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Transvenous pacing in fontan circulation - with and without a lead

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Introduction: A relevant proportion of patients with Fontan circulation require cardiac pacing during their lifetime. While epicardial pacing has been the standard of care, its major disadvantage is the need for re-thoracotomy. However, pacemaker implantation via a transvenous access as an alternative is complicated due to the complex and variable anatomy. Here, we present two cases in which electro-anatomical mapping was used to identify different possibilities of transvenous pacemaker implantation.
Methods: We evaluated the possibility of transvenous endocardial pacing in two patients with Fontan circulation and need for cardiac pacing, with no other indication for cardiac surgery. The basic clinical work-up included the medical history, physical examination, ECG, stress-ECG, echocardiography and CT-imaging. Additionally, electro-anatomical mapping of the Fontan tunnel or right atrium was performed in order to identify viable myocardium for pacing.
Results: The first patient (19-year-old male) with a total cavopulmonary connection had been implanted with an epicardial pacemaker due to sinus arrest with normal AV-conduction, and presented to our clinic with an exit block of the atrial lead. The electrophysiological study with mapping of the Fontan tunnel revealed an area of acceptable sensing and pacing thresholds in the posterior aspect of the tunnel. We successfully implanted an atrial lead in this area with a sensing of 2,5 mV and an pacing threshold of 0,5V/0,4ms. The second patient (32-year-old female) with tricuspid atresia had undergone Fontan-Kreutzer correction in 1988 and implantation of the pulmonary valve as homograft in tricuspid position in 2014. She presented with syncope due to intermittent sinus arrest. Chronotropic competence was not impaired. Electro-anatomical mapping of the right atrium revealed no sensing $>$0.5mV and no pacing possibilities (pacing thresholds $>$ 10 V). Since access to the right ventricle could be achieved via the tricuspid homograft and allowed ventricular pacing, we decided to implant a MICRA leadless pacemaker (Medtronic Inc, Minneapolis, MN) within the hypotrophic right ventricle. It was successfully implanted in apico- septal position with good sensing and pacing performance. In both presented cases, sensing, pacing thresholds and impedances following pacemaker implantation remained stable during follow-up of 15 and 9 months respectively. No device- or procedure-related adverse events occurred.
Conclusions: Transvenous pacemaker implantation remains a challenge in patients with Fontan circulation. However, it is feasible in many cases, and may obviate additional thoracotomies. As our cases demonstrate, electro-anatomical mapping allows thorough evaluation of possible pacing sights. As a result, two different pacemaker systems could be implanted successfully via a transvenous access. Moreover, we present leadless pacing as an option in patients with Fontan circulation.

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Hisian pacing restores physiological cardiac function and synchrony

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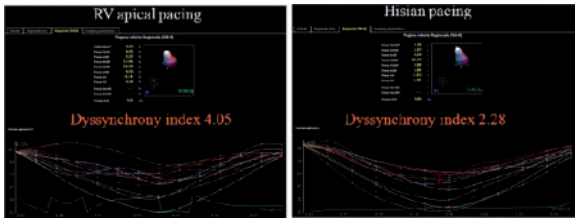
Abstract: His Bundle Pacing (HBP) provides the most physiologic activation pattern and can avoid heart failure in patients with expected high rate of ventricular pacing.
Case Report: A female patient born in 1935 was referred to our centre due to paroxysmal atrial fibrillation and hypertension. Cardiac function was normal (EF 69%). Symptoms started in 1990 when she was 55. Pharmacological therapy failed to provide complete symptoms control: flecainide had been interrupted due to side effects (iatrogenic atrial flutter 1C dependent with wide QRS and RBBB+LAHE morphology). In 1999, during summer holiday, she experienced fast AF recurrence with hospitalization in another centre where she underwent ablate and pace procedure with PM DR (paced QRS duration 200 ms). Patient developed over time permanent AF (while taking flacainide plus beta blocker) with progressive reduction in effort tolerance and contemporary deterioration in cardiac function (EF 45%). She experienced several heart failure hospitalizations over the years. In 2006 at time of device's ERI the clinical status was: advanced NYHA class III, marked reduction in effort tolerance, reduced EF but without indication for upgrading to CRT (according to guidelines). Then we upgraded the PM adding a new lead in the Hisian area and obtaining non-selective Hisian capture. The existing atrial lead was isolated. A new PM DR was connected with hisian lead in atrial port and apical lead in ventricular port. The device was programmed in DVI mode and the shortest AV interval (25 ms) was selected (thus the apical lead works as a sensing lead and back-up pacing). During follow-up symptoms quickly resolved, and ejection fraction normalized (EF at follow-up 65%). She did not have any further hospitalization after the upgrading and she's now in NYHA class I. Echocardiographic speckle-tracking analysis performed in the last May confirmed persistence of a normal EF and a good synchrony in the left ventricle.
Conclusion: Ablate and pace lead to detrimental effect of RV apical pacing due to prolonged and 100% pacing. Hisian pacing maintains a physiological ventricular electromechanical activation and consequently better LV function and clinical status. In our patient His pacing resulted in a rapid normalization of EF and resolution of heart failure symptoms.



