and Herman in a smaller series from New York did not confirm that age is of prognostic importance,²⁰ nor did van Voorhis in a series of 762 patients from Iowa.²¹ An early series in which radium alone was used failed to find any prognostic value in age.¹⁹

Series in which both surgery and radiotherapy have been given have not found age a significant factor in prognosis,^{17,22-24} and indeed Gynning *et al* noted a different effect of age when two different treatment techniques were used for stage IB tumours (radical radiotherapy alone, both intracavity and external beam, or radical radiotherapy followed by elective hysterectomy).²⁹ Other radiotherapy series have found that the effect of age on survival varies with stage.^{30,31}

These divergent and potentially confusing findings must result, at least in part, from the effect of other prognostic factors. Age alone does not adequately indicate prognosis even when the effect of stage is also considered. In this study there was no evidence that young patients with cervical cancer treated by radical radiotherapy during the 1970s had a more aggressive form of malignancy. In most stages of disease their prognosis was similar to that of older patients, and in stage IB it was considerably better. We therefore conclude that younger age alone is not an indication for adjuvant treatment for cervical cancer.

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Faecal blood loss in response to exercise

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Abstract

Recently qualitative tests have indicated that gastrointestinal bleeding during exercise may be an important contributory factor in sports anaemia. In six healthy men who walked 37 km on four consecutive days faecal haemoglobin content remained normal (reference range 0.10-2.53 mg/g faeces) with no significant differences between values. In 28 marathon runners who refrained from taking drugs or food containing blood the median faecal haemoglobin content increased by 0.42 mg/g faeces (95% confidence interval 0.12 to 0.83 mg/g) from 1.06 (0.86 to 1.31) mg/g

before the race. In 13 runners who had taken drugs before the race the corresponding increase in the median faecal haemoglobin content was 0.87 (-0.03 to 2.20) mg/g from the value before the race of 0.93 (0.46 to 1.55) mg/g.

Prolonged walking had no effect on gastrointestinal blood loss. Intense endurance exercise in the form of marathon running induced a significant but clinically unimportant increase. This may be exaggerated by the ingestion of drugs and assume importance in causing iron deficiency and sports anaemia. The use of drugs, particularly analgesics, by marathon runners should be actively discouraged.

Introduction

Sports or runners' anaemia is a well recognised complication of endurance exercise and has been variously attributed to plasma volume expansion, traumatic red cell haemolysis, and iron deficiency. This iron deficiency has been ascribed to haematuria, haemoglobinuria, iron loss through excessive sweating, impaired iron absorption, and, more recently, occult gastrointestinal blood

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loss.¹ A pilot study reported that occult gastrointestinal blood loss was not unusual after a marathon race,² and an increased loss was subsequently observed in trained athletes after racing.³

Subjects and methods

Prolonged walking—Six healthy men (mean age 28, range 24-39) walked three laps of a flat 12.3 km course on four consecutive days. Their diet was unrestricted except that no caffeine, alcohol, or drugs were allowed. Total daily faecal collections were made and a small sample (about 1 g) taken from each bowel movement for subsequent analysis of blood content.

Marathon running—Forty six volunteers (three women, 43 men) who were taking part in marathons (42.2 km) run in Aberdeen and Fortrose were studied. They were diverse in terms of age (mean 37, range 20-61), running ability (race time 218 minutes, range 161-290), and training (weekly training distance 67 km, range 10-176). Each subject completed a questionnaire detailing dietary habits, drugs taken, gastrointestinal disturbances, and training programme and provided a faecal sample (about 1 g) sometime in the two days preceding the race and from the first and second bowel movements passed after the race.

MARATHON RUNNING

The 46 subjects were retrospectively classified into two groups depending on whether their faecal occult blood results were likely to have been complicated by ingestion of drugs ($n=13$) or not ($n=28$). Three subjects were eliminated from the study because of abnormally high values before the race not attributable to drugs or food containing blood; and two who reported that they regularly ate a food containing blood (black pudding or sausage) and showed falsely high results throughout (mean 5.7 mg haemoglobin/g before the race and 3.6 and 8.0 mg/g after the race) were also excluded.

The table shows the distribution of positive slide test results for both groups. According to the HemoQuant assay, all tests yielded a comparable number of false positive results: Hema-Chek 60%, Hemocult 44%, and Fecatwin S 57%.

