Stress Fractures in 295 Trainees: A One-Year Study of Incidence as Related to Age, Sex, and Race

*CPT Tracy J. Schmidt Brudvig, AMSC, USA**
MAJ Trina D. Gudger, AMSC, USA
CPT Lee Obermeyer, AMSC, USA

In military basic training centers, the stress fracture is a common orthopaedic problem. Countless hours of training are missed due to stress fractures. Recent evidence reveals that stress fractures can be characterized in regard to body type and training activities. Protzman[1] has recently documented that females at West Point have a higher incidence of stress fractures compared with their male counterparts. Ozburn and Nichols[2] have related the occurrence of pubic ramus stress fractures in female trainees to body build and length of stride. Gilbert[3] noted a difference in the types of stress fractures in trainees, due to their manner of marching. Marine trainees who "dig their heels in" have a higher incidence of calcaneal stress fractures, as opposed to Navy trainees who incur more metatarsal stress fractures because they maintain their cadence by slapping their left foot.

Review of recent orthopaedic literature reveals little information in regard to rate of incidence of stress fractures in the male and female basic trainee. The large military training population provides an excellent study population. This study concerns the retrospective analysis of stress fractures in 295 trainees at Fort McClellan, Alabama.

Clinical Material and Methods

Data were collected on 339 stress fractures occurring in 295 trainees, both male and female, who had radiologically diagnosed stress fractures during the period of 1 February 1981 through 31 January 1982. Some stress fractures of the hip region were diagnosed by means of bone scan. From 1 February 1981 through 30 September 1981, basic training consisted of six weeks of training. On 1 October 1981, the length of basic training was increased to eight weeks. The data collected during these two time spans were not differentiated and therefore were grouped together. Fort McClellan has two battalions of basic training, three battalions of one station unit training, and two companies of advanced individual chemical training. Data were collected on all troops in basic and advanced training. Training population during this 12-month period was 20,422 military trainees. Total post population was further divided with respect to sex, sex and race, and sex and age. Marine training population on post was only obtainable with respect to total Marine trainees and was not further categorized. Data collected on each trainee with a diagnosed stress fracture included age, sex, race, height, weight, week of training stress fracture was diagnosed, and location of stress fracture. These data were compared with total post population during this time period. Results were analyzed by T-test and Chi-square analyses.[4]

Results

A total of 339 stress fractures occurred in 295 trainees; 178 stress fractures occurred in 151 female trainees, while 161 stress fractures occurred in 144 male trainees. This produced a total rate of incidence of 1.44 during this 12-month period. A further breakdown of these data revealed a rate of incidence of 3.41 in female trainees, compared with .90 in their male counterparts. A T-test

TABLE I

DISTRIBUTION OF STRESS FRACTURES

Location	Number of Fractures	Per Cent
Metatarsal	96	28.32
Navicular	4	1.18
Calcaneus	85	25.07
Medial Tibial Plateau	53	15.63
Tibial Shaft	38	11.21
Fibula	13	3.83
Distal Femur	4	1.18
Femoral Shaft	14	4.13
Pubic Ramus	20	5.90
Femoral Neck	12	3.54
Totals	339	100.0

TABLE II

DISTRIBUTION OF RATE OF INCIDENCE OF STRESS FRACTURES AND FEMALE TRAINEES

Location	Number of Trainees		Rate of Incidence	
	Male	Female	Male	Female
Metatarsal	64	27	.40	.61
Navicular	3	1	.02	.02
Calcaneus	27	37	.17	.84
Medial Tibial Plateau	5	35	.03	.79
Tibial Shaft	23	12	.14	.27
Fibula	6	7	.04	.16
Distal Femur	3	1	.02	.02
Femoral Shaft	3	10	.02	.22
Pubic Ramus	4	15	.03	.36
Femoral Neck	6	6	.04	.14
Totals	144	151		

From the Physical Therapy Clinic, Noble Army Hospital, Ft. McClellan, Ala. 36205.

* Asst. Chief, Physical Therapy Clinic. Presented at American Physical Therapy Annual Conference, June 1982.

produced a significant difference between these two independent proportions.

Table I shows the distribution of stress fractures with regard to location. Metatarsal stress fractures occurred most frequently, followed by calcaneal and tibial stress fractures. These results are very similar to the results of an analysis of 250 stress fractures at Fort Benning, Georgia, by Wilson and Katz[5] in 1969.