Abstract P1242 Figure. Dyssynchrony: apical vs hisian pacing

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New approach for challenging implants in cardiac resynchronization therapy

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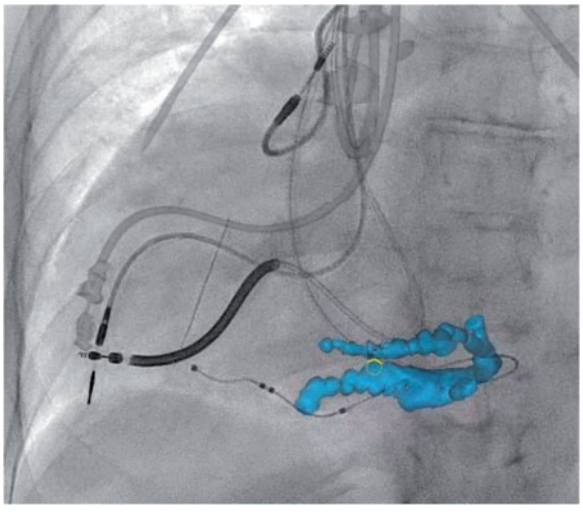
Cardiac resynchronization therapy (CRT) has been proven clinically useful to improve symptoms and prognosis in heart failure patients with significant ventricular systolic dysfunction and electric dysynchrony. Despite its technical complexity, experience and development of specific tools have made LV coronary sinus lead implant a routine with high success rates. However, specific anatomical variations may still represent a great challenge.
We present the case of 54 y.o. female with a corrected L-transposition of the great arteries, with aorta arising from the morphologic right ventricle and pulmonary artery arising from the morphologic left ventricle, and dextrocardia. The patient presented with severe systolic dysfunction of the systemic ventricle, chronic heart failure despite optimal medical therapy and important electric dysynchrony due to permanent ventricular stimulation by a conventional bicameral pacemaker implanted because of complete AV block. An upgrade implant to CRT defibrillator using integration of CT anatomical information on the fluoroscopy system was then planned.
We performed a ECG-gated multislice cardiac angiography in a CT 256-slices. With an specific software we segmented the coronary sinus and its branches, finding a lateral one appropriate for CRT, and marked the drainage area of the coronary sinus to the right atrium. Then, we synchronized the patient's position on CT and fluoroscopy. We used the pacemaker electrodes as references for registration. After that we started working with real fusion, overlapping the two image modalities in the same screen.
We implanted first a defibrillator lead in the morphologic left ventricle. The coronary sinus was then catheterized using a guide catheter with the help of a Cournand-type electrocatheter. Next, a guidewire of 0.014" was advanced distally in the lateral vein and on it, with an over-the-wire technique, a quadripolar electrode for CRT was implanted. Appropriate stimulation parameters were checked, without phrenic capture at maximum output. This case shows the potential usefulness of cardiac imaging integration, overlapping different image modalities in the same screen to guide such challenging CRT implants.



Abstract P1243 Figure. Integration of image modalities for CRT