Subjects who had not taken drugs ($n=28$)—The quantitative values in samples obtained before the race showed no correlation with age ($r=0.243$, $p>0.1$) or the weekly distance run in training ($r=0.181$, $p>0.1$), but there was a significant correlation with race time ($r=0.384$, $p<0.05$). Twenty subjects showed an increase in blood loss after the race (five in excess of normal, range 3.0-4.35 mg haemoglobin/g), but this attained significance only for the peak values (table) and the increase did not correlate with age

Quantitative and qualitative results of tests for faecal occult blood in marathon runners

		After race		
	Before race	First bowel movement	Second bowel movement	Peak blood loss value
Subjects who did not report taking drugs (n=28)				
Mean Hb content by HemoQuant (mg/g) (95% confidence interval)	1.06 (0.86 to 1.31)	1.33 (1.01 to 1.77)	1.19 (0.91 to 1.49)	1.51** (1.17 to 2.02)
No positive by:				
Hema-Chek	3	6	4	
Hemocult	2	5	0	
Fecatwin S	3	4	4	
Subjects who reported taking drugs				
Mean Hb content by HemoQuant (mg/g) (95% confidence interval)	0.93 (0.46 to 1.55)	1.42 (0.88 to 3.07)	1.58 (0.82 to 2.78)	1.88* (0.95 to 3.46)
No positive by:				
Hema-Chek	1	3	4	
Hemocult	1	2	3	
Fecatwin S	1	3	4	

Hb=Haemoglobin.
* $p<0.05$, ** $p<0.01$.

Faecal blood testing—Faecal blood content was evaluated by both qualitative and quantitative techniques. Firstly, three slide tests based on guaiacum resin commonly used in screening were used according to the manufacturer's instructions: Hemocult (Smith Kline Instruments Inc, United States), Hema-Chek (Ames Division, Miles Laboratories Inc, United States), and Fecatwin S (LabSystems Oy, Finland). Secondly, a quantitative assay, HemoQuant, which is not yet commercially available, was performed as recommended.^{4,5} This two stage procedure, specific for faecal haem, measures not only total faecal haemoglobin but also the fraction converted to porphyrin by gut flora (the intestinal converted fraction). Unlike haem, this does not exhibit any pseudoperoxidase activity and hence is not measured by tests based on guaiacum resin.

Statistical methods—An analysis of variance for repeated measurements, which used the BMDP statistical package, was used followed by the Duncan multiple range test for the data obtained after prolonged exercise. Non-parametric analysis with a Wilcoxon signed rank procedure (Minitab) was used on the marathon data to avoid the bias of outlying values. Unless otherwise stated the results given are medians and 95% confidence intervals. Correlation coefficients (r) were calculated by linear regression.

Results

PROLONGED WALKING

No significant change in daily faecal weight was recorded, and all slide tests for faecal occult blood gave negative results. Faecal haemoglobin content, corrected for intestinal degradation, on each of the four consecutive days was (mean (SD)) 1.17 (0.87), 0.93 (0.71), 0.86 (0.52), and 0.78 (0.53) mg haemoglobin/g faeces (reference range 0.10-2.53 mg/g). There was no significant difference between values.

($r=0.148$), weekly distance run in training ($r=0.265$), or race time ($r=0.216$).

Subjects who had taken drugs ($n=13$)—These subjects reported taking a drug before the race: aspirin (three), paracetamol (three), naproxen and aspirin (one); and (one each) naproxen, pseudoephedrine, clavulanic acid, diphenhydramine, aluminium hydroxide, and thyroxine with nitrazepam. One subject had an increased faecal blood loss (7.34 mg haemoglobin/g) before the race but four had excessive peak losses (3.46, 3.62, 4.74, and 13.08 mg/g) after the race. The subject who took aspirin and naproxen before running had a normal value for faecal occult blood before the race but a highly significant loss (13.08 mg/g) in the sample taken immediately after the race.

Of the 46 runners, 11 reported gastrointestinal disturbances during the race, particularly stomach cramp that was subjectively ascribed to low environmental temperature or intake of water before or during the race. Although these subjects had a significant increase ($p<0.05$) in blood loss after the race, this did not exceed that in the other subjects.

Discussion

Several recent studies suggesting that iron deficiency and the anaemia commonly found in endurance athletes may be due to gastrointestinal blood loss have been based on qualitative stool tests.^{2,6,7} These depend on the peroxidase activity of haemoglobin and have, as substantiated in this study, variable sensitivity.⁸ They are influenced not only by extraneous peroxidases derived from meat containing blood, certain vegetables, and the reducing activity of products containing vitamin C⁹ but also by the loss of peroxidase activity after the degradation of haemoglobin during transit through the bowel. These major drawbacks do not apply to the HemoQuant

assay, which is quantitative, is not complicated by dietary factors other than ingestion of blood, and measures both intact haemoglobin and its degradation products.

When evaluating faecal occult blood loss during exercise variables other than analytical ones must also be considered; these include sampling methods,¹⁰ gut transit time,^{3,8} and the faecal mass and its water content.¹¹ The normal range of daily gastrointestinal blood loss has been established as 0.5-2.0 mg haemoglobin/g by radiochromium labelling methods^{12,13}; by HemoQuant assay we found a similar range (0.10-2.53 mg/g). During prolonged walking we did not show any significant day to day variation in faecal blood loss, and clearly this form of low intensity exercise had no adverse effects on the gastrointestinal tract.

