

# A Case of Atrial Fibrillation in a Patient with a Common Inferior Trunk of Pulmonary Veins Treated by Radiofrequency Catheter Ablation in Form of Mickey Mouse Figure

Masumoto, Akihiro  
Cardiology, Fukuoka Kinen Hospital

Takemoto, Masao  
Cardiovascular Center, Munakata Suikokai General Hospital

Kang, Honsa  
Cardiovascular Center, Munakata Suikokai General Hospital

Kumeda, Hiroshi  
Cardiology, Fukuoka Kinen Hospital

他

<https://doi.org/10.15017/2236691>

---

出版情報：福岡醫學雜誌. 110 (1), pp.45-50, 2019-03-25. 福岡医学会  
バージョン：  
権利関係：

---

---

## Case Report

---

---

# A Case of Atrial Fibrillation in a Patient with a Common Inferior Trunk of Pulmonary Veins Treated by Radiofrequency Catheter Ablation in Form of Mickey Mouse Figure

Akihiro MASUMOTO<sup>1)</sup>, Masao TAKEMOTO<sup>2)</sup>, Honsa KANG<sup>2)</sup>, Hiroshi KUMEDA<sup>1)</sup>, KO NAKAMURA<sup>1)</sup>, Kei-ichiro TAYAMA<sup>2)</sup>, Ken-ichi KOSUGA<sup>2)</sup> and Takafumi UENO<sup>1)</sup>

<sup>1)</sup>Cardiology, Fukuoka Kinen Hospital, Fukuoka, Japan.

<sup>2)</sup>Cardiovascular Center, Munakata Suikokai General Hospital, Fukutsu, Japan.

### Abstract

An 81-year-old female with drug-refractory paroxysmal atrial fibrillation (AF) underwent radiofrequency catheter ablation (RFCA). Her computed tomography before the RFCA demonstrated a common inferior trunk (CIT) of the pulmonary veins (PVs). At first, a circumferential PV antrum ablation of each 3 PVs was performed, which were in form of Mickey Mouse figure, under electroanatomic guidance with the 3D mapping system. Next, left atrium (LA) roof linear ablation was additionally performed, because AF was induced by the programmed stimulation in the posterior wall of LA. Then, firing from the left superior PV, a CIT, and posterior wall of LA was confirmed. Finally, the AF was successfully treated by RFCA without any complications, and she has remained well without any symptoms after one year the RFCA. The efficacy of a box isolation in patients with AF with a CIT of the PVs and/or the isolation of the PV carinas in patients with AF has been previously reported. Thus, RFCA in Form of Mickey Mouse figure with or without LA roof linear ablation may be one of the effective and optional therapeutic strategies for treating of AF by RFCA in patients with a CIT of the PVs.

**Key words** : abnormal anatomy, atrial fibrillation, catheter ablation, common inferior trunk, Mickey Mouse, pulmonary vein

### Introduction

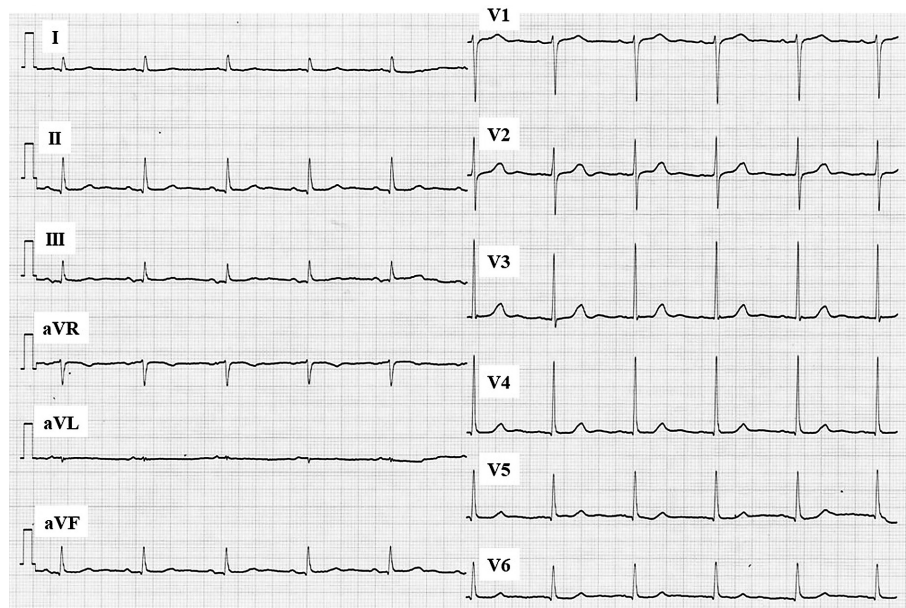
Pulmonary vein (PV) antrum isolation (PVAI) has proven to be a useful strategy for radiofrequency catheter ablation (RFCA) of atrial fibrillation (AF) worldwide<sup>1)</sup>. We and other physicians have previously demonstrated that RFCA of AF utilizing a three-dimensional (3D) mapping system is feasible and safe for achieving a favorable outcome even in patients with an abnormal cardiac anatomy<sup>2)</sup> and/or location<sup>3)</sup>.

