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Arrhythmia Detection: A Quest for Signal Quality and Computerized Tools

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WEBINAR

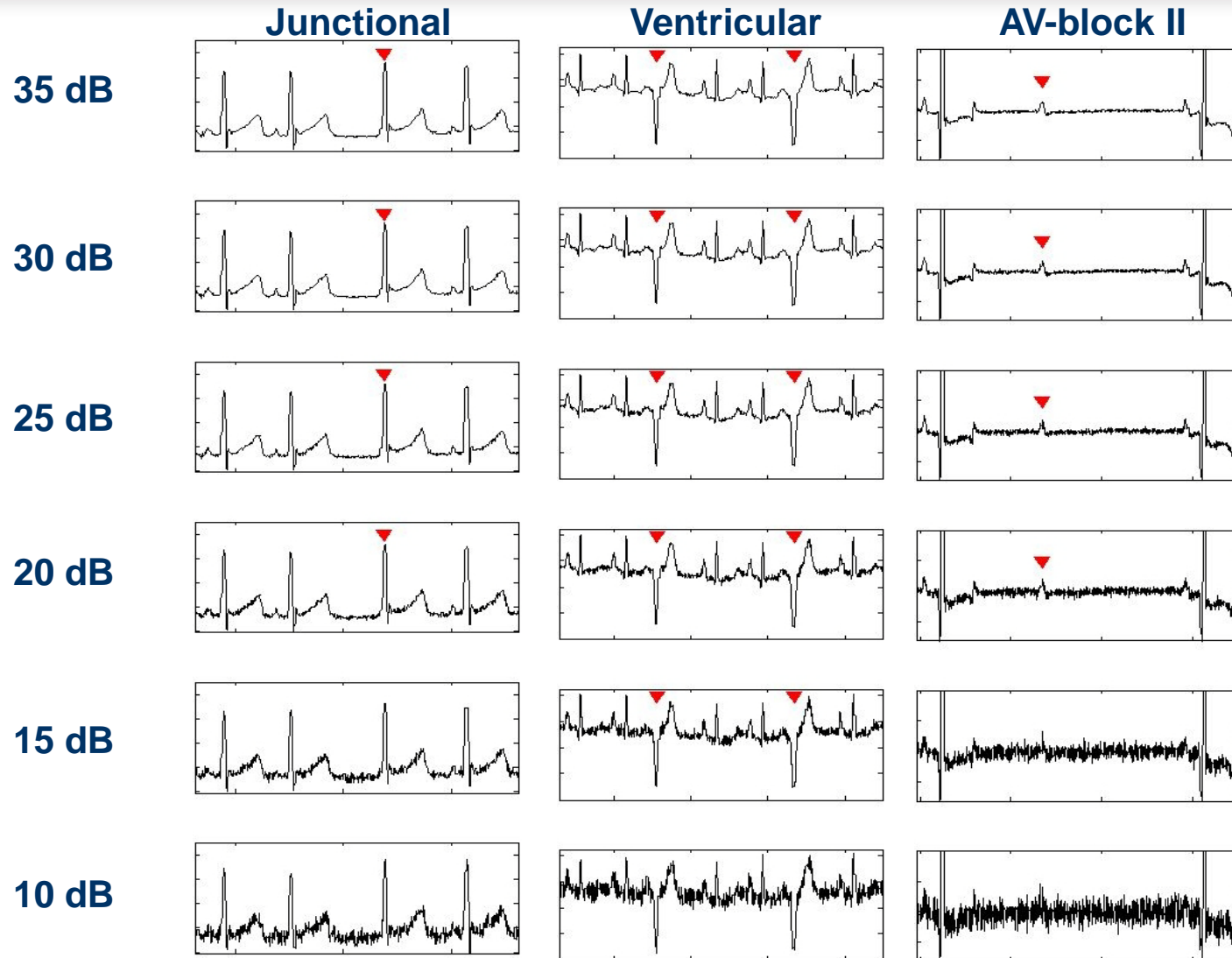


Background

- EMG artifacts interfere with automated detection
- Various ECG leads presented mixed results:
 - SC leads → significant EMG artifacts
 - IC leads → variable ECG morphology
 - Pericardiac leads → Invasive + lengthy recovery



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Intravenous Biopotential Lead

