

Holter Tracing Interpretation

Cardiology Updates for the Family Physician

Dr Mark Adrian Sammut
Consultant Cardiologist and Electrophysiologist

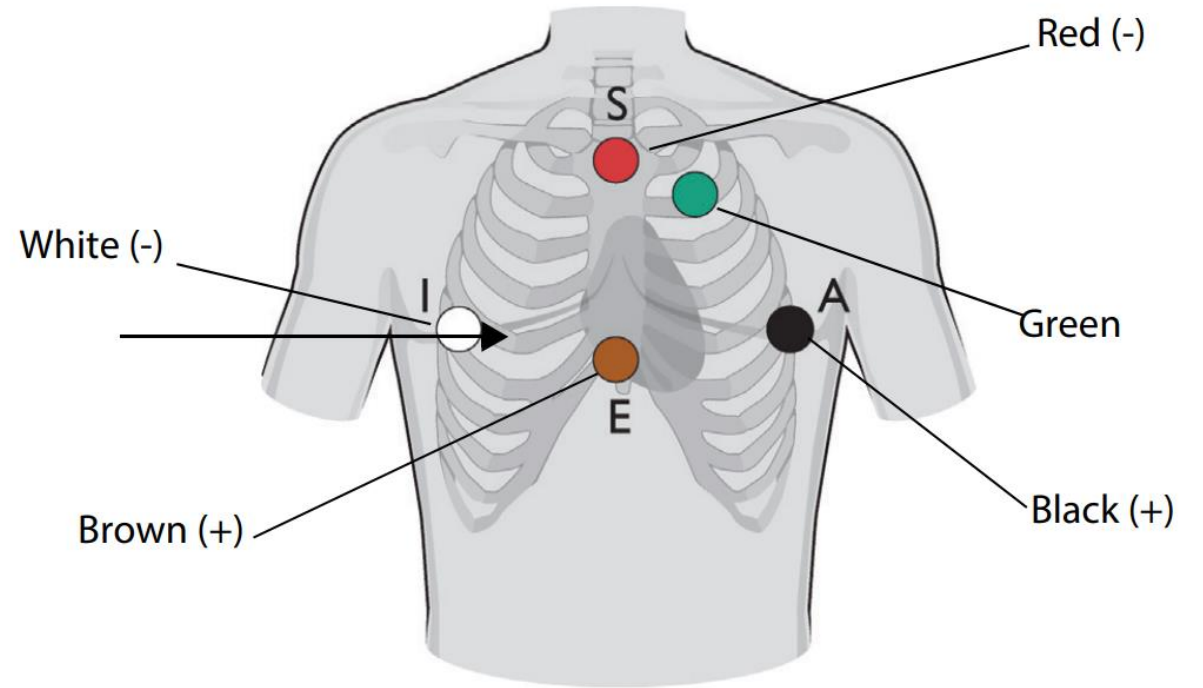
Maltese Cardiac Society Conference 2023
11th October 2023

Holter Monitor

- An ambulatory electrocardiographic system discovered by Dr. Norman J. Holter and his team in 1957.
- Continuously records electrocardiographic signals from an individual who is going about his daily activities.
- Constitutes the backbone of rhythm detection and analysis in Cardiac Electrophysiology.
- Worn for 24 hours, 48 hours or longer during normal activity.
- Commonly displays 2 or 3 leads, some manufacturers can display 12 leads.

Lead Placement

Electrode	Placement
E (Brown)	Level of 5th intercostal space, midsternum
A (Black)	Same level as E and I, left mid-axillary line
S (Red)	Top of sternum, manubrium
I (White)	Same level as E and A, right mid-axillary line
Ground (Green)	Center of sternum or any convenient location
Raw Channel	Description
Channel 1	E (+) to S (-) Similar to MC V1, anterior view of the heart
Channel 2	A (+) to S (-) Similar to MC V6, a lateral view of the heart -- useful for ST measurements
Channel 3	A (+) to I (-) CC6, similar to the inferior I lead aVF – approximation suitable for ST measurements



Mid-axillary leads should be placed on the sides of the patient, not in an anterior location.

Note: Accurate placement and care in proper hookup techniques are absolutely critical for Holter leads.

