

HIGH-DENSITY MAPPING CATHETER (ADVISOR™ HD-GRID) USAGE FOR IART ABLATION IN CHILDREN AND YOUNG PATIENTS WITH CONGENITAL HEART DISEASE

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Abstract

Objectives: We aimed to share our experience of intra-atrial reentrant tachycardias (IART) mapping and ablation with new grid-style multi-electrode high density mapping catheter (Advisor TM HD Grid, Abbott techn.) in pediatric and young patients with operated with congenital heart disease (CHD).

Methods: Pediatric and young adult patients with operated CHD who were diagnosed with IART in our center between October 2019 and December 2021, and underwent electrophysiologic study (EPS) and ablation using HD-Grid catheter (Group-1) were included in the study, and the results were compared with the patients (Group-2) diagnosed before these dates (April 2010-September 2019), by whom conventional mapping methods were used during EPS. All procedures were performed under general anesthesia with the aid of limited fluoroscopy using a 3-dimensional electroanatomical mapping system (EnSite 3D mapping system, Abbott Laboratories, Abbott Park, IL).

Results: IART ablation was performed using HD-Grid catheter in Group-1 (n=16; 9 men; 56.2%). The mean age was 21.8 ± 7.6 years (range: 10.2-37) and the mean body weight was 60.7 ± 14.3 kg (range: 40-76). Compared to 18.8 ± 6.1 years and 57.9 ± 17.1 kg in Group-2 (n=10; 5 men; 50%) respectively. Diagnoses of operated CHD were Tetralogy of Fallot (n=7), D-Transposition of great arteries (Senning operation; n=2), Ebstein anomaly (n=2), atrioventricular septal defect (n=2), ventricular septal defect (n=2), atrial septal defect (n=1) and single ventricle (Fontan operation; n=1). The mean procedure time was 161.5 ± 33.3 minutes (range: 110-233) in Group-1; significantly shorter compared to 284.7 ± 68.4 minutes in Group-2 ($p < 0.05$). In Group-1 a median of 13,000 points was taken during the mapping process and a median of 3300 points was used. 18 separate IART loops were detected in 16 patients, and also two of the IART loops were in a 'Figure of 8' configuration. An additional arrhythmia substrate was observed in two patients (ectopic atrial tachycardia; EAT). In Group-2, one patient had two separate IART loops, and one patient had an additional arrhythmia substrate (EAT). While irrigated radiofrequency ablation was preferred in all patients, the mean number of lesions (19.7 ± 9.9) in Group-1 was significantly less than in Group-2 (51 ± 28 units) ($p = 0.027$). The acute success rate was 100% in , and the recurrence rate was 0% in a mean follow-up period of 15.7 ± 8.9 months in Group-1, compared to 80% (7/10) and 20% (2/10) respectively in Group-2 ($p = 0.045$ and $p = 0.090$ respectively). No serious complications were observed in any of the patients in both groups.

Conclusions: The use of the Advisor™ HD Grid multielectrode catheter for mapping in IART ablation in children with operated CHD appears to significantly shorten the procedure time and increase procedural success.

Key Words: High Density mapping catheter (HD GRID), Radiofrequency ablation, Intra-atrial reentrant tachycardias Congenital heart defect (CHD)

Table 1: Patient characteristics (n=26)

GRID

NO

	1. Group (n=16)	2. Group (n=10)	p value
Mean age (year)	21,8±7,6	18,8±6,1	0,391
Mean weight (kg)	60,7±14,3	57,9±17,1	0,586
Male sex n= (%)	9/16 (%56,25)	5/10 (%50)	0,999
Arrhythmia/IART characteristics n= (%)			-
-CTI dependent	9 (%56,25)	8 (%80)	
-Double IART loop	2(%12,5)	1 (%10)	
-‘Figure of 8’ IART loop	2(%12,5)	0	
-Add.l arrhythmia (EAT)	2(%12,5)	1 (%10)	
Operated CHD n= (%)			-
ASD	1 (%6,25)	1 (%6,25)	
AVSD	2 (%12,5)	1 (%6,25)	
VSD	2 (%12,5)	2 (%12,5)	
Ebstein	2 (%12,5)	1 (%6,25)	
D-TGA (Senning)	2 (%12,5)	1 (%6,25)	
TOF	7 (%43,75)	3 (%18,75)	
Single Ventricle (Fontan)	1 (%6,25)	1 (%6,25)	
Mean procedural time (min)	161,5±33,3	284,7±68,4	<0,05
Mean Fluoroscopy time (min)	9,8±9,3	15±17	0,452
Mean lesion (n=)	19.7±9.9	51±28	0,027
Acute success/Recurrence rate (%)	100/0	70/20	0,045
Mean follow up time (month)	15,7±8,9	92,7±38,3	

