

Cardiac Rhythm Management

121 THE 12-LEAD ELECTROCARDIOGRAM OF THE ELITE RUGBY FOOTBALL LEAGUE PLAYER

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Introduction Specific ECG criteria have been proposed to differentiate physiology (athlete's heart) from pathology that may increase the risk of sudden cardiac death. Although the current European Society of Cardiology (ESC) guidelines have clear criteria for physiological adaptation to intense training, their sensitivity and specificity are sub-optimal and hence the more recent Seattle and Refined criteria have attempted to improve diagnostic accuracy of the athlete's ECG.

Rugby Football League (RFL) is a moderate dynamic and moderate static sport with recent high profile fatalities linked to inherited cardiomyopathy. This study utilises resting 12-lead ECG, in elite RFL players to compare 3 sets of diagnostic ECG criteria in the athlete and specifically false positive rates.

Methods 103 consecutive, male, elite RFL players (mean age 25.4 years) underwent pre-participation cardiac screening. Participants were predominantly white Caucasian (n = 81) with a minority of ethnic backgrounds being represented (Pacific Islander, n = 16; mixed race, n = 5; African-Caribbean, n = 1). All athletes had resting blood pressure assessed and a standard resting 12-lead ECG. In addition *all* athletes had a standard transthoracic echocardiogram and where indicated further investigations were undertaken. Standard ECG parameters were measured and the ESC recommendations for interpretation of 12-lead ECG in the athlete were used to define normal training (Group 1) and abnormal (Group 2) changes. All ECG's were also assessed for normality using the Seattle and Refined criteria. False-positive rates were presented for each ECG criteria.

Results Based on ECG, echocardiography and/or follow-up investigation all athletes were considered normal with no evidence of underlying cardiac disease. The continuous ECG

Abstract 121 Table 2 % Training unrelated ECG changes for ESC, Seattle and Refined Criteria (% False Positive Rate)

ECG Abnormality	False Positive Rate (%)		
	ESC Criteria	Seattle Criteria	Refined Criteria
Long QTc Interval	1	0	0
Short QTc Interval	44	0	Not Relevant
Intraventricular conduction delay (IVCD)	5	0	1
Right atrial enlargement (RAE)	1	0	1
Right ventricular hypertrophy (RVH)	3	0	3
Right axis deviation (RAD)	1	0	1
Left axis deviation (LAD)	3	3	3
T wave Inversion	1	1	1
≥2 PVC's per 10s tracing	Not Relevant	1	1
False Positive Rate according to Criteria	58	5	3

measurements are shown in Table 1. According to ESC criteria 95% of athletes had at least one group 1 "normal training-related" ECG change. 58% of athletes had at least one Group 2 "abnormal training-related" change. This is therefore a false positive rate of 58%. Following application of the revised Seattle and Refined criteria the false-positive rates reduced to 5% and 3% respectively (Table 2).

Conclusion A significant proportion of RFL players present with an abnormal, non-training related, 12-lead ECG according to ESC criteria. In the cardiac screening setting this would result in significant extra cardiac investigation burden. Application of the Seattle and refined criteria decreased the false-positive rate and hence improves ECG specificity in this population.

Imaging

122 INTRODUCTION OF STRESS ONLY MYOCARDIAL PERFUSION SCINTIGRAPHY: A QUALITY IMPROVEMENT PROGRAMME

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Abstract 121 Table 1 Continuous ECG variables of 103 elite RFL players

Continuous ECG variables	Mean ± SD(Range)
Heart Rate (bpm)	54 ± 9 (39–89)
P Duration (ms)	105 ± 16 (58–176)
PR Interval (ms)	174 ± 26 (129–309)
QRS Duration (ms)	95 ± 12 (11–123)
QT Corrected (ms) (Bazett)	381 ± 20 (338–442)
QRS Axis (degrees)	61 ± 32 (-46–117)

Introduction Myocardial perfusion scintigraphy (MPS) is one of the most commonly performed non-invasive imaging procedures for the diagnosis of Coronary Artery Disease (CAD). Two large trials evaluating over 21,000 patients with a normal SPECT study have demonstrated the safety of stress-only imaging as compared to traditional stress/rest imaging. Comparably low all-cause and cardiac mortality rates were observed with both imaging protocols. This was true irrespective of patient age, gender, cardiac risk factor profile, or stressor employed with SPECT. These results are consistent with earlier studies evaluating patient outcome following normal stress-only imaging. The best use of a stress-only imaging strategy is likely to be in the selected low or intermediate risk population, which forms the referral basis for myocardial perfusion imaging. In this study, we describe the introduction of stress only MPS in comparison to traditional stress/rest MPS.

Old Pathway The traditional stress/rest MPS pathway requires two imaging sessions either the same day or on two separate days according to the patient's Body Mass Index (BMI). For a 1 day protocol typically the injected activity is split in a 1:3 ratio between the first and second injections. For BMI <30, a total of 1125 MBq is administered. For BMI 30–35, a total of 1475 MBq is administered. For BMI >35, a total of 2000 MBq is administered 1:1. If the BMI is not provided by the requesting clinician then a letter is sent to the patient asking their height and weight.

