**RAPID COMMUNICATION**

**Novel Three-Dimensional Imaging of the Anatomical Relationship Between the Pulmonary Vein and Left Atrium**

--- Transparent View ---

Minoru Yamada, MS; Masahiro Jinzaki, MD*; Kozo Sato, MD*; Yutaka Tanami, MD*; Kotaro Fukumoto, MD**; Kojiro Tanimoto, MD**; Seiji Takatsuki, MD**; Satoshi Ogawa, MD**; Sachio Kuribayashi, MD*

**Background:** Visualization of the inner anatomical relationship of the pulmonary veins (PVs) and left atrium (LA) is important for achieving a better success rate and avoiding complications in circumferential LA ablation for atrial fibrillation (AF).

**Methods and Results:** Twelve patients with AF underwent computed tomography and novel post-processing images that emphasized the boundaries of the PVs and LA were produced.

**Conclusions:** The “Transparent View” images enabled visualization of the inner anatomical relationship of the PVs and LA in the same geometry as in pulmonary venography in all cases. (Circ J 2009; 73: 573–574)

**Key Words:** Multidetector-row computed tomography; Post-processing; Pulmonary vein ablation

Circumferential left atrial ablation to isolate the pulmonary veins (PVs) from the left atrium (LA) has become a common method of treating atrial fibrillation (AF). In this procedure, detailed anatomic information about the PVs, LA, and left atrial appendage (LAA) plays a crucial role, because the PV–LAA boundary corresponds to the anterior cauterization line. However, it is sometimes difficult to understand the anatomical relationships in this region using pulmonary venography alone.

**Editorial p 436**

Multidetector-row computed tomography (MDCT) has made it possible to visualize the anatomy of the PVs and their surrounding structures, with use of post-processing techniques to enhance the images. Although several novel methods of displaying cardiac computed tomography (CT) images have been reported, there has not been a post-processing technique that can visualize the inner anatomy in a single image in accordance with the findings on pulmonary venography. Standard volume rendering (VR) images do not allow visualization of the inner construction because the surface is not transparent. Endoscopic views pose difficulties in terms of observation in the same geometry as on pulmonary venography, because of the perspective projection. Hence, we propose a novel post-processing imaging technique that enables visualization of the inner anatomical relationships of the PVs, LA, and LAA in the same geometry as that afforded by pulmonary venography, and present its advantages.

The newly proposed post-processing “Transparent View” images, based on the VR technique, are obtained in 3 steps: (1) the PV and LA, including the PV wall and LA muscle, are segmented; (2) the standard VR technique is applied; (3) a VR parameter, opacity, is switched to the parameter that is scaled by the voxel’s gradient magnitude to emphasize the boundaries between the lumina and the soft tissues. The Transparent View is produced with parallel projection (Figure 1).

In 12 patients (10 with paroxysmal AF, 2 with persistent AF) scheduled for PV ablation, ECG-gated contrast-enhanced CT examination was carried out using a 64-slice MDCT (LightSpeed VCT, GE Healthcare, Milwaukee, WI, USA). The scanning protocol was as follows: collimation, 64×0.625 mm, 120 kV, 400–500 mA, rotation time, 0.35 s, helical pitch, 0.2–0.24. The iodine contrast medium was injected at a volume of 40–60 ml (Iopamidol 370 mgI/ml, Bayer Schering, Berlin, Germany), followed immediately by 20 ml of saline, at the rate of 3–4 ml/s. During the CT scan, heart rate monitoring revealed 55–66 beats/min in sinus rhythm in 10 patients, and AF in 2 patients. The reconstructed axial images were transferred to a workstation (Advantage Workstation, GE Healthcare) and the Transparent View was produced as described. In all cases, the Transparent View images enabled visualization of the inner anatomical relationships of the PVs, LA and LAA in the same geometry as in pulmonary venography (Figure 2).
High contrast attenuation is not necessarily required for creating “Transparent View” images. In this study, the attenuation of PV and LA was distributed from 203 to 488 HU. All cases were successfully created, even in the case of low attenuation, opacity is defined by the voxel’s gradient magnitude to emphasize the boundaries between the lumina and the soft tissues. Thus, a reduction in the amount of contrast medium is made possible. Transparent View images can also be observed with parallel projection during the session at the same time as the fluoroscopic images, and rotated to match the orientation of pulmonary venography, which may reduce the operational procedure time and improve the therapeutic results. Previous studies have reported the fusion of the standard VR image and pulmonary venogram or the fusion of the standard VR image and an electroanatomical map. Because the Transparent View image is based on the VR technique, we expect the possibility of fusion with either the pulmonary venogram or the electroanatomical map.

In conclusion, we propose a new post-processing image that enables visualization of the inner anatomy between the PVs and LA, similar to that of pulmonary venography. We hope that this method will become widespread and widely used.

References