Isolation of an Automatic Purkinje Focus for Ablation of an Incessant Ventricular Tachycardia

Nikola Pavlović, MD; Tobias Reichlin, MD; Sven Knecht, ScD; Aline Mühl, MS; Michael Kühne, MD; Christian Sticherling, MD

Case Report
A 19-year-old man was admitted with an incessant ventricular tachycardia (VT, 150–170 beats per minute). Structural heart disease was ruled out by echocardiography and magnetic resonance tomography. The 12-lead ECG revealed a left bundle-branch block morphology (QRS, 142 ms) and a late precordial R/S transition (Figure 1). During an electrophysiological study, rapid atrial pacing temporarily suppressed the VT, which returned after cessation of atrial pacing. Using an electroanatomic mapping system (CARTO 3, Biosense Webster Inc, Diamond Bar, CA), the site of earliest ventricular activation was found mid-anteroseptal region of the right ventricle. Here, high-frequency Purkinje potentials (PP) preceded the ventricular activation by 42 ms. Radiofrequency energy applied in a power-controlled mode terminated the VT. During sinus rhythm, normal AH (atrio-His) and HV (His-ventricular) intervals and an ablation-induced right bundle-branch block were documented. After 48 hours, the VT recurred, now slower with a wider QRS complex (200 ms) and the earliest ventricular activation was now found distal and more lateral to the previous ablation site (Figure 2A). The earliest PP preceding the QRS complex by 82 ms, however, was found on the right ventricular septum at the septal insertion of the moderator band (Figure 2B). Ablation at this site terminated the tachycardia. The intracardiac electrogram recorded from the proximal electrodes of the ablation catheter positioned at the successful ablation site is shown in Figure 3. With VT termination, an exit block from the Purkinje focus to the ventricle was observed (asterisk). The focus was active with the same cycle length but the PPs were now dissociated from ventricular activation in sinus rhythm. Additional ablation in this area abolished the PPs.

Discussion
We report a case of an incessant automatic VT originating from the Purkinje system of the right ventricle. We could prove the automaticity by terminating the VT by isolation of the continuously firing Purkinje focus. Because of extensive previous ablation more septal and proximal to the earliest activation, it is possible that several exits from the Purkinje focus had already been ablated. This can be seen in Figure 2A where the earliest ventricular activation is more lateral to the earliest PP and along the lateral wall while more septal and basal parts of the ventricle are activated later. The differences in activation patterns between images Figure 2A and Figure 2B depend on whether early ventricular or PP activation is annotated. This shows that an electroanatomic mapping system is a helpful tool for mapping and ablation; however, understanding the arrhythmia mechanism is crucial for successful ablation. The suggested target for ablation of a focal Purkinje tachycardia is the earliest PP preceding the QRS in VT.1–3 Although exit block, defined as PP not conducted to the ventricle, has been noticed and reported in patients with Purkinje-related PVCs,3 to our knowledge, this is the first report describing exit block from the Purkinje focus with termination of the VT during ablation and ongoing dissociated activity of the focus in sinus rhythm.

Disclosures
Dr Pavlović was supported by an educational grant of the EHRA (European Heart Rhythm Association). A. Mühl is a former employee of Biosense Webster. Dr Kühne has served on the speakers’ bureau for Boston Scientific, St. Jude Medical and Biotronik and serves as a proctor for Medtronic. He has received lecture/consulting fees from Sorin, Boehringer Ingelheim, Bayer, Sanofi Aventis, Novartis and MSD. He has received unrestricted grants from Sanofi Aventis, Bayer, and Boehringer Ingelheim. Dr Sticherling has served on the speakers’ bureau for Medtronic, Biotronik, Boston Scientific, Sorin and Sanofi Aventis, has received study grants from Boston Scientific and Biotronik, and has received consulting fees from Sanofi Aventis and Medtronic. The other authors report no conflicts.

References

Key Words: ablation techniques ■ Purkinje fibers ■ tachycardia, ventricular
Figure 1. Twelve-lead ECG showing wide QRS tachycardia, with left bundle-branch block morphology, late precordial transition, and left superior axis.

Figure 2. A, Right anterior oblique (RAO) view on a CARTO activation map during the ventricular tachycardia in the second procedure. Tagging only ventricular activation, the earliest activation is mid-anterolateral in the right ventricle. Septal and more basal parts are activated later. White dots indicate areas with Purkinje potentials preceding the QRS during the tachycardia. B, Same view on a CARTO activation map during the second ablation. Purkinje potentials are tagged and the earliest activation now shifts to the mid-anteroseptal right ventricle. Red dots indicate the successful ablation site. The site with documented Purkinje exit block is marked in dark blue. White dots indicate areas with Purkinje potentials preceding the QRS during tachycardia.

Figure 3. Intracardiac recording at the successful ablation site. Abl d and p indicate distal and proximal electrodes on the ablation catheter. Surface ECG leads are also shown. On the ablation catheter, a small Purkinje potential can be seen preceding the QRS by 82 ms (arrows). After the beat marked by asterisk, tachycardia terminates with block between the Purkinje and the ventricular potential. Purkinje potential automaticity continues dissociated from both the atrium and the ventricle (arrows). HRA indicates high right atrium.
Isolation of an Automatic Purkinje Focus for Ablation of an Incessant Ventricular Tachycardia

Nikola Pavlovic, Tobias Reichlin, Sven Knecht, Aline Mühl, Michael Kühne and Christian Sticherling

*Circ Arrhythm Electrophysiol.* 2014;7:1275-1276
doi: 10.1161/CIRCEP.114.001971

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circep.ahajournals.org/content/7/6/1275

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Circulation: Arrhythmia and Electrophysiology* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to *Circulation: Arrhythmia and Electrophysiology* is online at:
http://circep.ahajournals.org//subscriptions/