



Paper Accepted*

ISSN Online 2406-0895

Case Report / Приказ случаја

Nikola N. Radovanović^{1,†}, Siniša U. Pavlović^{1,2}, Bratislav Kirčanski¹,
Srđan Raspopović¹, Velibor Jovanović¹, Ana Novaković¹, Goran Milašinović^{1,2}

Transvenous lead placement and its pre-sternal tunneling to the contralateral side as a solution for pacemaker system upgrade in case of the subclavian vein thrombosis

Уградња електроде венским путем и њено пребацивање на супротну страну престерналним тунелирањем као решење за болеснике са тромбозом поткључне вене и потребом за надоградњом пејсмејкер система

¹ Pacemaker Center, Clinical Center of Serbia, Belgrade, Serbia;

² University of Belgrade, School of Medicine, Belgrade, Serbia

Received: July 12, 2016

Accepted: October 4, 2016

Online First: March 7, 2017

DOI: 10.2298/SARH160712060R

* **Accepted papers** are articles in press that have gone through due peer review process and have been accepted for publication by the Editorial Board of the *Serbian Archives of Medicine*. They have not yet been copy edited and/or formatted in the publication house style, and the text may be changed before the final publication.

Although accepted papers do not yet have all the accompanying bibliographic details available, they can already be cited using the year of online publication and the DOI, as follows: the author's last name and initial of the first name, article title, journal title, online first publication month and year, and the DOI; e.g.: Petrović P, Jovanović J. The title of the article. *Srp Arh Celok Lek*. Online First, February 2017.

When the final article is assigned to volumes/issues of the journal, the Article in Press version will be removed and the final version will appear in the associated published volumes/issues of the journal. The date the article was made available online first will be carried over.

† **Correspondence to:**

Nikola RADOVANOVIĆ

Pacemaker Center, Clinical Center of Serbia, Dr Koste Todorovića 8, 11000 Belgrade, Serbia

E-mail: nikolar86@gmail.com

Transvenous lead placement and its pre-sternal tunneling to the contralateral side as a solution for pacemaker system upgrade in case of the subclavian vein thrombosis

Уградња електроде венским путем и њено пребацивање на супротну страну престерналним тунелирањем као решење за болеснике са тромбозом поткључне вене и потребом за надоградњом пејсмејкер система

SUMMARY

Introduction Chronic right ventricular pacing can deteriorate cardiac function. Consequently, pacemaker system upgrades are more frequently indicated. These interventions can be hindered by venous thrombosis. In literature, it is rarely described that this problem is resolved by implanting of the new lead for left ventricle (LV) stimulation on the opposite side of the previously implanted pacemaker and then by its subcutaneous transfer to the old pocket.

Case Outline A 75-year-old male patient was hospitalized due to planned pacemaker upgrade in December 2015. Dual chamber pacemaker had been implanted due to sinus node dysfunction in 2011. During last 18 months he had been complained about symptoms of heart failure. Upgrade to cardiac resynchronization therapy (CRT) with new CRT-P device was indicated due to LV dilatation with ejection fraction decrease, clinical deterioration and the presence of high percentage of ventricular pacing. In October 2015, listed intervention was unsuccessful due to total left subclavian vein thrombosis on the side of previously implanted pacemaker. Anticoagulation therapy was ordained and the reevaluation was postponed. During this hospitalization, venography confirmed total left subclavian vein thrombosis despite the anticoagulation therapy. It was decided to implant a new LV lead on the right side and then to shift it, subcutaneously, by pre-sternal tunneling, to the previous left prepectoral pocket. The intervention was without complications. First controls have shown stable pacemaker parameters.

Conclusion This case report confirms that contralateral lead placement and subcutaneous pre-sternal tunnelling of the lead is feasible and safe in patients with implanted pacemaker, an indication for system upgrade and ipsilateral vein obstruction.

