CATHETER ABLATION

COMPLEX CASE STUDY

Fluoroleless Pacemaker Implant and Atrioventricular Node Ablation

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ABSTRACT. Usually fluoroleless procedures in electrophysiology are related to ablation and performed as an option to fluoroscopy which is readily available. This case combined two fluoroleless techniques (pacemaker implant and ablation) without fluoroscopic back up. Given the patient's size and inability of using fluoroscopy a pacemaker and an AV node ablation were performed in the patient's bariatric bed using a three-dimensional mapping system. This non-conventional procedure was driven by medical necessity and was thought to be the most effective and safest approach for the patient at the time. The author had previously described a "DOT" mapping technique to navigate catheters and establish landmarks in the patient's vascular and cardiac anatomy. He also established in a prior study during cardiac resynchronization therapy implants that the device leads can be connected to the three-dimensional mapping system (Ensight, St. Jude Medical, St. Paul, MN) which can accurately represent in real time the electrodes shape and location. These integrated experiences with fluoroleless techniques allowed a successful outcome.

KEYWORDS. atrial fibrillation, catheter ablation, cardiac pacing, imaging modalities, mapping.

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Case presentation

The patient is a 73-year-old morbidly obese male (187 kg (411 lb); height 75 inches; BMI 51.4) with multiple comorbidities (hypertension, hyperlipidemia, diabetes, restrictive cardiomyopathy, chronic diastolic heart failure, chronic volume overload, lymphedema, sleep apnea, chronic pleural effusion, pulmonary hypertension, chronic renal insufficiency, hypothyroidism). In addition, he had persistent atrial fibrillation with rapid ventricular response leading to hemodynamic compromise that had not responded to previous cardioversions and medical regimen. Given his clinical condition he was thought not to be a candidate for the atrial fibrillation ablation procedure.

Dr. Kloosterman is an advisor and consultant receiving modest honoraria from Medtronic, St. Jude Medical and Boston Scientific. Although St. Jude products were used during the case reported, the company had no involvement in the design or execution of the study or in the preparation of this manuscript. Manuscript received January 17, 2016, Final version accepted February 1, 2016.

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Atrioventricular node ablation and pacemaker implantation was required to achieve adequate heart rate control.

Procedure

The patient was brought to the electrophysiology (EP) laboratory, and it became apparent that although the fluoroscopy table weight limit was not exceeded, the patient's width constituted an unacceptable fall hazard. It was then decided to proceed with a fluoroleless technique using the patient's own special bariatric bed, which was wheeled into the EP laboratory and placed at a 30° angle (**Figure 1A,B**).

The patient was prepped and draped in the usual sterile fashion. Patches for using a three-dimensional mapping system (3D) (Ensight™, St. Jude Medical, St. Paul, MN) were applied. Conscious sedation was provided by the anesthesia service.

Using the modified Seldinger technique, the left subclavian vein was accessed, eventually placing a total of three sheaths with three separate punctures.

First a 4F quadripolar catheter was advanced for back-up temporary pacing. The catheter's position was tracked using a three-dimensional mapping system. A cardiovascular

Figure 1: (A,B) Fluoroless technique using the patient's own special bariatric bed. (C,D) A cardiovascular "DOT" map was generated along the way showing anatomic landmarks. (E) Intraoperative digital chest X-ray was obtained to confirm adequate "slack" of the pacemaker right ventricular lead. (F) Two-month postoperative chest X-ray with the system in place.

"DOT" map¹ was generated showing anatomic landmarks, with final positioning of the catheter at the right ventricular (RV) distal septum (**Figure 1D**). Using an adaptor the pacemaker 7F bipolar, passive lead (1948-58; St. Jude Medical, St Paul, MN) was connected to the 3D system in order to tract its trajectory. The lead was positioned in the mid RV septum with adequate stability, pacing, and sensing thresholds: R, 14 mV; 599 Ω ; 0.6 V for 0.4 ms (**Figure 1C,D**). A subcutaneous pocket was

created and the single-chamber pacemaker (1240; St. Jude Medical, St Paul, MN) was connected to the lead and set in place, initially programmed to VVI 40 bpm.

At this point, using a third separate access point, an 8-mm-tip F curve mapping and ablation catheter (Biosense™, Diamond Bar, CA) was maneuvered following the established 3D shell anatomic map to the level of the His bundle region, which was marked for reference (**Figure 1C,D**, yellow marker). One radiofrequency (RF) application was

delivered for 45 s, achieving persistent AV block within 15 s. A second insurance RF application was given adjacent to the first one (**Figure 1C,D**). The ablation catheter was then pulled back to the superior vena cava and temporary pacing was performed at 80 bpm (**Figure 1E**).

An intraoperative digital chest X-ray was obtained to confirm adequate “slack” of the pacemaker RV lead, which could not be otherwise accurately established (**Figure 1E**). No lead repositioning was needed, and it was then anchored to the muscle. Of note is that an external calculation of the lead-required slack was performed before inserting the lead. After confirming complete AV block for 10 min, the pacemaker final parameters were programmed with a lower-rate (LR) of 80 bpm. The temporary quadripolar catheter and the ablation catheter were then withdrawn from the body uneventfully, applying a purse string suture to the insertion site for adequate hemostasis. The pocket incision was sutured and closed. The patient tolerated the procedure well and there were no complications.

A 2-month postoperative chest X-ray is shown (**Figure 1F**) with the system in place; he remained with complete heart block.

Discussion

This case combined two fluoroless techniques (implant and ablation) in a way not previously described. The procedure was performed because of medical necessity and was thought to be the safest approach. Of note is that extensions to the fluoroscopy table were considered to increase its surface so that the procedure could be performed in a conventional way; however, the result was structurally unstable. The operating room bariatric table was not compatible for fluoroscopy.

The operator had previous experience of fluoroless techniques for ablation procedures and cardiac device implants. On this regard a “DOT” mapping technique² using a 3D mapping system (Ensite™, St. Jude Medical, St. Paul, MN) has been previously described, showing that it is helpful and very precise at depicting the vascular anatomy. As the catheter progresses, it leaves a

trail of points within the vein lumen that can be subsequently and accurately followed.

A separate experience was presented connecting cardiac device leads with the 3D mapping system (Ensite™, St. Jude Medical, St. Paul, MN) to establish and track their positions. This was performed during cardiac resynchronization therapy implants, with a detailed electroanatomic representation of the cardiac and venous anatomy, including the coronary sinus branches along with the lead shape, position, and activation electrogram recordings.² Although in this case a passive lead was used, an active fixation lead could have been an alternative. In that case, pre-testing of the number of turns required to deploy the screw and attention to current injury and the usual parameters (impedance, sensing and pacing thresholds) to establish adequate lead fixation would be warranted.

Conclusion

Fluoroless atrioventricular node ablation and pacemaker implant is feasible and can be safely performed with an operator experienced in this technique. Although this was an extreme case requiring a fluoroless approach, this technology may be expanded for cardiac device implantation, provided additional tools continue to be developed.

References

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