reduction in mortality from cardiomyopathies and cardiac conduction disorders. Although PPCE is endorsed by large medical and sporting organisations, including the European Society of Sports Cardiology, the International Olympic Committee and FIFA, the state health system in the UK (and many other Western countries) does not support cardiovascular evaluation of athletes. Certain elite sporting organisations in the UK mandate PPCE in all athletes prior to competition. In 2010 the English Premier Rugby league introduced formal PPCE in all competing players.

Methods Athletes participating in the English Premiership Rugby underwent PPCE with a structured clinical questionnaire and 12-lead ECG. Trans-thoracic echocardiogram (TTE) and additional investigations were performed where indicated.

Results A total of 606 players were assessed (mean age 22.9 years; range 15–37). Of these, 45 (7.4%) required TTE (35 (5.7%) due to ECG abnormalities; 5 (0.08%) due to family history of sudden death; 5 (0.08%) due to symptoms). ECG abnormalities warranting TTE included right axis deviation (n=4), left axis deviation (n=17), right bundle branch block (n=3), right ventricular hypertrophy (n=1), abnormal T wave inversion (n=5) and prolonged QT (n=1). Six of the 45 subjects demonstrated mild changes on TTE (markedly dilated LV cavity (n=3), mitral regurgitation (n=1), pulmonary stenosis (n=1), dilated aortic root (n=1)), requiring serial surveillance. Five demonstrated abnormalities on TTE and/or ECG that warranted referral for further evaluation including exercise stress test (n=5), 24-h ECG (n=5) and cardiac MRI (n=3). The reasons for these tests included possible arrhythmogenic right ventricular cardiomyopathy (n=3), suspicion of hypertrophic cardiomyopathy (n=1) and QT prolongation on ECG (n=1). None of the players exhibited a cardiac disorder that warranted disqualification from sport. Overall 7.4% of athletes required further investigation following initial ECG, and 1.8% required further tests following TTE. False positive rate was 5.6%.

Conclusion Cardiovascular evaluation of British rugby players with a structured questionnaire and ECG resulted in clearance of 92.6% following initial tests, and 5.6% were reassured after TTE. Only 1% players required surveillance echocardiograms and 0.8% were referred for further diagnostic evaluation. False positive rate was 5.6%. The results indicate that PPCE carried out in an expert setting results in a relatively small number of athletes requiring further tests, and a low false positive rate.

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DARBEPOETIN ENHANCES ENDOTHELIAL-DEPENDENT VASOMOTOR FUNCTION IN PATIENTS WITH STABLE CORONARY ARTERY DISEASE ONLY AFTER PRECEDING ISCHAEMIA-REPERFUSION

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Background Vasoprotective effects of erythropoietin in animal models are mediated by endothelium-derived nitric oxide (NO) and/or mobilisation of endothelial progenitor cells (EPC) and may be

enhanced by ischaemia; whether they are present in humans is unknown. We examined whether the erythropoietin analogue darbepoetin improves flow mediated dilatation (FMD), a measure of endothelium-derived NO, and whether this is influenced by preceding ischaemia-reperfusion.

Methods 36 patients (50–75 years) with stable coronary artery disease were randomised to receive a single dose of darbepoetin 300 µg or saline placebo. Immunoreactive erythropoietin was measured by an enzyme linked immunospecific assay. FMD was measured at the brachial artery using high resolution ultrasound. CD34+/VEGFR2+/133+ circulating EPC were enumerated by flow cytometry. Measurements were made immediately before darbepoetin/placebo and at 24 h, 72 h and 7 days. At 24 h FMD was repeated after 20 min ischaemia-reperfusion of the upper limb. A further group of 11 patients were studied according to the same protocol, all receiving darbepoetin, with omission of forearm ischaemia-reperfusion at 24 h.

Results Immunoreactive erythropoietin peaked at 24 h in the darbepoetin group (median value of 724 U/l (IQR 576–733 U/l), compared to 12 U/l (IQR 9–21 U/l) in the placebo group) and remained elevated at approximately 500 fold baseline at 72 h. FMD did not differ significantly between groups at 24 h (before ischaemia-reperfusion). At 72 h, (48 h after ischaemia-reperfusion) FMD increased from baseline in the darbepoetin group but not in the placebo group so that FMD (and change in FMD from baseline) was significantly greater in the darbepoetin group (change from baseline $1.7 \pm 0.3\%$ and $-0.6 \pm 0.4\%$ in darbepoetin and placebo groups respectively, $p < 0.001$). The increase in FMD at 72 h after darbepoetin and ischaemia-reperfusion at 24 h was significantly greater than that without preceding ischaemia-reperfusion ($p < 0.01$). A ~20% increase in CD133+/VEGFR2+ cells after darbepoetin was temporally dissociated with the increase in FMD.

Conclusions Preceding ischaemia-reperfusion is required for darbepoetin to enhance endothelial function, possibly by increasing expression of the erythropoietin receptor and by a mechanism likely to involve Akt/NO rather than circulating EPC.

Abstract 48 Figure 1 Change from baseline in FMD at 72 h, 48 h after ischaemia-reperfusion (+IR), after placebo and darbepoetin (study 1) and after darbepoetin without preceding ischaemia-reperfusion (-IR, study 2).

Abstract 48 Table 1 Endothelial function and EPC

Endothelial function	Placebo Baseline	Placebo 24 h	Placebo 72 h	Placebo 7d	Darbepoetin Baseline	Darbepoetin 24 h	Darbepoetin 72 h	Darbepoetin 7d
FMD%	3.5±0.80	3.4±0.73	2.9±0.63	3.4±0.75	3.5±0.92	4.4±0.97	5.2±0.9***	3.7±0.61
Progenitor cells								
CD133+/VEGFR2+	110±17.6	117±19	101±19	123±21	146±13	180±13*	180±11*	182±16*
CD34+/VEGFR2+	4.1±0.6	3.9±0.5	3.1±0.6	4.7±0.8	8.7±3.07	11.1±3.9	7.1±1.4	13.3±4.5
CD133+/CD34+	17.3±2.9	17.0±1.9	17.7±3.6	20.4±3.2	23.6±2.4	29.3±4*	31.6±4.6*	29.9±4.8*

Values are means±SE.

* $p < 0.05$, *** $p < 0.001$