

Initial Experience of Conduction System Pacing using Stylet Driven Lead guided by a Deflectable Mapping catheter

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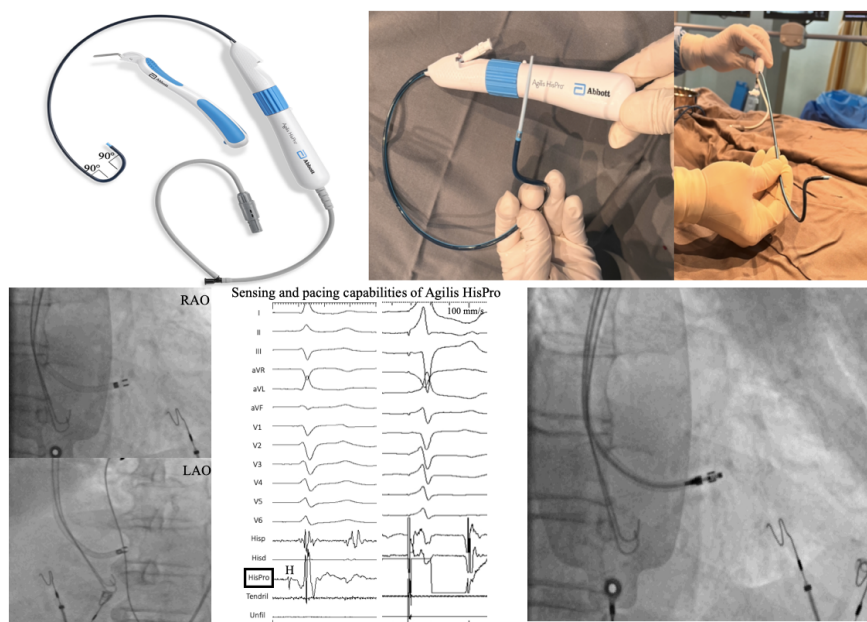
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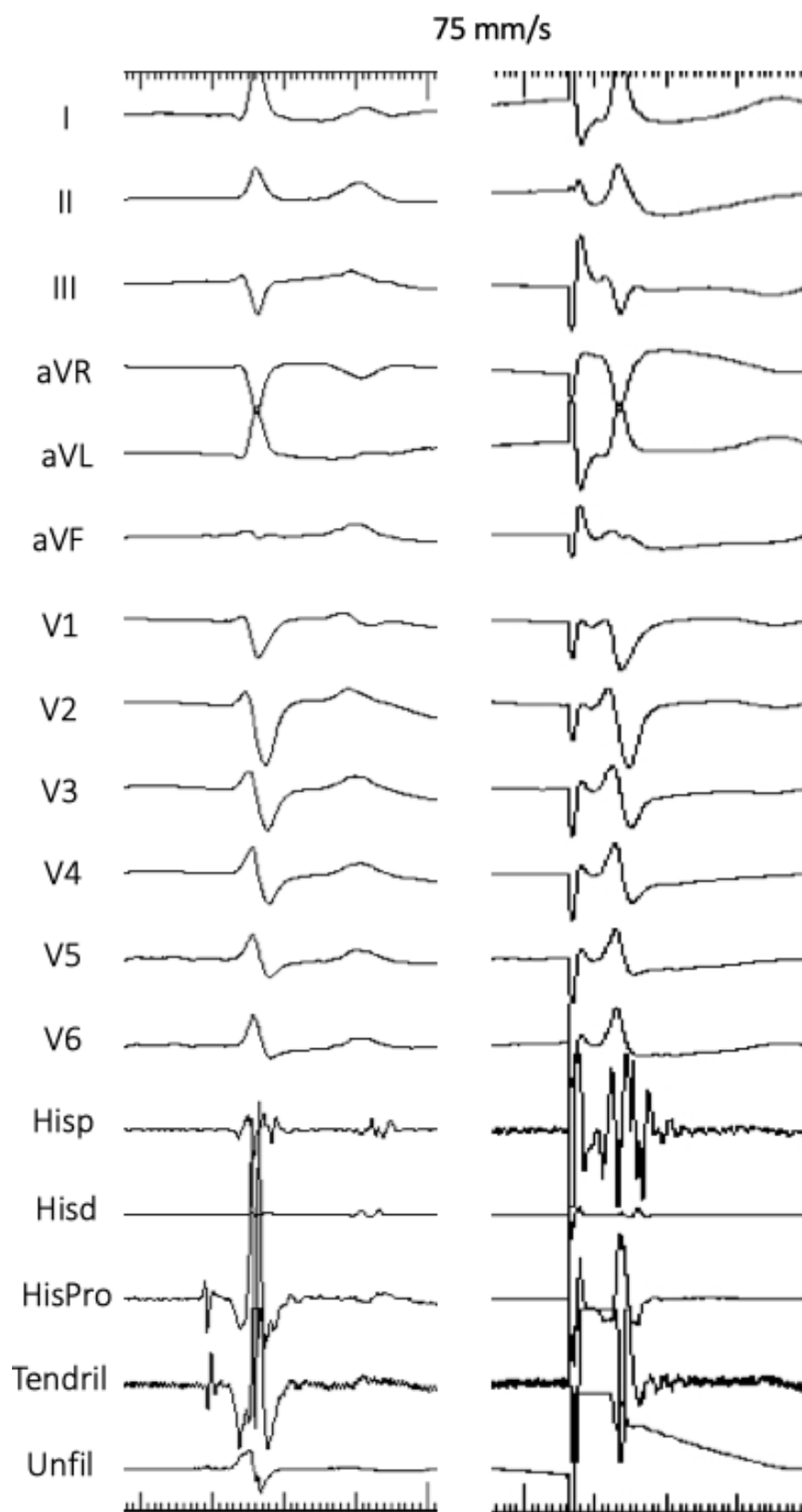
Abstract

