

Haemodynamic response in soccer spectators: is Scottish football exciting?

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Abstract

**Objective**—To determine the effect of watching a game of Scottish football on heart rate and blood pressure.

**Design**—Prospective study.

**Setting**—Two Scottish Premier League football grounds.

**Subjects**—10 healthy men, each a supporter of one of two clubs.

**Main outcome measures**—Systolic and diastolic blood pressure and heart rate at home, while walking, and during the match.

**Results**—Systolic blood pressure and heart rate were significantly higher when the men were watching the match than when they were at home. While they were watching the match, heart rate was maximal immediately after a goal had been scored by the supported team.

**Conclusion**—The emotional stress invoked by Scottish football is associated with significant increases in heart rate and systolic blood pressure.

Introduction

Emotional stress has been shown to influence heart rate and blood pressure in controlled experimental settings<sup>1</sup> and during everyday activities such as car driving.<sup>2</sup> Although some studies have documented the heart rate of participants in sporting activities,<sup>3</sup> no information regarding the haemodynamic response in sports spectators, who often seem to be experiencing considerable stress, is available. We therefore studied the effect of watching a game of Scottish football on the heart rate and blood pressure of Scottish football fans.

Methods

Ten healthy men with a mean age of 44 (range 35-59) years, no history of hypertension or coronary heart disease, and taking no regular drug treatment were enlisted from local football supporters' clubs. All were regular football attenders and considered themselves supporters of one of two Premier League football teams. All were studied during, and for two hours before and after, a Saturday afternoon Premier League match (duration 90 minutes) in which their team was participating (four different games; Hibernian v Heart of Midlothian; Hibernian v Glasgow Rangers; Heart of

Midlothian v Hibernian; Heart of Midlothian v Celtic). Heart rate was continuously recorded by an ambulatory monitor. Blood pressure was recorded at 10 minute intervals by a Takeda 2040 ambulatory sphygmomanometer.<sup>4</sup>

All matches were attended by an independent observer (ATE) who kept a timed diary of key match moments. The blood pressure and heart rate recorders had previously been synchronised. All volunteers kept a timed record of their activities before and after the match, and they rated the excitement produced by the match on a linear analogue scale (0=not at all exciting, 10=very exciting).

Eight of the 10 were standing during the match. One man drank two pints of beer one hour before the match. Eight supporters saw their team score once and two, twice. Five supporters saw their team win; three, draw; and two lose.

Monitoring lasted about five and a half hours and was divided into three main activity periods: at home, walking, and the match. Recordings taken at other times—for example, while travelling by car or bus or while in the ground before the match or at half time—were excluded from the analysis. Mean systolic and diastolic pressure and heart rate were calculated for each subject for each of the three periods of interest and the median and interquartile range of each variable in each activity period for the group derived. In addition, the median differences between the values at home and while walking and at home and at the match were calculated; they are given with 95% confidence intervals. The significance of these differences was further assessed by the Wilcoxon signed rank test. The possibility of association between the linear analogue scores and the haemodynamic variables was assessed by the Spearman rank correlation test. A p value of <0.05 was considered significant.

Results

In nine of the 10 men studied the mean systolic blood pressure, diastolic blood pressure, and heart rate were all higher during the match than during the baseline (home) period. The median values for the whole group during the home, walking, and match periods are summarised in the table.

Systolic blood pressure rose by a median of 25.8 (95% confidence interval 12 to 39) mm Hg and heart rate by 13.5 (4 to 29) beats/minute between the home and walking periods, and diastolic blood pressure fell by 7.9 (−19 to +3) mm Hg, as would be expected during mild isotonic exercise. The systolic and diastolic blood pressure and heart rate increased between the home and match periods by median values of 25.6 (7 to 34) mm Hg, 4.6 (1 to 12) mm Hg, and 7.6 (2 to 16) beats/min respectively. Diastolic blood pressure did not differ significantly between the baseline and match periods, but was significantly higher during the match than while the subject was

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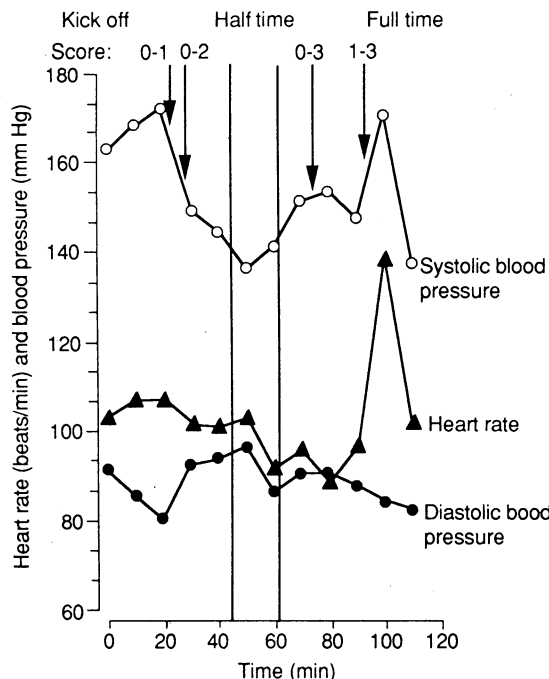
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Median (interquartile range) blood pressure and heart rate of 10 male soccer spectators

