

# Successful detection of covert paroxysmal atrial fibrillation due to Insertable Cardiac Monitor in embolic stroke of undetermined source in a patient with situs inversus totalis

Yuhei Kasai<sup>1</sup>, Sandeep Shakya<sup>1</sup>, Kotaro Miyaji<sup>1</sup>, and Junji Kanda<sup>2</sup>

<sup>1</sup>Affiliation not available

<sup>2</sup>Asahi General Hospital

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## Abstract

We describe a case of ICM implantation in a 74-year-old woman with SIT and ESUS for detection of AF. ICM implantation was performed successfully without any complications. AF was detected at 28 days after ICM insertion. ICMs can be safely implanted in patients with SIT, allowing successful detection of AF.

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Yuhei Kasai<sup>1</sup>, Sandeep Shakya<sup>1</sup>, Kotaro Miyaji<sup>1</sup>, Junji Kanda<sup>1</sup>

<sup>1</sup> Department of Cardiology, Asahi General Hospital, Chiba, Japan

Correspondence to: Dr. Yuhei Kasai, MD.

1326, I, Asahi-city, Chiba 2892511, Japan

Tel: +81-479-63-8111; Fax: +81-479-62-8383

email: yuheikasai\_1025@yahoo.co.jp

## KEYWORDS

embolic stroke of undetermined source, covert paroxysmal atrial fibrillation, insertable cardiac monitor, situs inversus totalis

## Key Clinical Message

Insertable Cardiac Monitors are feasible in patients with situs inversus totalis. Care must be taken to note the opposing anatomic locations of electrical conduction systems such as sinoatrial node, atrioventricular node, and His-Purkinje system.

## Abstract

We describe a case of ICM implantation in a 74-year-old woman with SIT and ESUS for detection of AF. ICM implantation was performed successfully without any complications. AF was detected at 28 days after ICM insertion. ICMs can be safely implanted in patients with SIT, allowing successful detection of AF.

## 1 | INTRODUCTION

Approximately 25% of all ischemic strokes are cryptogenic.<sup>1</sup> Of these, a clinical entity of embolic stroke of undetermined source (ESUS) was recently established. ESUS is defined as a non-lacunar brain infarction without a proximal arterial steno-occlusive lesion or cardioembolic source. Thus, the pathogenesis of ESUS is varied and includes covert paroxysmal atrial fibrillation (CPAF), aorto/arteriogenic embolism, paradoxical embolism, and cancer-related embolism. CPAF is a major cause of ESUS.<sup>1</sup> However, detecting CPAF during hospitalization is often difficult, even with continuous electrocardiographic (ECG) monitoring.

Insertable cardiac monitors (ICMs) combined with remote monitoring have been used in ESUS patients with mild symptoms (modified Rankin scale from 0 to 2) to detect CPAF and to prevent recurrent ischemic stroke. ICMs are usually implanted into the left margin of the sternum, from the 3<sup>rd</sup> to the 6<sup>th</sup> intercostal space parallel to the cardiac shadow, using the provided insertion tools.<sup>2</sup> Because these tools are very simple and easy to use, complications of ICM (e.g., bleeding or infection) are very rare. However, to our knowledge there are no reports of ICM implantation in patients with situs inversus totalis (SIT). Herein, we describe ICM implantation for detection of CPAF as an embolic source of ischemic stroke in a patient with SIT.

## 2 | CASE REPORT

A 74-year-old woman with sudden right hemiparesis was admitted to our hospital with a diagnosis of acute ischemic stroke. She was treated with intravenous tissue plasminogen activator and thrombectomy in the left M2 segment of the middle cerebral artery, after which her symptoms improved remarkably (modified Rankin scale 0). The patient met the criteria of ESUS and a thorough examination was performed to determine the cause. Transesophageal echocardiography showed minor plaque formation in the aortic arch (a potential cause of aortogenic embolism) and absence of a patent foramen ovale (a potential cause of paradoxical embolism). Although CPAF was not identified by telemetry at admission, it was suspected and we decided to implant an ICM device. However, SIT was observed by chest X-ray. Thus, the ICM device was implanted into the right chest in a symmetrical position (Figure 1).