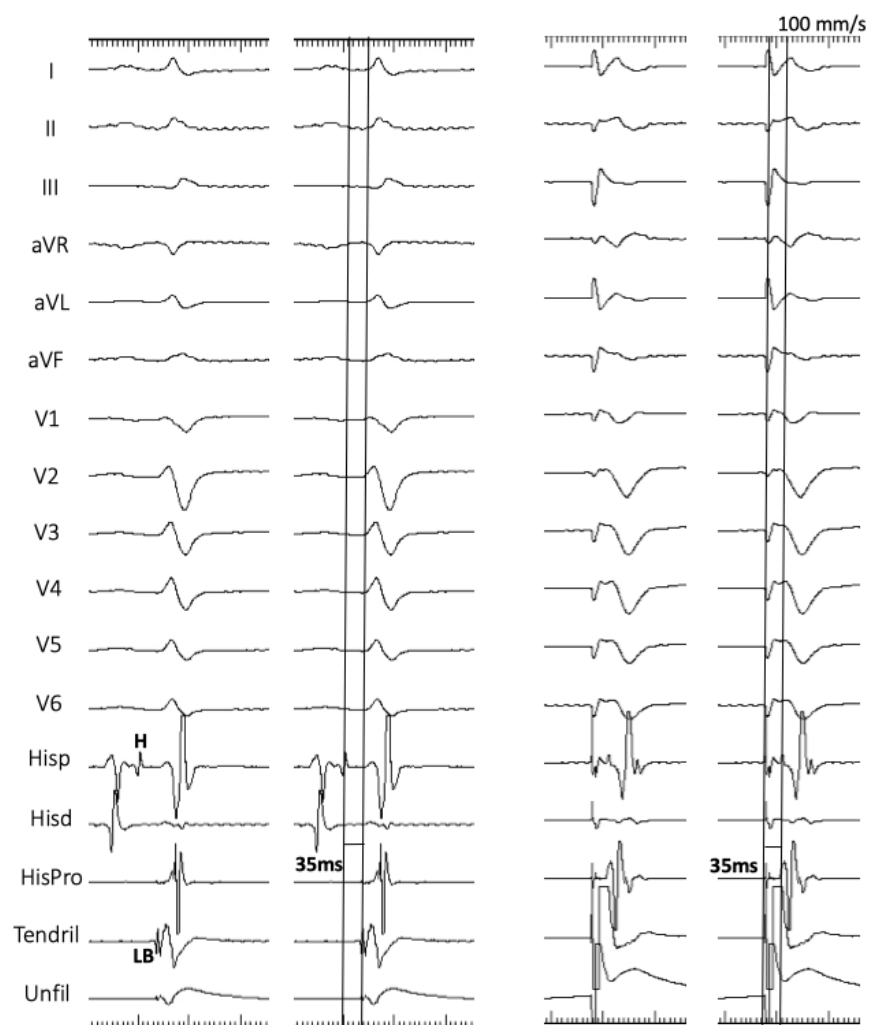
BACKGROUND Conduction system pacing (CSP) in recent years is being considered as the ideal pacing strategy. Lumen less leads (LLs) have been the predominantly used technology since its inception until recently. We herein share the largest single-center experience of Stylet-driven leads (SDLs) using deflectable mapping catheter, a recent technology for conduction system pacing at both HB and LB areas, and their medium-term outcomes. **MATERIALS AND METHODS** Patients with standard pacing indications were enrolled between June 2021 and November 2022. The aim of this study was to evaluate safety and feasibility of CSP using SDL guided by deflectable mapping delivery catheter by analyzing implant tools, parameters during implant and follow-up. **RESULTS** A total of 37 patients (mean age 67.16 ± 9.89 years, 53.3% males, 31 pacemakers, 4 His-CRT-Ps and 2 dual chamber Defibrillators, Mean follow up duration 210.7 ± 25.1 days) were enrolled. HBP was the default strategy. Procedural success was seen in 17/37 (45.9%) patients. Incidence of lead dislodgement was 17.6%. LBBaP was tried in the rest (20/37). A septal curve was manually made in 3 patients. Procedural success was seen in all patients (3/3) in whom septal curve was added and in 12/17 (70.5%) patients without it. Compared to HBP, procedural parameters didn't differ significantly for LBBaP. Sensing and Pacing parameters remained stable on follow up. **CONCLUSION** Use of SDL is adequate for both HB and LB areas. Pre-shaping the deflectable mapping catheter can help in achieving better results and also lower the overall procedure time.

