

Case Studies

Stuart Allen

Principal Cardiac Physiologist
Manchester Heart Centre

- Pacemaker
- CRT
- ICD





**Device Specialist Symposium
Surfers Paradise
Case study**

**Stuart Allen
Lead Cardiac Scientist
CRM/ Invasive
Monash Medical Centre**

Patient MF

- 20yr QT1 syndrome -brother & sister also have Long QT1+ pacemakers implanted
- Medtronic KDR 721 implanted 18/09/05 RCH (2nd pacemaker) - DDD 90ppm
- Transferred to Monash at 18y
- Frequently failed to turn up for pacemaker appointments
- July 2008 found to be near ERI- scheduled for generator change

745

Model: Medtronic.Kappa KDR721
Number: PGR633924

07/30/08 10:15:07 AM
Medtronic.Kappa 700 Software 5.3
Copyright (c) Medtronic, Inc. 1999

Atrial Interrogation Report

Page 1

Patient/Device Information

Dependency:		Physician Name:	A.Davis		
Implanted Defibrillator?:	No	Physician Phone:			
Pacemaker Model:	Kappa	KDR721	PGR633924	Implanted:	02/26/04 12:11 PM
Atrial Lead:	Medtronic	10366	LDW000145R	Implanted:	8/12/99
Ventricular Lead:	Medtronic	4965	LBT015019R	Implanted:	8/12/99

Pacemaker Status

Estimated remaining longevity: 4 months, < 1 - 8 months (Based on Past History)
Battery Voltage/Impedance 2.60 V / 4,489 ohms

	Atrial	Ventricular
Amplitude/Pulse Width	1.66 V / 0.34 ms	3.30 V / 0.46 ms
Sensitivity	0.70 mV	2.00 mV
Measured Impedance	689 ohms	605 ohms

- FTA for 2 generator replacements
- Turned up to clinic 26/11/08
- Pacemaker in ERI (ERI since 3/8/08)
- Further gen replacement organised for 1st week in Jan 09

FOLEY, Michael 0844745
Pacemaker Model: Medtronic.Kappa KDR721
Serial Number: PGR633924

11/26/08 9:41:12 AM
Medtronic.Kappa 700 Software 5.3
Copyright (c) Medtronic, Inc. 1998

Page 1

Investigation Report

Device Information

Agency:		Physician Name:	A.Davis	
Implanted Defibrillator?:	No	Physician Phone:		
Pacemaker Model:	Kappa	KDR721	PGR633924	Implanted: 02/26/04 12:07 PM
Atrial Lead:	Medtronic	10366	LDW000145R	Implanted: 8/12/99
Ventricular Lead:	Medtronic	4965	LBT015019R	Implanted: 8/12/99

Pacemaker Status

Estimated remaining longevity: Replace Pacer
Battery Voltage/Impedance 2.61 V / 5,750 ohms

	Ventricular
Amplitude/Pulse Width	3.30 V / 0.46 ms
Sensitivity	2.00 mV
Measured Impedance	624 ohms

FTA Generator replacement Jan 09

Why?

- Rescheduled and had a routine generator change at fourth attempt
- Had a call up to the Australian cricket squad to play in the Ashes! (they are accepting all offers!)
- Went to Surfers Paradise on holiday
- Won the lottery and decided to have the latest 'bling' accessory - a diamond encrusted Adapta

This happened Next!!

TITLE: SURF PATROL

EP#: ONE (Series 3)

KEY#: SPTL3-001

DUR: 21'41"

SEG: 6'21"

AUDIO STEREO MIX 1&2

M&E 3&4

DATE: 19/06/2009



After Failing to Die!!

- Pt admitted to Coolangata Hospital QLD - refused ICD implantation
- After 24mins of CPR - No cerebral hypoxia
- Self discharged after 7 days

Back In Melbourne

- At Monash Medical Centre OPD - still refused ICD implantation
- Generator change 16/04/09 - Medtronic ADSR01 implanted- Epicardial
- AAI 90ppm

Initial Interrogation Report

Page 1

Patient/Device Information

Dependency: Physician Name: A.Davis
Implanted Defibrillator?: No Physician Phone:

Pacemaker Model:	Kappa	KDR721	PGR633924	Implanted:	02/26/04 11:05 AM
Atrial Lead:	Medtronic	10366	LDW000145R	Implanted:	8/12/99
Ventricular Lead:	Medtronic	4965	LBT015019R	Implanted:	8/12/99

Pacemaker Status

Estimated remaining longevity: Replace Pacer
Battery Voltage/Impedance 2.43 V / 11,616 ohms

	Ventricular
Amplitude/Pulse Width	3.29 V / 0.46 ms
Sensitivity	1.40 mV
Measured Impedance	577 ohms

FOLEY Michael 0844745
Pacemaker Model: Medtronic,Kappa KDR721
Serial Number: PGR633924

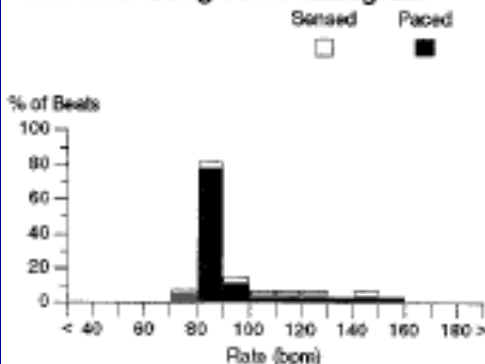
04/16/09 9:47:24 AM
Medtronic,Kappa 700 Software 5.3
Copyright (c) Medtronic, Inc. 1998

Initial Interrogation Report

Page 2

Clinical Status: Collection terminated by ERI - 08/03/08

Ventricular Long Term Histogram



Ventricular High Rate Episodes: 0

Pacing (% of total):

Sensed	5.0%
Paced	95.0%



Future Management

- Failed to turn up for 6/52 appt - took 2 attempts to get patient in for a follow up
- ?Carelink
- Unable to contact patient...Gone to Canada!
- Brother also FTA

Conclusions

- I obviously came to work in Manchester for the weather!
- Some patients are idiots
- One lucky son of a bitch!!