Table II displays the rate of incidence of stress fractures with respect to location in both male and female trainees. All stress fractures occurred at a higher rate of incidence in the female trainee. Chi-square analysis yielded a significant difference between the rate of incidence in the male and female trainee at all locations, except the navicular and distal femoral stress fractures. This lack of significant difference was probably due to the small number of stress fractures occurring at these two locations.

Table III shows the breakdown of the rate of incidence of stress fractures with respect to sex and race. Three categories of race were defined: Caucasian, Black, and Other. With respect to race, the rate of incidence was highest in the Caucasian training population. The female Caucasian had the highest rate of incidence, with a 11.83 rate. Chi-square analysis produced a significant difference between the Caucasian and Black races, and also in the comparison of the Caucasian and Black races with respect to sex. The category of "Other" was not tested for its significance as compared with the other races, because of the insignificant number of stress fractures occurring in the population in comparison with the other races. These data are simply reported.

Table IV shows the rate of incidence of stress fractures with regard to both age and sex. Age categories were arbitrarily defined as 17–22 years, 23–28 years, 29–34 years, and 35-and-over. The average age of male trainees developing stress fractures was 20.58 ± 4.53, whereas the average age of female trainees developing stress fractures was 22.46 ± 3.46. In both the male and female training population, the rate of incidence of stress fractures increased with each age group up to the 35-and-over group. The data for the 35-and-over age group proved to be insignificant due to the small number of trainees falling into this category, with regard to both post population and trainees developing stress fractures. Chi-square analysis yielded a significant difference in regard to age and the occurrence of stress fractures in both male and female trainees, with the exclusion of the 35-and-over age group.

The factor of weight was analyzed with respect to its influence on the development of stress fractures. Army weight standards were used in the analysis. There was an insignificant number of trainees who were either over or under weight in the group that developed stress fractures.

TABLE III

RATE OF INCIDENCE OF STRESS FRACTURES IN REGARD TO SEX AND RACE

Race	Caucasian		Black		Other	
Rate of Incidence	1.92		.56		.62	
Rate of Incidence	Male 1.07	Female 11.83	Male .23	Female 1.39	Male .09	Female 4.32

TABLE IV

RATE OF INCIDENCE OF STRESS FRACTURES IN REGARD TO SEX AND AGE

Age	17–22		23–28		29–34		35-and-over	
Rate of Incidence	1.27		2.32		5.01		2.36	
Rate of Incidence	Male .88	Female 2.73	Male 1.30	Female 4.70	Male 2.95	Female 8.18	Male 0.00	Female 7.69

Comment

From this study, it would appear that: (1) Sex plays a role in the development of stress fractures. Female trainees have a higher rate of incidence of all stress fractures in comparison with their male counterparts. In this study, females had a rate of incidence of 3.41 per cent compared with .90 per cent for males. (2) Race seems to be a factor in the development of stress fractures. The Caucasian training population had a much higher rate of incidence of stress fractures compared with the Black training population. In addition, female Caucasian trainees yielded the highest rate of incidence of stress fractures with 11.83 per cent. (3) Age is a factor in the development of stress fractures. The incidence of stress fractures was greater with increasing age, up to the 35-and-over group.

Summary

The results of a study of 339 stress fractures in 295 military trainees provide information concerning the incidence of these injuries with regard to sex, race, age, and weight in military trainees. Sex, race, and age all have a significant influence in the development of stress fractures in the military training population.

References

[1] Protzman, R. R. and Briffis, C. C.: Comparative Stress Fracture Incidence in Males and Females in an Equal Training Environment. Athletic Train., 12:126–130, 1977.

[1] Ozburn, M. S. and Nichols, J. W.: Pubic Ramus and Adductor Insertion Stress Fractures in Female Basic Trainees. Milit. Med., 146:332–334, 1981.

[3] Gilbert, R. S. and Johnson, H. A.: Stress Fractures in Military Recruits. Milit. Med., 131:716–721, 1966.

[4] Furguson, G. A.: Statistical Analysis in Psychology and Education. McGraw-Hill, 1976.

[5] Wilson, E. S. and Katz, F. N.: Stress Fractures: An Analysis of 250 Consecutive Cases. Radiology, 92:481–486, 1969.