We experienced a case of paroxysmal AF in a patient with a common inferior trunk (CIT) of PVs

and successfully treated by RFCA in form of Mickey Mouse figure.

### Case Report

An 81-year-old female was admitted to our hospital to undergo RFCA of drug-refractory symptomatic paroxysmal AF. She had 2-year history of AF and took medicines with beta-blocker and class Ia agent, Ic agent, or bepridil. However, those drug did not have sufficiently effect to suppress her symptomatic AF, and she had an AF attack several times in a month. She had a history of hypertension. On admission, her



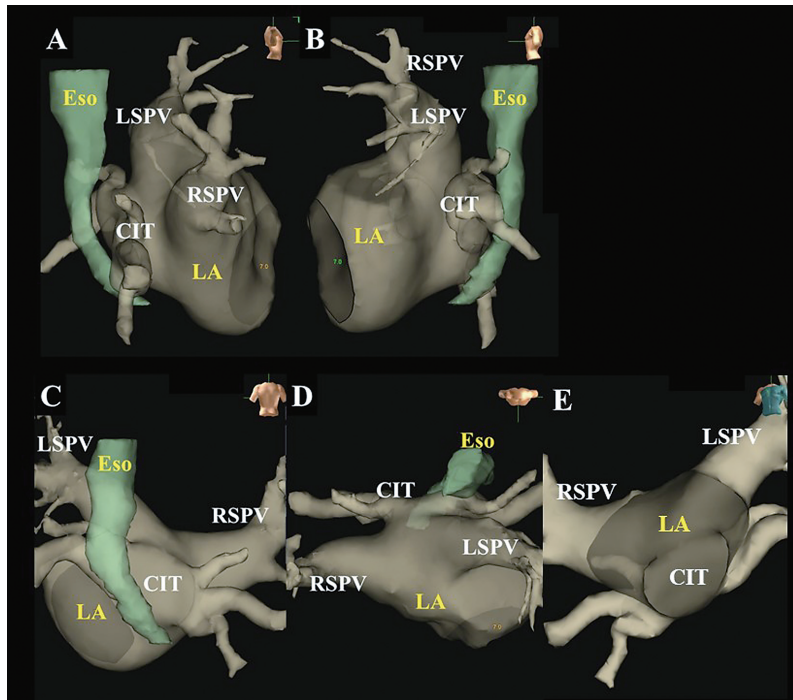
**Fig. 1** The 12-lead electrocardiograms on admission

physical examinations and laboratory analyses yielded no abnormalities. Her 12-lead electrocardiogram exhibited normal sinus rhythm (Fig. 1). Her echocardiogram yielded a normal heart and left atrial (LA) dimension of 32 mm. Her CHADS<sub>2</sub> score was 2 points. Her computed tomography before the RFCA demonstrated a CIT of the PVs (Fig. 2A-E). Her esophagus ran left side of a CIT, and just only contacted the left bottom of a CIT (Fig. 2A-D).

A temperature probe (SensiTherm™, St. Jude Medical, St. Paul, MN, USA) for monitoring the esophageal temperature was inserted and placed between the levels of the left superior PV and a CIT. Femoral arterial access was routinely acquired for continuous blood pressure and heart rate monitoring. A double transseptal puncture was performed under guidance with intracardiac echography (Ultra ICE catheter, EP Technologies, Boston Scientific Corporation, San Jose, CA, USA). A 100 unit per kilogram administration of heparin was administered following the transseptal puncture and heparinized saline was additionally infused to maintain the activated clotting time at 300–400 seconds. Then, an open irrigated 3.5-mm-tip ablation catheter (FlexAbility™, St.

