Long-term experience with coronary sinus side branch stenting to stabilize left ventricular electrode position

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BACKGROUND Despite technical advancements, implantation of coronary sinus (CS) leads may be challenging, and dislocation remains a relevant clinical problem.

OBJECTIVE The aim of this study was to investigate the effectiveness, safety, and long-term outcome of stent implantation to anchor the lead to the wall of the CS side branch.

METHODS Stenting of a CS side branch was performed in 312 patients. The procedure was performed because of postoperative lead dislocation in 16 patients and because of an intraoperative unstable lead position or phrenic nerve stimulation in 296 cases. A bare metal coronary stent was introduced over a second guide wire in the same CS sheath. The stent was deposited 5–35 mm proximal to the most proximal electrode. Mechanical damage of the CS side branch or pericardial effusion was not observed owing to stenting.

RESULTS During follow-up (median 28.4, interquartile range 15–37, maximum 70 months), a clinically important increase in the left ventricular pacing threshold was found in four cases and reoperation was necessary in only two patients (0.6%). Phrenic nerve stimulation was observed in 18 instances, and repositioning with an ablation catheter was performed in seven cases. Impedance measurements did not suggest lead insulation failure. Three stented leads were extracted without complication after 3–49 months owing to infection, while four leads were extracted easily during heart transplantation after 7–27 months.

CONCLUSION Stent implantation to stabilize CS lead position seems to be an effective and safe procedure in prevention and treatment of CS lead dislocation in selected cases.

KEYWORDS Cardiac resynchronization; LV lead implantation; Coronary sinus; Lead dislocation; Stent implantation

ABBREVIATIONS **CRT** = cardiac resynchronization therapy; **CS** = coronary sinus; **INR** = international normalized ratio; **LV** = left ventricle; **NYHA** = New York Heart Association; **PNS** = phrenic nerve stimulation

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Introduction

Cardiac resynchronization therapy (CRT) plays an important role in the treatment of severe heart failure in patients with wide QRS complex and mechanical dyssynchrony. Despite continuous technical developments in the last few years, implantation of a CRT system may be challenging. The success rate of coronary sinus (CS) lead positioning is 88%–96% in previous clinical studies,[1–4] but even in the recently published MADIT CRT trial, 7.5% of the CS lead implantations were unsuccessful.[5] During follow-up, 5%–10% of patients require reoperation because of CS lead dysfunction.[2,3,5–7]

Stent implantation, which anchors the CS electrode to the wall of the CS side branch, may increase the stability of the lead position. A more stable lead position may increase implantation success rates and decrease the number of postoperative complications. The procedure of CS lead stenting was described elsewhere in detail.[8–11] In this study, long-term follow-up results of CS stenting are reported in a larger patient population.

Methods

CS sinus stenting has been performed since August of 2004 in selected patients after receiving informed consent. The consent form and the protocol were approved by the Hungarian Scientific and Research Ethics Committee of the Medical Research Council. Data were collected in consecutive patients who underwent CS lead stabilization with stenting in the Heart Center of the Semmelweis University, Budapest.

CS side branch stenting was performed in 312 patients with wide QRS (>120 ms). New York Heart Association (NYHA) functional stage was mainly III–IV despite optimal medical therapy, while 12 patients were in NYHA II stage at implantation, but their preceding clinical status made this treatment reasonable (Table 1). At our institute, 784 CRT

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Table 1 Baseline Characteristics

Mean age	65.4
Sex:	
Male	236
Female	76
NYHA class at implantation:	
II	12
III	247
IV	53
Left ventricular ejection fraction (%, median)	28 (23–34)
Medication (% of patients):	
Aspirin	36
Clopidogrel or ticlopidine	24
Coumarin	48
Aspirin + coumarin	14
Clopidogrel + coumarin	7
Aspirin+clopidogrel	12
Spironolactone	54
Other diuretics	71
Beta-blocker	87
Angiotensin-converting enzyme inhibitors or angiotensin receptor blockers	84

systems were implanted between August 2004 and September 2009, and stenting was applied in 39.7% of CRT patients. Stent fixation of the CS lead was indicated in cases of postoperative dislocation (n = 16). Furthermore, stenting was applied when intraoperative macroscopic or microscopic dislocation occurred or phrenic nerve stimulation (PNS) was observed in a stable anatomical position and the lead needed to be fixed in a more proximal position (n = 296) (Figure 1).

