JAE JOURNAL OF ARRHYTHMIA AND ELECTROPHYSIOLOGY

EDITORIAL

Coronary Sinus Stenting to Enable Left Ventricular Lead Implantation During CRT: Revisiting an Established Technique in the Era of Conduction System Pacing

Serkan Cay, MD*

Note

See related article, Karacali et al. 2025;3(3): pages 31-33.

Keywords: cardiac resynchronization therapy, conduction system pacing, coronary sinus stenting

Correspondance*

Serkan Cay, MD

cayserkan@yahoo.com

Division of Arrhythmia and Electrophysiology, Department of Cardiology, University of Health Sciences, Yuksek Ihtisas Cardiovascular Building, Ankara City Hospital, Ankara, Turkey

DOI: 10.5281/zenodo.18703152

The case report by Karacali et al. describes successful drug-eluting stent (DES) implantation in a stenotic posterolateral coronary sinus (CS) branch to facilitate left ventricular (LV) lead delivery during cardiac resynchronization therapy (CRT).[1] Although coronary venous interventions were first described nearly two decades ago, this report repositions the technique within the contemporary CRT landscape—now increasingly influenced by conduction system pacing (CSP).

Anatomical Barriers to CRT: A Persistent Challenge

CRT remains a Class I indication in appropriately selected patients with heart failure with reduced ejection fraction (HFrEF), left bundle branch block (LBBB), and prolonged QRS despite optimal medical therapy according to the 2021 ESC Heart Failure Guidelines and the 2022 AHA/ACC/HFSA Heart Failure Guideline.[2,3]

In the presented case, a 63-year-old woman with ischemic cardiomyopathy, LVEF 30%, LBBB (QRS 158 ms), and NYHA IV symptoms underwent CRT implantation. However, CS venography demonstrated critical stenosis in the posterolateral branch, precluding LV lead passage. Balloon angioplasty followed by DES implantation enabled successful LV lead placement, QRS narrowing, and symptomatic improvement.

The effectiveness of CRT depends not only on patient selection but also on LV lead location. Lateral or posterolateral LV positioning has been consistently associated with improved reverse remodeling and clinical response.[4,5] However, CS anatomical challenges—including stenosis, tortuosity, small caliber veins, or unfavorable angulation—remain important causes of implantation difficulty and non-response.[4-6]

Contemporary registries report CRT implantation failure rates between 3–8%, with CS anatomy contributing significantly.[6]

Coronary Sinus Angioplasty and Stenting: Historical Perspective and Contemporary Relevance

Coronary Sinus Angioplasty and Stenting: Historical Perspective and Contemporary Relevance Percutaneous coronary sinus interventions to facilitate LV lead implantation were first systematically described in the mid-2000s.[7,8] These early reports demonstrated high procedural success and acceptable complication rates. Coronary sinus stenting was subsequently used to stabilize LV leads and overcome venous stenosis.[8]

More recent case reports and small series have confirmed that CS angioplasty and stenting remain feasible options when anatomical obstacles are encountered.[9,10] Medeiros et al. reported successful coronary sinus angioplasty enabling optimal LV lead positioning with favorable short-term outcomes.[10]

In the present case, DES was chosen instead of bare-metal stent (BMS), citing lesion complexity and anticipated restenosis risk.[1] While BMS have historically been preferred in the venous system, the theoretical advantages of DES—reduced neointimal proliferation and sustained lumen patency—may be relevant in selected patients.[10] However, no comparative randomized data exist regarding DES vs. BMS in CS branches.

Antithrombotic management following CS stenting is not standardized. Limited available data suggest short-term dual antiplatelet therapy (DAPT) may be sufficient in low-flow venous systems,[1,10] but robust evidence is lacking. An important unresolved issue is the impact of CS stenting on future lead extraction. Data in this area remain sparse and warrant prospective evaluation.

