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Case Report

Intra-Atrial Re-Entrant Tachycardia (Iart) Ablation in a Male with History of Complex Congenital Disease and Fontan Surgery

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Abstract

Intra-atrial re-entrant tachycardia (IART) is one of most common atrial tachycardia after congenital heart surgery, IART was defined as a macro reentrant atrial tachycardia with typical entrainment characteristics (entrainment with endocardial fusion and entrainment at 2 sites ≥2 cm apart demonstrated characteristics of being "in the circuit").

A 30 years old Male with history of complex congenital disease brought to EP lab in Sinus rhythm for evaluation of WCT, Mapping was performed using multipolar mapping with HD Grid (10 pole), entrainment mapping and detailed 3D activation mapping. Entrainment was performed; linear ablation was done in slow conduction zone. Thereafter, multiple RF application at this area resulted in termination of arrhythmia. Arrhythmia was not induced with and without Isoproterenol.

Keywords*: Intra-atrial re-entrant tachycardia, macro reentrant atrial tachycardia, Focal atrial tachycardia, complex congenital disease, Fontan surgery*

Introduction

Intra-atrial re-entrant tachycardia (IART) is one of most common atrial tachycardia after congenital heart surgery, IART was defined as a macro reentrant atrial tachycardia with typical entrainment characteristics (entrainment with endocardial fusion and entrainment at 2 sites ≥2 cm apart demonstrated characteristics of being "in the circuit"). Focal atrial tachycardia (FAT) was defined as a stable atrial arrhythmia originating from a focal area with centrifugal activation; Ablation was performed using a bidirectional irrigated catheter. The critical isthmus was targeted when activation and entrainment mapping was possible.

Case Report

A 30 years old Male with history of complex congenital disease as Abdominal and atrial situs solitus, , Levocardia , L-looped ventricles, Dominant left sided ventricle with RV morphology with moderate to severe systolic dysfunction(GEF:35%), also Both AV-valves empty to RV(DIRV),Moderate to severe left and right AV valve regurgitation, Both great arteries arise from dominant ventricle(DORV),Aorta was anterior and right sided to PA(D-malposition of great arteries),PA closed surgically with no ante grade flow, confluent PA branches(RPA=1.4mm,LPA=1.4mm),Left sided aortic arch, Patent Glenn shunt with normal respiratory variation and low velocity laminar flow,Patent conduit between IVC and RPA with slow flow ,4mm fenestration with MPG:4 mmHg, Moderate size secondum type ASD(Fontan surgery, intracardiac tunnel with fenestration).(fig1,2,3)

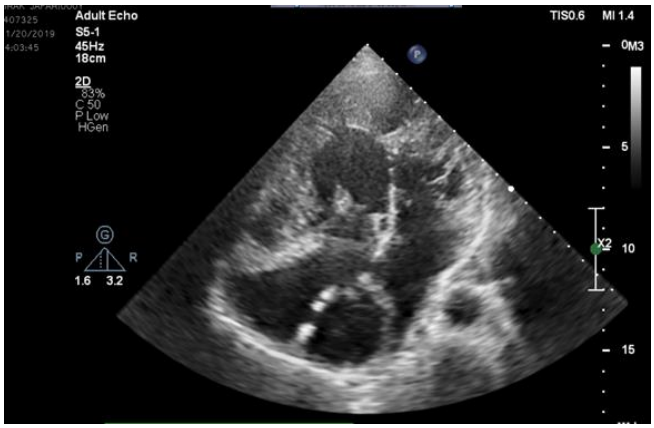

Fig. 1: Echocardiography in standard apical 4 chamber showed Both AV-valves empty to RV