Key words: pacemaker system upgrade; vein obstruction; subcutaneous pre-sternal tunnelling

САЖЕТАК

Увод Дуготрајни пејсинг десне коморе може бити повезан са појавом срчане слабости. Једна од наредних терапијских могућности је надоградња пејсмејкер система уградњом додатне електроде за стимулацију леве коморе (ЛК). Ова интервенција може бити отежана због тромбозе приступне вене. У литератури је описан врло мали број болесника код којих је овај проблем решен уградњом електроде за стимулацију ЛК са супротне стране од претходно уграђеног пејсмејкера и супкутаном пребацивањем до првобитне ложе пејсмејкера.

Приказ болесника Мушкарац стар 75 година хоспитализован је децембра 2015. године због надоградње пејсмејкера. Године 2011, због дис-функције синусног чвора, имплантиран је антибра-дикардни пејсмејкер са леве стране. Јуна 2014. имао је прву манифестацију срчане слабости. Због дилатације и пада ејекционе фракције ЛК, а присутног високог процента коморског пејсинга, индикована је надоградња срчане ресинхронизације терапије тип П. Октобра 2015. године, покушана интервенција није успела због истостране потпуне тромбозе поткључне вене и започета је антикоагулантна терапија. Приликом последње хоспитализације, урађена венoграфија је потврдила перзистирање тромбозе леве поткључне вене те је одлучено да се имплантира нова електрода за стимулацију леве коморе са контралатералне, десне стране, а да се она поткожно, престерналним тунелирањем, пребаци до претходне ложе пејсмејкера. Интервенција је протекла без компликација, а прве контроле показале су стабилне параметре пејсмејкер функције.

Закључак Овај приказ потврђује да је контралатерална уградња нове електроде и њено пребацивање до старе пејсмејкер ложе поткожним, престерналним тунелирањем, изводљив и сигуран приступ код болесника са индикацијом за надоградњом пејсмејкер система и истостраном венском опструкцијом.

Кључне речи: надоградња пејсмејкер система; венска опструкција; поткожно престернално тунелирање

INTRODUCTION

The extending the average length of life and the indications for pacemaker implantation, has led to an increase in the number of implanted devices in the world and in our country [1]. Large randomized trials demonstrated the adverse effects of chronic right ventricular pacing associated with an increased risk of atrial fibrillation and heart failure [2,3]. Therefore, it is not surprising that the number of system upgrades to implantable cardioverter defibrillators (ICDs) or cardiac

resynchronization therapy (CRT) devices increases. The main reasons are decrease in ejection fraction of left ventricle and increase in NYHA class in patients with implanted antibradycardia pacemakers, due to the consequences of chronic right ventricle pacing [3]. In the case of system upgrade, logical approach is to try a new lead implantation on the same side where the pacemaker system has already existed. In a certain percentage of patients presence of pacemaker leads can lead to venous thrombosis. It is estimated that in 5–26% of the patients with a chronically implanted devices there is a significantly obstructed or occluded respective vein [4,5]. In these patients, it is possible to: 1) implant entire new pacemaker system on the opposite side, 2) implant LV epicardial lead via lateral minithoracotomy, 3) implant only new lead on the opposite side, which will be transferred subcutaneously, by pre-sternal tunneling, to the pocket on the other side. While the first two solutions are often used in clinical practice, the third one is rarely described in literature.

CASE REPORT

A 75-year-old male patient was admitted to the Pacemaker Center in Clinical Center of Serbia in December 2015 for pacemaker upgrade to CRT. The dual chamber pacemaker was implanted due to sinus node dysfunction in our center in June 2011. Patient was feeling better after pacemaker implantation, he well tolerated effort and had no more dizziness. Preoperatively, LV ejection fraction was 50% (according to Simpson) with LV end-diastolic volume of 110cm³. From July 2014 patient has been complaining about low effort tolerance, peripheral edema and nocturnal shortness of breath. Echocardiography that was performed in August 2014 revealed dilatative cardiomyopathy with significantly decreased left ventricle ejection fraction (32% according to Simpson) and increased left ventricle end-diastolic volume (190cm³). Since then he has been treated with optimal medical therapy for heart failure. Paroxysmal atrial fibrillation has been registered since October 2014. Stress echocardiography testing was negative. On February 2015, echocardiography was performed once again and it confirmed low left ventricle ejection fraction (34% according to Simpson) with left ventricle end-diastolic volume of 210cm³. During regular ambulatory pacemaker controls, normal function of device was ascertained, with the percentage of ventricular pacing over 90%. The percentage of ventricular pacing could not be decreased because of the long PR interval. System upgrade to CRT was indicated but the patient postponed intervention due to personal reasons.