Indications for Holter Monitoring

- To establish the link between palpitations and abnormal heart rhythms
- To diagnose the cause of syncope or near syncope
- To evaluate transient episodes of symptomatic or silent myocardial ischemia
- To investigate patients with neurologic events when transient atrial fibrillation or flutter is suspected
- To monitor the efficacy and safety of pharmacological or nonpharmacological therapies
- To analyze the function of pacemakers or other implantable devices
- To evaluate prognosis and risk of SCD in heart conditions that increase the risk of arrhythmias

Holter Report

PATIENT DEMOGRAPHICS		
Last Name	Physician	SAMMUTDr. Mark
First Name	Scanned By	JP xuereb
Middle Initial	Reading Physician	
ID Number	Test Date	24/05/2023
Date Of Birth	Analysis Date	25/05/2023
Sex	Hookup Time	08:56
Source	Recording Time	23 hr 43 min
Billing Code	Analysis Time	23 hr 43 min
Recorder Format	User Field #1	
Reason for Test	User Field #2	
Medications		

Heart Rate Data	
Total Beats	: 84400
Min HR	: 42 BPM at 02:42:24
Avg HR	: 61 BPM
Max HR	: 91 BPM at 09:22:45

Heart Rate Variability	
ASDNN 5	: 63.2 msec
SDANN 5	: 124.4 msec

QT Analysis	
QT Min	: -
QT Avg	: -
QT Max	: -

ST Episode Analysis			
	Ch1	Ch2	Ch3
Min ST Level	: -	-	-
Max ST Level	: -	-	-
ST Episodes	: -	-	-

Pacer Analysis	
Sinus Beats	: -
Paced Beats	: -
Atrial Paced	: -
Ventricular Paced	: -
Dual Paced Beats	: -
Fusion Beats	: -

Ventricular Ectopy	
Total VE Beats	: 6784 (8.0%)
Vent Runs	: 0
Beats	: 0
Longest	: 0
Fastest	: 0 BPM
Triplets	: 1 Event
Couplets	: 33 Events
Single/Interp PVC	: 281/6392
R on T	: 0
Single/Late VE's	: 22/0
Bi/Trigeminy	: 0/20 Beats

Supraventricular Ectopy	
Total SVE Beats	: 376 (0.4%)
Atrial Runs	: 0
Beats	: 0
Longest	: 0
Fastest	: 0 BPM
Atrial Pairs	: 155 Events
Drop/Late	: 0/0
Longest R-R	: 1.6 sec at 13:35:30
Single PAC's	: 66
Bi/Trigeminy	: 0/0 Beats

Atrial Fibrillation	
AFib Beats	: 0 (0.0%)
Duration	: 0.0 min
Events	: 0

INTERPRETATION
<p>Sinus rhythm dominant throughout recording. No significant R-R intervals detected. Longest R-R interval- 1.6sec at 13:35.</p> <p>AV conduction: Normal limits.</p> <p>Supraventricular Episodes: Rare, occasionally multiple; (100-500). No cycles of Bigeminy/Trigeminy. No episodes of supraventricular tachycardia (narrow complex tachycardia) / atrial flutter/fibrillation.</p> <p>Ventricular Episodes: Frequent, polymorphological; (>7000, 8%). Trigeminy 20 cycles. Couplets:33 & Triplet: 1 in 24hrs. No Ventricular Tachycardia (wide complex tachycardia).</p> <p>ST segment Analysis: No significant ST segment depression/variation noted.</p>

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Fastest	: 0 BPM
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Heart Rate Variability	

Test Date

24/05/2023

Analysis Date

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Report Summary

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1st degree

2nd degree (Mobitz 1/Mobitz 2/high grade)

3rd degree

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Ectopy (%)

Regular NCT

Atrial fibrillation/flutter

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Ectopy (%)

Bigeminy/trigeminy/couplets/triplets

Ventricular tachycardia (triplet or longer)

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Atrial Fibrillation

AFib Beats	:	0 (0.0%)
Duration	:	0.0 min
Events	:	0

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AFib Beats	:	0 (0.0%)
Duration	:	0.0 min
Events	:	0

INTERPRETATION

...-500).
 ...x tachycardia) / atrial flutter/fibrillation.
 ...8%).