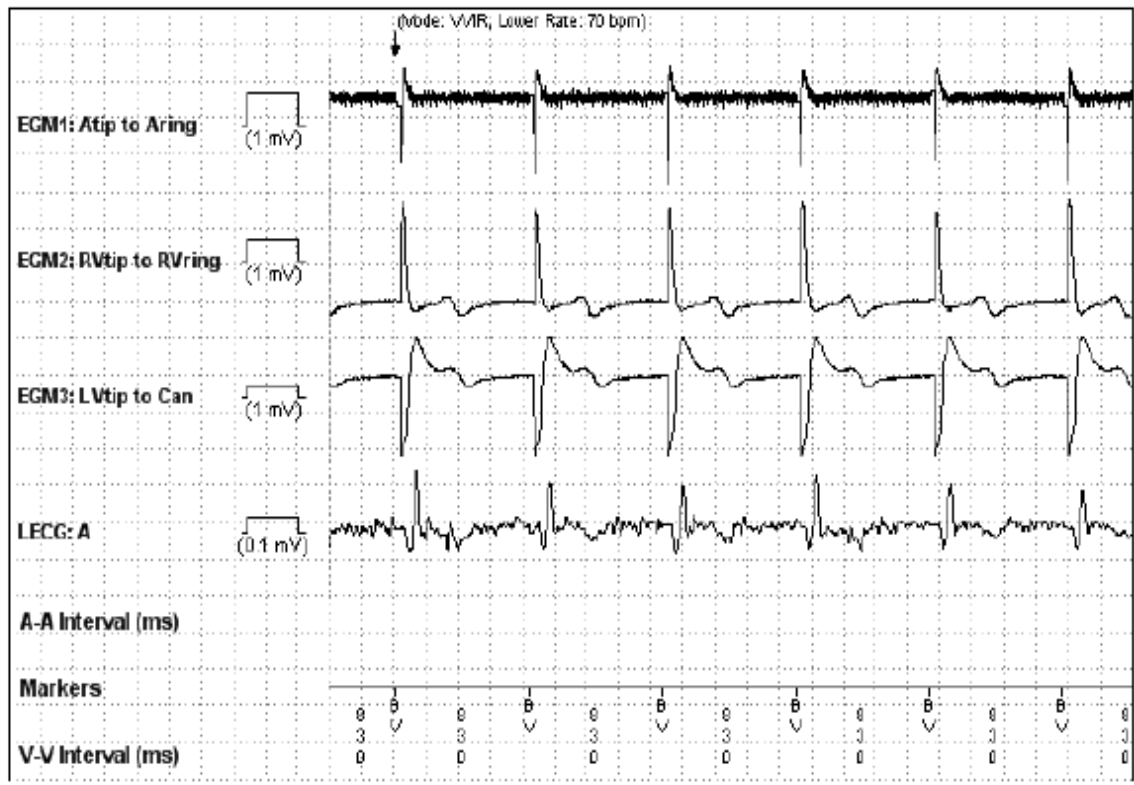
Case Presentation 2

CRT-P

Varying LV Threshold

Implant Details

- 76y Male, SOBOE, EF 25%, Permanent AF
- Medtronic Syncra CRT-P implanted 15/11/10
- RV lead Medtronic 5076 – Threshold <1.0v
- LV lead Medtronic 4296 – Lowest threshold 1.0v LV tip – LV ring
- Pre discharge check – LV threshold 1.25v
- 4 week check LV threshold 2.25v

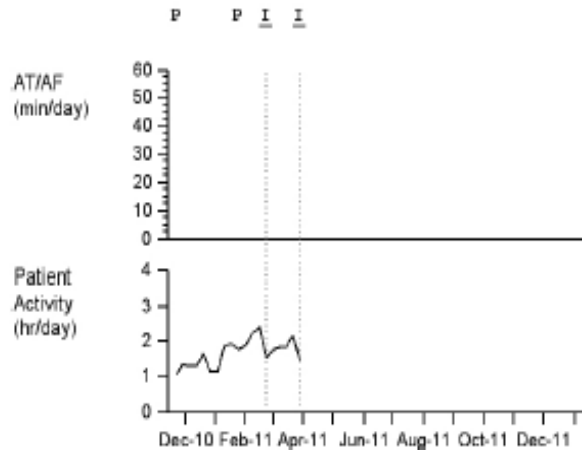


Device Status (Implanted: 15-Nov-2010)

Battery Voltage (RRT=2.77V)	3.01 V	(28-Mar-2011)		
Remaining Longevity (based on initial interrogation)	4 years (2.5 - 5.5 years)			
Lead Impedance	Atrial >3000 ohms	RV(5076) 570 ohms	LV(4296-88) 780 ohms	
Capture Threshold Measured On			2.250 V @ 0.40 ms 28-Mar-2011	
Programmed Amplitude/Pulse Width		2.50 V / 0.40 ms	4.50 V / 0.40 ms	
Measured P/ R Wave	2.4 mV	7.8 mV		
Programmed Sensitivity	0.45 mV	0.90 mV		

Clinical Status Since 21-Feb-2011 Longest Cardiac Compass Trends (Nov-2010 to Mar-2011)

Monitored		
VT (>4 beats)	0	
Fast A&V	0	
AT/AF	0	
Time in AT/AF	0.0 hr/day (0.0%)	
Functional	Last Week	
Patient Activity	1.8 hr/day	



Pacing	(% of Time Since 21-Feb-2011)
AS-VS	98.8%
AS-VP	3.4%
AP-VS	0.0%
AP-VP	0.0%

OBSERVATIONS (1)

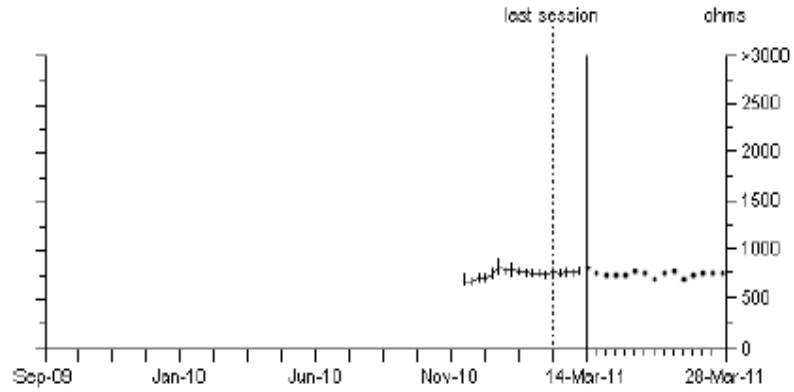
· LV Capture Management determined that threshold increased by 1.75 V from 26-Mar-2011 to 27-Mar-2011. This increase was greater than Amplitude Safety Margin (+1.5 V) and may have compromised capture.