In previous studies of marathon runners tests for faecal occult blood gave positive results in 8% (n=39),⁷ 13% (n=63),⁶ and 22% (n=32)² of runners after the race, but only peroxidase based screening tests were used and none excluded possible interference by medicinal or dietary factors. In our study 13 out of 46 (28%) marathon runners reported taking some form of drug before the race, and in two runners dietary factors invalidated the test results.

In the only previous study that measured actual gastrointestinal blood loss before and after races of between 10 and 42.2 km faecal blood increased in 20 out of 24 (83%) runners, from a mean loss of 0.99 mg haemoglobin/g before the race to a mean peak value of 3.96 mg/g after the race, although this last figure seems to have been biased by the inclusion of one subject with a blood loss after the race of 43.2 mg/g.³ Our study of a larger and more heterogeneous population who completed a marathon found only a minor median increase in blood loss after the race equivalent to 0.4 ml of whole blood a day after we had excluded results complicated by drug or dietary factors. Although this increase was significant, we regard it as having no clinical relevance in healthy athletes. More important, however, we showed that this increase was significantly exaggerated in those who took drugs, especially analgesics, before the race. We

believe that the apparently common practice of taking analgesics before marathon running² should be strongly discouraged.

The mechanism of the gastrointestinal blood loss associated with marathon running has been recently reviewed¹⁴ and variously attributed to gut ischaemia, mechanical factors including "caecal slap"¹⁵ and volvulus,¹⁶ and aggravation of pre-existing occult or overt gut lesions.

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SHORT REPORTS

Echocardiography in ischaemic cerebrovascular disease

Despite several studies the indications for echocardiography in ischaemic cerebrovascular disease and its impact on treatment remain undefined. In randomly tested patients the yield has been poor and echocardiography has not been reported as a screening method.¹ On the other hand, liberal use of echocardiography has been encouraged in young patients with cardiac disease, especially when angiograms have been unhelpful.^{2,3}

The purpose of this study was, firstly, to identify useful predictors that would detect patients with embolic cardiac disease and, secondly, to discover the prevalence and type of echocardiographic abnormalities in these patients.

Patients, methods, and results

During September 1983 to December 1985 we examined a total of 97 patients, most of whom were suffering from ischaemic infarction of the carotid territory. All patients were aged under 70 and the 55 patients aged 49 or less accounted for three quarters of all patients of that age in our own hospital's catchment area who suffered ischaemic strokes. Both two dimensional and M mode echocardiography was performed on all patients according to the recommendations of the American Society of Echocardiography.⁴ The type of equipment used was an ATL Mk 300C with a 3.0 MHz transducer.

We chose the following as possible predictors of echocardiographic abnormalities: evidence of cardiac disease reported in the case notes, cardiac murmurs, electrocardiographic abnormalities, and increased size of the heart in radiographs. Carotid angiography of the affected artery was performed in 72 patients and the angiograms classified according to presence or absence of atheromatosis.

Fifty eight of the 97 patients had an abnormal echocardiogram, 11 showing left atrial or ventricular thrombi (table). The prevalence and type of abnormalities in patients under 50 were identical with those in the whole sample. The presence of

one or more of the four predictors was associated with an increased risk of echocardiographic abnormalities ($\chi^2=23.4$; $df=4$; $p<0.0005$), 31 out of 35 patients positive for two or more of the predictors having an abnormal echocardiogram. On the other hand, 11 of the 34 patients without any of the predictors had an abnormal echocardiogram, in two cases showing left atrial or ventricular thrombi. Carotid angiograms had no predictive value; the echocardiogram was abnormal in 12 out of 20 patients with atheromatous changes in the angiogram and in 32 out of 50 patients whose angiograms either were completely normal or showed occlusions of some of the distal cerebral arteries only.

Echocardiographic findings in 97 patients with ischaemic cerebrovascular disease

	No of patients
Left atrial/ventricular thrombus associated with local hypokinesia (three cases) and hypertrophic obstructive cardiomyopathy, mitral valve prolapse, prosthetic valve, mitral stenosis/insufficiency, and aortic valve thickening (one case each)	11
Left atrial/ventricular dilatation	11
Mitral valve prolapse	9
Aortic cusp fibrosis/thickening	7
Local hypokinesia	5
Hypertrophic obstructive cardiomyopathy	3
Ventricular wall hypertrophy	3
Aortic stenosis/insufficiency	2
Mitral stenosis/insufficiency	1
Mitral insufficiency	2
Intramycardial calcification, right ventricular hypertrophy, atrial septal defect, fibrous plaque of myocardium (one case each)	4
Normal	39
Total	97