(Add.: additional, ASD: Atrial septal defect, AVSD: Atrioventricular septal defect, CHD: Congenital heart defect, CTI: Cavatricuspid isthmus, EAT: Ectopic atrial tachycardia, IART: Intra-atrial reentrant tachycardia, irrig.RF; irrigated radiofrequency (ablation), op: operated, RA: right atrium, RAA: right atrial appendage, TCL: Tachycardia cycle length, D-TGA: D-Transposition of great arteries, TOF: Tetralogy of Fallot, VSD: Ventricular septal defect)

Table 2: Characteristics of the patients, EPS and ablation procedures, where HD-GRID catheter was used for mapping

Patient No	Age(year)/Weight(kg)	Opereted CHD	Points taken/used by HD-Grid cath. during mapping	IART substrate localisation/ TCL	Max. Fractional signal duration (ms)	Ablation catheter#/ lesion n= (30-60 sec)	Procedural/ Floroscopy time(min)	Acute success/ Recurrence	Follow up time (month)
1 [^]	15/74	TOF	>5000/>2000	RA/350	>105	7-F/23	185/6.0	Yes/No	26
2	27/52		10000/Ns	RA/220	>110	7-F/15	150/4.6	Yes/No	23
3*	37/68		21000/6000	RA/	>105	7-F/12	163/6.5	Yes/No	18
4**	16/41		23000/3000	RA/210	>110	7-	155/3.1	Yes/No	17
5	31/55		>20000/3800	RA/220	100-105	F/13(+3)	140/6.7	Yes/No	9
6	15/55		15000/?	RA/230	150	8-F®/9	175/7.4	Yes/No	2
7&	29/48		?/5500	RA/420-240	?-?	8-F®/38	165/5.1	Yes/No	1
8	22/76	AVSD	40000/6000	RA/250	>100	7-F/34	233/10.5	Yes/No	25
9	22/75		>10000/>2000	RA/250	140-170	8-F/10	155/6.2	Yes/No	13
10*	17/75	TGA (Senning)	18000/2500	Systemic venous buffle/285	>110	7-F/24	110/5.1	Yes/No	24
11*	30/70	TGA (Senning)	18000/2500	Systemic and pulmonary venous buffle/270	>110	8-F/27	300/40	Yes/No	17
12	12/45	ASD	26000/3600	RA/320	180	7-F/8	118/4.3	Yes/No	22
13*,&	20/87	VSD,TV R, Maze	13000/3000	RA/285-270	>110	8-F/26+12	198/14.5	Yes/No	14
14 [^]	23/58	Ebstein	13000/3700	RA290	110-140	8-F®/14	165/22.3	Yes/No	12
15	10/40	VSD, TVR	8000/2000	RA/230	100-112	8-F®/15	132/9.3	Yes/No	9
16***	16/53	Fontan	10000/1000	RA/295	?- ₋	8-F®/14(+4)	130/6.2	Yes/No	1

(ASD: Atrial septal deckett, AVSD: Atrioventricular septal defect, CTI: Cavatricuspid isthmus, EAT: Ectopic atrial tachycardia, IART: Intra-atrial reentrant tachycardia, irrig.RF: irrigated radiofrequency (ablation), , op: operated, RA: right atrium, RAA: right atrial appendage, TCL: Tachycardia cycle length, TGA: Transposition of great arteries, TOF: Tetralogy of Fallot, TVR: Treuspid valve replacement, VSD: Ventricular septal defect)

[^] Figure of '8' configuration of the IART loop

* (recurrent case) 2. Ablation procedure

**IART (13 lesions) and EAT originating from RAA (3 lesions) successful ablation

*** Non-CTIdependent right atrial mid-anterior scar related IART (14 lesions) and EAT originating from right atrial upper septum (3 lesions) successful ablation

&& Successful ablation of two different IART loops (26+12; total 38 lesions). The case had also a Maze procedure history before.