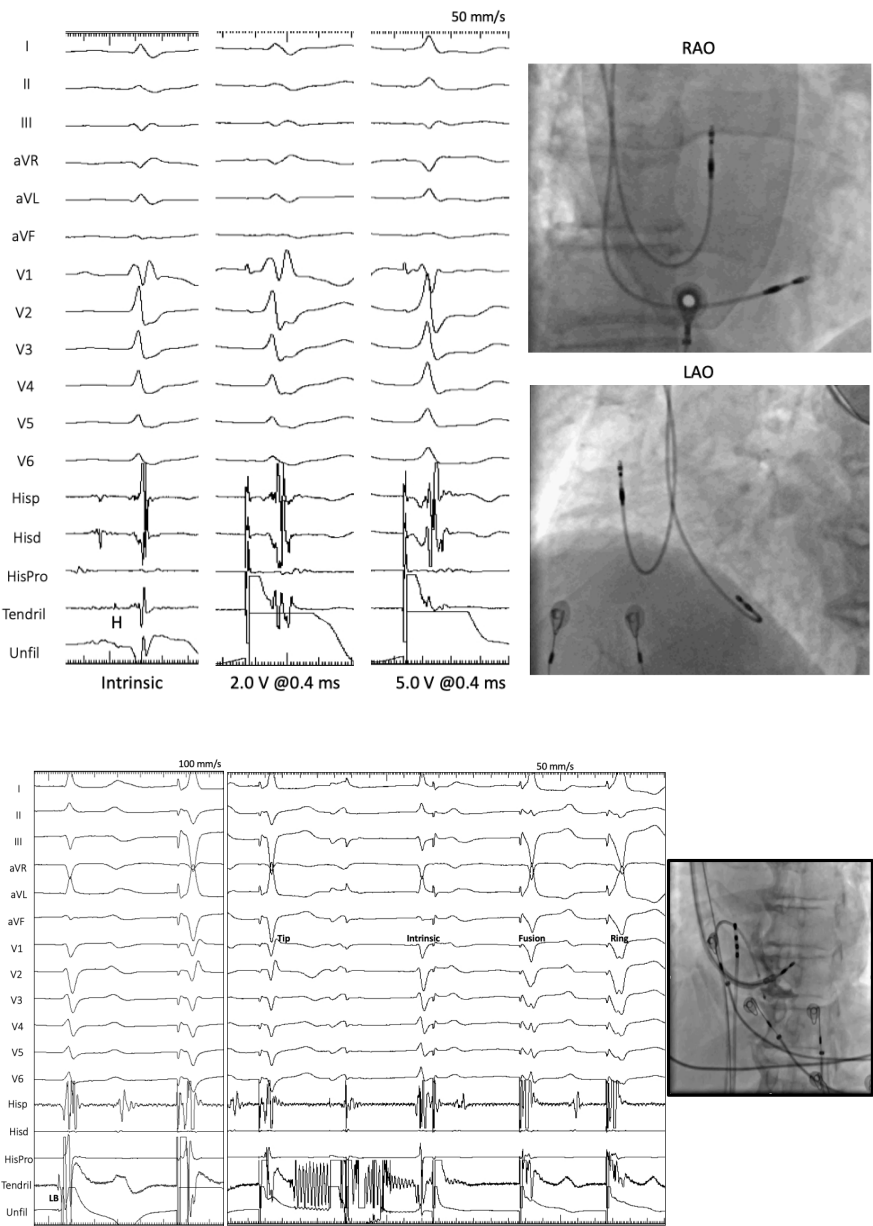
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