A case for ambidextrous doctors

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We report the case of a 30-year-old man with situs inversus totalis, recurrent orthodromic reciprocal tachycardia, and the Wolff–Parkinson–White syndrome. He underwent, in our department, radiofrequency ablation of an accessory pathway (AP) located in the lateral mitral atrioventricular ring. Ablation of the AP was carried out successfully through a patent foramen ovale under fluoroscopic guidance, in a right anterior oblique projection with a 30° tilt and in anteroposterior views. We also used a mirror reversal of electrocardiogram (ECG) leads to better judge the site of the AP by using existing ECG algorithms. Complete situs inversus is a rare disorder, which has no consequence for the patient in the absence of cardiac or extracardiac involvement. Ablation of APs in situs inversus has been previously reported in only three cases of complete situs inversus and one case of situs ambiguous. In patients with mirror-image dextrocardia, APs seem more often located on the ‘left’ free wall (mitral annulus), as in the normal population. Radiofrequency ablation is feasible and safe after mirror reversion of the ECG electrodes and fluoroscopy.

We report the case of a 30-year-old man with known situs inversus totalis and without structural cardiac abnormalities admitted in our arrhythmia department for accessory pathway (AP) radiofrequency (RF) ablation.

Case report

A 30-year-old man was referred to our institution for recurrent episodes of palpitations. Past medical history was significant for complete situs inversus without associated structural cardiac abnormalities. On admission, we obtained first a standard 12-lead electrocardiogram (ECG) (Figure 1, left) and another one with inversion of the precordial and upper limb electrodes (Figure 1, right). Standard ECG shows sinus rhythm with a right axis deviation of the QRS (+120°) and negative QRS from V2 to V6 in the precordial leads. This last finding associated with a right axis deviation of the P-wave (+120°) and a negative P-wave in I and aVL confirms the diagnosis of dextrocardia and rules out an electrode displacement. A short PR interval is associated with a delta wave in leads III and aVF, suggesting

![Figure 1](https://academic.oup.com/europace/article-abstract/12/11/1645/486165)

Figure 1  (Left) Standard ECG.  (Right) Twelve-lead ECG with complete inversion of precordial and limb electrodes.
the Wolff–Parkinson–White syndrome. After reversion of upper limb electrodes (Figure 1, right), ECG shows sinus rhythm with normal P-wave morphology (positive in leads I, II, and III), short PR interval with a delta wave in leads I, II, III, aVF, V3, V4, V5, and V6, and a normal QRS axis. A small Q-wave is seen in aVL, suggesting the presence of an AP in the mitral atrioventricular ring (morphologically ‘left lateral’ although anatomically situated at the right).

The next day, an electrophysiological study confirmed the presence of an AP with short anterograde refractory periods (<250 ms), located in the lateral mitral annulus. During coronary sinus pacing, a typical orthodromic atrioventricular re-entrant tachycardia (AVRT, Figure 2A) was induced and degenerated into non-sustained atrial fibrillation with spontaneous termination. Ablation was performed using a modified 12-lead ECG (precordial leads from left to right: V2, V1, V3R, V4R, V5R, and V6R; inverted limb leads) and a 4 mm-tip catheter (Mariner MC, Medtronic Inc., Minneapolis, MN, USA) with an anterograde approach through a patent foramen ovale. Mapping to localize and ablate the AP was performed under fluoroscopic guidance in a right anterior oblique (RAO) projection with a 30° tilt (Figure 3A) and in anteroposterior views. Although an unusual approach, the ablation was performed during tachycardia instead of sinus rhythm because of incessant orthodromic reciprocal tachycardia during coronary sinus pacing (performed to enhance pre-excitation, which is the usual way of ablating left-sided APs, Figure 2B). The first RF application terminated reciprocal tachycardia within 4 s and suppressed only transiently the anterograde conduction of the AP which recurred shortly after RF cessation. The RF catheter was then repositioned to an atrioventricular ring site where ventricular–atrial (VA) fusion was observed during new episodes of AVRT (Figure 2C). A second RF application (temperature-control mode set to 60°C, mean temperature during RF = 55°C) delivered at this site suppressed tachycardia, as well as both anterograde and retrograde conductions within 4.5 s (Figure 3B). The final ECG showed PR lengthening and disappearance of the Q-wave in modified aVL (Figure 2D). Adenosine infusion at 30 min showed blocked P-waves without pre-excitation and the absence of retrograde VA conduction. The fluoroscopy time was 21 min and the total procedure time was 120 min (including 30 min of observation after the successful lesion application). No complication occurred. The follow-up remains unremarkable.
Discussion

Situs inversus totalis is a rare disorder which has no consequence for the patient in the absence of an associated structural organ abnormality. This disease belongs to congenital laterality defects (or heterotaxy) including isolated dextrocardia, situs inversus totalis (mirror image of normal visceroatrial arrangement) and situs ambiguous (visceroatrial isomerism). Heterotaxia prevalence has been reported to occur in 1.78 per 10,000 live births\(^1\) and dextrocardia in 1 per 12,019 pregnancies.\(^2\)

Although all experienced ablationists have had or will have to confront with AP ablation in patients with dextrocardia, this situation has been rarely reported on. Only two cases of AP RF ablation in patients with isolated situs inversus totalis have been reported [a left (mitral annulus)\(^3\) and a right (tricuspid annulus)\(^4\) free wall APs]. A third case\(^5\) was reported in a patient with Kartagener’s syndrome (autosomal recessive disease associating situs inversus totalis, primary ciliary dyskinesia with nasal polyposis, and bronchiectasia) with a left free wall AP. Another case was described in a patient with incomplete situs inversus and a right posteroseptal AP. It appears that in patients with mirror-image dextrocardia (situs inversus totalis) in the absence of additional congenital defects, APs are more often located on the mitral ring, as in the normal population. Radiofrequency ablation was performed in all cases with no major difficulties after mirror reversion of the ECG electrodes and fluoroscopy. Although successful, such procedures did pose a challenge for electrophysiologists accustomed to different anatomical landmarks.

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References


Figure 3 (A) A 30\(^\circ\) RAO fluoroscopic view of the catheters during the first RF application which suppressed transiently the AP. (B) A 30\(^\circ\) left anterior oblique fluoroscopic view during the second successful RF application at a more ventricular site. ABL, 4 mm ablation catheter inserted anterogradely through a patent foramen ovale; DEC, decapolar catheter; RV, right ventricular quadripolar catheter. (C) Anteroposterior chest X-ray showing situs inversus totalis: G, ‘gauche’ (in French = left); RMB, right main bronchus, located to the left side; S, stomach (air pocket); L, liver.