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QT Avg	: -	QTc Avg : -

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Supraventricular Ectopy

Heart Rate Variability

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Fusion Beats	: -	Events	: 0
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QT Analysis

QT Min	: -	QTc Min	: -
QT Avg	: -	QTc Avg	: -
QT Max	: -	QTc Max	: -
QTc > 450 msec : -			

ST Episode Analysis

	Ch1	Ch2	Ch3
Min ST Level	: -	-	-
Max ST Level	: -	-	-
ST Episodes	: -	-	-

Pacer Analysis

Sinus Beats	: -	FTO	: -
Paced Beats	: -	FTS	: -
Atrial Paced	: -	FTC	: -
Ventricular Paced	: -		
Dual Paced Beats	: -		
Fusion Beats	: -		

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Paced Beats	: -	FTS	: -
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Ventricular Paced	: -		
Dual Paced Beats	: -		
Fusion Beats	: -		

Ventricular Ectopy

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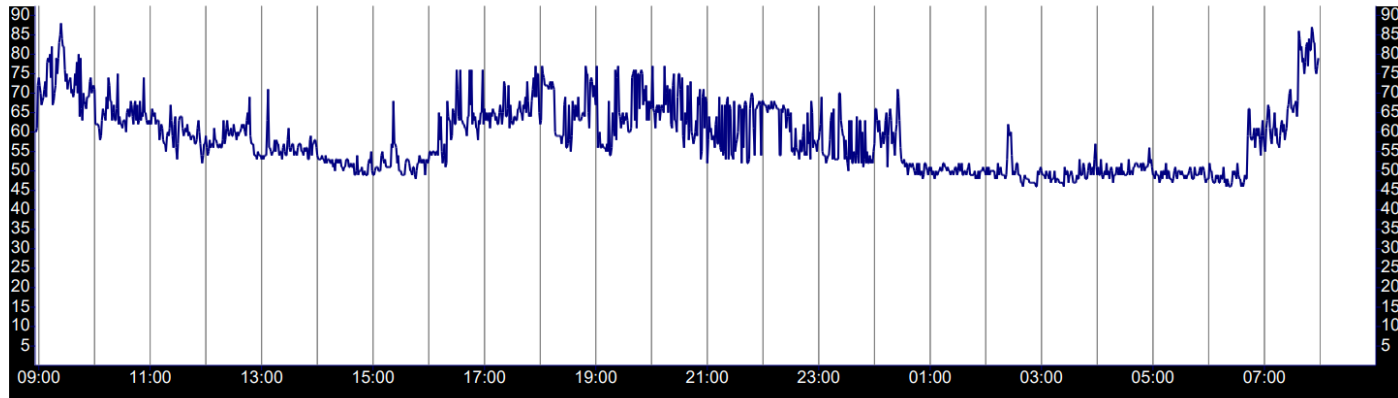
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Special event Graphs