Jude Medical) and circular mapping catheter (Optima™, St. Jude Medical) were positioned in the LA. The LA and three PVs were then reconstructed by a 3-D mapping system (EnSite NavX/Velocity™ Cardiac Mapping System, St. Jude Medical), and EnSite voltage maps revealed that the three PVs had PV potentials, but there were no low voltage areas (< 0.5 mV) in the LA (Fig. 3A).

The generator was set to a maximal temperature of 45°C, maximum power of 35 W, and irrigation rate of 13 ml per minute. When ablating the posterior wall in front of the esophagus, a maximum power of 20 to 25 W was used to avoid esophageal damage from the high energy supplied, and when the temperature exceeded 39°C, the energy supply was discontinued. Each application of radiofrequency energy was delivered for about 30 to 90 seconds while dragging, with a goal of a ≥70% decrease in the electrogram amplitude at the local site<sup>3)4)</sup>. At first, a circumferential PVAI of both superior PVs and a CIT was performed, which were in form of Mickey Mouse figure (blue tags in Fig. 3BC), under electroanatomic guidance with the 3D mapping system until the achievement of a bidirectional conduction

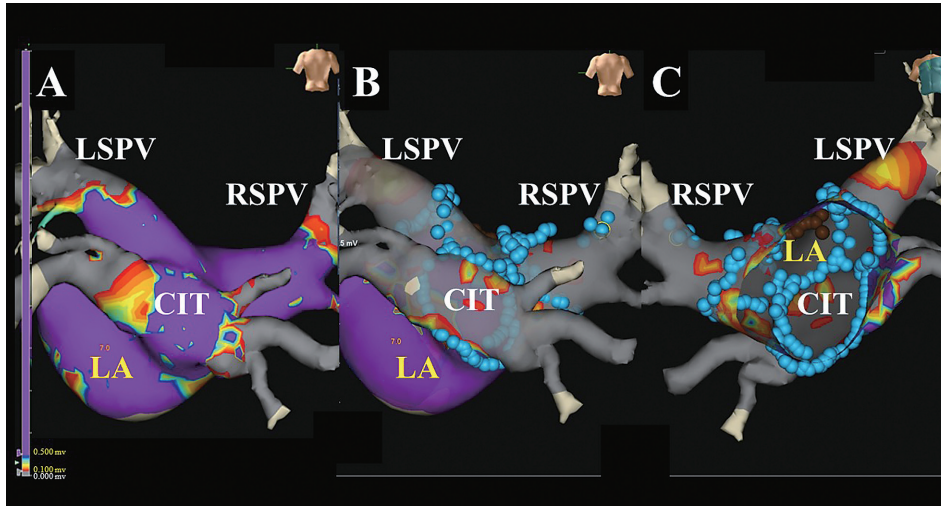


**Fig. 2** The 3-dimensional computed tomography images viewed from the right (**A**), left (**B**), back (**C**), top (**D**), and an endoscopic view from the front (**E**), demonstrated the presence of a common inferior trunk (CIT) of the pulmonary veins (PVs) arising from the posterior wall of the left atrium (LA). RSPV=right superior pulmonary vein, LSPV=left superior pulmonary vein, Eso=esophagus.

block between the LA and PVs under the administration of isoproterenol. Moreover, because AF was induced by the programmed stimulation in the posterior wall of LA under the intravenous administration of isoproterenol, LA roof linear ablation was additionally performed (brown tags in Fig. 3BC). After isolations of 3PVs and LA posterior wall, spontaneous firing from the left superior PV, a CIT, and the posterior wall of LA was confirmed. Finally, any arrhythmias including AF could not be induced under the intravenous administration of isoproterenol and/or programmed stimulation. Fortunately, the rise of esophagus temperature to 39°C or more was not seen during a radiofrequency energy delivering. She has remained well without any recurrence of AF and no medications for one year after the RFCA.