Based on Standard DSI ECG Lead

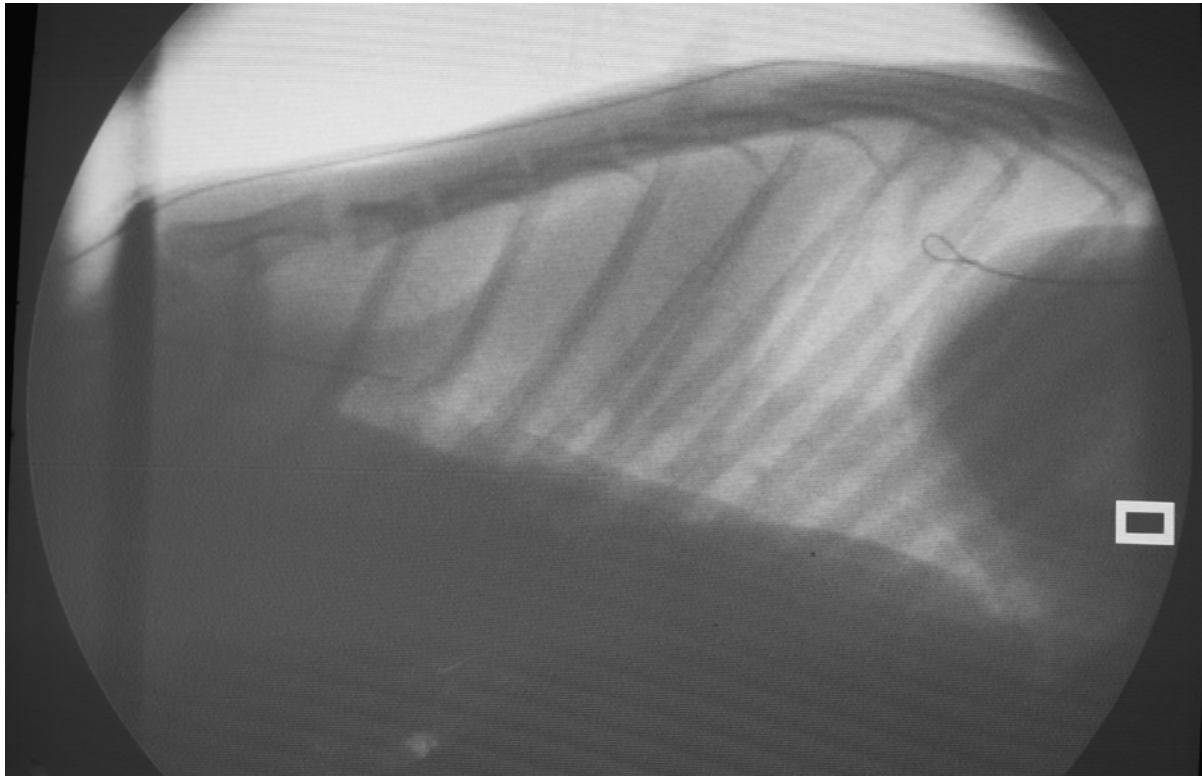


Standard DSI ECG Lead Coil & Insulation

Added:
Rounded Bullet Tip:
For easy passage through
vessel.



