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Case Report

A case of extensive encircling pulmonary vein isolation in a patient with severe scoliosis

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ABSTRACT

The patient was a 62-year-old man with atrial fibrillation and severe scoliosis. Scoliosis may impair cardiorespiratory function. Enhanced computed tomography (CT) was helpful for the Brockenbrough method. Three-dimensional (3D) mapping also demonstrated clockwise rotation of the heart. We successfully isolated extensive encircling pulmonary vein in this patient using enhanced CT and 3D mapping. The CT venous images revealed appropriate localization of the vein and heart. CT and 3D mapping may ensure a more stable and safer procedure.

1. Introduction

The magnitude of spinal deformity is quantified by the Cobb angle, especially in the case of scoliosis. To measure the Cobb angle, we must first identify the vertebrae involved in the curvature deformity (i.e., upper and lower extent). The Cobb angle is formed by the intersection of two lines, which are parallel to the endplates of the superior and inferior vertebrae. The angle may be manually or digitally plotted, and scoliosis is defined as a lateral spinal curvature with a Cobb angle of 10° or more.

Scoliosis forms a complex curve in all three planes, not only in the coronal plane, leading to deformities caused by the self-rotating movement of the spine [1]. Spinal anomalies may impair cardiorespiratory function.

Atrial fibrillation (AF) is increasing in prevalence, and catheter ablation has become the first-line therapy in patients with symptomatic, recurrent, or drug-refractory AF. We are confronted with many difficult cases with anatomic variations, such as severe scoliosis.

2. Case report

A 62-year-old man visited our emergency department complaining of palpitations. His Cobb angle was over 50°, indicating severe scoliosis [Fig. 1(A)]. He was diagnosed with paroxysmal AF, and the heart rhythm was restored to normal by defibrillation. We planned to perform catheter ablation on an outpatient basis.

Computed tomography (CT) performed prior to ablation revealed that the inferior vena cava did not join the right atrium (RA) as expected, but joined horizontally.

We performed the Brockenbrough method safely under CT guidance, but an ordinary radiofrequency (RF) needle (Japan Lifeline Co.) was unsuitable for the patient. Normally, the Brockenbrough needle is positioned posterior to the septum at approximately 5 o'clock, but CT had shown that the patient's heart was rotated clockwise from the usual position. The needle was curved and positioned at 4 o'clock in this case [Fig. 1(B)].

After transseptal puncture, we obtained an X-ray image of the left atrium (LA) following injection of a radiopaque dye. CT performed prior to the procedure was integrated into the 3-dimensional (3D) reconstruction electromechanical map of the patient's atrium (EnSite® NavX®, St. Jude Medical Inc. St. Paul, Minnesota, USA). The 3D map also showed abnormal position and clockwise rotation of the heart: both the LA and RA were rotated clockwise. The anatomical relationship between the esophagus and pulmonary vein is shown in Fig. 1(C).

The right pulmonary vein was difficult to isolate because there was insufficient space for manipulating the ablation catheter near the right pulmonary vein [Fig. 2(A)]. The ablation catheter was positioned slightly differently in the RA isthmus [Fig. 2(B)]; however, we successfully performed extensive encircling pulmonary vein isolation and ablation of the RA isthmus without any complications, using enhanced CT and 3D mapping [Fig. 2 (C) and (D)].