& Successful ablation of two different IART loops (5+8; total 13 lesions). The second IART loop had also a 'figure of 8' configuration

Ablation catheters used were; 7 F irrigated RFA catheter (Therapy™ Cool Flex™ catheter, monodirectional, St Jude, St paule, MN), 8 F irrigated RFA catheter (Abbott Flexability™ ablation catheter, Sensor enabled™, bidirectional D/F curve, St Jude Medical), 8 F irrigated RF® (Abbott TactiCath™ Contact Force Ablation Catheter, Sensor Enabled™, bidirectional D/F curve, St Jude Medical)

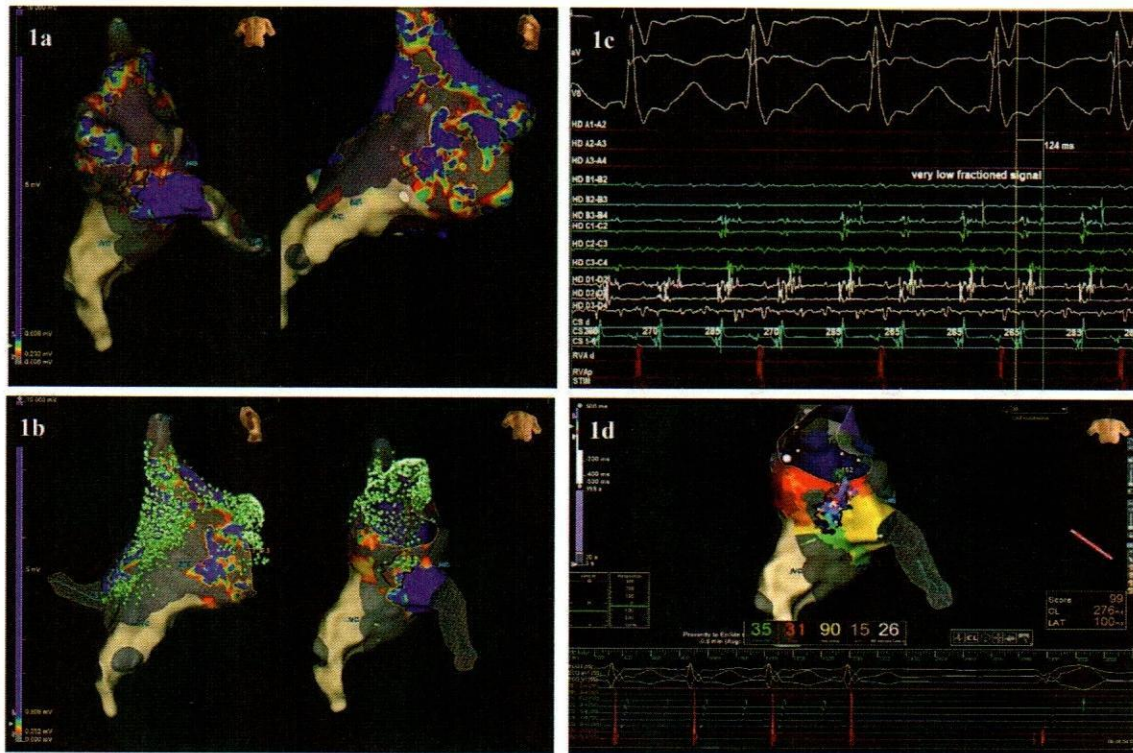


Figure-1: HD-Grid catheter usage in a patient with Ebstein anomaly 1a:Color-coded voltage map showing scar areas 1b:Sparkling map showing 'Figure of 8' IART loop 1c:Very low fractional signals in CTI region 1d:Successful ablation