The Emergence of Conduction System Pacing

Since 2021, conduction system pacing (CSP)—including His bundle pacing (HBP) and left bundle branch area pacing (LBBAP)—has emerged as a major alternative to conventional biventricular CRT. The 2023 HRS/APHRS/LAHRS expert consensus statement recognizes CSP as:

* A reasonable alternative to biventricular pacing in selected patients
* A bailout strategy when CS lead implantation fails
* A physiologic resynchronization method that bypasses CS anatomy

Observational studies and meta-analyses suggest that LBBAP may provide comparable or even superior electrical resynchronization compared with conventional CRT in selected populations, with favorable improvements in LVEF and QRS duration.[11] However, randomized superiority data remain limited.

CSP avoids CS anatomical challenges altogether, but it has its own limitations, including learning curve, lead positioning complexity, long-term extraction considerations, and uncertainty in ischemic scar-related conduction disease.

Therefore, in contemporary practice, the management algorithm in the presence of CS stenosis includes venous angioplasty with or without stenting, alternative venous branch targeting, surgical epicardial lead placement, and conduction system pacing (CSP), which is increasingly adopted in experienced centers, with the optimal strategy depending on operator expertise, institutional experience, and patient-specific anatomy.

Precision LV Targeting Versus Physiologic Activation

The broader clinical question raised by this case is whether overcoming venous anatomical obstacles to achieve optimal lateral LV pacing remains preferable to adopting CSP as a first-line strategy. Mechanical dyssynchrony studies have demonstrated that targeted LV lead placement in the site of latest activation improves CRT response.[4,5] However, CSP offers direct engagement of the intrinsic conduction system, potentially restoring near-normal ventricular activation.[11] Large randomized trials directly comparing CSP and conventional CRT in diverse heart failure populations are ongoing. Until definitive evidence emerges, individualized decision-making remains essential.

Conclusion

Karacali et al. provide a timely reminder that coronary sinus stenting remains a viable and effective strategy for facilitating LV lead implantation during CRT in anatomically challenging cases. In the modern era of conduction system pacing, this technique should not be viewed as

obsolete but rather as part of a comprehensive resynchronization toolkit. The future of CRT will likely be defined not by a single dominant technique but by tailored strategies integrating anatomical feasibility, electrical physiology, and long-term device management considerations.

References

1- Karacali K, Celik I, Oksuz F, Varol E, Karadeniz M, Duran M. Coronary sinus stenting to enable left ventricular lead implantation during cardiac resynchronization therapy: a case report. J Arrhythm Electrophysiol. 2025;3(3):31-33.
2- McDonagh T, Metra M, Adamo M. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2021;42:3599-3726.
3- Heidenreich P, Bozkurt B, Aguilar D. 2022 AHA/ ACC/HFSA guideline for the management of heart failure. Circulation. 2022;145:e895-e1032.
4- Singh J, Klein H, Huang D. Left ventricular lead position and clinical outcome in the MADIT-CRT trial. Circulation. 2011;123:1159-1166.
5- Ypenburg C, van Bommel R, Delgado V. Optimal left ventricular lead position predicts reverse remodeling and survival after cardiac resynchronization therapy. J Am Coll Cardiol. 2008;52:1402-1409.
6- Rickard J, Michtalik H, Sharma R. Predictors of cardiac resynchronization therapy device implantation failure. J Interv Card Electrophysiol. 2010;28:63-69.
7- Oto A, Aytemir K, Okutucu S. Percutaneous coronary sinus interventions to facilitate implantation of left ventricular lead: a case series and review of literature. J Card Fail. 2012;18:321-329.
8- Kowalski O, Prokopczuk J, Lenarczyk R. Coronary sinus stenting for the stabilization of left ventricular lead during resynchronization therapy. Europace. 2006;8:367-370.
9- Kamalzadeh H, Yazdani S, Jalali M. Coronary sinus stenting for the management of left ventricular lead displacement during resynchronization therapy. J Tehran Heart Cent. 2018;13:27-31.
10- Medeiros P, Lousinha A, Oliveira M. Coronary sinus angioplasty to enable optimal left ventricular lead placement for resynchronization. Heliyon. 2023;9:e16090.
11- Bressi E, Grieco D, Luermans J, Burri H, Vernooy K. Conduction system pacing for cardiac resynchronization therapy: state of the art, current controversies, and future perspectives. Front Physiol. 2023;14:1124195.

Conflict of Interests

None

Funding

The authors state that the current study received no financial support.