CS side branch stenting was executed as described elsewhere.[9] Briefly, after cannulation of the CS ostium with the Scout Pro 8F (Biotronik GmbH&Co, Berlin, Germany; inner diameter 8 Fr) or Attain LDS 6216A MB2 (Medtronic Inc., Minneapolis, MN; inner diameter 7 Fr) CS sheaths, CS venography was performed using an occlusion balloon. Generally, over-the-wire left ventricular (LV) unipolar passive fixation electrodes were applied: Attain OTW 4193-78 (Medtronic; n = 186), Corox OTW 75 UP/Steroid (Biotronik; n = 118), and Quicksite 1056K-86 (St. Jude, Sylmar, CA; n = 1). Seven patients received bipolar passive fixation leads (Corox OTW 75 BP/Steroid, Biotronik). After positioning of the lead, signal amplitude, pacing threshold, and pacing impedance were measured. PNS was assessed in all cases. Repositioning of the LV lead was performed if PNS was apparent during 10 V at 0.5 ms pacing. In case the physician performing the implantation decided to use stent implantation, a second guide wire was introduced into the target vein over the same CS sheath. Over this second guide wire, a short (mainly 8–15 mm) bare metal coronary stent was positioned into the CS side branch. The distance between the pacing tip (or ring) of the lead and the distal end of the stent was 5–35 mm. The diameter of the stents (2.25–4 mm, mainly 3 or 3.5 mm) was chosen according to the diameter of the target CS side branch, which was measured on the CS venogram. The applied bare metal stents were as follows: Trimaxx (Abott Vascular, Redwood City, CA; n = 142), Driver (Medtronic, n = 57), MicroDriver (Medtronic, n = 21), S670 (Medtronic, n = 6), Lekton Motion (Biotronik, n = 35), ProKinetic (Biotronik, n = 29), Liberte (Boston Scientific, Maple Grove, MN, n = 19), and Tsunami Gold (Terumo, Tokyo, Japan, n = 3). After measuring the control pacing threshold and testing the PNS, the stent was deployed with a pressure of 6–14 atmospheres (Figure 2). The duration of balloon inflation was 4–6 seconds.

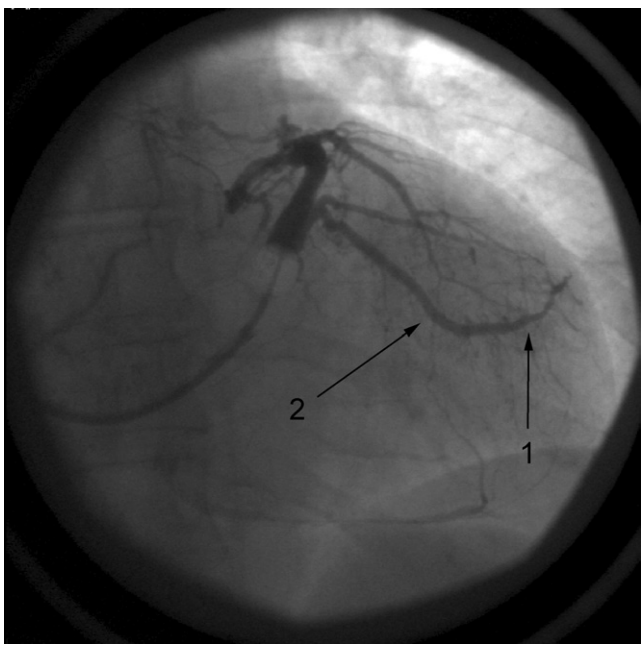

Figure 1 Coronary venogram. *Arrow 1*: stable, distal wedge position, where PNS was observed. *Arrow 2*: proximal position with ideal pacing parameters. Intraoperative dislocation was experienced.

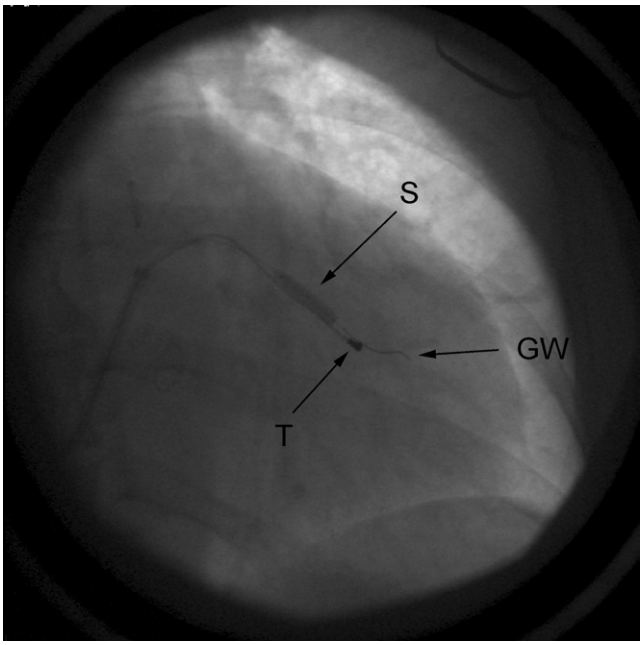

Figure 2 Coronary stent implantation. S: inflation of the stent; GW: guide wire of the stent; T: tip of the lead in the final position.