International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Study of Incidence and Pattern of Distribution of Stress Fracture in One Training Center of Paramilitary Force of Central India

Brajesh Dadarya[1], Sameer Gupta[2]

[1]Assistant Professor, Department of Orthopaedics, NSCBMC, Jabalpur, M. P.
[2]Professor, Department of Orthopaedics, GRMC, Gwalior, M. P.

Corresponding Author: Brajesh Dadarya

Received: 13/03/2015 *Revised: 24/03/2015* *Accepted: 26/03/2015*

ABSTRACT

Background: Stress or "March" fractures are tiny breaks or crack in normal bone due to repeated micro trauma. It is the response of bone to repeated stress, none of which by itself is sufficient to cause fractures. The stress are submaximal and usually due to unaccustomed activity The extrinsic demands of training programme place the trainee at risk to develop stress fracture. It is very essential to recognize stress fracture at an early stage otherwise pain and morbidity increase and many man hours and training hours are lost. Stress fracture which occurs so frequently in military personnel are least studied.

Aims & Objectives: The present study is aimed to evaluate

1. The incidence of stress fracture among military personnel during training.
2. Pattern of distribution (Anatomical location) of stress fractures.

Method: The study was carried out in one of the training centre of paramilitary force of Central India. The study is a prospective study and all the trainees were registered for the study at the time of joining of the training and observed for the development of symptoms of stress fracture during the entire period of training.

Results: At the 8th week of training the incidence of stress fracture were very high among recruit constable(21%) as compared to sub inspector(17%) and Assistant constable(8%).At 32nd week of training incidence were 12%, 8% and 4% respectively in Constable, Sub inspectors and Assistant constable respectively.

Conclusion: Among 580 Military personnel 116 cases of stress fracture were detected. Among this maximum number of fractures occurred in recruit constable. Upper half of the tibia was the most common site involved followed by lower half of the tibia. It is concluded that there is clear correlation between the increase in physical stress and decreased rest time and development of stress fracture.

Key Words: Stress fracture, Incidence, Anatomical location, Paramilitary personal

INTRODUCTION

Stress fractures are common injuries frequently seen in athletes and military recruits. Although the reported incidence of stress fractures in the general athletic population is less than 1%, the incidence in runners may be as high as 20%. It has multifactorial pathogenesis and repetitive sub maximal stress is commonly involved. [(1)] Stress fractures are caused by repetitive

micro traumas that occur during unusual or increased activities. [2] Stress fractures are a common injury in runners. They are consistently among the five most common running injuries, and account for 50% of all injuries sustained by runners and military recruits. The overall incidence of stress fractures ranges from 1.5 to 31 %. [3]

Studies of stress fracture in female or female and male military recruits and trainees have also produced somewhat inconsistent and tentative results. [4] A stress fracture can be defined as a partial or complete fracture of bone that results from repeated application of stress lower than that required to fracture the bone in a single loading situation. [5]

Tibia, metatarsals and calcaneus are the most commonly affected sites. Clinical suspicion is essential for the diagnosis. Although observed in all ages, stress fractures are common in adolescent athletes and recruits. [2] Stress fracture at the fifth metatarsal as a late complication of total knee arthroplasty is also reported. [6]

Studies also suggested that stress fractures are seen even in high-level adolescent athletes, with similar proportions for males and females, and that particular sports are associated with specific sites for stress fractures. [5] In view of scarcity of available literature and information about the incidence of stress fracture and affected bones during the training session in paramilitary personnel, this study was conducted in one of the training centre of paramilitary force of central India

MATERIALS AND METHODS

This study is a prospective study. All the trainees were registered for study at the time of joining the training and they were observed for the development of symptoms of stress fracture. In this case series *"population at risk"* were military personnel (Total 580) taking training at Military Training Centre, B.S.F. Tekanpur. A "Case" of stress fracture was defined as *"a trainee with a history of localized pain of insidious onset with training which worsen with progressive activity and is relieved by rest"*.

A person with stress fracture at more than one anatomical site was considered as one case only. All the personnel who joined the training between the study period were registered for study (population at risk) and they were interrogated at regular interval for sign and symptoms of stress fracture and who showed positive signs & symptoms were recorded as cases of stress fracture. Also the data of military hospital was checked at regular interval to find out cases who had consulted in the hospital. Radiological examination of all personnel showing sign & symptoms were carried out at regular intervals. All the anthropometric parameters were recorded at the beginning of study

RESULTS

Patients are carefully evaluated on the basis of their history and symptoms. Total 116 cases of stress fracture were found. The findings are observed at 8th week and 32nd week of training after careful physical evaluation of subjects. Incidence of stress fracture was very high among recruit constable (21%) as compared to Sub-Inspector (17%) and Assistant commandants (8%).

