








Left bundle branch-optimized cardiac resynchronization therapy in a patient with ischemic cardiomyopathy: a case report

 Alenka Tuličić-Mihelčić^{1*}
 Ivan Bitunjac¹
 Blaženka Miškić^{1,2}
 Katica Cvitkušić-Lukenda^{1,2}
 Željka Stojkov^{1,2}
 Barica Stanić^{1,2}
 Domagoj Vučić¹

¹General Hospital "Dr. Josip Benčević" Slavonski Brod, Slavonski Brod, Croatia

²Faculty of Dental Medicine and Health osijek, Osijek, Croatia

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***ADDRESS FOR CORRESPONDENCE:** Alenka Tuličić-Mihelčić, Opća bolnica "Dr. Josip Benčević" Slavonski Brod, Andrije Štampar 42, HR-35000 Slavonski Brod, Croatia. / Phone: +385-98-771-551 / E-mail: alenkaveyron@gmail.com

ORCID: Alenka Tuličić-Mihelčić, <https://orcid.org/0000-0002-4745-1066> • Ivan Bitunjac, <https://orcid.org/0000-0002-4396-6628>
Blaženka Miškić, <https://orcid.org/0000-0001-6568-3306> • Katica Cvitkušić-Lukenda, <https://orcid.org/0000-0001-6188-0708>
Željka Stojkov, <https://orcid.org/0000-0003-1856-1554> • Barica Stanić, <https://orcid.org/0000-0002-9407-5614>
Domagoj Vučić, <https://orcid.org/0000-0003-3169-3658>

Introduction: Ischemic cardiomyopathy is characterized by significantly impaired left ventricular function (ejection fraction [EF] \leq 40%) due to coronary artery disease (CAD) and is the most common cause of heart failure. Non-pharmacologic treatments for heart failure, such as cardiac resynchronization therapy (CRT) via biventricular pacing (BVP), have played an important role in improving heart failure prognosis¹. In patients with electrical dyssynchrony, especially those with a widened QRS complex, CRT combined with a defibrillator (CRT-d) is a proven therapy. However, up to 30% of patients show no clinical benefit, often presenting with a broad QRS complex and a suboptimal response². Certain studies suggest that left bundle branch area pacing (LBBAP) is effective in improving cardiac function, mechanical synchronization, and efficiency³. Both strategies can be combined with left bundle branch-optimized cardiac resynchronization therapy (LOT-CRT) to provide greater electrical resynchronization⁴. This case illustrates the successful use of LOT-CRT-d in a patient with heart failure with reduced ejection fraction (HFrEF) and progressive clinical deterioration.

Case report: 74-year-old male with long-standing ischemic cardiomyopathy and a baseline ejection fraction (EF) of 30% had been stable for many years on optimal medical therapy—New York Heart Association classification of heart failure (NYHA) class I. Over the past six months, he experienced worsening symptoms, including exercise intolerance and nocturnal orthopnea, with elevated N-terminal pro-Brain Natriuretic Peptide (NT-proBNP) (780 pg/ml) and QRS widening to 170 ms, leading to a clinical decline to NYHA class II. Due to this deterioration, the patient was selected for LOT-CRT-d implantation. The procedure was uneventful, with left bundle branch area pacing achieved via a transseptal lead. A quadripolar left ventricular lead was positioned in the posterolateral region. A defibrillation lead was placed in the right ventricle, and a pacing electrode in the right atrium. Biventricular pacing successfully reduced the QRS duration from 170 to 100 ms, and the patient was discharged the following day without complications. At the one-month follow-up, the patient reported significant symptomatic improvement, returning to NYHA class I, walking 10 km daily without limitations, and no longer requiring diuretics. Echocardiography showed an improved EF of 40%, and NT-proBNP levels dropped to 150 pg/ml.

Conclusion: This case demonstrates the effectiveness of LOT-CRT-d in improving both clinical and echocardiographic outcomes in a patient with worsening ischemic cardiomyopathy and HFrEF. LOT-CRT offers several advantages over traditional CRT, including more physiological pacing by targeting the left bundle branch area, which enhances interventricular synchronization. The patient's significant improvement in QRS duration, EF, and NT-proBNP levels supports the growing evidence of the benefits of LOT-CRT over conventional biventricular pacing, especially in patients with severe interventricular dyssynchrony.

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