Intravenous Biopotential Lead in a Cynomolgus monkeys



Anatomical placement is critical for stable ECG morphology

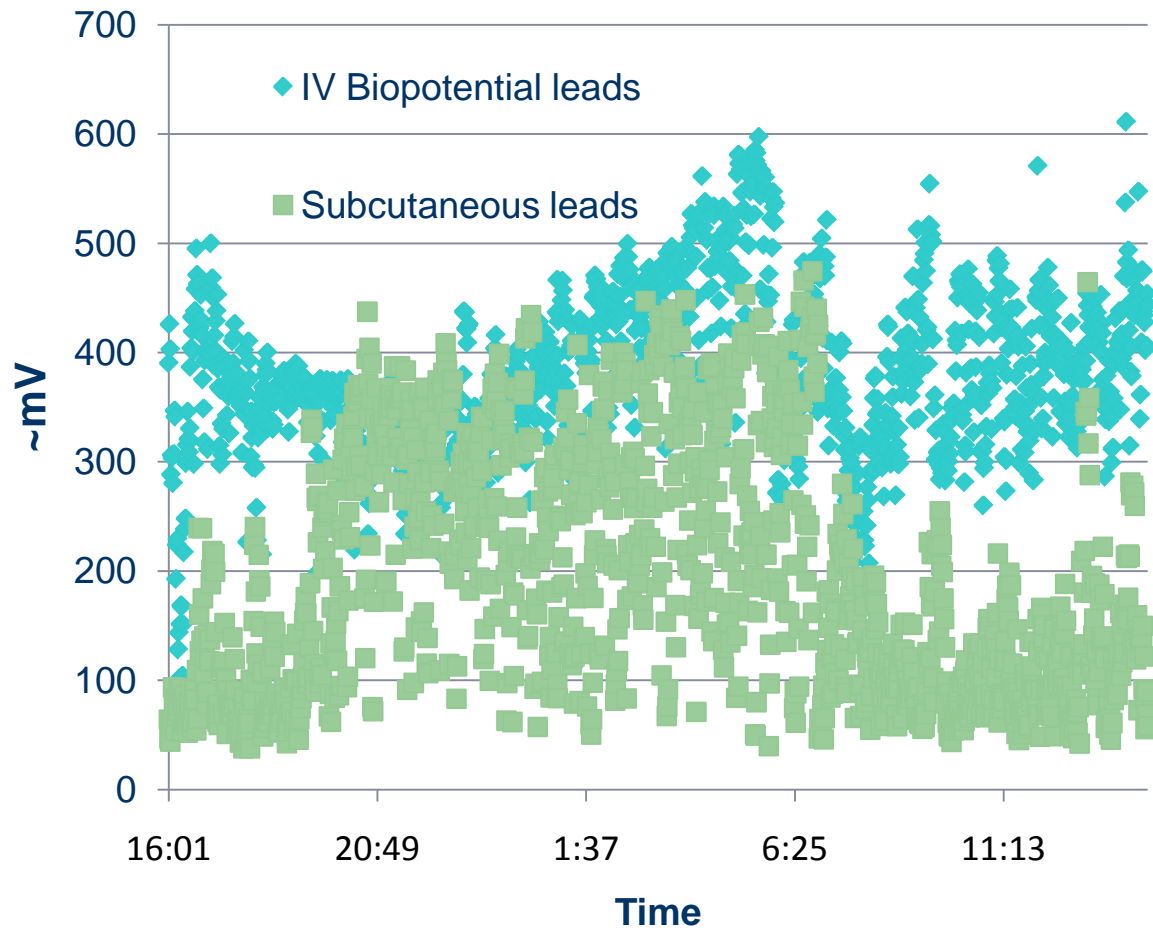


ECG from Cynomolgus Monkey with IV Biopotential Leads





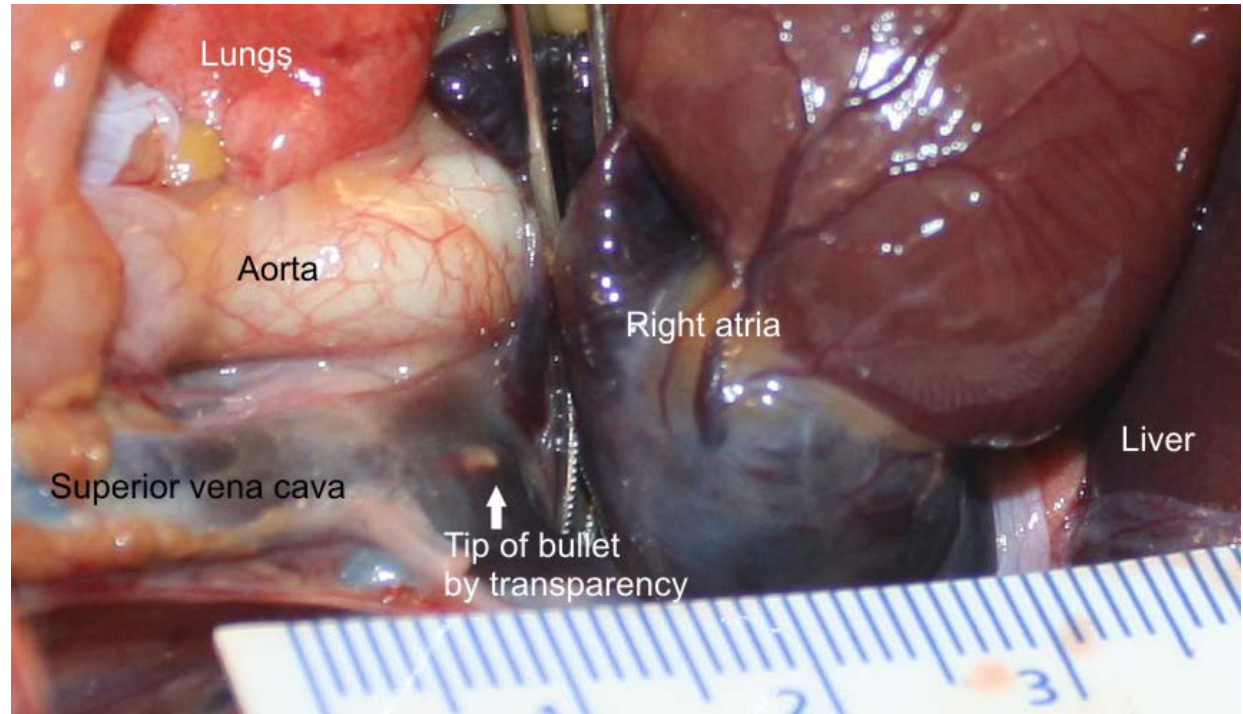
Signal (R-wave) to noise ratio: Comparison of SC leads with IV Biopotential lead and diaphragmatic





