

## CRT IMPLANTATION IN A PATIENT WITH CONGENITAL HEART MALFORMATION

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**Abstract.** *Treatment of patients with functional single-ventricle physiology is achieved using surgical corrections known as the “Fontan Procedure”. Two separate blood circulations are created from the single-ventricle function. These are non-cyanogenic patients, but at high risk of developing HF. CRT implantation is an option to improve the functional class and EF.*

**Key words:** CRT-P, functional single ventricle, Fontan surgery

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### INTRODUCTION

In modern cardiac surgery, treatment of patients with functional single ventricle physiology is now achieved through series of surgical corrections, known as the „Fontan procedure“ [1, 2, 3, 4]. To create the functional single ventricle physiology, a surgical correction, combined with different types of complex cyanotic cardiac abnormalities, is performed. A separation of the two blood circulations of the single ventricle function is obtained using the correction. In cases of morphological left ventricle, there is a better outcome. These are non-cyanotic patients but at high and long-term risk of low heart rate, development of heart failure and atrial arrhythmias. Even in most successful cases of corrections, a late development of heart failure occurs [5].

Hemodynamic problems are mainly associated with the single ventricle function, the lack of preload and the presence of vessel resistance [6]. Fontan anastomosis obstructions, atrial dilation, pulmonary vein obstruction and chronic venous hypertension as well as AV insufficiency are preconditions causing additional valve issues [7, 8].

We would like to present a case of a 31-year-old woman, with congenital heart abnormality of functional single ventricle and pulmonary atresia, who underwent an

implantation of a CRT system. Potts surgery (an anastomosis between the descending aorta and the left pulmonary artery in the second stage) and Fontan surgery (atrial-pulmonary connection) were performed. Due to complete AV block, a pacemaker with an epimyocardial pacing lead was implanted. Ten years after the Fontan surgery, the patient came to the clinic with severe symptoms of heart failure – NYHA functional class IV and 20% EF. In 2010, a CRT-P device was implanted to improve the pumping function and to reduce the HF. Anatomically, the venous system of the functional single ventricle was constituted by one target vessel only, defined as an anterior lateral branch (Fig. 1).

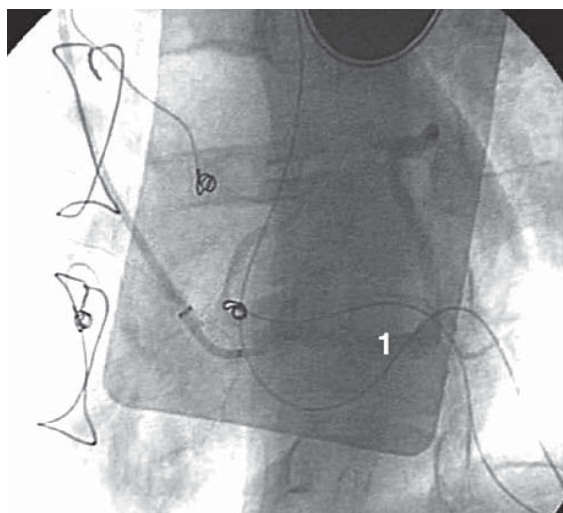
A bipolar (BP) left ventricle (LV) lead was implanted in the anterior-lateral branch of the coronary sinus (CS) (Fig. 2).

A multisite stimulation of the functional single ventricle was created between the epimyocardial and the endocardial lead with programmed VV time of 15 ms. A significant decrease in QRS duration was recorded and EF was improved (Fig. 3).

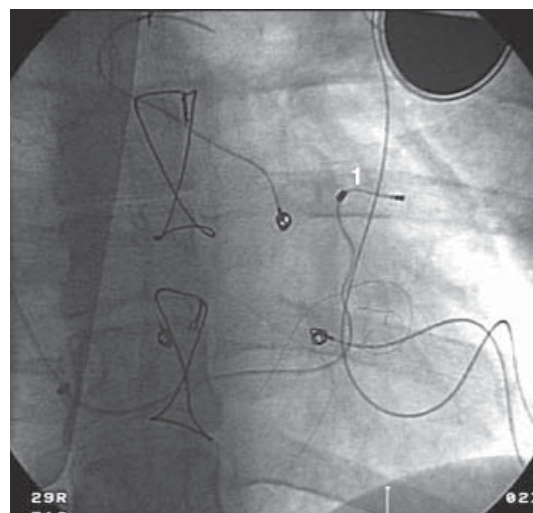
The patient was followed-up for 7 years. At the 7th year after CRT implantation, an X-ray of the multisite stimulation of the functional single ventricle was performed (Fig. 4).

In the years after the implantation, an improvement in the pumping function of the functional single ventricle up to 38% was demonstrated and these values were preserved for 3 years as the NYHA functional class improved to II-III. Seven years after the CRT

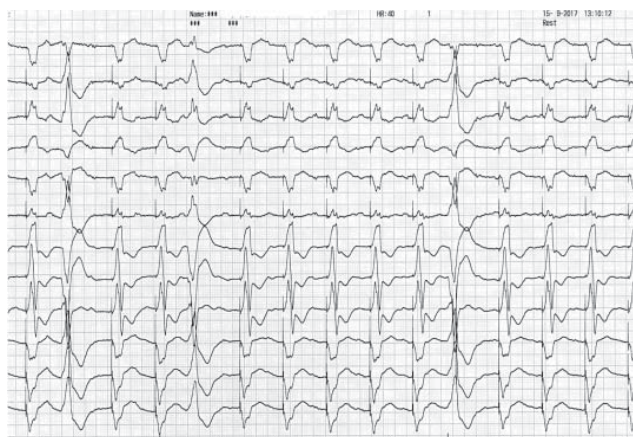
implantation, the EF of the functional single ventricle deteriorated and the patient came to the clinic with severe HF symptoms. Dysfunction of epimyocardial lead – exit block (high threshold of stimulation without ventricle capture) was found.



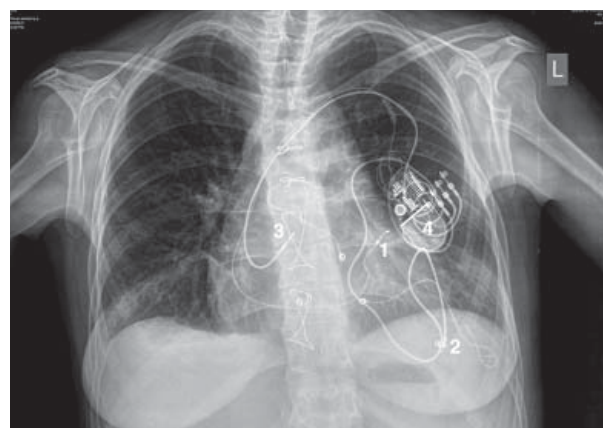
**Fig. 1.** Unobscured retrograde venography, proving anterior – lateral branch of CS, suitable for LV lead implantation



**Fig. 2.** Implantation of BP LV lead in the target vessel



**Fig. 3.** ECG records after CRT programming



**Fig. 4.** X-ray of implanted device

## CONCLUSION

Cardiac resynchronization therapy with multisite stimulation in patients with congenital heart defect of the functional single ventricle is a good option for a good clinical response to therapy.

Due to the rarity of these cases and their heterogeneity, clinical experience around the world is not sufficient for general conclusions to be drawn.

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