We used fluoroscopy to locate the heart. An ICM (BIOMONITOR III<sup>TM</sup>; Biotronik, Berlin, Germany) was then inserted into the right margin of the 3<sup>rd</sup> to 6<sup>th</sup> intercostal sternum along the long axis shadow of the heart using the provided tools. The procedure duration was 5 min and the fluoroscopy time was 15 s. There were no complications during the procedure.

AF was successfully detected at 28 days after ICM insertion (Figure 2A). Figure 2B shows the sudden drop rate alarm, the feature unique to the BIOMONITOR III device. It shows the moment when rhythm changed from AF to sinus rhythm. P wave can be clearly seen during the sinus rhythm. AF was then detected on a number of occasions.

Aspirin was used initially for prevention of recurrent ischemic stroke. However, we changed to edoxaban after CPAF was detected.

## 3 | DISCUSSION

To our knowledge this is the first report of CPAF detection in an ESUS patient with situs inversus totalis. The detection rate of CPAF in ESUS patients using ICM is 30%.<sup>3</sup> However, because the incidence of SIT is very low in the general population<sup>4</sup> and because the heart and the conduction system are located on the right side of the body, the safety and efficacy of ICM in these patients remains unclear. In our experience, ICM insertion into the right margin of the sternum along the heart shadow using fluoroscopy is safe and effective for detecting CPAF.

There are three types of ICM devices used in Japan. In the present case we used the BIOMONITOR III, a novel ICM device that combines a long sensing vector with a miniaturized profile. Previous studies have described visible P-waves in >80% of cases.<sup>2</sup> In our case there was no P-wave in the subcutaneous ECG during AF compared with that during sinus rhythm (Figure 2A, B). In the subcutaneous ECG recorded by the sudden drop rate alarm, the P-wave was not visible during AF, but appeared when the system returned to sinus rhythm. These findings provided a clear diagnosis of AF rather than sinus tachycardia, and the patient's medicine was changed from aspirin to edoxaban. There are several case reports on the feasibility

and safety of catheter ablation for AF with SIT.<sup>5</sup> Thus, if our patient shows drug-refractory AF, we will consider catheter ablation.

#### **4 | CONCLUSION**

ICM (e.g., the BIOMONITOR III) implantation can be performed safely and successfully in patients with situs inversus totalis and can be used to detect CPAF.

#### **CONFLICT OF INTEREST**

None declared.

#### **AUTHOR CONTRIBUTIONS**

YK: implanted an ICM in this case and wrote the entire manuscript. SS: supervised the writing of the manuscript. KM: supervised the project. JK: supervised the project.

All authors read and approved the final manuscript.

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Published with written consent of the patient.

#### **CONSENT FOR PUBLICATION**

Written informed consent was obtained from the patient for publication of this case report and the accompanying images.

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#### **REFERENCES**

1. Hart RG, Diener HC, Coutts SB, et al. Embolic strokes of undetermined source: the case for a new clinical construct. *Lancet Neurol.* 2014 Apr; 13(4): 429–38.
2. Mariani JA, Weerasooriya R, van den Brin O, et al. Miniaturized implantable cardiac monitor with a long sensing vector (BIOMONITOR III): Insertion procedure assessment, sensing performance, and home monitoring transmission success. *J Electrocardiol.* 2020 May-June; 60: 118–25.
3. Sanna T, Diener HC, Passman RS, et al. Cryptogenic stroke and underlying atrial fibrillation. *N Engl J Med.* 2014 Jun 26; 370(26): 2478–86.
4. Bohun CM, Potts JE, Casey BM, Sandor GGS. A population-based study of cardiac malformations and outcomes associated with dextrocardia. *Am J Cardiol.* 2007 Jul 15; 100(2): 305–9.
5. Benjamin MM, Kipp R, Wright J. Pulmonary vein and cavotricuspid isthmus ablation in situs inversus totalis. *Clin Case Rep.* 2015 Dec 6; 4(2): 126–8.

#### **Figure Legends**

##### **Figure 1.**

Chest radiograph shows cardiac apex points to the right, indicating situs inversus totalis. Insertable Cardiac Monitor can be seen in the right margin of the 3<sup>rd</sup> to 6<sup>th</sup> intercostal sternum along the long axis shadow of the heart.

##### **Figure 2A.**

Subcutaneous ECG showing Atrial Fibrillation.

##### **Figure 2B.**

The sudden drop rate alarm, the feature unique to the BIOMONITOR III device. P wave (arrow) can be clearly seen during the sinus rhythm.

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