Macroscopic examination

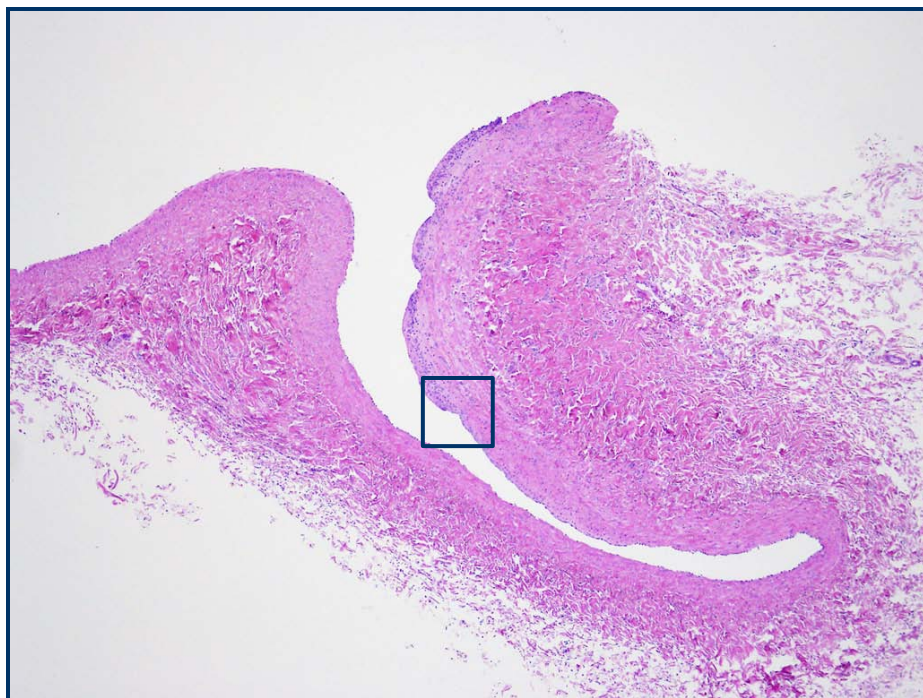
- 6 animals: 6 months
- No macroscopic abnormality