Table 1: Incidence of Stress Fractures according to rank (at 8th week of training)

Rank	No. of trainee having stress fracture	Incidence
Recruit Constable	43	21%
Sub-Inspector	32	17%
Asstt. Commandant	15	8%

There was substantial decrease in the incidence of stress fracture after 32 weeks of training. It was 12% among recruit constables and in Sub-Inspectors and

Assistant Commandants, 8% and 4% respectively.

Table 2: Incidence of Stress Fractures (at 32nd week of training)

Rank	No. of cases	Incidence
Recruit Constable	12	12%
Sub-Inspector	9	8%
Asstt. Commandant	5	4%

Maximum numbers of stress fracture cases were seen among Recruit constables (47% of all cases) who were subjected to most intense training.

Table 3: Incidence of Stress Fractures.

Rank	No. of cases	% of total cases
Recruit Constable	55	47%
Sub-Inspector	41	36%
Asstt. Commandant	20	17%

In total 116 cases, anatomical location of stress fracture were analyzed on the basis of personal history and symptoms. Most common site involved was upper half of tibia (52%) followed next in frequency by lower half of tibia (42%). The incidence of stress fracture at metatarsal was very less (0.9%).

Table 4: Anatomical location of Stress Fractures.

S. No.	Site	No. of cases	Percentage
1.	Upper half of tibia	60	52%
2.	Lower half of tibia	49	42%
3.	Neck femur	3	2.6%
4.	Shaft femur	1	0.9%
5.	Medial Malleolous	2	1.8%
6.	Metatarsals	1	0.9%

DISCUSSION

Stress fracture is fairly common condition encountered in military training centers. This is due to the large number of young males exposed to unaccustomed vigorous training conditions. The incidence of stress fracture varies at different training centers depending upon the nature of training itself.

Recruit studies often use prospective cohort designs to determine stress fracture incidence rates. These studies start with injury free populations who are monitored for stress fractures throughout training. When all recruits, or a statistically valid sample, are used, these rates are the best estimates of stress fracture incidence. When passive surveillance methods are used for case identification in recruit populations, the tendency of individuals to report symptoms of stress fracture should be expected to vary.

The present study was a prospective study, and case ascertainment relied upon the active surveillance. Our study started with injury free trainees who were monitored for stress fracture throughout the training.

In present study we found a very high incidence of stress fractures specially among recruit constables. Incidence of stress fracture at the end of 8th week of training was 21% in recruit constables, 17% in Sub-Inspector and 8% in Assistant Commandants. There was a substantial decrease in the incidence after 32 weeks of training; it became 12% in recruit constables, 8% sub-inspectors and 4% in Assistant Commandants. This decrease in incidence might be due to adaptation of trainees to the training programme or trainees were knowingly hesitating to report their injuries knowing that it might delay their graduation which would have completed in 36 weeks time.

There may be some reason for such a difference in incidence of stress fracture in our study like difference in training schedule and difference in imaging modalities for the evaluation of stress fracture. As only X-ray is considered for evaluation of bones along with symptoms as told by the trainee himself and more sensitive imaging modalities such as radio nucleotide imaging studies were not used. In this study case ascertainment was based on clinical finding and radiographic examination was not included in initial diagnostic criteria.

In present study difference in incidence is also observed according to the

rank.Of the total 116 stress fracture cases studied in the present series, 47% occurred in Recruit Constable, 36% in Sub-Inspectors and 17% in Assistant Commandants. The possible reason for such findings may be due to difference in their training schedule. The maximum capacity training of recruit constable was started from 5th week onwards. The maximum capacity training of Sub-Inspectors and Assistant Commandants was started from 9th week onwards. Sub-Inspectors and Assistant Commandants got more relaxation in between the training as compared to the Recruit Constables.