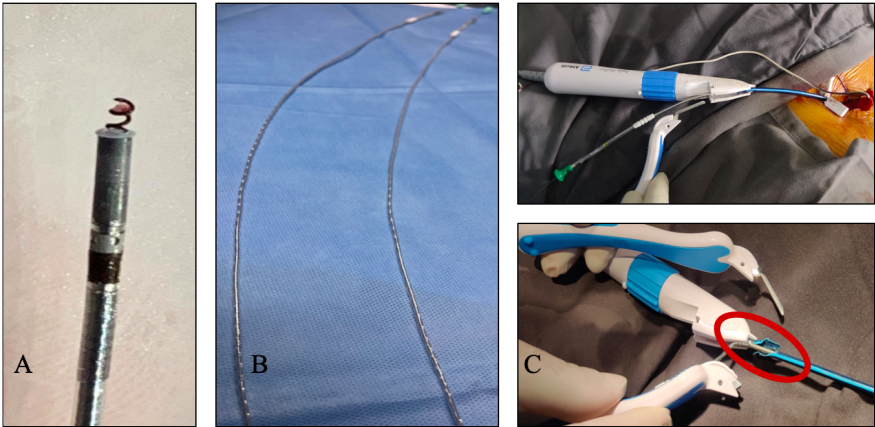
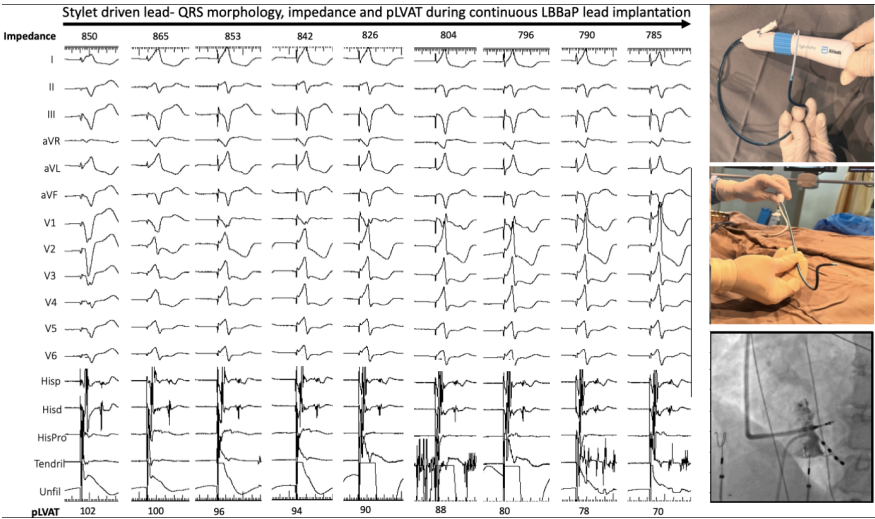