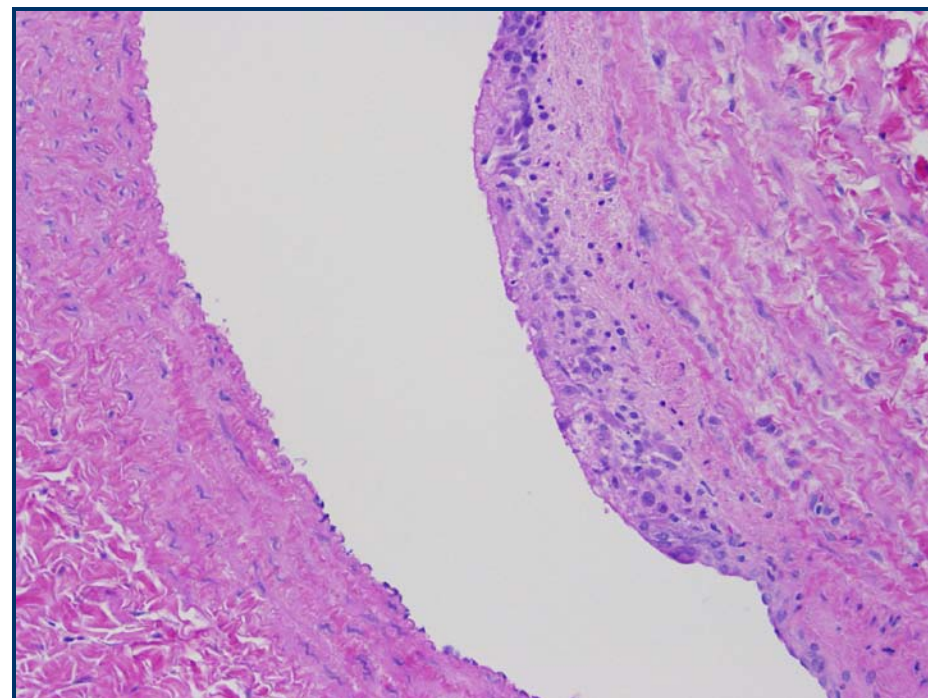
Intravenous Biopotential Lead

Histopathology of vena cava of cynomolgus monkeys after 6 months



20x

Mild thickening intima/subintima with intimal proliferation.



400x



Comparison with Permanent IV Catheters

Incidences of Catheterization System-Related Microscopic Observations in Cynomolgus Monkeys after 6 months (AVA Biomedical Cath-in-Cath)

Finding	Males (n=3)	Females (n=4)
<i>Chronic Active Inflammation</i>	2	1
Minimal	0	0
Mild	0	0
Moderate	1	1
Marked	1	0
<i>Intimal Proliferation</i>	0	3
Minimal	-	2
Mild	-	1