As reported by Kurkulu M et al (2010) ceremonial march training may cause stress fracture of bilateral tibial metaphysic. Walking on the hard surface for a prolonged period may be the cause of this stress fracture among recruit. [(2)] Walking on hard surfaces increases the axial compressive forces acting on the knee joint. Milgrom et al (2003) have determined that axial compressive and tensile forces were 48-285% higher during over ground running compared to treadmill. [(7)] Elliot and Blanksby reported that while running over ground; the stride length is more, stride rate is less and period of non support is more as compared to running on a treadmill. [(8)] Nigg et al (1994) observed that subjects plant their feet in a less flatter position during overground running. They found that most of the lower extremity kinematic variables showed inconsistent trends for individual subjects depending on the subject's running style, running speed, and footwear. [(9)]

In our study the upper and lower half of the tibia was observed as the most common site of the stress fracture followed by neck of femur and medial malleolus. Mechanical loading during physical activity produces strains within bones. It is thought that these forces provide the stimulus for the adaptation of bone. Running had a statistically significant higher principal tension, compression and shear strain and strain rates than walking. [(10)]

Most of the studies which are conducted on athletes generally showed that tibia is the most common site for stress fracture. Other common sites are fibula, metatarsal bones and in some cases navicular bone. Brukner P et (1996) al studied the site of stress fracture according to the type of sport and level of activity and found that navicular bone, tibia fibula are the common sites for stress fracture. [(11)]

CONCLUSIONS

Maximum incidence of stress fractures was seen among Recruits Constables who undergo most intense training (Incidence was 21%). Upper half of tibia was the most common site involved (in 52% cases) followed next in frequency by lower half of tibia (42%). Average time after joining training when symptoms developed was 6-8 weeks. Strong correlation was noted between rapid increase in physical stress with decreased rest time and development of stress fracture. In the present series we found that adequate rest, which is the key factor in stress fracture management, was not provided to symptomatic individual for recovery.

It may be concluded that rapid increase in activity after joining training and insufficient rest given to recruits between training are few causes for the stress fracture. There are certain limitations of the study. Though utmost care was taken for the diagnosis of stress fracture; more sensitive modalities are not used. The level of activity was also different at different rank. It is to emphasize that further studies are required to evaluate the factors causing stress fracture and effect of other contributing factors with similar level of activity in paramilitary personnel with larger cohort.

Source of Support: Nil

Conflict of Interest: None declared

REFERENCES

1. Boden BP, Osbahr CD. High-Risk Stress Fractures: Evaluation and Treatment, Am Acad Orthop Surg 2000; 8:344-353
2. Kurklu M, Ozboluk S, Kilic E, Tatar O, Ozkan H and Mustafa basbozkurt. Stress fracture of bilateral tibial metaphysis due to ceremonial march training: a case report. cases Journal 2010, 3:3: 1-4
3. Milner C E, Ferber R, pollard C D, Hamill J, and Davis I S. Biomechanical Factors Associated with Tibial Stress Fracture in Female Runners. Journal of the American College of Sports Medicine, Applied Sciences Biodynamics,2005; 323-328
4. Kelsey J L, Bachrach L K, Gray E P, Nieves J, Greendale G A, Sowers M, Brown B W Matheson K A, Crawford S L, and Cobb K. Risk Factors for Stress Fracture among Young Female Cross-Country Runners jennifer Medicine & Science In Sports & Exercise,2007; 1457-1463
5. Iwamoto J and Takeda T. Stress fractures in athletes: review of 196 cases. J Orthop Sci (2003) 8:273–278
6. Fujioka H, Kokubu T, Makino T, Hirata H, Nagura I, Inui A, Tanaka J, Yoshiya S, and Kurosaka M. Kobe J. Stress Fracture of the Fifth Metatarsal Bone as a Late Complication of Total Knee Arthroplasty. Med. Sci., Vol. 2009; 55(4): E93-E97.
7. Milgrom C, Finestone A, Segev S, Olin C, Arndt T, Ekenman I. Are overground or treadmill runners more likely to sustain tibial stress fracture? Br J Sports Med 2003;37:160–163
8. Elliot BC and Blanksby BA. A cinematographic analysis of overground and treadmill running by males and females. Med Sci Sports 1976; 8(2):84–87.
9. Nigg BM, DE-Boer RW and Fisher V. A kinematic comparison of overground and treadmill running, Med Sci Sports Exerc 1995; Vol 27(1) :98–105.
10. Milgrom C, Finestone A, Simkin A, Ekenman I, Mendelson S, Millgram M Nyska M, Larsson E and Burr D, In vivo strain measurements to evaluate the strengthening potential of exercises on the tibial bone, J Bone Joint Surg [Br] 2000;82(4):591-4.
11. Brukner P, Bradshaw C, Khan MK, White S, Crossley K. Stress fracture :A review of 180 cases, Clinical Journal of sport medicine, 1996;6(2): 85-9

How to cite this article: Dadarya B, Gupta S. Study of incidence and pattern of distribution of stress fracture in one training center of paramilitary force of central India. Int J Health Sci Res. 2015; 5(4):26-30.

****