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BALLOON ANGIOPLASTY OF CARDIAC VEIN IN CRT PATIENT
BALON ANGIOPLASTIKA SRČANE VENE KOD CRT PACIJENATA

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Abstract

Introduction. Cardiac resynchronization therapy (CRT) reduces mortality and hospitalization in patients with symptomatic heart failure and left bundle branch block (LBBB) on optimal drug therapy. Among all, the reasons for “non-response” to CRT pacemaker could be the failure to achieve optimal left ventricular (LV) lead position, due to severe curve or stenosis/occlusion of target vein. Case report. We present a of male patient, age 79, NYHA class III, with atrial fibrillation, chronic coronary syndrome (CCS), prior myocardial infarction, who underwent coronary artery bypass surgery and mechanical prosthetic aortic valve implantation, indicated for CRT in whom venogram revealed ostial/proximal severe curve and stenosis of posterolateral vein, the only vein of coronary sinus leaded to anatomical optimal LV segment for stimulation. After the balloon angioplasty of curved and stenotic portion of target vein with compliant balloon 4.0 x 30 mm, satisfactory and stable position of quadripolar LV lead was achieved. Conclusion. Compliant balloon angioplasty could be safe and efficient way how to override severe coronary vein stenosis in some CRT cases.

Key words: cardiac resynchronization therapy; heart failure; compliant balloon; angioplasty; coronary vein stenosis.

Apstrakt

Uvod. Kardioresinhronizaciona terapija (CRT) smanjuje smrtnost i hospitalizaciju kod pacijenata sa simptomatskom srćanom insuficijencijom i blokom leve grane (LBBB) koji su na optimalnoj terapiji lekovima. Između ostalog, razlozi za „nereagovanje“ (“non-response”) nakon ugradnje CRT pejsmekera mogu biti posledica neuspeha u postizanju optimalnog položaja electrode koja stimuiše levu komoru zbog izražene krivine ili stenoze/okluzije ciljne vene. Prikaz bolesnika. Predstavljamo slučaj muškarca, starosti 79 godina, NYHA klasa III, sa atrijalnom fibrilacijom, hroničnim koronarnim sindromom (CSS), preležanim infarktom miokarda koji je hirurški revaskularizovan sa implantacijom veštačke mehaničke aortne valvule, kome je indikovana ugradnja CRT pejsmekera, i kod koga je venogramom detektovana ostijalno/ proksimalna teška krivina i stenoza.
posterolateralne vene koronarnog sinusa, anatomski jedine vene za optimalnu stimulaciju leve komore. Nakon balon angioplastike zakrivljenog i stenotičnog dela ciljne vene sa komplijantnim balonom 4,0 x 30 mm, postignuta je zadovoljavajuća i stabilna pozicija kvadriplolarne elektrode za stimulaciju leve komore. **Zaključak.** Komplijantna balon angioplastika mogla bi biti siguran i efikasan način za prevazilaženje teške stenoze vene koronarnog sinusa u nekim slučajevima ugradnje CRT-a.

**Ključne reči:**
kardioresinhronizaciona terapija; srčana slabost; komplijantni balon; angioplastika; stenoza koronarne vene.

**Introduction**

Cardiac resynchronization therapy (CRT) is Class I indication for treatment symptomatic systolic heart failure (HFrEF), and QRS > 150 msec and left bundle branch block (LBBB) QRS morphology, on optimal drug therapy.

One of the main reasons for “non-response” on CRT is suboptimal lead placement due to impassable target vein because of vein anatomy, i.e. severe curve or/and thrombosis/stenosis/occlusion, which occurs in 1 - 4 % of the cases. One of the non-routine option is to use PTCA (percutaneous transluminal coronary angioplasty) balloon.

**Case report**

We present a case of 79-year-old male patient, NYHA class III, with history of hypertension, chronic coronary syndrome (CCS), prior myocardial infarction, and who underwent coronary artery bypass surgery, together with implantation of mechanical prosthetic aortic valve six years ago.

The electrocardiogram showed permanent atrial fibrillation (AF) and complete LBBB, with QRS duration of 180 ms, and ECG signs of antero-apical scar. Echocardiography revealed reduced LVEF (left ventricular ejection fraction) 30%, dilated left ventricle (LVEDD 61 mm, LVESD 45 mm), with mechanical dyssynchrony, and normal function of mechanical prosthetic aortic valve. Since patient has had no history of ventricular
tachycardia or ventricular fibrillation and on ambulatory 24-hours HOLTER monitoring only isolated VPBs were recorded, CRT pacemaker was intended to be implanted.