On December 2015, the attempt to upgrade pacemaker system to CRT-P was not successful due to venous thrombosis of the subclavian vein on the left side. It was decided to administer oral anticoagulation therapy and to try to implant lead for coronary sinus on the left side, again, in two months. In the next hospitalization, before re-intervention, digital subtraction angiography (DSA) was done. The venous occlusion was verified (Figure 1), so an alternative solution was needed. We decided to try to implant the LV lead on the right side, than to shift it to the left and to connect it with the new CRT-P device in previous left prepectoral pocket. So, we implanted LV lead in the posterolateral coronary sinus tributary, using technique of the right subclavian vein puncture. Then,

we transferred the distal end of the lead subcutaneously, by pre-sternal tunneling, and connect with the new CRT device on the left side (Figure 2). To make the subcutaneous tunnel, a special chest tube was advanced from the contralateral side under guidance of a trochar. Then, the trochar was removed

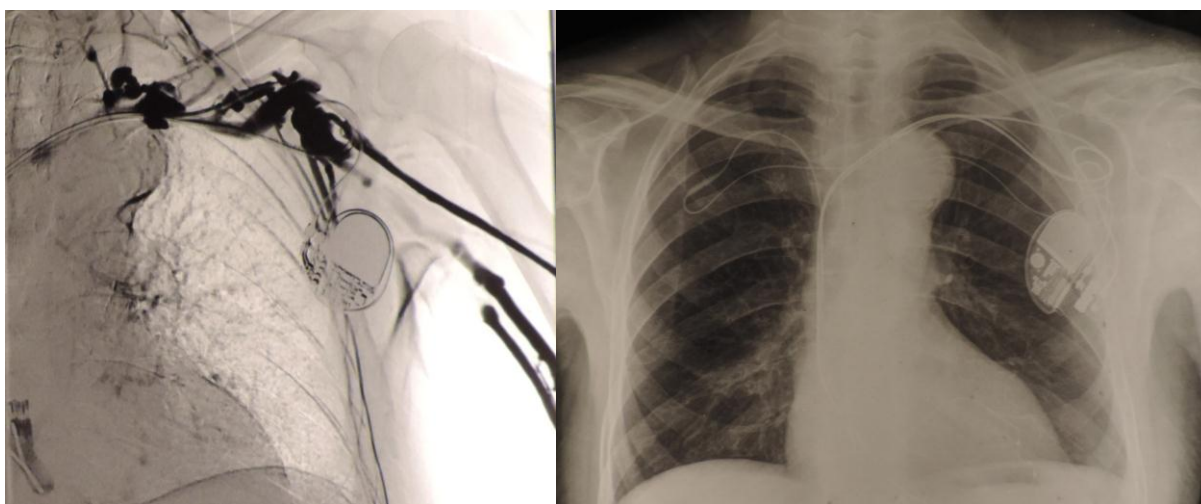


Figure 1. Digital subtraction angiography.

Figure 2. New CRT device.

and the lead was put into the chest tube. Finally, the tube was drawn out and lead was left at the side of the pocket. The intervention was done under general endotracheal anesthesia. Intraoperatively measured parameters of the pacemaker function were stable. Postoperatively, there were no complications, and patient was discharged on the first postoperative day in good condition. After one-month and three-month follow-ups CRT control showed stable parameters, with no differences in relation to those obtained during the intervention.