LV Pace Polarity
Lead Model

LVtip to LVring
4296-88

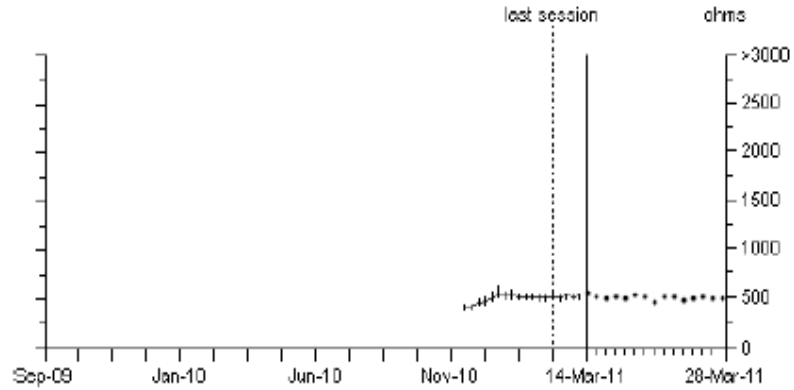
**LV Impedance
(LVtip to LVring)**

Last Measured 760 ohms



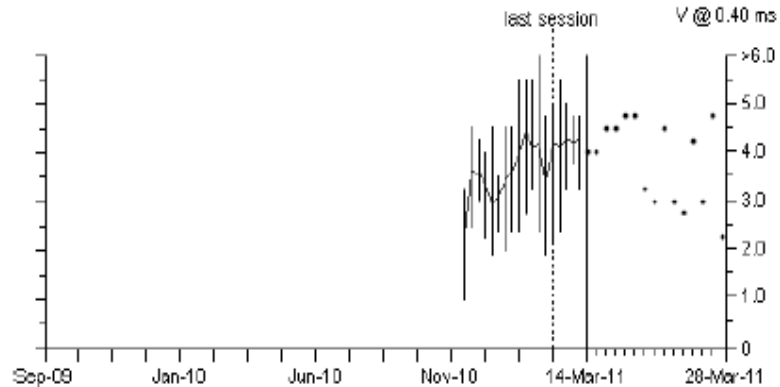
**LV Impedance
(LVtip to Can)**

Last Measured 494 ohms



LV Threshold

Capture Monitor
Amplitude 4.50 V
Pulse Width 0.40 ms
Max. Adapted 6.00 V
Last Measured 2.250 V @ 0.40 ms
Measured On 28-Mar-2011

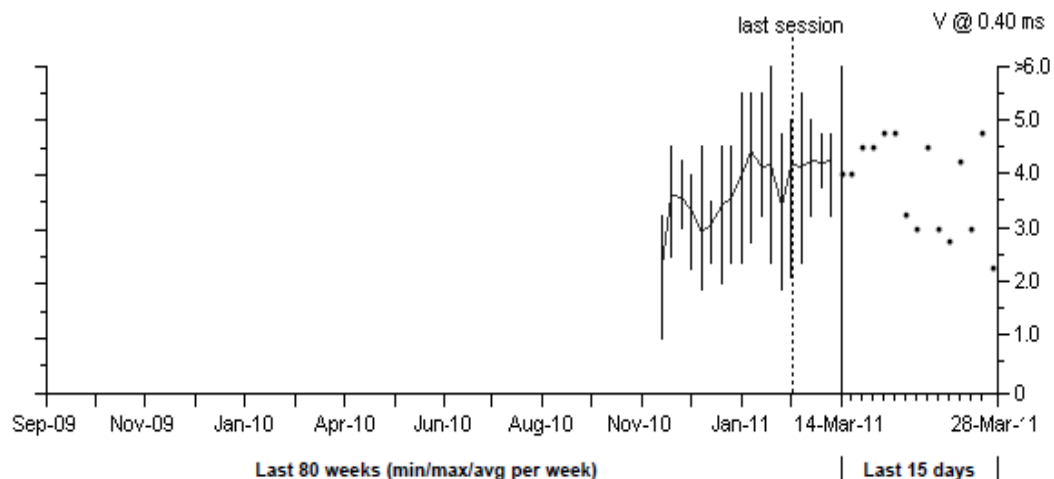


Last 80 weeks (min/max/avg per week)

Last 15 days

Lead Trend - LV Threshold 15 Days Detail

Amplitude	4.50 V	Capture	Monitor
Pulse Width	0.40 ms		
Last Measured	2.250 V @ 0.40 ms 28-Mar-2011	Max. Adapted Amplitude	6.00 V



LV Threshold Last 15 days detail

Date	Time hh:mm	Threshold (V)	Pulse Width (ms)	Amplitude (V)	Notes
28-Mar-2011	01:01	2.250	0.40	4.50	Measurement OK
27-Mar-2011	01:01	4.750	0.40	4.50	Measurement OK
26-Mar-2011	01:01	3.000	0.40	4.50	Measurement OK
25-Mar-2011	01:01	4.250	0.40	4.50	Measurement OK
24-Mar-2011	01:30	2.750	0.40	4.50	Measurement OK
23-Mar-2011	01:01	3.000	0.40	4.50	Measurement OK
22-Mar-2011	01:01	4.500	0.40	4.50	Measurement OK
21-Mar-2011	01:00	3.000	0.40	4.50	Measurement OK
20-Mar-2011	01:01	3.250	0.40	4.50	Measurement OK
19-Mar-2011	01:00	4.750	0.40	4.50	Measurement OK
18-Mar-2011	01:00	4.750	0.40	4.50	Measurement OK
17-Mar-2011	01:01	4.500	0.40	4.50	Measurement OK
16-Mar-2011	01:00	4.500	0.40	4.50	Measurement OK
15-Mar-2011	01:00	4.000	0.40	4.50	Measurement OK
14-Mar-2011	01:01	4.000	0.40	4.50	Measurement OK

Clinical Status

Since 28-Mar-2011 Longest

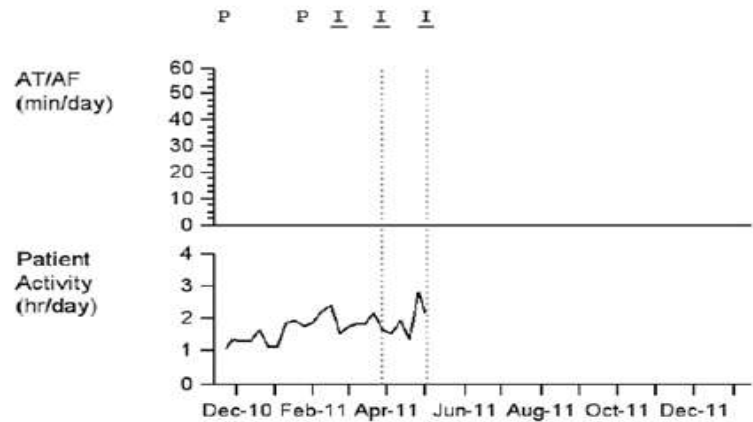
Cardiac Compass Trends (Nov-2010 to May-2011)

Monitored

VT (>4 beats) 0
 Fast A&V 0
 AT/AF 0
 Time in AT/AF 0.0 hr/day (0.0%)