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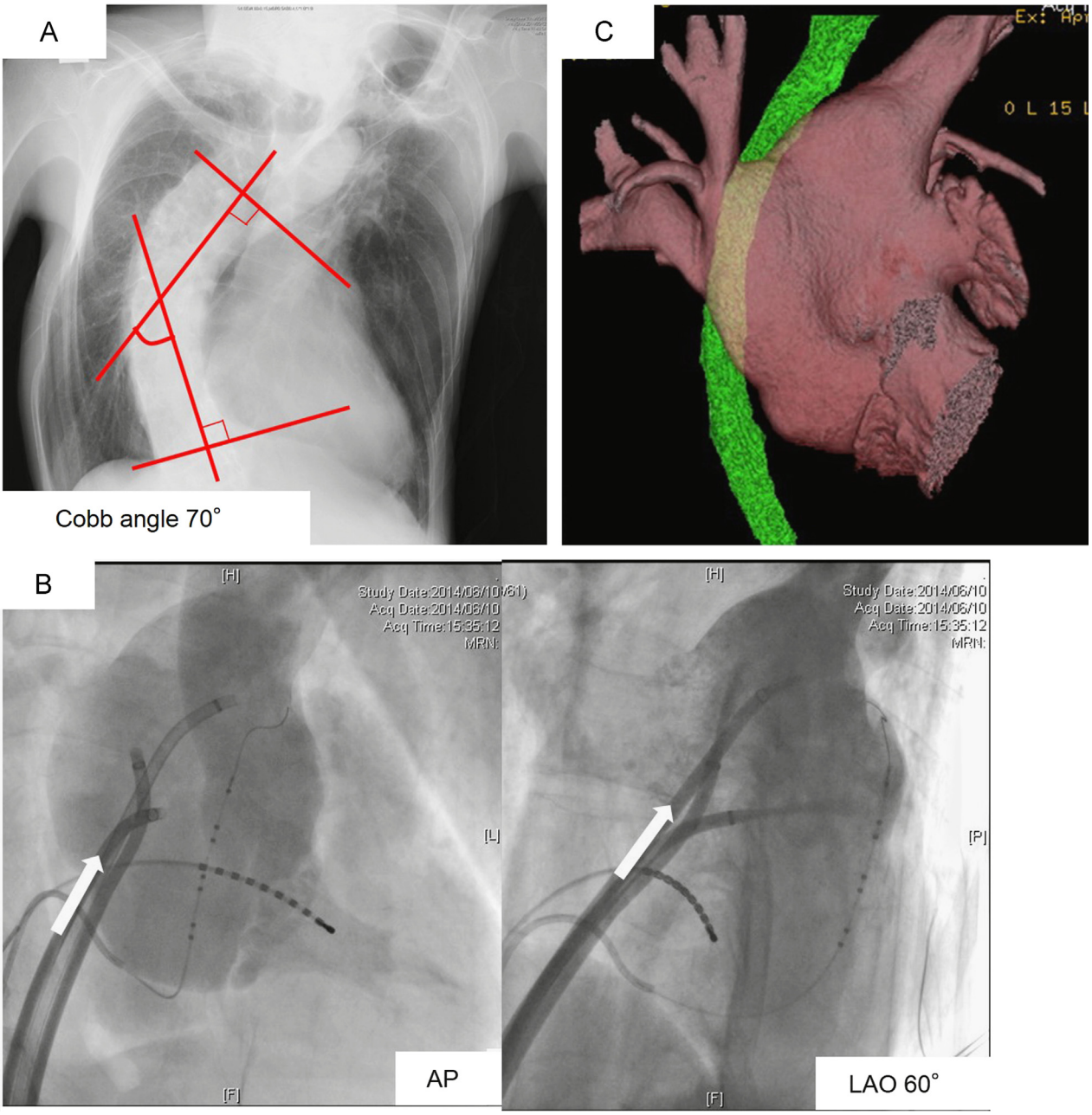

Fig. 1. The anatomic locations. Chest X-ray (posteroanterior view) (A); the left atrial (LA) angiogram in the anteroposterior and left anterior oblique views (B); and the 3-dimensional computed tomography (3D CT) image of the LA and esophagus (C). (A) The Cobb angle was 70° and severe scoliosis was diagnosed. (B) The LA was positioned in clockwise rotation. The Brockenbrough needle was positioned in the septum at 4 o'clock. The white arrows indicate the Brockenbrough needle direction. (C) The esophagus was located immediately behind the right pulmonary vein.

3. Discussion

This is the first case report to describe AF ablation in a patient with scoliosis. AF ablation with scoliosis required extra precautions with respect to the anatomical position, based on data obtained by CT. The superimposition of pre-acquired CT/magnetic resonance imaging (MRI) images onto the electroanatomic 3D reconstruction is associated with an improved clinical outcome in AF ablation procedures [2]. 3D-CT fusion images provide an excellent overview of the morphology of the LA and pulmonary vein, thereby enhancing the safety of the AF ablation procedures [3].

There are many instances of angiectopia other than those associated with scoliosis. For example, anomalies and variations of inferior vena cava anatomy without abnormal cardiac comorbidity occur in approximately 0.3% of the population, depending on the specific abnormality [4]; however, these anatomical variations are often clinically silent and incidentally discovered. Venous CT images, particularly in cases that are anatomically different, ensure appropriate localization of the vein and heart. Prior CT is very effective to avoid discovering unexpected anatomical differences during ablation. Therefore, not only 3D CT reconstruction of the LA and pulmonary vein, but also venous CT images, is important in AF ablation with complex heart and vein morphology.