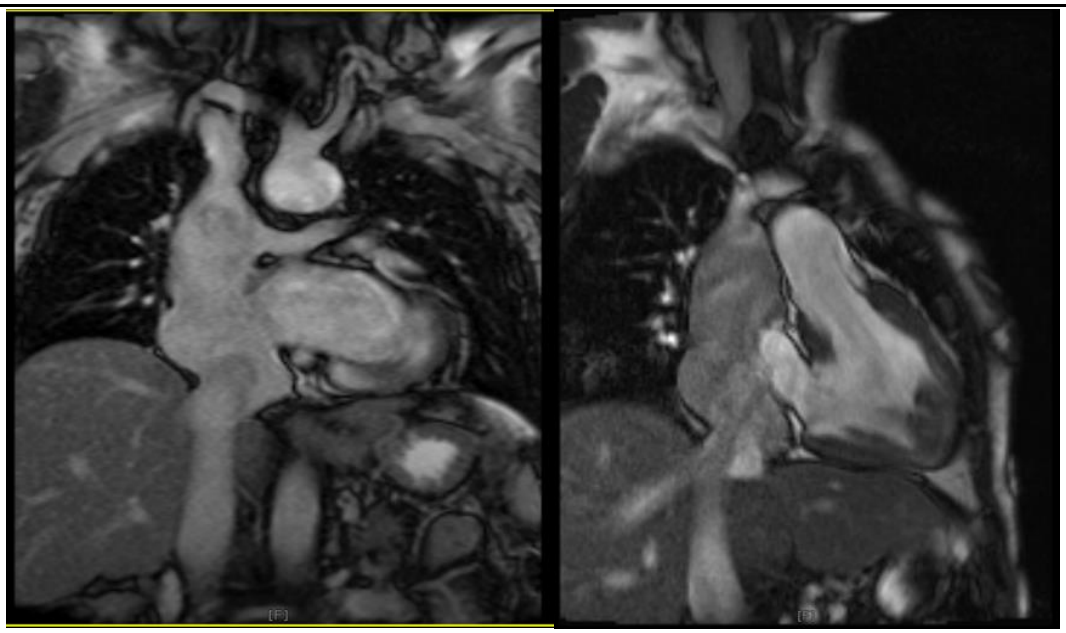

Fig. 2: CMR showed Patent conduit between IVC and RPA with slow flow, Fontan surgery, intracardiac tunnel with fenestration.

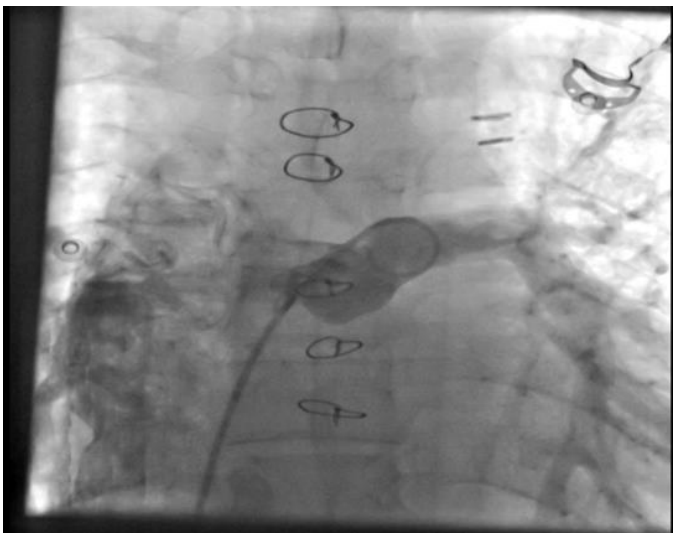

Fig. 3: Angiography AP View showed conduit between IVC and RPA, Fontan surgery, intracardiac tunnel with fenestration.

Due to low LVEF and episodes of WCT S-ICD was implanted(fig 4).

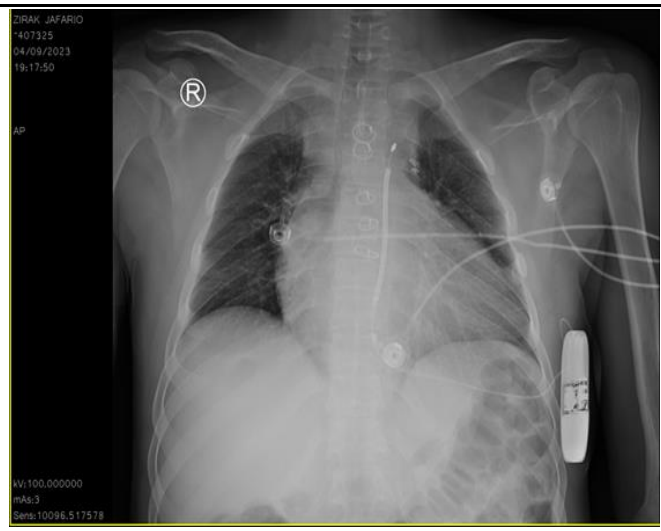

Fig. 4: CXR showed Position of S-ICD after implantation.