## Discussion

AF is the most common clinical arrhythmia and is associated with significant clinical morbidity and increased mortality<sup>1</sup>. It has been reported that AF develops in one of ten to twenty people aged 65 years or older<sup>1</sup>. In real world clinical practice, we sometimes encounter patients with abnormal cardiac and/or vessel anatomies. A CIT of the PVs is a comparably rare anatomical variant and occurs in about 1.5% of cases with AF<sup>5</sup> who underwent the RFCA. Moreover, the prevalence of both inferior PVs completely conjoined prior to the junction with the LA and structured completely independent one CIT, such as this present case, is less than 1% with AF<sup>5</sup>. The prevalence of a CIT of the PVs in patients who underwent RFCA of AF in our hospitals was 0.2% (1 : 500 patients). Thus, although the high-volume centers which perform 500-1000



**Fig. 3** The EnSite 3-dimensional mapping system in voltage maps viewed from the back (**A** and **B**) and an endoscopic view from the front (**C**) before (**A**) and after (**B** and **C**) the radiofrequency catheter ablation (RFCA) of atrial fibrillation are shown by the RFCA lines demonstrated by the colored tags, and disappearance of the voltage in the three pulmonary veins and posterior wall of the left atrium (LA) (**B**), can be observed. The areas of colored with purple in the LA and three pulmonary veins were normal voltage area ( $\geq 0.5$  mV) evaluated by EnSite 3-dimensional mapping system. RSPV=right superior pulmonary vein, LSPV=left superior pulmonary vein, CIT=common inferior trunk.

RFCAs of AF per a year may experience 1 to 2 case with this anomaly in a year, the physicians who work in non-high-volume centers which perform 50–100 RFCAs of AF per a year rarely may encounter these patients in real world clinical practice.

It has been reported that the successful RFCA with box isolation without isolation of the PV carinas in a patient with a CIT of PVs<sup>2)</sup>. On the other hand, the non-isolation of the PV carinas after a successful PVAI may be an independent predictor of recurrence of AF<sup>6)</sup>. Thus, we performed a circumferential PVAI of each 3 PVs with isolation of the PV carinas, which were in form of Mickey Mouse figure (Fig. 3BC) under electroanatomic guidance with the 3D mapping system in this present case. Moreover, LA roof linear ablation was additionally performed to surround the posterior wall of LA, so-called box isolation. Finally, the complete bidirectional conduction block could be achieved between the LA and PVs and/or the posterior wall of LA, and the

programmed stimulation failed to induce any arrhythmias, including AF under the administration of isoproterenol and/or programmed stimulation in this present case.

It has been reported that only small amounts of arrhythmogenic activities were observed in a CIT of PVs<sup>5)</sup>. However, in this present case, the PV potentials and spontaneous firing from a CIT was confirmed. Thus, if for present case, the circumferential PVAI of each 3 PVs with isolation of the PV carinas may be one of the effective strategies for RFCA of a CIT in patients with AF.

In this present case, fortunately, the esophagus of the patient ran left side of a CIT, and just only contacted the left bottom of a CIT (Fig. 2A–D). If the esophagus runs on a CIT and contacts the posterior wall of LA and a CIT, this procedure may be technically difficult because Mickey Mouse ablation has to cross directly above the esophagus two or three times. This may be the disadvantage of this procedure. Thus, the patients whose esophagus do not contacts the posterior

wall of LA and a CIT may be good candidates for this procedure.

Because a CIT of PVs may be a comparably rare cardiac anomaly, preoperative recognition of these venous anomalies by 3-D imaging and carefully planning a strategy before the procedure in patients with an abnormal cardiac and/or vessel anatomies is important for a smooth and safe RFCA of AF. Finally, the AF was successfully treated by RFCA without any complications in this present case, and she has remained well without any symptoms after the RFCA.

In view of these findings, when the bidirectional conduction block between the LA and PVs and/or the posterior wall of LA can not be completely achieved by a only box isolation in patients with a CIT of the PVs, RFCA in the form of a Mickey Mouse figure with or without LA roof linear ablation may be one of the effective and optional therapeutic strategies for treating of AF by RFCA in patients with a CIT of the PVs.

Finally, to our knowledge, this is the first report concerning a circumferential PVAI with isolation of the PV carinas, which were in form of Mickey Mouse figure (Fig. 3BC) in a patient with a CIT of PVs.

### Acknowledgements

We thank Mr. Kensuke Kawasaki and Kazutaka Yamaguchi for their technical assistance with the electrophysiological study in the cardiac catheterization laboratory and Mr. John Martin for his linguistic assistance with this paper.