Special Event Graphics

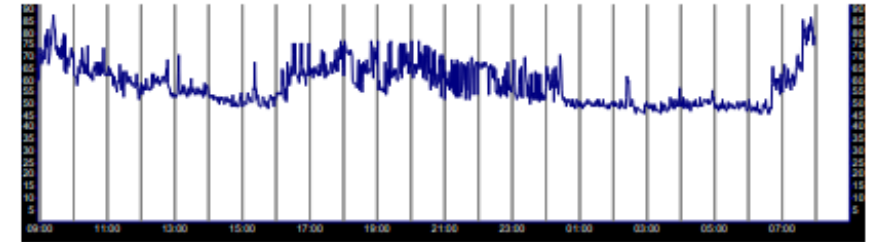
Heart Rate



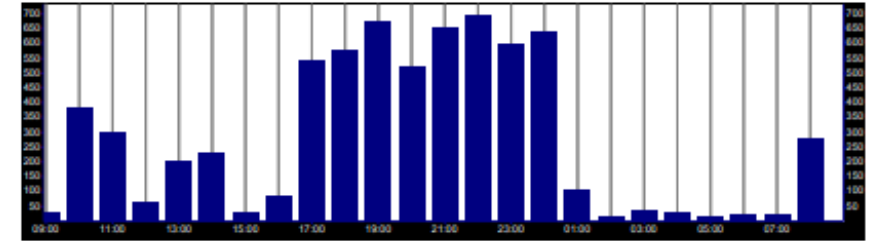
VENTRICULAR EVENTS

Special Event Graphics

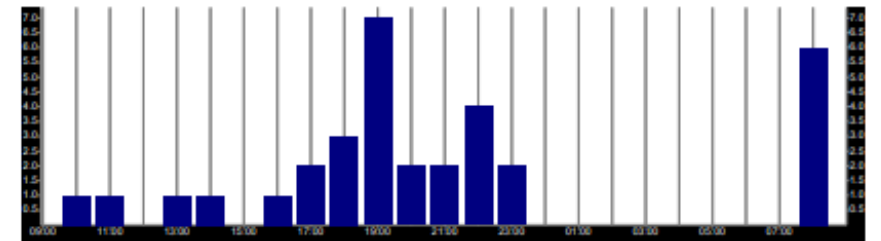
Heart Rate



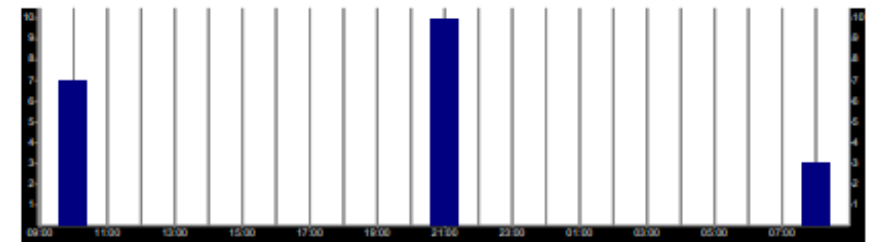
Ventricular Beats Per Interval



Ventricular Couplets Per Interval



Ventricular Bigeminy/Trigeminy Beats Per Interval



Recorded Tracings

Automated but reporter can select which tracings to present

- Maximum and minimum heart rates and RR intervals
- Tachycardias ($> 100\text{bpm}$)
- Bradycardias ($< 60\text{bpm}$)
- Supraventricular arrhythmias (regular NCT)
- Atrial fibrillation
- Ventricular arrhythmias(non-sustained/sustained VT)
- Pauses ($>2\text{secs}$)
- Patient triggered events

Red Flags

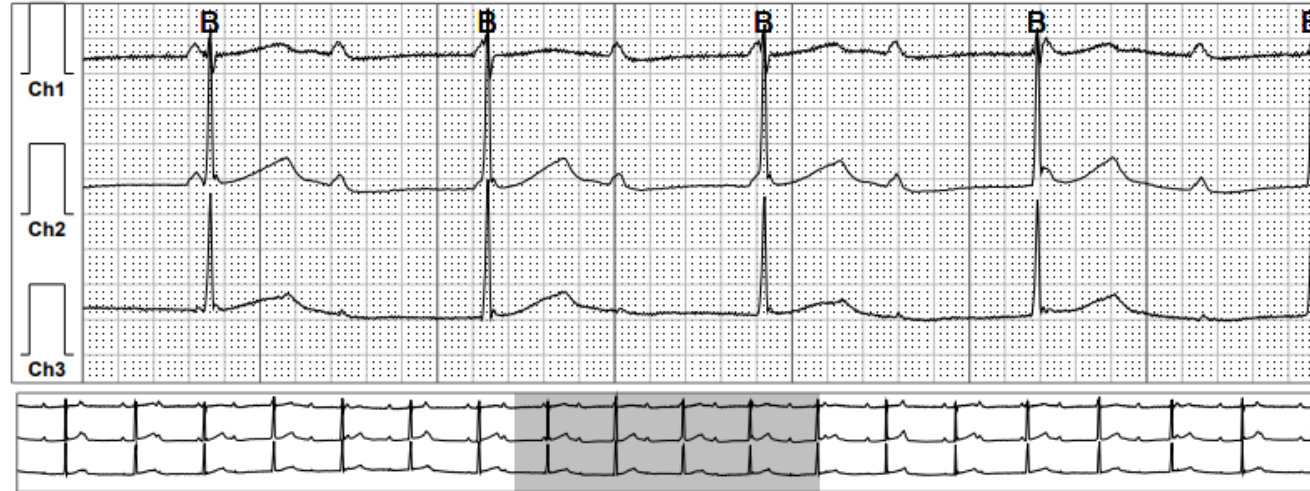
- Bradyarrhythmias
 - 2nd degree/3rd degree AV block
 - Significant pauses (RR intervals > 3secs)
 - Slow AF especially if regular
- Tachyarrhythmias
 - Ventricular tachycardia (sustained/non-sustained)
 - Regular NCT > 30secs or symptomatic
 - Newly diagnosed AF or fast AF (average rate > 110bpm)
- Frequent Ventricular ectopy (> 10% burden)
- Significant ST shifts
- Pacemaker malfunction