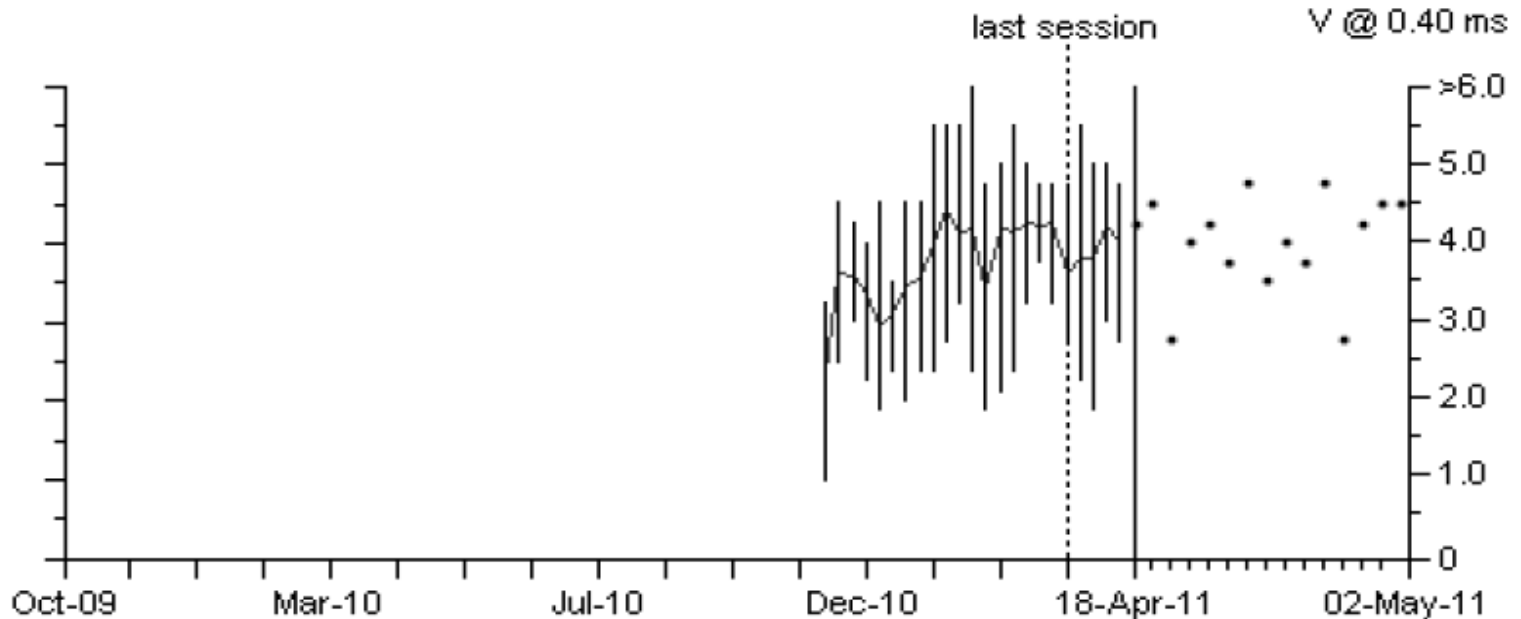
Functional

Patient Activity **Last Week**
 2.3 hr/day



Pacing (% of Time Since 28-Mar-2011)

