



Knowledge Assessment of Stress Bone Fractures among Soldiers in Saudi Arabia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i54B33762

Editor(s):

(1) Koteswara Mudigonda, Director of Novel Drug Delivery Systems Propharmex Company, India.

Reviewers:

(1) Kastanis Grigorios, General Hospital of Heraklion – Venizelio Crete, Greece.

(2) Seyed Reza Mousavi, Shahid Beheshti University Medical Sciences, Iran.

Complete Peer review History, details of the editor(s), Reviewers and additional Reviewers are available here:

<https://www.sdiarticle5.com/review-history/77706>

Original Research Article

Received 25 September 2021

Accepted 01 December 2021

Published 11 December 2021

ABSTRACT

Background: Stress fractures are well perceived in military preparing and athletes. Aside from knowledge of the frequency of these fractures and their impact on the economy and lost training hours, there are just a few studies in Saudi Arabia that show the real incidence of these fractures. The precise incidence must be known in order to provide recommendations for future preventative initiatives. This study aims to assess the knowledge of stress fractures among Saudi soldiers.

Methodology: An observational cross-sectional study was conducted in medical centers; these centers are located in Saudi Arabia on male and female patients of all ages who are in Saudi military society to assess the knowledge of stress fractures among Saudi military society. Data collection was done by questionnaire that distributed between Saudi soldiers. Data was entered and analyzed using (SPSS) program, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

Results: Of all 1178 studied participants, 51.5% aged between 20- 30 years old. 91.7% were males. 47.5% of all participants had never heard of stress fractures before, 26.2% heard about it when joined military and 17.4% heard about it before joining the military field. 20.8% of all participants had stress fractures before, 10.4% were diagnosed through x-rays and medical history with the doctor, 4.6% were diagnosed through medical history only, and 2.4% diagnosed themselves. 85.3% of all participants agreed that stress fractures occur due to repetitive loading on the bones, 76.6% agreed that predominance of stress fractures of the lower extremities, over fractures of the upper extremities, 67.6% reported that stress fractures can be treated with painkillers, physiotherapy and reduce the risk and 78.6% agreed that stress fractures can be prevented by wearing appropriate footwear.

Conclusion: Participants and relatively good knowledge of stress fractures. Knowledge of stress fracture was significantly associated with years of experience of participants, military sector, and residence area in the kingdom.

Keywords: Stress fractures; military sector; athletes; physiotherapy.

1. INTRODUCTION

Stress fractures are well perceived in military preparing and athletes, with the primary detailed case being recognized in 1855 by Breithaupt and the first imaging of a stress fracture recorded by Stechow in 1897 [1].

Fractures, occurring mostly in weight-bearing bones as a consequence of repetitive and immoderate efforts, which might also additionally development to a entire fracture if left untreated.[2] This harm happens as a result of tall numbers of occurrences of patterned overburdening of concentrated lower than the greatest bone quality, on non-pathological bone tissue [3]. SFs have been detailed in about any bone within the limits [2]. Accurate diagnosis for stress fractures is dependent on the anatomical space. Regardless, early recognition is that the optimum goal to attenuate the potential for microfractures to become macro fractures [4]. Special tests and treatment regimes, however, square measure similar among most stress fractures with resolution between 4weeks to a year [4].

The first description of stress fractures was by Prussian military physician called Breithaupt in 1855, he described soldiers with oedematous painful feet. Then, in 1897 Stechow found an evidence of fractures on imaging, so he called these fractures by "march fractures" [3,5]. The incidence of stress fractures among military recruits has been estimated to be in the range of 1.9%-31% [6]. In other studies, reported in India the incidences were 11.4% and 7.04% in two different military training centers, The occurrence of SFs was higher during their initial training period and reached its peak at 12 weeks of

training [7]. Despite the fact that the clinical prevalence of stress fractures decreased after 8 weeks, incident lower limbs stress fractures persisted for over 20 weeks [8]. Actually, the incidence of stress fractures were higher in female soldiers than men [6].