Table 1- Baseline characteristics

No	Age	Gender	Underlying structural heart disease	PPM Indication	DM	HTN	IHD	LVEF	CSP +/- CRT	Result
1	65	M	Ischemic cardiomyopathy	CHB with RBBB morphology escape	No	No	Yes	22	HOT CRT	S- HBP
2	68	M	Rheumatic Heart Disease	Atypical Afl- intermittent CHB	Yes	No	No	46	HBP	NS-HBP
3	71	F	None	Intermittent AV block	Yes	Yes	No	58	HBP	NS-HBP
4	57	M	Non ischemic cardiomyopathy	Sinus rhythm with LBBB	No	No	No	28	HOT CRT	S- HBP
5	55	F	None	2:1 AV block with narrow QRS	Yes	Yes	Yes	60	HBP	NS-HBP
6	80	F	None	2:1 AV block with narrow QRS	Yes	Yes	No	65	HBP	NS-HBP
7	57	M	None	Degenerative high grade AVB	No	Yes	No	44	HBP	NS-HBP
8	75	M	None	2:1 AV block	Yes	Yes	Yes	61	LBBaP	S-LBBaP
9	50	F	None	Sick sinus syndrome	Yes	Yes	Yes	60	LBBaP	NS- LBBaP
10	65	F	Hypertensive Heart disease	Persistent AF- Post AVN ablation	No	Yes	No	55	HBP	NS-HBP
11	53	M	Non ischemic cardiomyopathy	Sinus rhythm with LBBB	No	No	No	28	HOT CRT	NS- HBP
12	59	M	Hypertensive Heart Disease	Sick Sinus Disease	Yes	Yes	No	60	HBP	NS-HBP
13	63	M	Ischemic Cardiomyopathy	Sick sinus syndrome	Yes	Yes	Yes	35	HOT-CRT	S- HBP
14	62	M	Ischemic cardiomyopathy	VT storm	No	No	Yes	28	LOT-ICD (Changed to LLL)	NS- LBBaP
15	62	F	None	CHB with LBBB escape	No	Yes	Yes	60	LBBaP	NS-LBBaP
16	87	M	None	High grade AV block with RBBB escape	No	Yes	Yes	55	LBBaP	Septal
17	71	F	None	CHB with RBBB escape	Yes	Yes	No	56	RVaP	RVaP
18	81	M	None	CHB with Junctional escape	Yes	Yes	No	55	HBP	NS- HBP
19	62	M	None	Sick Sinus syndrome	Yes	No	No	60	LBBaP	NS-LBBaP
20	82	M	None	CHB with RBBB escape	Yes	Yes	No	56	Septal	Septal
21	64	F	None	High grade AV block with Narrow QRS escape	Yes	Yes	No	56	LBBaP	NS- LBBaP
22	79	M	None	CHB with RBBB escape	No	Yes	No	27	LBBaP	S- LBBaP
23	52	F	none	CHB with Narrow	No	Yes	No	54	HBP	NS- LBBaP
24	83	M	Non ischemic cardiomyopathy	CHB with RBBB escape	Yes	Yes	No	44	HBP	NS-HBP
25	69	M	Ischemic cardiomyopathy	CHB with narrow escape	Yes	Yes	Yes	51	HBP	Septal
26	57	F	None	High grade AV block with Narrow QRS escape	No	No	No	50	LBBaP	S- LBBaP
27	60	F	None	Sick Sinus Disease	No	No	No	55	LBBaP	NS- LBBaP
28	62	F	None	Paroxysmal AV block	Yes	Yes	No	52	LBBaP	NS- LBBaP
29	76	M	None	Intermittent CHB- Infrahisian	Yes	No	No	53	LBBaP	NS- LBBaP
30	67	F	None	High Grade AV block	Yes	Yes	No	54	LBBaP	NS- LBBaP
31	62	M	Ischemic cardiomyopathy	Degenerative CHB with alternative BBB escape rhythm	Yes	Yes	Yes	54	LBBaP	Septal
32	80	F	Ischemic cardiomyopathy	Degenerative CHB, RBBB escape rhythm	No	Yes	Yes	55	HBP	NS- HBP
33	66	M	None	Degenerative CHB, LBBB escape rhythm	Yes	No	Yes	54	HBP	NS-HBP
34	61	M	Ischemic cardiomyopathy	Sick Sinus syndrome	No	Yes	Yes	60	HBP	S-HBP
35	62	F	None	CHB with narrow escape	Yes	Yes	No	60	LBBaP	NS-LBBaP
36	81	F	None	2:1 AV block with RBBB escape	No	Yes	No	54	LBBaP	NS-LBBaP
37	68	M	Ischemic cardiomyopathy	High grade AV block with Narrow QRS escape	Yes	Yes	Yes	32	HOT-ICD	NS-HBP