New Pathway From September 2014 through December 2014, we introduced selective stress only imaging. A single high dose MIBI stress dose of 800 MBq, was authorised for all patients, regardless of BMI. After stress imaging, a decision was made regarding the necessity of rest imaging.

Results Patients were referred from 10 hospitals. 407 patients were scanned. 55% were male and 45% female. Their average age was 66 years (+/-12.9). Their average BMI was 29.4 kg/m² (+/-6.4).

Of the total, 35% percent were normal at stress imaging and did not have rest imaging. Of the 65% who were abnormal, 60% of the combined rest/stress scans were interpreted as abnormal. As a result of this, the average time from request to appointment date for the stress scan reduced from 27 to 14 days.

The average time between stress scan and rest scan was 2.5 (range: 1–21 days). The average report turn around time from request to report for MPS was 5 days, but 97% of normal stress only scans were reported the same day. Furthermore, the administered radiation dose was lower for 67% of all patients.

In addition to scanning parameters being assessed, patients preferences were also assessed via a questionnaire. 49% expressed a preference for the test to be split across 2 days. 7% said either 1 day or 2 days. 20% of patients had to take a day off work to attend the hospital.

Conclusion Stress only MPS reduces radiation exposure, increases efficiency and thereby reduces cost.

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THE DEVELOPMENT OF A DIETARY PREPARATION PROTOCOL FOR OPTIMAL INFLAMMATORY IMAGING USING 18F-FDG PET

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Background Positron emission tomography (PET) performed utilising the glucose analogue and radiotracer 18F-FDG (FDG) to detect active inflammation, offers enormous potential for detecting disease presence and activity in myocarditis. However, the clinical utility of PET imaging is limited by the unpredictable nature of physiological FDG uptake within cardiac muscle. Methods to minimise physiological FDG uptake are necessary to depict active inflammation and to avoid false negative and positive findings. Studies have suggested the use of fasting conditions to shift myocardial metabolism to primary free fatty acid (FFA) utilisation for energy and oxygen consumption to suppress physiological FDG uptake by normal myocardium. Specific dietary preparation regimens using a very high-fat content and low-carbohydrate diet prior to scanning have also been proposed, as has the administration of heparin to reduce FDG uptake through the activation of lipoprotein lipase (LPL) and hepatic lipase (HL) which enhances

plasma lipolytic activity and leads to preferential free fatty acid consumption.

This study was therefore performed to develop an optimal dietary preparation protocol for imaging in PET/CT. We sought to establish whether patient preparation using heparin in addition to a high fat, low carbohydrate diet and prolonged fast prior to scanning increases the diagnostic capability of PET scanning in myocarditis.

Methods All patients referred for PET scans for the assessment of myocarditis were enrolled. We prospectively examined three preparation rationales to determine the optimal rationale for minimising physiological FDG-uptake. All subjects underwent strict preparation prior to scanning using one of the following protocols to enable comparison:

1. A 6-hour fast only, no dietary preparation.
2. Dietary preparation for 24 h prior to the scan with a high-fat content, low carbohydrate diet, followed by a prolonged fast for 12 h.
3. Dietary preparation for 24 h prior to the scan with a high-fat content, low carbohydrate diet, followed by a prolonged fast for 12 h and the administration of 50IU/kg of heparin prior to scanning.

The imaging findings were analysed by two independent and blinded clinicians. FDG uptake was categorised as none (complete suppression, no uptake = 0), focal (localised uptake, = 1), focal on diffuse (2) and diffuse (poor, failed suppression, = 4).

Results A total of 280 PET scans were performed. 36 patients underwent preparation using a 6-hour fast only, 128 underwent dietary preparation and a 12-hour fast, and 118 underwent dietary preparation followed by a 12-hour fast and the administration of heparin prior to scanning.

A 6-hour fast alone was associated with a 44% failure to suppress physiological metabolism – equivalent to almost one in every two scans being suboptimal or un-interpretable. In contrast, restriction of carbohydrate intake with high fat intake alongside a prolonged 12-hour fast was successful in suppressing normal myocardial metabolism in 89% of subjects. Similarly, of those who also received heparin, there was a failure to suppress normal myocardial metabolism in 11% of subjects.

Conclusion Strict patient preparation prior to PET scanning is key to ensuring an optimal diagnostic disease assessment in myocarditis. A short duration of fasting of 6-hours or less alone is suboptimal in suppressing physiological uptake. In contrast, strict dietary preparation (using a high fat, low carbohydrate diet) and prolonged fast of > 12 h increases the diagnostic capability by 75%. Interestingly, the addition of heparin to this regimen provided no additive benefit suggesting that the addition of heparin adds little to the diagnostic quality of scans and is therefore unnecessary.

Valve disease/pericardial disease/ cardiomyopathy

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THE USE OF NEXT GENERATION SEQUENCING TO DETERMINE GENOTYPE-PHENOTYPE CORRELATIONS IN DILATED CARDIOMYOPATHY

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