The incidence of sustained stress fractures in military recruits may be as excessive as 12%, compared with a charge of 21.1% of elite athletes and 1% of the overall populace [1]. In the USA, the incidence of stress fractures in military recruits during training has been estimated to be in the range of 0.9%–12.3% Stress fractures in military recruits during training are estimated to occur in the range of 0.9 percent to 12.3 percent in the United States [9]. Most bones have reported cases of stress fractures, but the lower extremities have the highest prevalence. In a study of 320 athletes, the tibia (49.1%), tarsals (25.3%), and metatarsals (8.8%) were the most frequently involved bones affected by a stress fracture have been reported in most bones, but the lower extremities have the highest occurrence. The tibia (49.1%), tarsals (25.3%), and metatarsals (8.8%) were the most commonly involved bones damaged by a stress fracture in a sample of 320 athletes [10]. The incidence of SFs ranges from 1.5% to 31% depending on the population studied and the occurrence of SFs varies from 1.5% to 31% relying at the populace studied [5]. The number of studies on stress fractures in Saudi Army recruits is minimal, particularly in terms of invalidments. Furthermore, data on the actual occurrence is necessary to establish a foundation for future prevention initiatives and to improve the overall health of the troops. Aside from knowledge of the frequency of these fractures and their impact on the economy and lost training hours, there are

just a few studies in Saudi Arabia that show the real incidence of these fractures. The precise incidence must be known in order to provide recommendations for future preventative initiatives [7].

1.1 Study Objective

To assess the knowledge of stress fractures among Saudi soldiers.

2. METHODOLOGY

2.1 Study Design

This is an observational cross-sectional study was conducted in military medical centers, in different areas of Saudi Arabia, during the period from July to November, 202.

2.2 Subjects and Sample Size

Study included 1178 male and female patients of all ages who are in Saudi military society, who had stress fracture, to assess the knowledge of stress fractures among Saudi military society. The sample size was estimated using the Qualtrics calculator with a confidence level of 95%.

2.2.1 Inclusion criteria

Inclusion criteria are as follow:

- (1) Age between 20-40
- (2) males and females
- (3) In military fields

2.2.2 Exclusion criteria

Exclusion criteria are as follow:

- (1) Not a soldier
- (2) No previous history of stress fractures.

2.3 Data Collection and Study Tool

Data collection was done by questionnaire that distributed between Saudi soldiers. The questionnaire contains demographic data such as age, region, education level, profession, and how long in occupation. The participants were asked if they hearing about stress fractures (SF), if they recognize stress fractures in military, where the predominance of stress fractures, most cause of stress fractures. Also, they were asked if the pain & swelling are symptoms

of SF, treatment and prevention of stress fractures.

2.4 Analysis and Entry Data

Data was entered on the computer using the "Microsoft Office Excel Software" program (2016) for windows. Data was then transferred to the Statistical Package of Social Science Software (SPSS) program, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) to be statistically analyzed.

3. RESULTS

Of all 1178 studied participants, 51.5% aged between 20- 30 years old, 24.2% aged between 31- 40 years old and 13.8% aged between 41- 50 years old. 91.7% were males. 24.8% live in the western region and 23.8% live in the southern area of the kingdom. 40.2% had university education, and 34.8% had secondary school education. 43% of all participants work in the ministry of Interior (Public Security), 37.4% work in ministry of Defense while 13.1% work in ministry of National Guard. Regarding years of experience, 34.5% were employed for more than 10 years, 31.7% were less than 5 years, while 19.9% had 5- 10 years of experience.

According to Table (2); 47.5% of all participants had never heard of stress fractures before, 26.2% heard about it when joined military and 17.4% heard about it before joining the military field. 20.8% of participants had stress fractures before, 10.4% were diagnosed through x-rays and medical history with the doctor, 4.6% were diagnosed through medical history only, and 2.4% diagnosed themselves.

