Left Atrioventricular Groove Mapping Via Placement of a Multipolar Electrode Microcatheter in the Circumflex Coronary Artery

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A 6-year-old boy with Wolff–Parkinson–White syndrome underwent his third electrophysiology study and attempted ablation of a left-lateral accessory pathway. He had previously suffered an out-of-hospital ventricular fibrillation arrest with prolonged resuscitation and subsequent neurological injury. Prior electrophysiology studies were complicated by multiple pathways and rapid conduction of a left-lateral pathway with difficulty differentiating atrial from ventricular electrograms. Previous electrophysiologic catheterization had documented abnormal coronary sinus anatomy with a persistent left superior vena cava to the coronary sinus. Because the coronary sinus was not paralleling the atrioventricular groove, the signals from the coronary sinus catheter showed pure atrial electrograms. After heparin was administered, a left coronary artery angiogram was performed that demonstrated abnormal coronary sinus anatomy with a persistent left superior vena cava to the coronary sinus and coronary sinus ostial atresia.

A decapolar catheter was placed in the coronary sinus from the right femoral vein, through the right atrium, right superior vena cava, across the innominate vein, and down a persistent left superior vena cava to the coronary sinus. Because the coronary sinus was not paralleling the atrioventricular groove, the signals from the coronary sinus catheter showed pure atrial electrograms. After heparin was administered, a left coronary artery angiogram was performed that demonstrated a discrepancy between the true atrioventricular groove as delineated by the circumflex coronary artery and the connection of the left superior vena cava to the coronary sinus. A 2.5 French 16-pole catheter (Cardima, Fremont, CA) was then advanced through a 5 French Judkins right coronary catheter into the left main coronary artery and positioned in the circumflex coronary artery for mapping and anatomic localization (Figures 1 and 2). With the EnSite three-dimensional system (St. Jude Medical, Endocardial Solutions, St. Paul, MN), electroanatomic mapping was performed both in pre-excited sinus rhythm and with ventricular pacing. In pre-excited sinus rhythm, the earliest ventricular electrogram was seen on the coronary artery catheter (Figure 3) which localized the pathway to the lateral mitral annulus. The location of these early ventricular electrograms was saved in the three-dimensional system, and the microcatheter was removed from the coronary artery. There were no arrhythmias or ST segment changes.

Using the three-dimensional mapping obtained from the left coronary artery catheter position, endocardial radiofrequency ablation was then attempted via transseptal and transaortic approaches. Cryoablation was also attempted retrograde from the coronary sinus. The procedure was unsuccessful from an endocardial approach. The patient was referred for arrhythmia surgery where he was found to have adhesion of the left atrial appendage to the left ventricular wall. Successful surgical resection was performed.

The use of a coronary microcatheter to map abnormal atrioventricular grooves has been reported by Olgun et al., who describe right coronary artery mapping for patients with structurally normal hearts, tetralogy of Fallot, single ventricle, and dilated cardiomyopathy. One case of left circumflex mapping in a patient with double-inlet left ventricle and pulmonary stenosis was also reported in the same article.

These images demonstrate how microcatheter mapping of the left circumflex coronary artery, when used in
conjunction with a three-dimensional electroanatomic mapping system, can be a valuable technique when the coronary sinus does not follow the atrioventricular groove. This case also shows that this approach is useful in recording epicardial activation that is earlier than any endocardial site, suggesting an unusual, and possibly epicardial, atrioventricular connection.

References
Figure 2: Left anterior oblique (LAO) of coronary microcatheter in the circumflex coronary artery (CA). His (quadrapolar catheter in the His position); Decapolar catheter advanced to the coronary sinus through a persistent left superior vena cava (LSVC to CS).

Figure 3: Coronary microcatheter electrograms in pre-excited sinus rhythm. Earliest ventricular electrogram at the 5–6 bipole of the 16 pole catheter (CAR 5–6).