Epidemiology of Stress Fracture in Police Trainees

Norman Lamichhane,[1] Arjun Prasad Dumre,[1] Gopesh Kumar Thakur[1]

[1]Department of Orthopedics, Nepal Police Hospital, Kathmandu.

ABSTRACT

Background: Military recruits and athletes have high occurrence of stress fractures, with very high incidence among military recruits. Symptomatic stress fractures can be disabling in some people. This study aims at identifying pattern and distribution of such fractures in Nepal Police trainee and assess the risk factors and demographics that may help to develop the local guidelines.

Methods: This study analysed 65 police trainees who presented to the orthopaedic Out Patient Department at Nepal Police and Province Police Hospital diagnosed as a case of stress fracture from 29 December, 2020 to 29 December, 2021. Ethical approval was obtained and different variables analysed were age, sex, Body Mass Index, location of fracture, duration of pain, method of treatment, time to heal the fracture and time to pain free mobilisation of patient.

Results: There were 65 trainees with 86 sites of fracture at different bones with 50.8% (33) of male population. The majority of fracture was located at tibia (58.1%) followed by pubic rami (33.7%) with potentially debilitating fracture neck of femur seen in 4.6% subjects. Mean duration of pain was 20.7±14.2 days with mean time for pain free mobilisation 42.2±17.7 days after presentation. 96.5% of those recovered with conservative treatment (activity restriction or cast).

Conclusions: The location of stress fracture depends upon the type of training or activities. Modification of activities in early phase of training with early visit for medical care in case of trainees with increasing pain may decrease morbidities and complications requiring operative treatment.

Keywords: Nepal Police; stress fracture; trainees.

INTRODUCTION

Stress fracture occurs due to repetitive, prolonged muscular force on the bone that hasn't accommodated such action.[1] Intrinsic risk factors for it are bone density, skeletal alignment and body size and composition, bone turnover rate, flexibility, and muscular strength and endurance, along with hormonal and nutritional factors. Extrinsic risk factors like surface of activity, footwear and external loading contribute to it. As the number of microfracture increases, it leads to complete fracture which is devastating. [2, 3] As high as 12% of military sustain stress fracture during intense physical training predominantly in lower extremity.[4,5] The recruits during military training who suffer stress fracture are over four times likely to be discharged from training programme implicating huge financial implication in budget.

We present such fractures in Nepal Police trainees evaluating different factors associated with them and, time to heal and return to activity among them.

METHODS

A descriptive cross-sectional study was carried out among Nepal Police trainees who suffered from stress fracture and presented at Nepal Police and Province Police Hospital for the duration of one year starting from December 29, 2020. Ethical approval was taken from National Health Research Council (Proposal ID: 779/2020 P and Reference no. 1706). Diagnosed cases of stress fracture as evidenced by X-ray or CT scan or MRI were included in the study.

The subjects in this study were the Nepal Police personnel involved in basic or advanced level training and presented to Nepal Police Hospital or Province Police Hospitals with history of pain over different bony parts associated with training related activities. On the basis of suspicion of stress fracture, they underwent radiological investigations. X-ray was done primarily in all cases and CT/MRI was done in those cases with high degree of suspicion where X-ray was non-evident. The

Correspondence: Norman Lamichhane, Department of Orthopedics, Nepal Police Hospital, Kathmandu, Nepal. Email: norman3082@gmail.com, Phone:+9779851183726.

orthopaedic surgeon treating the subjects confirmed the diagnosis.

After receiving informed written consent from the patients, proforma was filled accordingly after examining the patient, taking structured interviews and recording the X-ray, CT scan or MRI findings in the proforma. The variables entered were location of fracture, duration of pain at the site before presentation, duration of training, type of activity, modality of management for the case, duration of healing from presentation and time taken for pain free mobilization including demographic variables.

The data collected were evaluated periodically and the images obtained were verified by multiple researchers. Diagnosed cases of stress fracture were managed according to the location and severity of fracture line. They were followed up regularly (every two weeks or month according to progress of symptoms and healing) to complete the proforma and to evaluate the stage of recovery.

Data collected was entered into excel form and was analysed with latest SPSS tool (version 22). Data analysis was carried out by descriptive statistics including mean and standard deviations.