AS-VS 96.1%
 AS-VP 3.9%
 AP-VS 0.0%
 AP-VP 0.0%

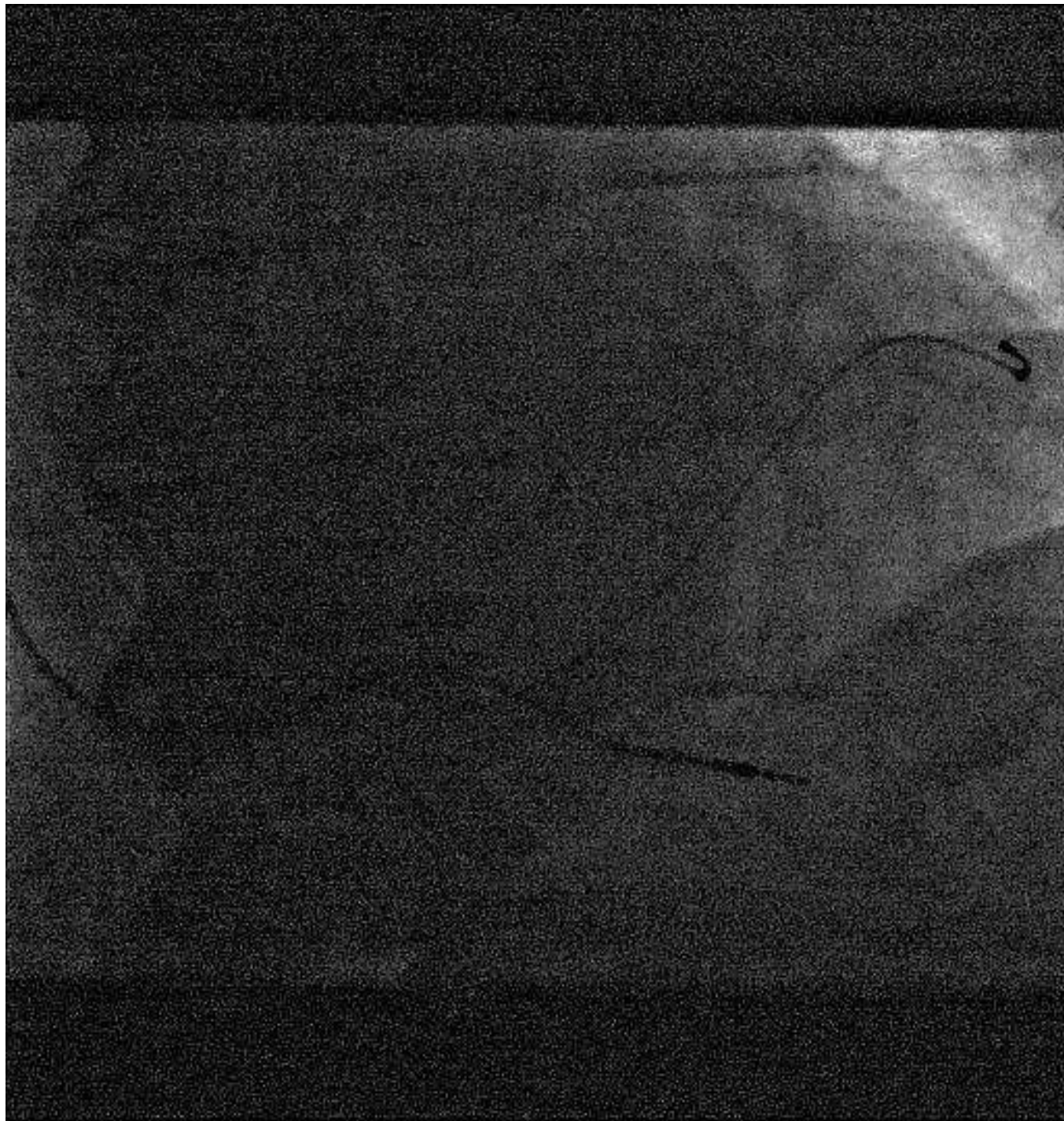


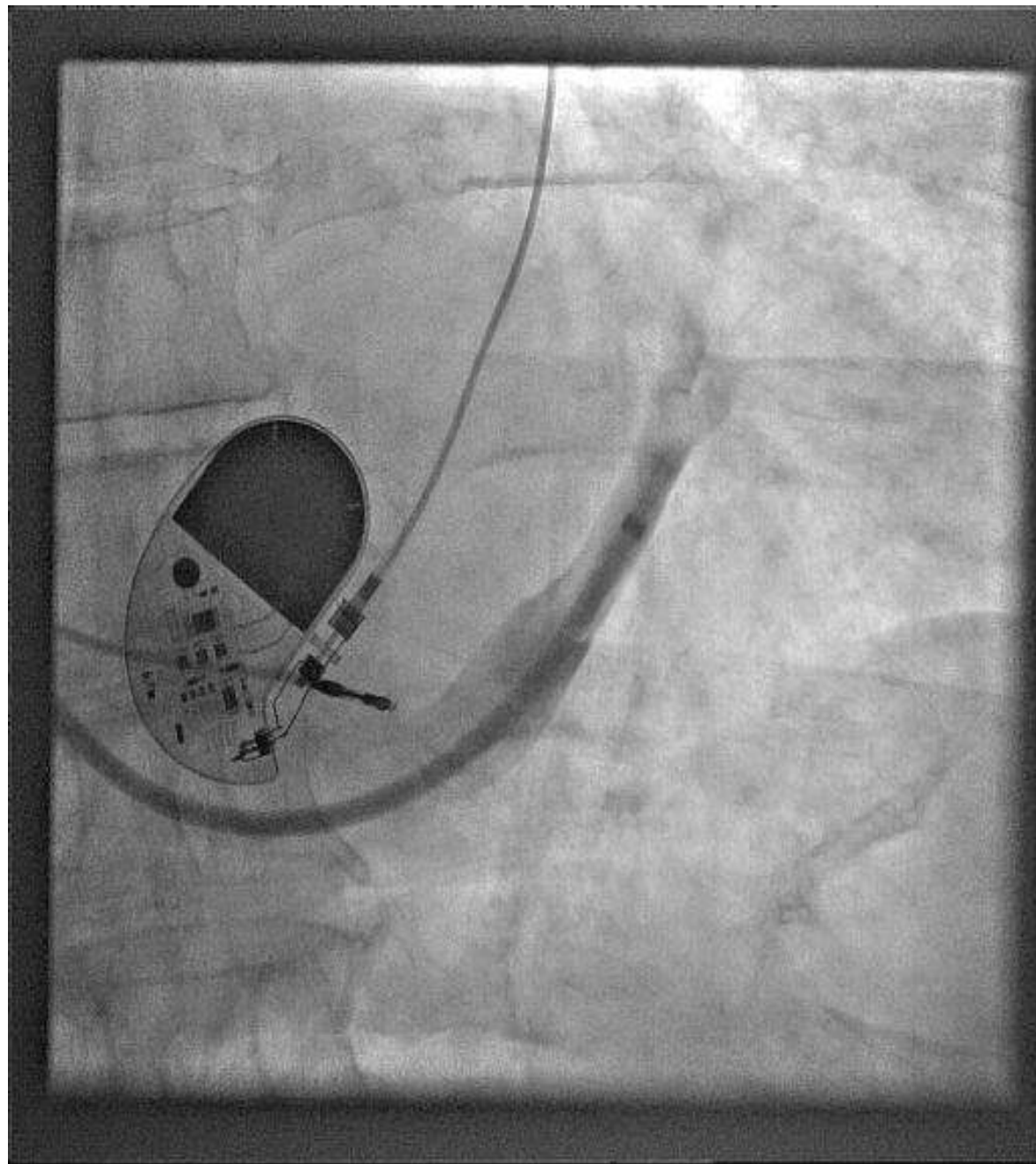
Last 80 weeks (min/max/avg per week)