DISCUSSION

Many studies have confirmed the efficacy of CRT therapy in patients with symptomatic heart failure, left ventricular dysfunction and wide QRS complex [6,7]. Therefore, it is important that every patient in whom CRT is indicated achieve resynchronization. In order to reach that goal, it is valuable to have available alternative approaches. Contralateral lead placement and subcutaneous pre-sternal tunnelling of the lead to the device is an approach that has been described first by Belott in 1983 [8]. Since then, this technique has been sporadically described in literature. The only retrospective study that evaluated the acute success, complication rates, long-term lead function and subject tolerability of contralateral pacemaker lead placement and subcutaneous, pre-sternal lead tunnelling in patients with chronically implanted rhythm devices, showed that this approach has high acute success and acceptable long-term outcome [5]. In this study, one of the twenty leads had to be replaced due to structural defect and one patient reported discomfort related to the tunneled lead [5].

This approach, in regard to the other described, has significant advantages. In contrast to the approach which involves the implantation of a new system on the opposite side, when it is necessary to implant three new leads through the venous system, that significantly increases the risk of further venous thrombosis and make the starting position for a new, possible, re-intervention significantly

more difficult, in this case, only one new lead should be implanted. On the other hand, this intervention takes less time than LV lead implantation via lateral minithoracotomy, and is followed by a complete and quick recovery. Also, for an experienced operator this is not too demanding intervention, but requires the use of specific tools.

It should be noted that the subcutaneously implanted leads are more susceptible to damage, fracture. Also, unlike the implantation of the new pacemaker system on the opposite side, this is more invasive intervention, done under general endotracheal anesthesia.

Presented case is specific due to the fact that the implantation of the left ventricle lead into the coronary venous system was performed on the right side, that is more complicated approach [9]. More common situation is that this technique is used when the device is on the right side and the upgrade procedure is done by adding the left ventricle lead from the left side.

In summary, this case report confirms that contralateral lead placement and subcutaneous pre-sternal tunnelling of the lead is feasible and safe approach in patients with chronically implanted pacemaker, an indication for system upgrade, and ipsilateral vein obstruction.

REFERENCES

1. Brignole M, Auricchio A, Baron-Esquivias G, Bordachar P, Boriani G, Breithardt OA, et al. 2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy: the Task Force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA). *Eur Heart J*. 2013; 34(29): 2281–329.
2. Tang AS, Wells GA, Talajic M, Arnold MO, Sheldon R, Connolly S, et al. Cardiac-resynchronization therapy for mild-to-moderate heart failure. *N Engl J Med*. 2010; 363: 2385–95.
3. Linde C, Leclercq C, Rex S, Garrique S, Lavergne T, Cazeau S, et al. Long-term benefits of biventricular pacing in congestive heart failure: results from the MULTISITE STimulation in cardiomyopathy (MUSTIC) study. *J Am Coll Cardiol*. 2002; 40(1): 111–8.
4. Haghjoo M, Nikoo MH, Fazelifar AF, Alizadeh A, Emkanjoo Z, Sadr-Ameli MA. Predictors of venous obstruction following pacemaker or implantable cardioverter-defibrillator implantation: a contrast venographic study on 100 patients admitted for generator change, lead revision, or device upgrade. *Europace*. 2007; 9(5): 328–32.
5. Lüthje L, Zabel M, Seegers J, Zenker D, Vollmann D. Acute and long-term feasibility of contralateral transvenous lead placement with subcutaneous, pre-sternal tunnelling in patients with chronically implanted rhythm devices. *Europace*. 2011; 13(7): 1004–8.
6. Moss AJ, Hall WJ, Cannom DS, Klein H, Brown MW, Daubert JP, et al. Cardiac-resynchronization therapy for the prevention of heart-failure events. *N Engl J Med*. 2009; 361(14): 1329–38.
7. Bristow MR, Saxon LA, Boehmer J, Krueger S, Kass DA, De Marco T, et al. Cardiac-resynchronization therapy with or without an implantable defibrillator in advanced chronic heart failure. *N Engl J Med*. 2004; 350(21): 2140–50.
8. Belott PH. Use of the contralateral subclavian vein for placement of atrial electrodes in chronically VVI paced patients. *Pacing Clin Electrophysiol*. 1983; 6(4): 781–3.
9. Hsu JC, Badhwar N, Lee BK, Vedantham V, Tseng ZH, Marcus GM. Predictors of fluoroscopy time and procedural failure during biventricular device implantation. *Am J Cardiol*. 2012; 110(2):2 40-5.