	Activity period		
	At home	Walking	Watching match
Blood pressure (mm Hg):			
Systolic	134.3 (116-144)	159 (148-167)*	145.5 (137-175)*
Diastolic	86.6 (80-90)	85.5 (56-92)	92 (82-95)
Heart rate (beats/min)	80.8 (76-94)	100 (90-112)*	97.1 (87-101)*

\*p=<0.01 Compared with baseline (home); Wilcoxon signed rank test.

Heart rate and systolic and diastolic blood pressure during the match of one supporter watching his team lose 1-3



walking (median difference 13.0 (1 to 23) mm Hg;  $0.05 > p > 0.02$ , Wilcoxon signed rank test).

In all 10 men the mean heart rate in the 30 seconds after the supported team scored its first goal was higher than in the 30 seconds before the goal. Median heart rate for the whole group in the 30 seconds before a goal was scored was 96 beats/min (interquartile range 86-101); it was 120 beats/min (109-129) in the 30 seconds after; median difference +23 (16 to 30) beats/min;  $p < 0.01$ , Wilcoxon signed rank test. All subjects recorded their maximum heart rate during the match in the 30 seconds following a goal for their team; in five this was the maximum rate recorded during the entire study period, the others having a higher rate recorded at least once during their journey to the match. The individual mean heart rate in the 30 seconds after the first goal for the supported team was a mean of 66% of the maximum predicted heart rate and in four men was greater than 70% of this value. No significant arrhythmia was documented in any subject.

The linear analogue excitement scores were 1,2,3,4,

4,4,5,6,7 and 7: seven men scored the match as 5 or less. There was a significant correlation between this subjective measure of excitement and the heart rate in the 30 seconds after the first goal was scored by the supported team (Spearman rank correlation coefficient 0.675;  $0.05 > p > 0.01$ ). There was, however, no correlation with any of the three variables measured over the whole match period, or with the change in their value between the home and match periods. The figure shows the haemodynamic response of one fan to his team's 1-3 defeat.

## Discussion

Although previous studies have shown the heart rate response to stressful daily activities such as car driving<sup>1</sup> and occasional activities such as public speaking<sup>2</sup> or riding a roller coaster,<sup>6</sup> few studies have additionally documented the effect of emotional stress on blood pressure beyond a controlled experimental environment.

We have shown a modest but significant increase in blood pressure (of a degree similar to that occurring during light exercise) and heart rate in healthy men watching football, most of whom rated the matches studied as relatively unexciting.

Although these changes are not as great as those found during other non-sporting activities such as roller coaster riding,<sup>6</sup> they were sustained over a longer period—90 minutes—and despite the subjective opinions of the supporters in this study and the intermittent doubts expressed by some sections of the English media—such as London Weekend Television's *Saint and Greavsie*—they may provide some evidence that Scottish football is indeed exciting.

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## Keeping the cat out of the bag: a hazard in continuous ambulatory peritoneal dialysis

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### Introduction

Continuous ambulatory peritoneal dialysis (CAPD) is an established method of renal replacement therapy. It uses the patient's own peritoneum as a dialysis membrane by running fluid from a bag into the abdominal cavity through a closed system consisting of a silastic catheter and a plastic dialysis line. The fluid is retained in the abdomen for several hours' "indwell" and is then drained out. This process is repeated several times a day. We report an unrecognised hazard for patients receiving this treatment.

### Case reports

**Case 1**—A 39 year old man who had been receiving continuous ambulatory peritoneal dialysis for one year presented an hour after his kitten had bitten through his dialysis line while fluid was running into his

abdomen. He was given a single dose of intravenous vancomycin as prophylaxis and discharged. Eight hours later he was readmitted with severe peritonitis. He was feverish and had bilateral digital ischaemia, a rigid abdomen, and an ileus. He was given benzylpenicillin and peritoneal lavage with vancomycin and gentamicin into each dialysis bag. Nasogastric aspiration and intravenous fluids were necessary until bowel activity returned. Gram negative intracellular diplococci were seen in the dialysis fluid and intravenous ampicillin was started. Subsequent culture grew *Neisseria pharyngis*; this was resistant to vancomycin but sensitive to ampicillin and gentamicin. The patient returned to continuous ambulatory peritoneal dialysis and made a full recovery.

**Case 2**—A 58 year old woman was draining in when her kitten scratched and punctured her dialysis line. She was given vancomycin and did not develop peri-

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