CHB- Complete Heart Block, RBBB- Right Bundle Branch Block, LBBB- Left Bundle Branch Block, AVB- Atrioventricular Block, HBP- His Bundle Pacing, LBBaP- Left Bundle Branch area Pacing, HOT-CRT- His Bundle Pacing optimized Cardiac Resynchronisation Therapy, S- Selective, NS- Non- Selective, LOT-ICD- Left Bundle area Pacing optimized Cardiac Resynchronisation Therapy, RVaP- Right Ventricular apical Pacing, VT- Ventricular Tachycardia

Table 2- Implant characteristics

No.	Anaesthesia	CSP +/- CRT	Result	His/LB signal on lead	Capture	Sensed R	QRSd (ms)		Complication	Procedure Time (min)	Fluoroscopy time (min)
					Threshold @0.4ms (V)	(mV)	Pre	Post (VVI)			
1	GA	HOT CRT	S- HBP	Yes	1.25	4	147	116	No	138	74.5
2	LA	HBP	PHP	No	2.5	10.1	140	142	No	98	79.2
3	LA	HBP	NS-HBP	Yes	1	0	100	110	No	100	28.3
4	LA	HOT CRT	S- HBP	Yes	2	0	152	136	No	89	47.5
5	LA	HBP	NS-HBP ^a	Yes	0.5	7	85	123	Yes (Macro-Dislodgement<24h)	95	22.9
6	LA	HBP	NS-HBP	Yes	1	3.1	88	115		90	16.8
7	LA	HBP	NS-HBP	Yes	1.1	7.4	96	124		106	36.1
8	LA	LBBAP	S-LBBaP	No	2	7.4	120	110	No	70	18.4
9	AL	LBBAP	NS- LBBaP	Yes	1	9	94	92	No	84	30.2
10	LA	HBP	NS-HBP	Yes	1	6	80	110	No	99	58.9
11	LA	HOT CRT	S- HBP	Yes	2	0	152	130	No	89	47.5
12	LA	HBP	NS-HBP	Yes	1	9	84	100	Yes (Macro-Dislodgement<24h)	90	60.8
13	LA-GA	HOT-CRT	S- HBP ^b	No	1	9	100	90		108	24.5
14	LA	LOT-ICD (Changed to MDT LLL)	NS- LBBaP ^c	No	0.5	7.6	170	149		102	85.6
15	LA		NS-LBBaP ^d	No	0.75	9	128	120	No	126	47.6
16	LA		Septal ^e	No	1.5	5	140	140	No	130	36.5
17	LA	LBBaP	RVaP ^d	No	1.7	7	120	140	No	152	46.6
18	LA	HBP	NS- HBP	No	0.6	5.2	100	110	No	65	25.6
19	LA	LBBaP	NS-LBBaP	No	1	6	90	110	No	72	45
20	LA	LBBaP	Septal ^e	No	0.6	5	130	120	No	94	19.9
21	LA	LBBaP	NS- LBBaP	No	1.1	6	90	120	No	91	57.6
22	LA	LBBaP	S- LBBaP	No	0.6	4.6	150	110	No	73	30.5
23	LA	HBP	NS- LBBaP	No	0.7	8	100	120	No	124	44.7
24	LA	HBP	NS-HBP	No	0.9	9	150	110	No	90	45
25	LA	HBP	Septal ^e	No	1	5	110	120	No	110	47.9
26	LA	LBBaP	S- LBBaP	Yes	0.7	12	110	100	No	100	43.6
27	LA	LBBaP	NS- LBBaP	Yes	1	10.4	108	100	No	110	25.4
28	LA	LBBaP	NS- LBBaP	Yes	1.2	5.4	135	110	No	110	24.9
29	LA	LBBaP	NS-LBBaP	Yes	0.75	12	153	110	No	90	69.1
30	LA	LBBaP	Septal ^e	No	0.7	7	122	140	No	100	49.3
31	LA	LBBaP	LBBaP	Yes	1.5	13.2	145	124	No	88	28.3
32	LA	HBP	NS-HBP	Yes	0.75	4.3	140	142	No	94	74.5
33	LA	HBP	NS-HBP	Yes	2	5.2	140	143	No	85	23.7
34	LA	HBP	S-HBP	Yes	3.2	3	100	90	No	84	18.8
35	LA	LBBAP	S-LBBaP	Yes	0.7	5.6	153	120	No	100	43.6
36	LA	LBBAP	S-LBBaP	Yes	1	9	130	110	No	94	75.4
37	LA	HOT-ICD	NS-HBP ^f	No	1	4.5	100	120	Yes (Micro- Dislodgement<24h)		