Last 15 days

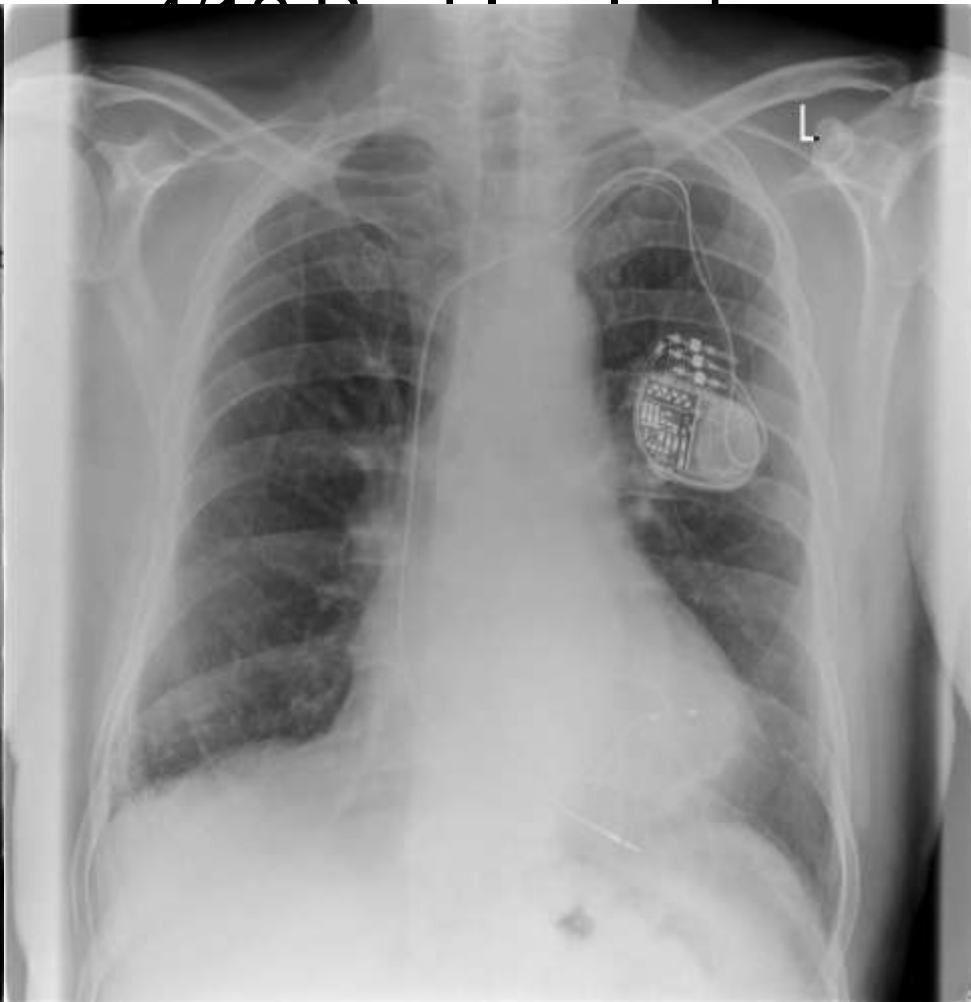
In Clinic Device Check

- Pt reports – some days has less energy than other days
- - ? related to intermittent LV non capture (or not!)
- Threshold checked - All LV pacing vectors
- Lowest threshold 3.5v LV tip to LV ring
- Reprogrammed LV O/P 4.5v to 5.5v – LVCM in monitor
- CXR
- Follow up phone call 4 weeks later – Pt feels able to do more
- Successive Carelink downloads still show varying LV threshold but <5.5v
- ? Threshold >5.5v as LVCM measured only once every 24hrs





Is the LV lead in the same place?

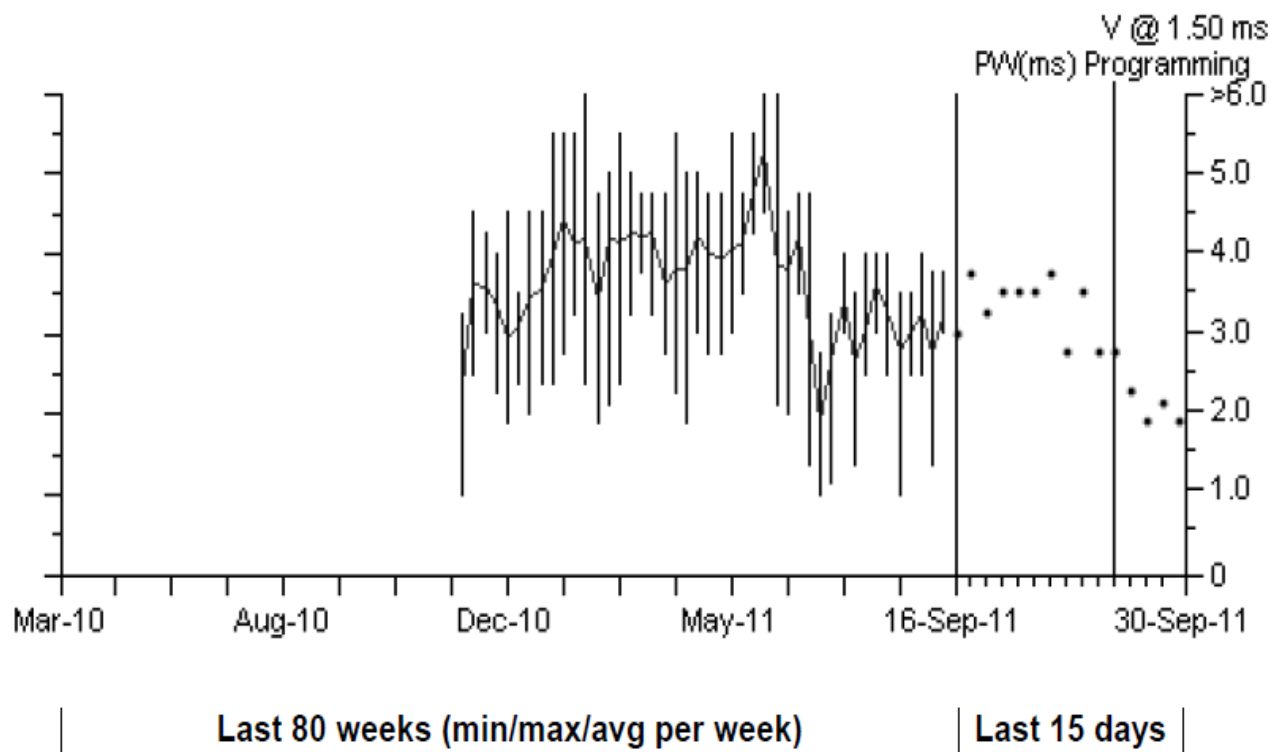


Domiciliary Check

- Lead probably has moved
- Pt has dementia and CHF stable. Lead reposition not considered at this time
- Threshold check @ 1.5ms and O/P reprogrammed to 1.5ms
- Carelink check 7/7

LV Threshold

Capture Adaptive
Amplitude 3.50 V
Pulse Width 1.50 ms
Max. Adapted 6.00 V
Last Measured 1.875 V @ 1.50 ms
Measured On 30-Sep-2011