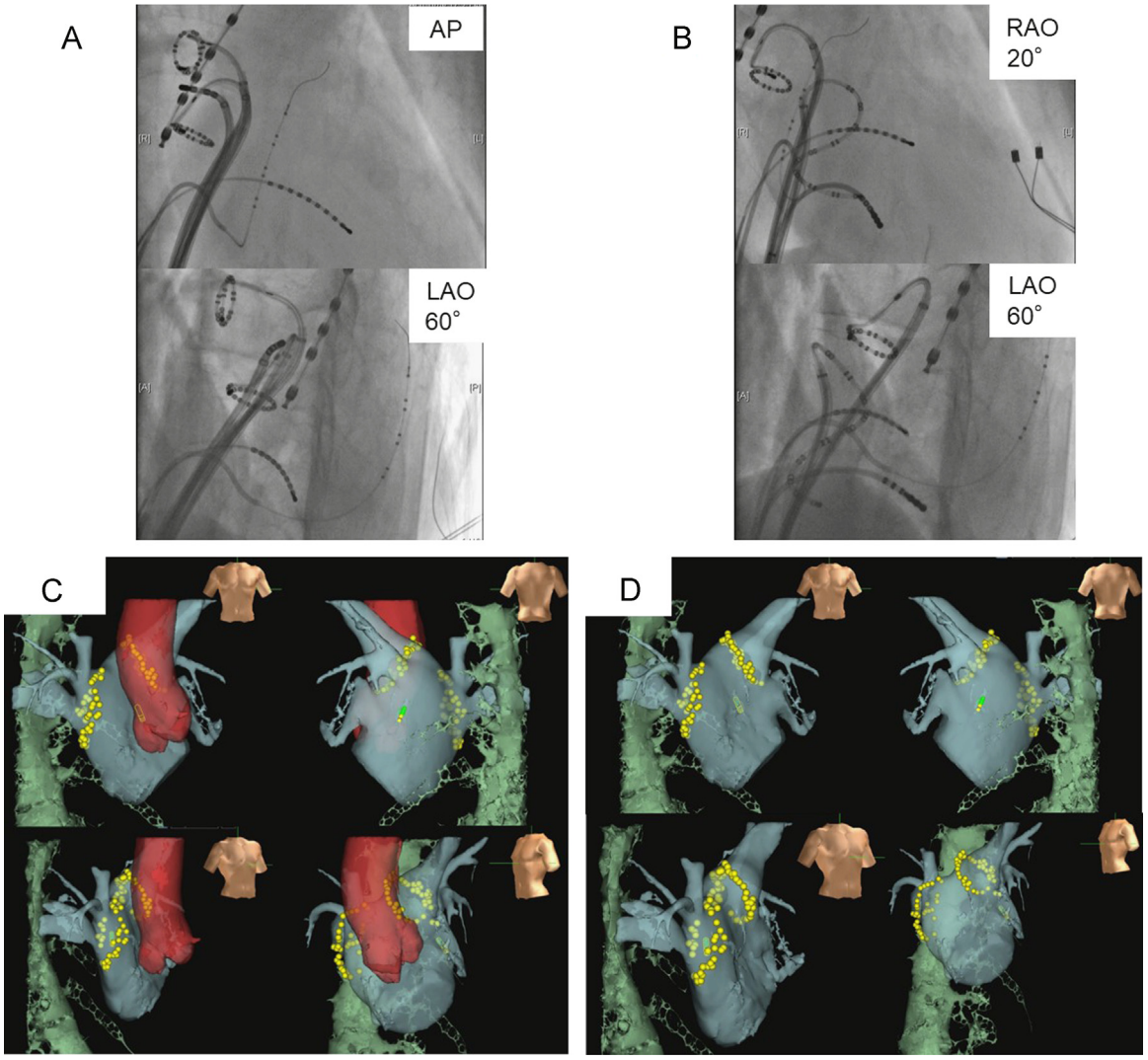

Fig. 2. The ablation points. The X-ray image of the right pulmonary vein in the anteroposterior and left anterior oblique views (A); the X-ray image of the right atrial (RA) isthmus in the right anterior and left anterior oblique views (B); the 3D CT image of the aorta, spine and LA (C); and the ablation points in the 3D CT image (D). (A) To clarify the position of the right pulmonary vein, this fluoroscopy image shows the ring catheters located in the right pulmonary vein. (B) The RA was positioned in clockwise rotation. The start position of the RA ablation catheter is shown in this figure. (C) The 3D CT shows the anatomical relationship between the aorta, spine, and LA. (D) The dots are ablation points. To make the ablation points visible, the aorta was erased.

Conflict of interest

The authors have no conflict of interest to disclose.

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