STRESS FRACTURES: EFFECT OF PRIOR PHYSICAL ACTIVITY, SPORTS PARTICIPATION AND MILITARY TRAINING

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ABSTRACT

A study was carried out to find out the effects of prior physical activity, sports participation and prior military training on the incidence of stress fractures among Gentlemen Cadets (GC's) undergoing military training at Indian Military Academy (IMA). One thousand and fourteen GC's were followed up for a period of 12 weeks. Thirty-seven GC's developed stress fractures during the study period. The incidence of stress fractures was significantly higher in GC's without any prior military training (p=0.0009). They were compared with 100 healthy controls drawn from the study population to study the influence of the other mentioned factors. There was no significant association between prior physical activity and stress fractures (OR=0.74, 95% CL=0.26 to 2.05, p=0.688). There was also no significant relationship between sports participation and stress fractures (OR=0.79. 95% CCL=0.35 to 1.81, p=0.684).

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KEY WORDS: Risk factors; Stress fractures.

Introduction

Pain and discomfort in the lower extremities following sudden, prolonged and sustained physical effort is a common symptom during military training [1-4]. Stress fractures form a significant cause of such symptoms. Stress fractures were first described 143 years ago in the Prussian army [5]. Inspite of many reports in the literature since then, opinions still differ about some of the risk factors related to stress fractures such as effects of prior physical activity, sports participation, and possible preventive measures [6-9].

We carried out the present study to resolve some of the above issues.

Material and Methods

A hybrid study design, using features of a case control as well a descriptive longitudinal study was used [10]. The study population comprised of 1014 Gentlemen Cadets (GC's) undergoing military training at Indian Military Academy (IMA). The GC's formed four groups, who differed in their exposure to prior military training. Term 1 (Direct entry) and Term 2 (Technical graduates) were new entrants without prior exposure to military training. Term 2 (Regular) and Term 3 (Regular) had previous exposure to military training.

The four groups were followed up for 12 weeks of military training. The outcome measure was stress fracture which was diagnosed on basis of history, clinical evaluation and confirmed at a service hospital by complete orthopaedic evaluation. The predictor variables were prior military training, prior physical activity before joining IMA, prior sports participation at high school/college level and rural/urban background. The last three variables were ascertained by a questionnaire administered to the cases of stress fracture and controls without stress fracture. A GC was classified as being physically active if prior to joining military training he ran between 5 to 25 km in a week and sedentary if less.

All cases of stress fractures among the four groups of study cohorts occurring within the twelve weeks of observation were identified. Controls were selected from the same source populations out of the GC's who did not develop stress fracture.

Sample size and selection

All incident cases of stress fracture identified as above were included. The controls were selected 25 from each group by systematic random sampling; the total number of controls being almost three times the number of cases, to ensure adequate statistical power.

Review of training programme

The training programmes during the 12 weeks of all the four groups were reviewed. The facilities for training like cross-country route, obstacle course and drill square were surveyed. Activities were observed in detail during the drill, physical training and obstacle training periods. The amount and duration of physical training in all the four groups did not differ significantly.

Results

Incidence

The incidence of stress fractures among the 1014 recruits is shown in Table 1. The incidence was significantly higher in GC's without prior military training (Term 1 and Term 2 technical graduates), compared to GC's with prior military training (Term 2 regular and Term 3 regular). Chi square=16.44, df=3, p=0.00091949.

Site

The location of the site of stress fractures was as follows-tibia 72.3%, tarsus 12.3%, femur 6.1%, metatarsus 6.2% and patella

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TABLE 1
Incidence of stress fractures

Group	Sustained stress fracture	Free from stress fracture	Total
Term 1 (Direct Entry)	13 (6.19%)	197	210
Term 2 (Technical)	6 (11.54%)	46	52
Term 2 (Regular)	9 (2.46%)	357	366
Term 3 (Regular)	9 (2.33%)	377	386
Total	37 (3.65%)	977	1014

Chi sq = 16.44, df = 3, p = 0.00091949

3.1%.

Rural/urban background

There was no significant association between rural/urban background and stress fractures as shown in Table 2. The Odds Ratio (OR) being 0.69, Cornfield 95% confidence limits between 0.24 to 1.98, p=0.6062367.

TABLE 2
Urban rural background and stress fracture

	Stress fracture	Controls (no stress fracture)	Total
Urban background	29	84	113
Rural background	8	16	24
Total	37	100	137

OR = 0.69, Cornfield 95% CL between 0.24 to 1.98, p = 0.6062367

Prior physical activity and stress fracture

(Table3). There was no significant association between prior physical activity and stress fracture (OR=0.74, Cornfield 95% confidence limits between 0.26 to 2.05, p=0.6883187).

TABLE 3
Prior physical activity and stress fracture

	Stress fracture	Controls (no stress fracture)	Total
Physically active	7	24	31
Sedentary	30	76	106
Total	37	100	137

OR = 0.74, Cornfield 95% CL between 0.26 to 2.05, p = 0.6883187

Prior sports participation and stress fracture

(Table4). There was no significant association between prior sports participation at high school/college level and stress fracture (OR=0.79, Cornfield 95% confidence limits between 0.35 to 1.81, p=0.6844139).

Discussion

Stress fractures are the largest single cause of loss of training among military trainees [5]. However, the incidence of stress fractures among military trainees reported by various workers vary very widely from as low as 1.3% incidence reported among 6,677 recruits by Scully and Besterman [11], to as high as 31% reported by Giladi et al among 295 recruits of the Israeli Army during 14 weeks of training [5]. The stress fracture incidence of 3.65% in the present study during the 12 weeks of training is on the lower side. One possible explanation for the difference in incidence is training demands. Here we are limited, by the lack of exact knowledge of the basic military training programmes of other countries.

TABLE 4
Prior sports participation and stress fracture

	Stress fracture	Controls (no stress fracture)	Total
Represented (School/college)	16	49	65
Not Represented	21	51	72
Total	37	100	137

OR = 0.79 Cornfield 95% CL between 0.35 to 1.81, p = 0.6844138

The distribution of site of stress fractures in the study was similar to other military studies [12-15], in that it showed the most affected site to be the tibia. The incidence of metatarsal fractures has been declining while the tibial incidence has been increasing [5]. There seems to be a changing epidemiological pattern. The reason for this may be change in intensity and type of training as well as equipment.

Prior military training reduced the incidence of stress fractures. Greaney et al [13] and Garcia et al [16], also reported that 60 and 40 percent of the stress fractures respectively, had occurred during initial military training. From this finding it follows that the most important changes in the training regime should be during initial military training, i.e. GC's in Term 1 and Term 2 (technical graduates). This may, however, compromise the standard of military training, and a certain baseline incidence of stress fractures among fresh inductees may have to be reconciled with.

Contrary to popular belief physical and sports activities before joining IMA did not significantly influence the incidence of stress fractures in our study. Provost and Morris [6], Leabhart [7], and Gilbert and Johnson [8], among American recruits noted that subjects who led sedentary existence prior to basic training were at a higher risk to develop stress fractures. Contradicting these results are the studies of Mustajoki [17], and Giladi et al [5] who found no difference between stress fracture and control group who did

not sustain stress fractures regarding pre-training physical or sports activities. Our findings are similar. We therefore cannot modify stress fracture incidence by instituting a pre-training programme among military aspirants.

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