3rd degree AV block

SELECTED STRIPS

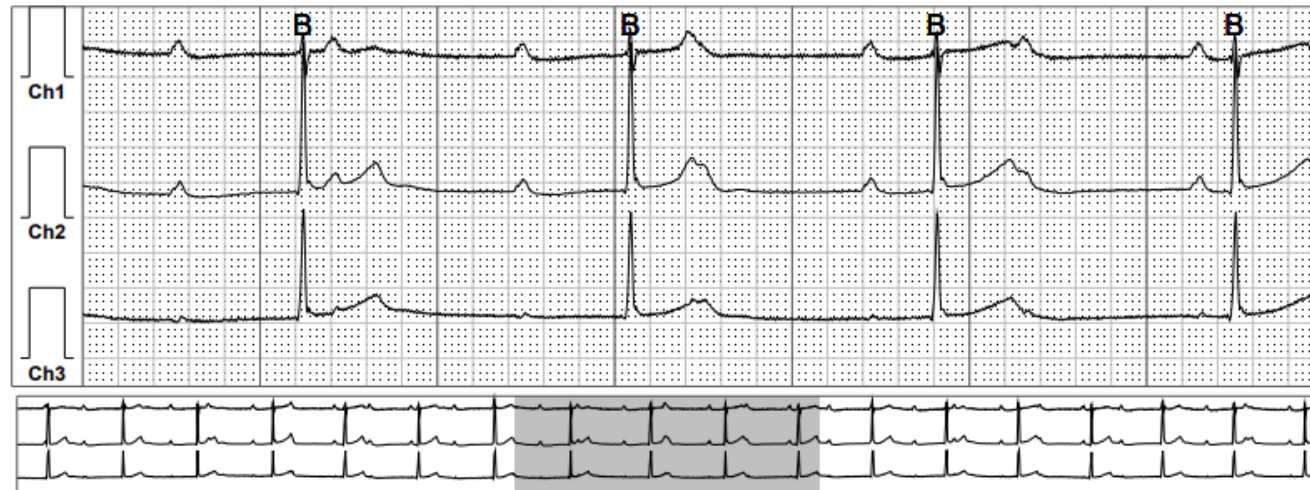
03:39:21 39 BPM Size x1,x1,x1 Brady

Strip 10 of 12



03:43:03 34 BPM Size x1,x1,x1 Brady

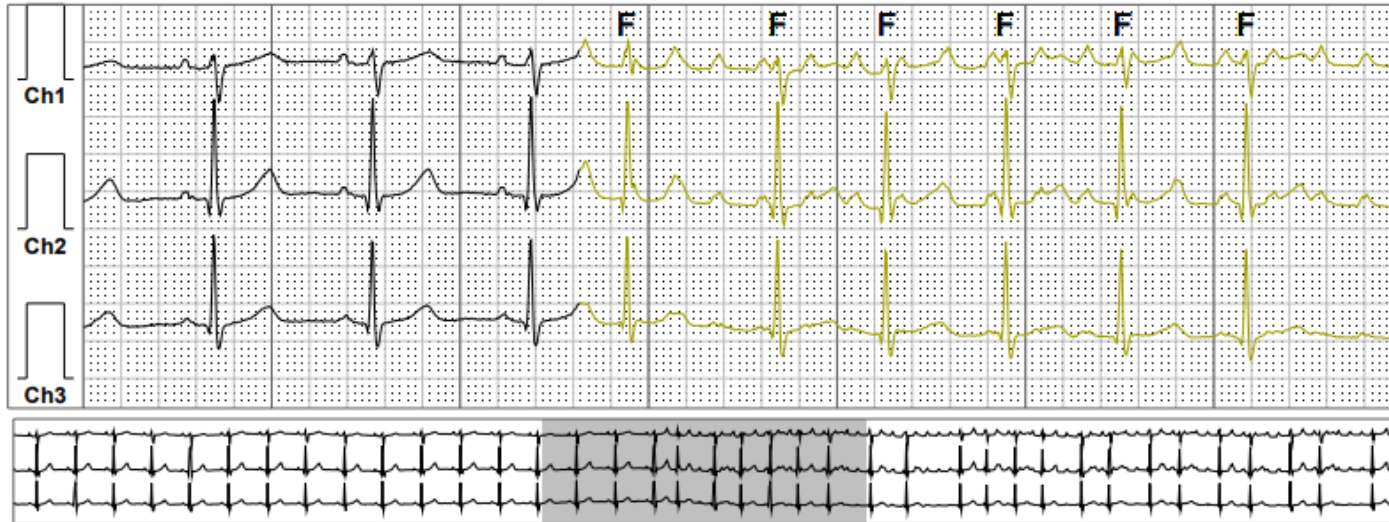
Strip 11 of 12



Atrial flutter/fibrillation

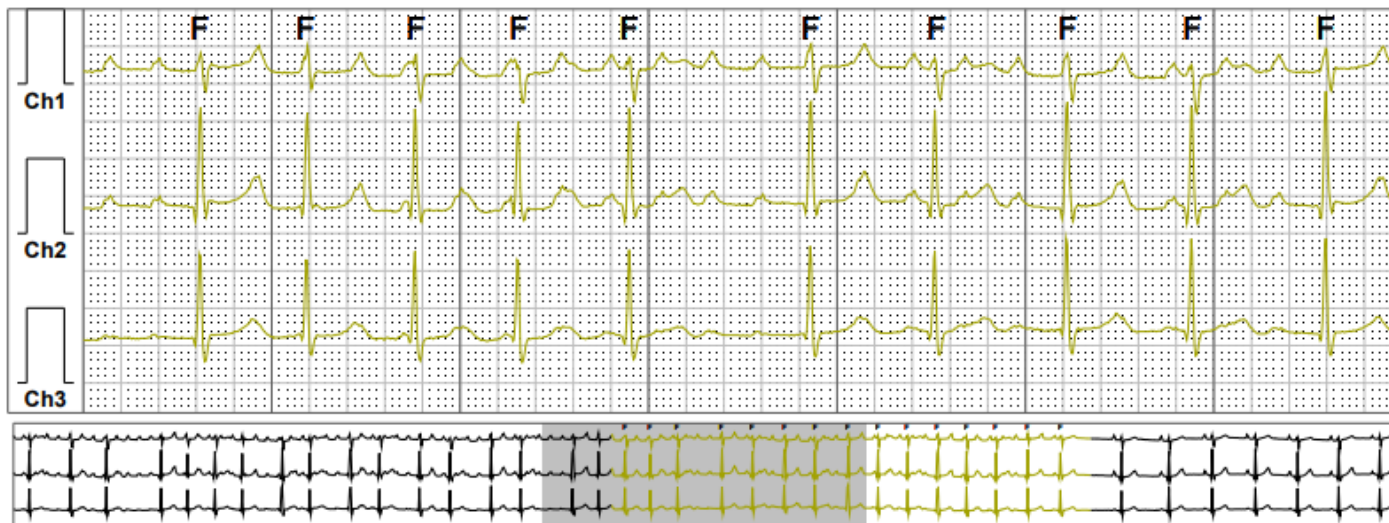