Right ventricular lead (Tendril™ STS, St. Jude Medical, 58 cm) was implanted via cephalic vein and placed on mid-interventricular septum, with satisfactory electrical parameters. On CS balloon-assisted venography (introducing sheath: Acuity™ Pro, Boston Scientific, 9F, 54 cm, plus Balloon catheter, model 6747, Boston Scientific) postero-lateral branch was identified with good distal diameter reaching the postero-lateral LV segment of latest activation. Unfortunately, the proximal tortuosity and sharp curve (figure 1) made the vein unpassable with quadripolar (QUARTET™ 1458Q-86, St. Jude Medical), or also with bipolar lead (QUICKFLEX™ 1258T-86, St. Jude Medical – figure 3), but only with coronary wire 0.014 Fr (ASAHI SION, 180 cm). Sub-selecting introducing sheath (Attain Select II™ 90°, Medtronic) with two different curves also failed to achieve the passage of the lead. Finally, we solved the problem with the compliant PTCA balloon (Sprinter Legend™ Medtronic) 4.0 x 30 mm, which was introduced and placed into the proximal part of postero-lateral vein with gradual expansion up to 12 atmospheres (Figure 2).

During the inflation of PTCA balloon, vein stenosis (probably due to local thrombus) was confirmed, and after the dilatation, the quadripolar LV lead (QUARTET™ 1458Q-86, St. Jude Medical) easily reached the desired destination (Figure 3). The electrical parameters for LV lead on anatomically optimal position were acceptable (P4/M3 threshold 0.625V/ 0.4 ms, without phrenic nerve stimulation).

Finally, the atrial lead (Tendril™ STS, St. Jude Medical, 52 cm) was implanted since the realistic chance of sinus rhythm in follow-up period was expected due to left atrial diameter less than 50 mm, and pulse generator (Quadra Allure MP™ St. Jude Medical) was placed in standard sub-clavicular subcutaneous pocket.

The patient was discharged from hospital next day without complication and with QRS narrowed for 40 ms, with normal biventricular capture (according to the lead V1/2). After four months of follow up the patient was referred as clinical “responder” (LVEF improved up to 45%), with evident signs of reverse remodeling, having one NYHA Class less and better tolerance of effort.
Discussion

Although cardiac resynchronization therapy (CRT) is clearly indicated in patients with symptomatic HFrEF and optimal drug treatment, having complete left bundle branch block with a QRS duration > 150 ms, in sinus rhythm (Class IA) or atrial fibrillation (Class IIA), randomized controlled trials reported 7.5% - 10% of unsuccessful implantation due to failure of pacing the LV lead on optimal and stable position.

We presented a case of a 79-year old male patient with permanent atrial fibrillation, mechanical prosthetic aortic valve with indication for CRT pacemaker, with the proximal stenosis of posterolateral coronary vein, which aggravated optimal LV lead positioning. After venous angioplasty with compliant PTCA balloon, optimal and stable position of quadripolar LV lead was achieved.

Multiple studies have reported the utility of applying interventional principles and equipment in coronary venous circulation to accomplish optimal biventricular stimulation. Luedorff et al. showed on retrospective analysis in single center with 705 CRT cases that in 3.5% of the cases venous angioplasty (balloon 3.0 mm in size usually) was needed and successfully performed. Moreover, the collateral veins also could be dilated in case of occlusion of big coronary vein branches, using small diameter guidewires and balloons to retrogradely approach the target zone of latest activation of LV, but which is risky, delicate and prolonged procedure.

Some authors propose placing the stent on the stenotic portion of the vein (after the dilatation), but these could lead to post-procedural vein occlusion in short follow up period with further deterioration of LV ventricle function which would diminish the positive effect of CRT. Such a case was described in case report by Jachec et al., making these option obscure and potentially dangerous.

On the other hands, some implanters perform stent implantation in the veins in parallel to the LV lead, but for other reasons than because of stenosis (to prevent lead dislodgement); in that case the potential huge technical and clinical problem would arise in case of need for extraction, therefore one should carefully analyze cost-benefit before the decision.

Finally, since the importance of reaching the optimal LV segment for LV stimulation was well established, and recently again emphasized (in 69% lateral or posterolateral segment), the present case report, which is the example of non routine approach and hasn´t...
been published up to now in domestic journals, showed the relatively easy and safe way to solve the problem of unpassable target vein by using only simple PTCA balloon. In our opinion the compliant balloon is better than non-compliant or semi-compliant balloon primarily because of safety issue with polyolefin copolymer material.

**Conclusion**

In case of vein stenosis which preclude placement of LV lead, balloon angioplasty is relatively easy and safe approach to facilitate the CRT procedure.

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Fig. 1 - Venogram of the coronary sinus. Note the stenosis of the proximal segment of the posterolateral vein.
Fig. 2- Venous angioplasty into the ostial and proximal part of PL vein with compliant PTCA balloon (Sprinter Legend™ Medtronic) 4.0 x 30 mm
Fig. 3- Successful implantation of quadripolar LV electrode (QUARTET™ 1458Q-86, St. Jude Medical) after balloon dilatation of proximal segment of postero-lateral vein

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