RESULTS

There were total of 65 trainees with 86 fracture sites at same or different occasion. Out of them 33 were male (50.8%) with 37 (43%) different location of fractures. Most commonly involved site was tibia (58.1%) followed by pubic rami (33.7%) (Table 1). There was no female athlete triad in any female subjects. Mean age of trainee was 21.2 years ranging from 19 to 30 years. Except for three cases, all were basic trainee (first time trainee).

Five out of seven patients who had BMI below 20 had two or more different site of stress fractures. 19 patients had stress fracture at two or more different sites, four of them in two different occasions.

Mean duration of pain before presentation was 20.7±14.2 days ranging from 4 to 90 days. All the patient who had Neck of Femur fracture presented earlier (mean -10 days).

Average time of training duration was 75.3±54.8 working days ranging from 11 to 365 days before presenting to hospital. The warm up period, stretching and strengthening exercises and footwear were similar in early and late phase of the training.

Mean time taken for healing of fracture was 31.7±16.2 days with mean pain free time of 42.2±17.7 days after presentation to hospital.

Most of the cases recovered completely with conservative treatment (rest, analgesics, calcium and vitamin D) and a few with cast application. Three patients underwent operative procedure, two of them for fracture neck of femur and one for fracture of proximal tibia (neck of femur fracture requiring Close Reduction and Internal Fixation (CRIF) with Cannulated Cancellous Screws (CCS) and proximal tibia fracture requiring CRIF with Intramedullary Interlocking (IMIL) nail) (Figure 1 and 2).

Table 1. Location of fracture.

Location of fracture		Right	Left
Tibia	Proximal 3rd tibia	6	17
	Mid shaft Tibia	10	4
	Distal 3rd Tibia	5	8
Pubic Rami	Superior Pubic Rami	5	1
	Inferior Pubic Rami	12	11
Neck of femur		1	2
Fibula		1	1
Tarsal bone (Navicular)		1	
Metatarsal bone		1	
Total		42	44

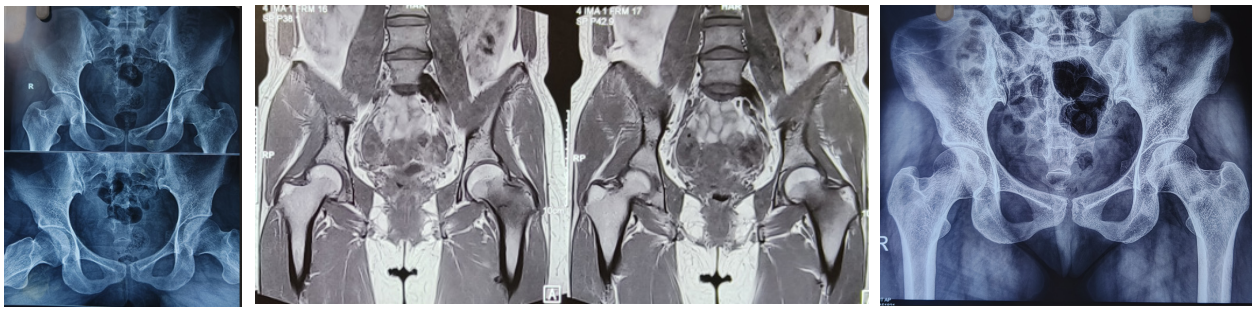

Figure 1. Stress fracture of neck of femur that has been managed conservatively (X-ray and MRI image (above) and Xray after healing of fracture (below).