Conclusion

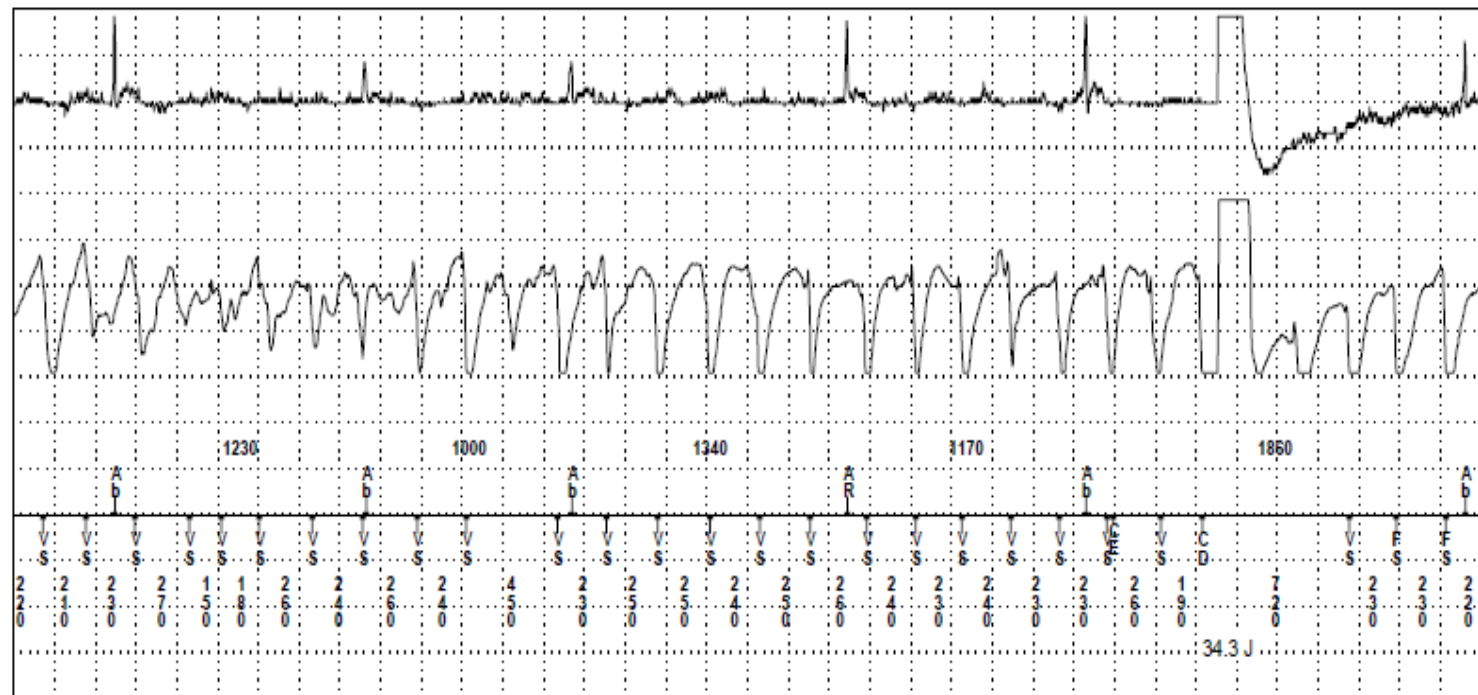
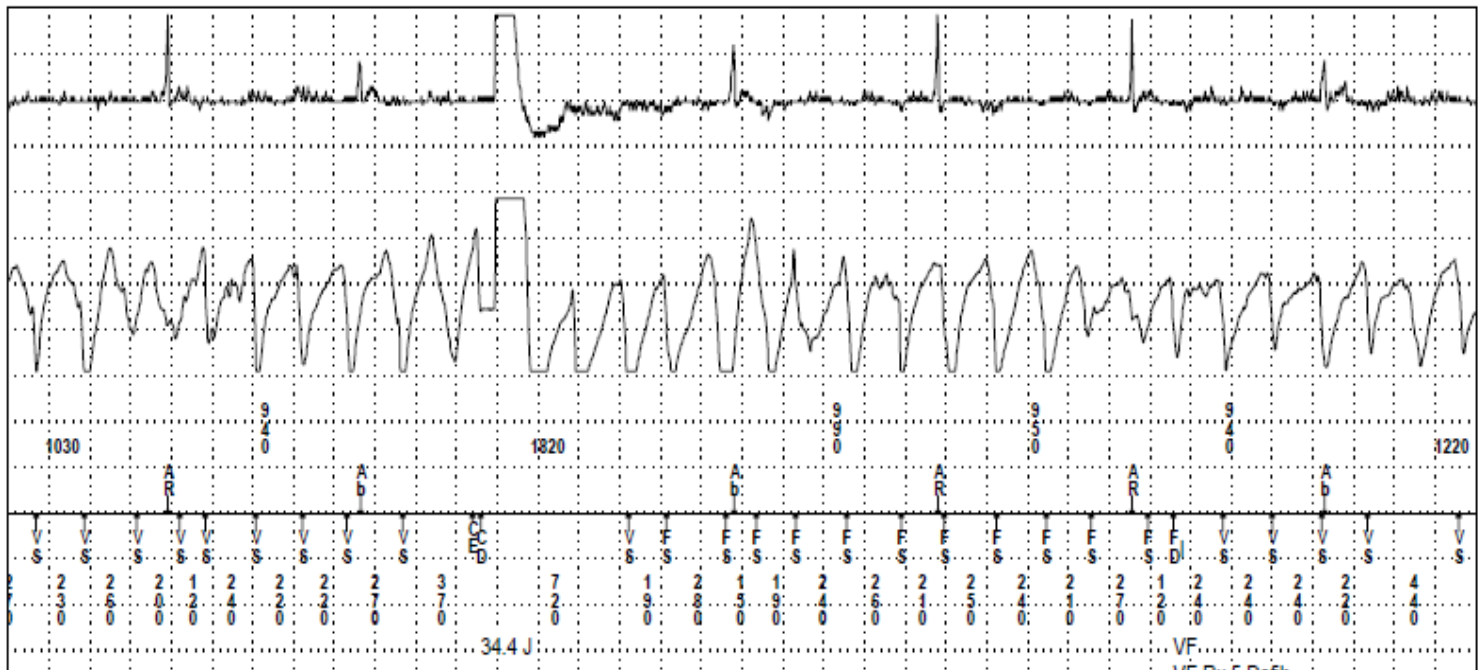
- Varying LV threshold's may increasingly be noted due to the availability of LV lead trend diagnostics in newer devices
- Don't rely on 'Quick Look/ Summary' for threshold data
- Always check the lead trends!
- Once every 24hr LV threshold measurement tests may not accurately show any threshold variance
- Thresholds $>2.5v$ may be more variable