He brought to EP lab in Sinus rhythm for evaluation of WCT(fig. 5).procedures were performed under general anesthesia, after that informed consent was obtained. Trans esophageal echocardiography (TEE) was doe to rule out intracardiac thrombus. 3D electro anatomic mapping was utilized (Nav X precision). Scar was traditionally defined as atrial areas with electrograms<0.05 mV and low voltage as <0.5 mV. Once femoral access was obtained, heparin was infused to obtain an ACT >250 s. The pulmonary venous atrium (PVA) was accessed; RV catheter was introduced via left femoral artery and RA catheter introduced via RFV in the lateral intra cardiac tunnel in Fontan circulation.

Fig 5:12 leads ECG with 50mm/s showed sinus rhythm

Extra stimulation with DCL=500 and PCL=350, entrainment mapping was done, sustained IART began with slow conduction zone in the systemic atrium. High density mapping with HD catheter was done slow conduction zone in the same systemic atrium was demonstrated (fig. 6).

Fig. 6: sustained IART after entrainment mapping

Mapping was performed using multipolar mapping with HD Grid (10 pole), entrainment mapping and detailed 3D activation mapping. Entrainment was performed when the cycle length (CL) was stable (<20 millisecond beat to beat variation) and at an entrainment CL ≤20 millisecond shorter than the tachycardia cycle length. Entrainment was used in order to confirm macro–re-entry; or identify regions either "in" (PPI of ≤20 millisecond > TCL) or "near" (PPI of 20 to 40 millisecond > TCL) the re-entrant circuit in order to focus detailed 3D mapping to the region of relevance.

Linear ablation was done in slow conduction zone. Thereafter, multiple RF application at this area resulted in termination of arrhythmia. Arrhythmia was not induced with and without Isoproterenol.

Discussion

Intra-atrial re-entrant tachycardia (IART) ,Atrial flutter and focal Atrial tachycardia are most common atrial tachycardia after congenital heart surgery, IART and Atrial flutter are defined as a macro reentrant atrial tachycardia with typical entrainment characteristics. Sometimes arrhythmias are seen together in Fontan patients and surface ECG is a poor tool for identifying patients with coexistent arrhythmias(1).cavo-tricuspid isthmus dependent Atrial flutter has characteristic inverted or positive

"saw tooth" P-waves in leads II, III, and AVF, implying inferior to superior atrial activation typically the reentrant loop or reverse ,these rates are typically very fast, ranging from 300 to 500 bpm . There is usually variable atrioventricular (AV) conduction yielding a pulse rate of near 150 bpm; in clinical practice, a fixed heart rate of 120–150 bpm strongly suggests the presence of atrial flutter with 2:1 AV block(2).

IART usually has a slower atrial rate—often less than 300 bpm (cycle length ≥200 ms). Atrial rates of 185–270 bpm (cycle length: 325–220 ms) are seen in Mustard patients and rates of 220–325 bpm (cycle length: 230–470 ms) in Fontan patients. The P-wave morphology is variable, often smaller and fractionated, and at times can be difficult to detect, particularly when evaluating on a few leads, typical with many event monitors(3)

In post Fontan patients with IART, intra-atrial mapping studies have demonstrated several conduction corridors or isthmuses between the atriotomy incision and the crista terminalis, around the atrial septal defect patches or between the inferior vena cava and tricuspid valve(4).

The incidence of incisional IART is related to both the underlying congenital heart defect and the type of surgical repair. In general, the more complex the defect and the surgery (number of incisions and suture lines within the atria), the higher is the incidence. Effective electrophysiology study and successful ablation of IART depends on an understanding of the complexity of the congenital heart disease, previous surgical intervention, and available vascular access, Goals for electrophysiological evaluation include evaluation of possible arrhythmia-related symptoms (palpitations, tachycardia, syncope) in patients with postsurgical congenital heart disease.

Entrainment mapping is performed by pacing at 10 to 30 ms less than the spontaneous IART cycle length for at least 10 beats at twice the diastolic threshold and proving that the suture line is in the arrhythmia circuit helps in the diagnosis, and finally, by ablation of this isthmus, the arrhythmia can be controlled.

Conclusion

Intra-atrial re-entrant tachycardia (IART) is one of most common atrial tachycardia after congenital heart surgery, but with good entrainment mapping and detailed 3D activation mapping and linear ablation coulde be successful treatment.

Declaration of competing interest

The authors declare no conflicts of interest.

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Patient permission/consent statement

The patient provided informed consent for the publication of this report, and the procedure was performed in accordance with the center's ethical policy.

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