### Conflict of Interest

None.

### Funding

None.

### References

- 1) Piccini JP and Fauchier L : Rhythm control in atrial fibrillation. *Lancet*. 388 : 829-840, 2016.
- 2) Providencia R, Combes S and Albenque JP : Adjusting treatment to pulmonary vein rare anatomic variants : a box lesion for the ablation of atrial fibrillation in a patient with an atypical common inferior trunk. *Europace*. 15 : 1420-2013.
- 3) Aoki R, Takemoto M, Nakasuga K, Kang H, Tanaka A, Mito T, Antoku Y, Matsuo A, Hida S, Okazaki T, Yoshitake K, Tayama KI and Kosuga KI : A case of paroxysmal atrial fibrillation in a patient successfully treated by radiofrequency catheter ablation with a severely right-sided dislocation of the heart after a total right lung excision. *J Arrhythm*. 34 : 305-308, 2018.
- 4) Hida S, Takemoto M, Masumoto A, Mito T, Nagaoka K, Kumeda H, Kawano Y, Aoki R, Kang H, Tanaka A, Matsuo A, Hironaga K, Okazaki T, Yoshitake K, Tayama KI and Kosuga KI : Clinical benefits of deep sedation with a supraglottic airway while monitoring the bispectral index during catheter ablation of atrial fibrillation. *J Arrhythm*. 33 : 283-288, 2017.
- 5) Yamane T, Date T, Tokuda M, Aramaki Y, Inada K, Matsuo S, Shibayama K, Miyazaki S, Miyazaki H, Sugimoto K, Sakuma T, Fukuda K, Mochizuki S and Yoshimura M : Prevalence, morphological and electrophysiological characteristics of confluent inferior pulmonary veins in patients with atrial fibrillation. *Circ J*. 72 : 1285-1290, 2008.
- 6) Takigawa M, Yamada T, Yoshida Y, Ishikawa K, Aoyama Y, Yamamoto T, Inoue N, Tatemasu Y, Nanasato M, Kato K, Tsuboi N and Hirayama H : The incidence and clinical significance of non-isolation of the pulmonary vein carina after encircling ipsilateral pulmonary veins isolation for paroxysmal atrial fibrillation : a pitfall of the double-Lasso technique. *Europace*. 15 : 33-40, 2013.

(Received for publication December 12, 2018)

(和文抄録)

## ミッキーマウス型肺静脈隔離アブレーションが奏功した 下肺静脈共通管を有する心房細動の1症例

<sup>1)</sup>福岡記念病院・循環器内科,

<sup>2)</sup>宗像水光会総合病院・心臓血管センター

舩元章浩<sup>1)</sup>, 竹本真生<sup>2)</sup>, 康 憲史<sup>2)</sup>, 久米田洋志<sup>1)</sup>, 中村 広<sup>1)</sup>,  
田山慶一郎<sup>2)</sup>, 小須賀健一<sup>2)</sup>, 上野高史<sup>1)</sup>

症例は81歳女性。薬剤抵抗性の症候性発作性心房細動のアブレーション治療目的にて入院となった。治療前に撮影した心臓CTにて下肺静脈共通管を認めた。心房細動に対するアブレーションでは3本の各肺静脈を個別に肺静脈広範隔離術をエンサイト3次元マッピングシステムを用いてミッキーマウス型に行った。その際、各肺静脈間にあるカリーナ部分の焼灼を十分に行った。その後の左房後壁のプログラム刺激にて心房細動が誘発されたため、左房後壁を箱状に隔離するため肺静脈上端のラインを結ぶ天井ラインの作成を行った。隔離後は左上肺静脈と左房後壁から発火を認めた。その後はプログラム刺激では心房細動は全く誘発出来なくなった。その後も心房細動の再発無く経過している。過去の報告では下肺静脈共通管を有する場合は左房後壁を含む箱型は静脈隔離術が有用と報告されている。一方で肺静脈間にあるカリーナの焼灼が重要との報告もある。今回我々はカリーナを含む各肺静脈のミッキーマウス型個別隔離が有用であった肺静脈共通管の症例を経験したので考察を加えて報告する。

**キーワード：**心臓奇形, 心房細動, カテーテルアブレーション, 下肺静脈共通管, ミッキーマウス, 肺静脈