.Case Study 3

ICD

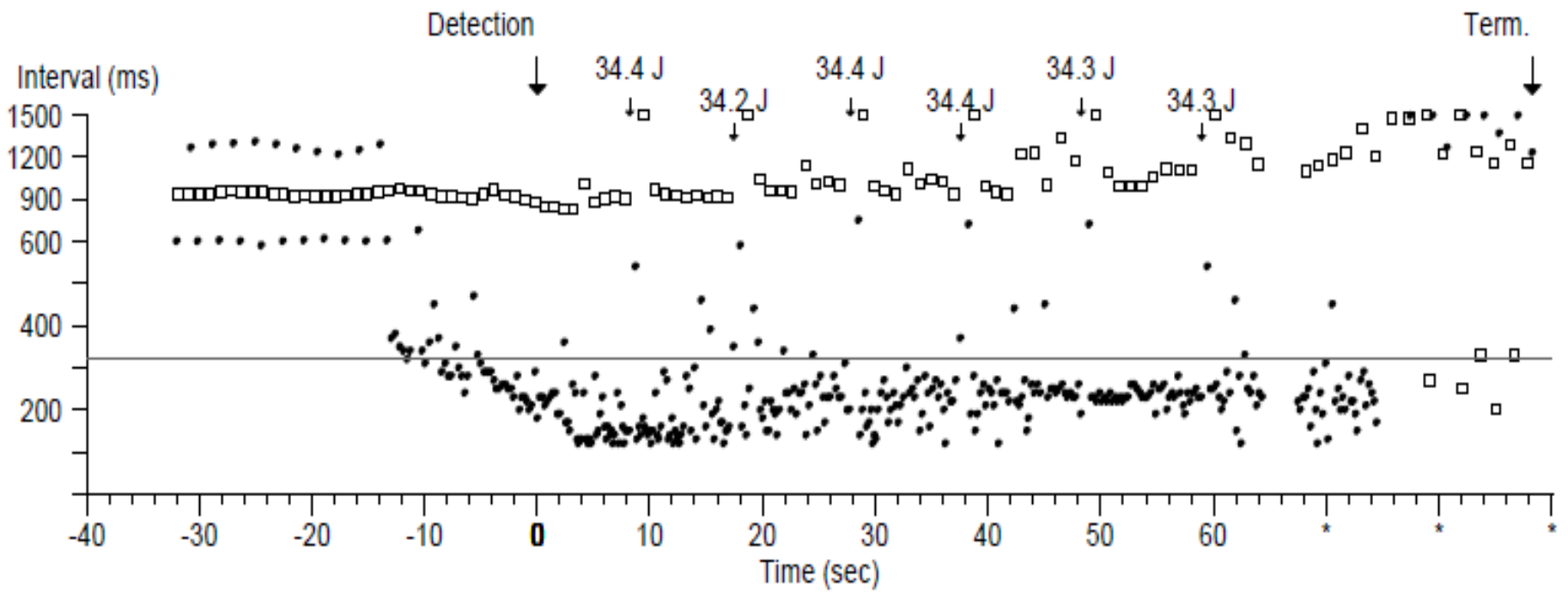
Patient History/Implant

- Male 45y DCM
- VF during dialysis
- ICD implant Right Sided, Medtronic Protecta XT DR.
Lead Medtronic 6947
- No DFT performed
- Day after discharge during dialysis.....Friday
afternoon!



Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm A/V	Max bpm A/V	Activity at Onset
VF	0	6	No	1	23-Sep-2011	13:25	:03:14	67/273	--/400	Rest

• V-V □ A-A VF = 320 ms



Why Did It Fail?

- High DFT?
- Low K?
- **Current Shunting**

Episode Summary

Initial Type	VF (spontaneous)
Duration	3.2 min
A/V Max Rate	---/400 bpm
V. Median	261 bpm (230 ms)
Activity at onset	Rest, Sensor = 43 bpm
Last Therapy	VF Rx6: Defib, Unsuccessful

**Initial VT/VF Detection
Withheld By**

None

Therapies	Delivered	Charge	Ohms	Energy
VF Rx 1 Defib	34.4 J	7.73 sec	28 ohms	0.0 - 35 J
VF Rx 2 Defib	34.2 J	6.37 sec	28 ohms	3.5 - 35 J
VF Rx 3 Defib	34.4 J	6.47 sec	28 ohms	3.5 - 35 J
VF Rx 4 Defib	34.4 J	6.67 sec	28 ohms	3.4 - 35 J
VF Rx 5 Defib	34.3 J	6.83 sec	28 ohms	3.4 - 35 J
VF Rx 6 Defib	34.3 J	6.96 sec	27 ohms	3.5 - 35 J
Termination				

Pre Discharge

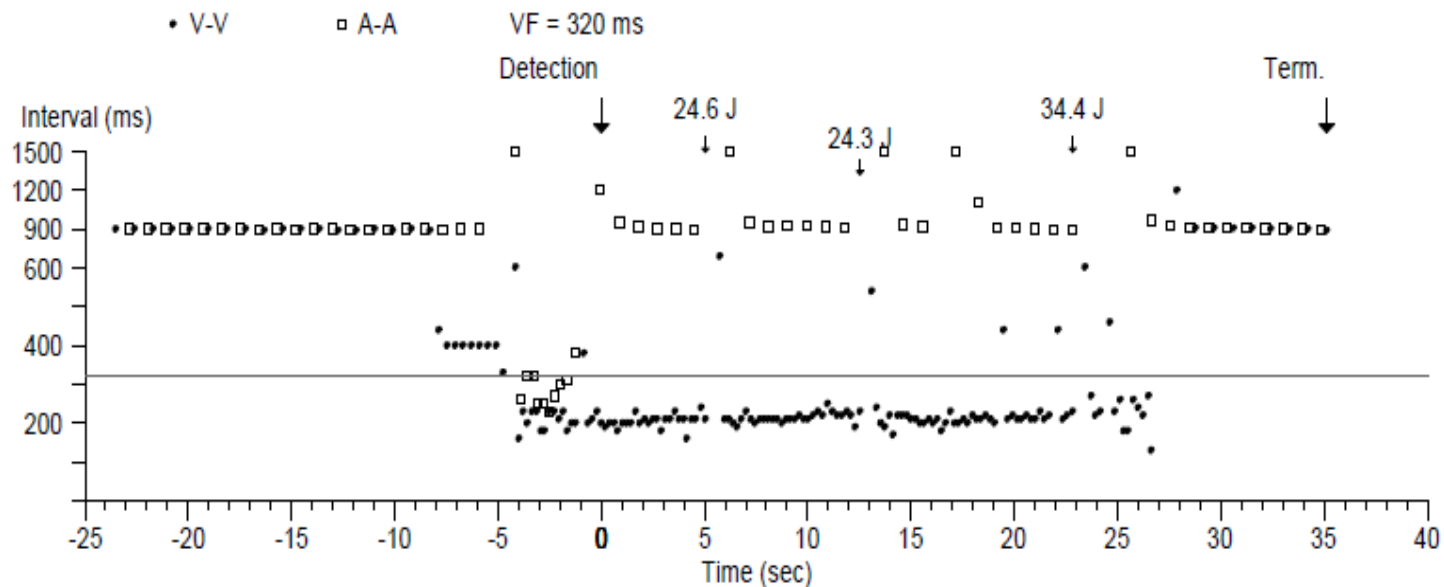
Battery Voltage (RRT=2.63V)	3.12 V	(22-Sep-2011)
Last Full Charge	9.0 sec	(21-Sep-2011)
	Atrial(5076)	RV(6947M-62)
		SVC
Pacing Impedance	304 ohms	418 ohms
Defibrillation Impedance		RV=25 ohms ←
		SVC=28 ohms ←
Capture Threshold	1.375 V @ 0.40 ms	0.375 V @ 0.40 ms
Measured On	22-Sep-2011	22-Sep-2011
Programmed Amplitude/Pulse Width	3.50 V / 0.40 ms	3.50 V / 0.40 ms
Measured P/ R Wave	1.3 mV	4.3 mV
Programmed Sensitivity	0.30 mV	0.30 mV

Parameter Summary:

What Next

- Programmed out SVC coil
- DFT test. Fail to convert VF RV – Can 35J

Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm A/V	Max bpm A/V	Activity at Onset
VF	0	3	No	4	26-Sep-2011	17:37	:33	109/286	---/286	Rest



Conclusion

- Pt will need- ?lead tunnelled to right side, array or patch
- Always check the non invasive shock lead impedance especially with dual coil leads
- <30 ohms – Risk of current shunting
- Data suggests defibrillation efficacy of single coil leads vs dual coil is <3J

Thank You