HBP- His Bundle Pacing, LBBaP- Left Bundle Branch area Pacing, HOT-CRT- His Bundle Pacing optimized Cardiac Resynchronisation Therapy, S- Selective, NS- Non- Selective, LOT-ICD- Left Bundle area Pacing optimized Cardiac Resynchronisation Therapy, RVaP- Right Ventricular apical Pacing, VT- Ventricular Tachycardia

a- Dislodgement, changed to RV apical pacing

b- Succumbed to Non- arrhythmia issues (Multiple Co-morbidities, Acute on Chronic Kidney injury)

c- Deep penetration could not be obtained with Tendril. Finally changed to MDT 3830 lead delivered through His315 sheath, septal capture

d- CS capture not attainable, changed to RVaP

e- Conduction system capture not possible changed to Septal Pacing

f- Microdislodgement noted on post- procedure day 1, Lead revised to LBBaP with LLL (3830), delivered through His315 sheath

Table 3- Follow-up characteristics

Case	QRSd (ms)		R waves (mV)		Pacing Impedance (ohms)		Pacing Threshold (V) at 0.4 ms		LVEF (%)		Complications	
	At implant	At F/U	At implant	At F/U	At implant	At F/U	At implant	At F/U	At Implant	At F/U	Threshold rise >1V	Lead dislodgement
1	116	120	4	4	810	700	3.25	2.75	22	22	No	No
2	142	138	10.1	-	640	510	2.5	0.5	46	46	No	No
3	110	114	0	6.5	440	390	1	0.75	58	58	No	No
4	136	138	0	2	500	340	2	1.5	28	28	No	No
5	130	130	7	5.7	500	490	0.5	1	60	60	No	No
6	115	110	3.1	3.1	540	270	1	0.5	65	65	No	No
7	124	138*	7.4	10.8	740	490	1.1	0.75	44	44	No	No
8	110	110	7.4	10.8	522	460	2	0.5	61	61	No	No
9	92	90	9	9	520	600	1	0.75	60	60	No	No
10	110	110	6	5.1	370	440	1	0.5	55	55	No	No
11	130	130	0	2	500	340	2	1.5	28	28	No	No
12	90	90	9	4.1	520	430	1	0.5	-	64	No	No
13	90	-	9	-	420	-	1	-	35	-	-	-
14	149	145	7.6	7.6	690	690	0.5	0.5	28	28	No	No
15	120	120	9	9.7	490	444	0.75	0.75	60	60	No	No
16	140	140	5	7	510	540	1.5	0.75	55	55	No	No
17	140	140	7	7	510	540	1.5	0.75	55	55	No	No
18	110	110	5.2	10	350	400	1.7	0.75	56	56	No	No
19	110	110	6	12	512	390	0.6	0.5	55	55	No	No
20	120	120	5	12	412	430	1	1	60	60	No	No
21	120	120	6	0	430	440	0.6	0.75	56	56	No	No
22	110	110	4.6	0	466	440	1.1	0.75	56	56	No	No
23	120	120	8	0	410	430	0.6	1	53	53	No	No
24	110	110	9	12	437	390	0.7	0.5	54	54	No	No
25	120	120	5	2.3	650	380	0.9	0.7	44	44	No	No
26	100	100	12	0	460	380	1	0.5	51	51	No	No
27	100	100	10.4	12	510	350	0.7	0.75	50	50	No	No
28	110	140	5.4	12	540	360	1	1.25	55	55	No	No
29	110	140	12	12	340	430	1.2	0.75	52	52	No	No
30	140	140	7	12	550	440	0.75	0.5	51	51	No	No
31	124	124	5.7	15	410	440	1	0.75	56	55	No	No
32	142	142	7.8	11	374	400	1.2	0.5	55	54	No	No
33	143	143	5.2	8	700	650	2	1.5	54	54	No	No
34	90	90	3	4.5	600	650	3.2	2.2	55	55	No	No
35	120	120	5.6	13	560	410	0.75	0.5	60	60	No	No
36	110	120	9	6.1	554	610	1	0.5	60	54	No	No
37	120	90+	4.5	8.2	650	620	0.8	1	35	40	No	No

*- lost conduction system capture on follow up

*- Result of LBBaP after lead revision