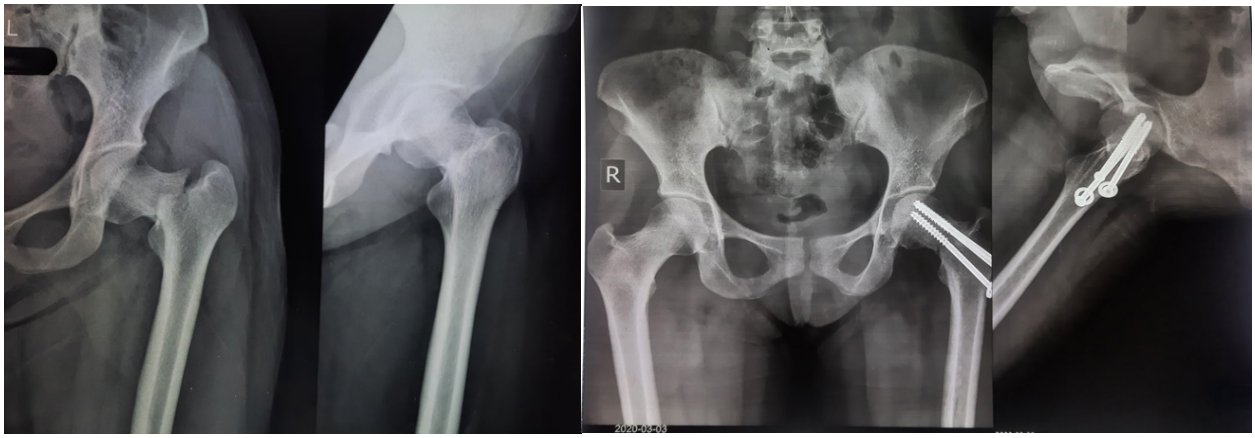

Figure 2. Stress fracture neck of femur before and after operative procedure.

DISCUSSION

Female are thought to be at increased risk of stress fracture due to their frequent hypoestrogenic status with increased activity leading to reduced bone mineral density.[6-8] Our study had 50.8% of male population. This was because enrolled male trainees being much higher in number as compared to female. But by location wise 57% of fractures were in female trainee. None of the female trainee had female athlete triad as risk factor.

Most of the studies showed tibia being the most common site for the stress fracture and few showed metatarsal bone.[9-11] The distribution of fracture in our case was in tibia (58.1%) followed by pelvic bone (33.7%). This distribution depends upon the type of activity of the subjects, as runners have high incidence of tibia involvement and dancers or marchers have high incidence of metatarsal involvement.[6] Potentially devastating femoral neck was involved in 4.6% of our cases as compared to 9% in a study conducted among military population.[7] Although common in military, no calcaneal fractures and few metatarsal or tarsal fractures were seen among the police trainees; possibly because of well-fitting sports shoes during running gave better protection than army boots.

Most of the stress fractures are uncomplicated and managed conservatively (rest and restriction from the activities). Some fractures like neck of femur fracture can be potentially devastating.[12, 13] Three cases in our study required cast application and other three required operative intervention (two neck of femur fracture requiring CRIF with CCS and one proximal tibia fracture requiring CRIF with IMIL nail).

Reduced BMI may indirectly contribute to stress fracture. A relationship between BMI, body height or weight and stress fractures has not been found in athletes, contributable to the homogeneity of such populations. Female athletes having low body fat may experience stress fractures, attributable to menstrual irregularities and/or low energy and nutrient consumption.[8] Mean BMI of trainee with stress fracture at presentation was 21.6±1.67. Five out of seven patients who had BMI below 20 had two or more different site of stress fractures.

Significant, acute weight loss combined with strenuous physical training among young military recruits may be a significant contributing risk factor for stress fracture injuries in them.

The mean rehabilitation time was reported to be 12.2 weeks for metatarsal fracture and 21.1 weeks for tibia in a study by Wood et al[14] and nine weeks in a study by Bhatnagar et al.[15] In our study, the mean time for pain free mobilisation and activity was 42.2±17.7 days after presentation to hospital. The earlier time for return to activity in our cases was because they presented to us at average time of 20.7±14.2 days of onset of pain and there was large number of cases involving pubic rami which was earlier to rehabilitate.

In our study we diagnosed all the stress fractures with plain radiography, CT scan or an MRI in contrast to bone scans performed in all suspected cases in other studies.[16,17] The number of cases and number of other locations could be higher had we performed such scans.

Prevention of stress fracture is difficult[18] due to multifactorial nature of the injury. The principle aspects of treatment still remains early diagnosis with high index of suspicions, identification of symptoms, radiological investigations and providing sufficient time to heal by abstaining from aggravating activity.[18,19]

CONCLUSIONS

The incidence of stress fracture which mostly occurs in initial phase of training is very high in tibia and pelvic bone with significant number involving neck of femur mostly affecting new recruits. It was more prevalent in the trainees with lower BMI. Strenuous exercise among trainees in earlier phase of training with inadequate warm up, less resting period and inadequate muscle stretching of lower extremities added by acute weight loss, improper foot wear and training surfaces are major contributing factors to stress fracture in them which can be modified. Early visit for medical care in case of trainees with increasing pain may decrease morbidities and complications requiring operative treatment.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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