03:28:35 88 BPM AFib

Strip 61 of 68

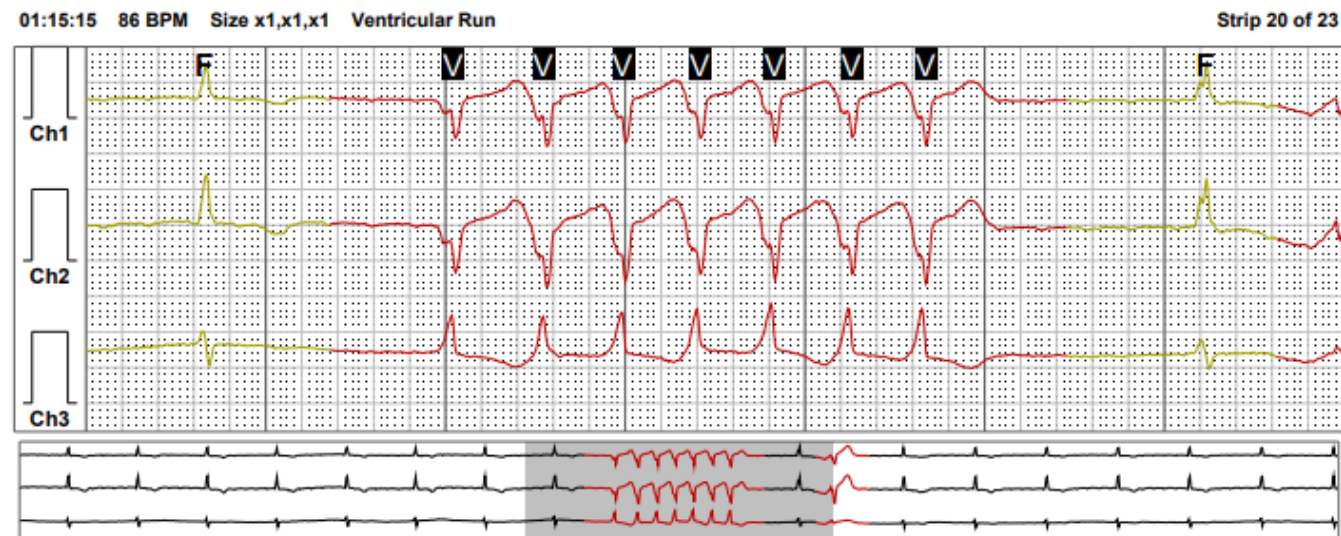
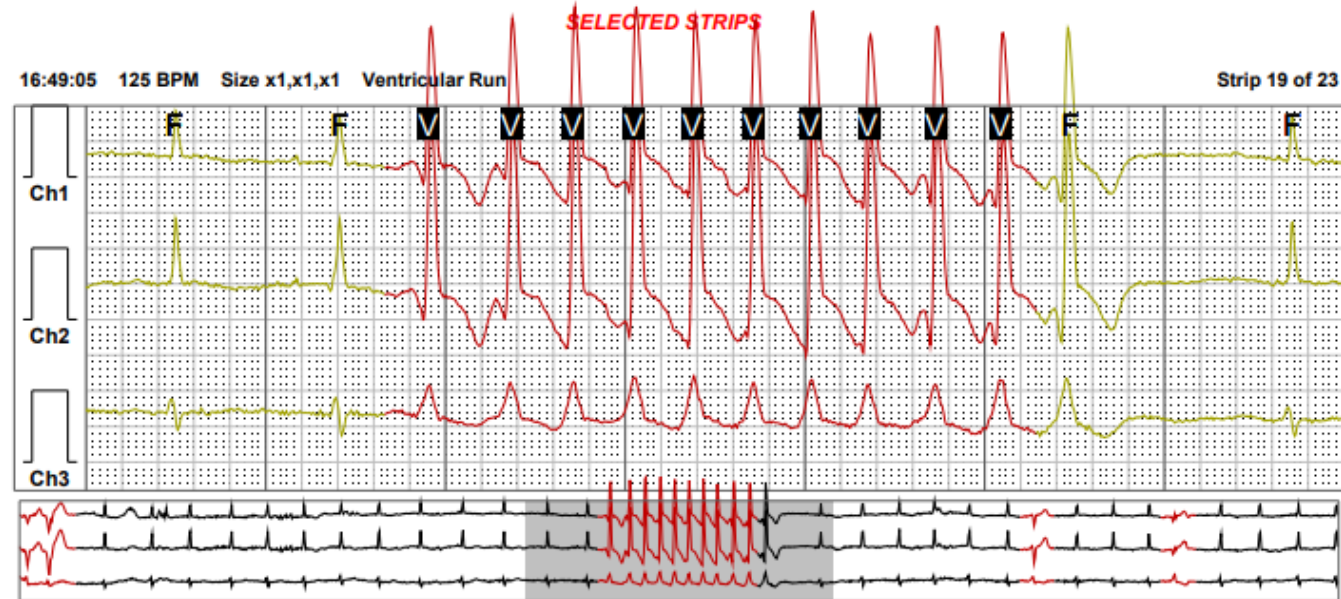


03:28:53 90 BPM AFib

Strip 62 of 68



Non-sustained VT



Conclusions

- Backbone investigation in Cardiac Electrophysiology
- Main indications are syncope, palpitations and prognostic assessment in cardiac conditions that carry an arrhythmia risk
- Report is best analysed in a stepwise fashion :
 - Patient demographics
 - Report summary
 - Automated data
 - Event tracings if available
- Look out for **red flags**

Thankyou