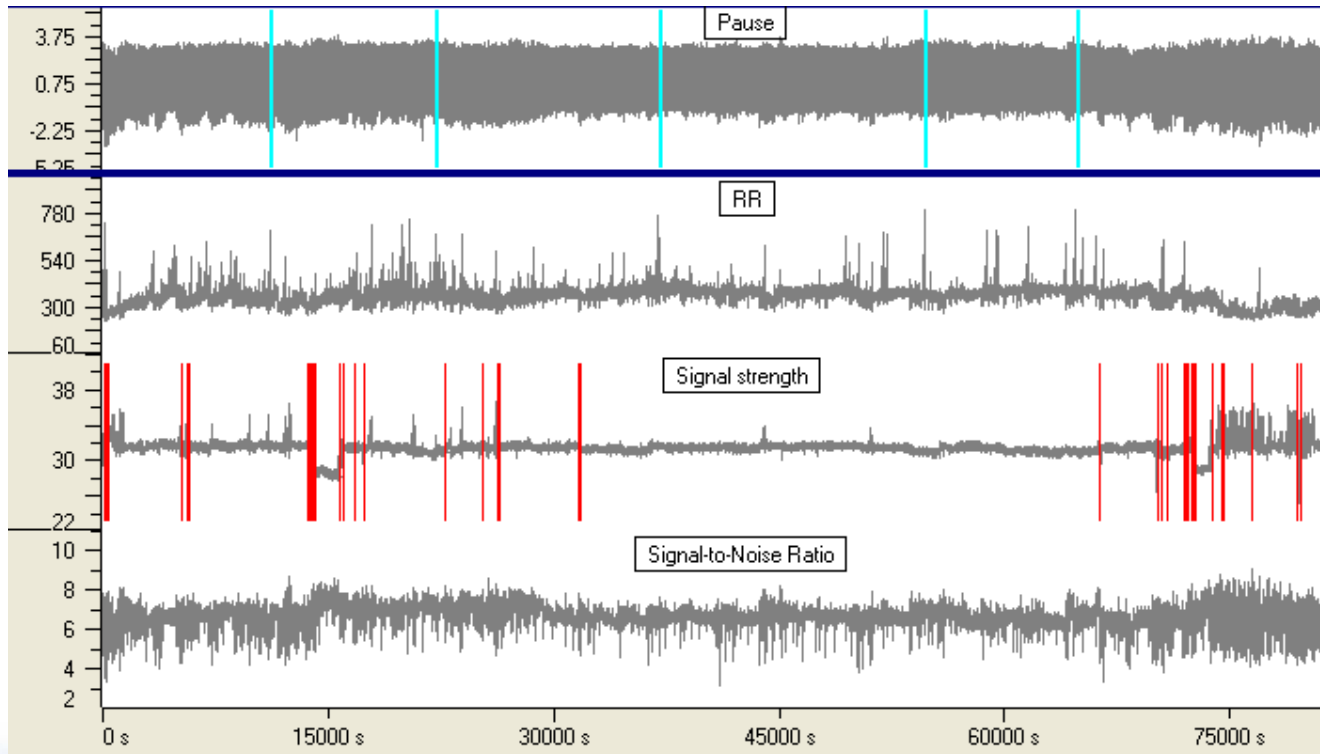


Automated arrhythmia detection using the ARR30a Module (NOTOCORD) Identified Arrhythmia:

- Sinus pause
- Premature atrial complex
- Junctional complex
- Ventricular complex (PVC or ventricular escape complexes)
- Atrio-ventricular block type II
- Abnormal complex



Detection of sinus pause in a Cynomolgus monkey NOTOCORD (ARR30a)





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Incidence of arrhythmia in telemetered cynomolgus monkeys over a 48-hour period (IV Biopotential lead and diaphragmatic ECG leads)

	Atrial pauses	Atrial premature contractions	Atrioventricular blocks	Junctional ventricular complexes	Ventricular arrhythmia
Monkey 1	7\7	0\0	2\0	0\0	0\0
Monkey 2	9\10	0\0	0\0	2\0	0\1
Monkey 3	39\43	8\10	1\0	180	N/A \0
Monkey 4	23\19	13\13	0\0	905\4	147\11

Automated arrhythmia detection\Confirmed arrhythmia after manual over-read

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Incidence of arrhythmia in telemetered beagle dogs with subcutaneous ECG leads over a 24-hour period (with and without LVP catheters) 3 months post-implant

	Atrial pauses	Atrial premature contractions	Atrioventricular blocks	Ventricular arrhythmia
Dog 1	9\9	3\0	1\0	9\5
Dog 2	1\1	1\0	8\0	2\2
Dog 3	28\28	7\0	33\0	2\0
Dog 4	9\9	5\4	7\0	139\3
Dog 5	6\6	1\1	3\0	1\0
Dog 6	38\38	3\3	N/A \0	0\0
Dog LVP 1	1\1	0\0	4\0	2\0
Dog LVP 2	0\0	0\0	5\0	0\0
Dog LVP 3	4\4	1\1	7\0	0\0
Dog LVP 4	8\8	0\0	1\0	63\0
Dog LVP 5	0\0	0\0	1\0	0\0

Automated arrhythmia detection\Confirmed arrhythmia after manual over-read



Automated Arrhythmia Detection

- Manual over-read: 5 to 45 min per animal per 24 hours
- Incidence of spontaneous arrhythmia higher than previously reported¹
- Analysis was adjusted to maximize the sensitivity as limited specificity was not considered to have a significant impact on interpretation after manual over-read
- Specificity of the automated arrhythmia detection was correlated with the quality of the ECG signal

1. Authier S, Pugsley MK, Troncy E, Curtis MJ. Arrhythmogenic liability screening in cardiovascular safety pharmacology: commonality between non-clinical safety pharmacology and clinical thorough QT (TQT) studies. *J Pharmacol Toxicol Methods*. 2010 Sep-Oct;62(2):83-8



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Conclusions

- Automated arrhythmia detection significantly increased efficiency of ECG data review with focus on data of interest
- Preliminary results suggest comparable incidence of arrhythmia with and without left ventricular catheters in dogs after complete recovery but more data needed to confirm this observation
- The quality of automated arrhythmia detection was proportional to the quality of the ECG tracing
- Automated arrhythmia detection appears to be the new GPS of ECG data analysis!