strain (GLS) after AV delay optimization.

Secondary Outcomes

- Change in LVEF
- Change in LVOT VTI
- Change in cardiac output
- Change in systolic pulmonary artery pressure
- Change in left atrial diameter
- Change in diastolic function parameters

Sample Size

A total of 39 participants were enrolled. Two participants were lost to follow-up and could not be contacted for post-optimization evaluation. Therefore, 37 participants were included in the final analysis.

Ethical Considerations

The study was approved by the local Ethics Committee and conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment.

Study Status

Completed.