Regarding knowledge of diagnosis method; half of participants reported medical history, X-ray, MRI, or bone scan, 11.8% reported patient history only, and 33.8% didn't know. Only 73.8% agreed that stress fractures are well recognized in military armies and athletes.

Table (3) show that 85.3% of all participants agreed that stress fractures occur due to repetitive loading on the bones, 76.6% agreed that predominance of stress fractures of the lower extremities, over fractures of the upper extremities, 76.3% agreed that most common cause of stress fractures is repetitive weight-bearing activities, 77.2% agreed that pain and swelling a symptom of stress fractures, 67.6% reported that stress fractures can be treated

with painkillers, physiotherapy and reduce the risk and 78.6% agreed that stress fractures can be prevented by wearing appropriate footwear.

Table (4) shows that; knowledge of stress fracture was significantly associated with years of experience of participants, military sector, and residence area in the kingdom (P value<0.05).

Table 1. Sociodemographic characteristics of participants (n= 1178)

| Parameter | | No. | Percent |
|--|--|------|---------|
| Age | • Less than 20 | 36 | 3.1 |
| | • 20 - 30 years old | 607 | 51.5 |
| | • 31 - 40 years old | 285 | 24.2 |
| | • 41 – 50 years old | 163 | 13.8 |
| | • 51 - 60 years old | 79 | 6.7 |
| | • more than 60 | 8 | .7 |
| Gender | • Male | 1080 | 91.7 |
| | • Female | 98 | 8.3 |
| Residence area | • Southern area | 280 | 23.8 |
| | • Eastern Region | 237 | 20.1 |
| | • The northern area | 169 | 14.3 |
| | • Western Region | 292 | 24.8 |
| | • Central Region | 200 | 17.0 |
| Education level | • primary | 8 | .7 |
| | • middle school | 27 | 2.3 |
| | • secondary | 410 | 34.8 |
| | • university | 474 | 40.2 |
| | • diploma | 187 | 15.9 |
| Military sector | • Postgraduate | 72 | 6.1 |
| | • General Intelligence Presidency | 76 | 6.5 |
| | • Ministry of National Guard | 154 | 13.1 |
| | • Ministry of Interior (Public Security) | 507 | 43.0 |
| Years of experience in military | • Ministry of Defense | 441 | 37.4 |
| | • trainee | 163 | 13.8 |
| | • Employee less than 5 years | 374 | 31.7 |
| | • 5-10 years employee | 235 | 19.9 |
| | • Employed for more than 10 years | 406 | 34.5 |

Table 2. Knowledge of participants of stress bone fractures (n= 1178)

| Parameter | | No. | Percent |
|--|--|-----|---------|
| Have you ever heard of stress fractures? | • I have not heard of it before | 559 | 47.5 |
| | • Yes, I've had it before | 105 | 8.9 |
| | • Yes, I heard about it when I joined the military | 309 | 26.2 |
| | • Yes, I heard about it before I joined the military field | 205 | 17.4 |
| If you have ever had a stress fracture, how were you diagnosed? | • I diagnosed myself | 28 | 2.4 |
| | • One of my co-workers mentioned me | 41 | 3.5 |
| | • Through x-rays and your medical history with the doctor | 122 | 10.4 |
| | • By showing your medical | 54 | 4.6 |

| Parameter | No. | Percent |
|--|---|----------|
| As far as you know, stress fractures can be diagnosed by: | history to the doctor | |
| | • I didn't hit | 933 79.2 |
| | • Patient history only | 139 11.8 |
| | • Medical history, X-ray, MRI, or bone scan | 589 50.0 |
| To your knowledge, stress fractures are well recognized in military armies and athletes | • You do not need a medical diagnosis | 52 4.4 |
| | • I do not know | 398 33.8 |
| | • agree | 869 73.8 |
| | • Disagree | 288 24.4 |
| | • I do not know | 21 1.8 |

Table 3. Knowledge of participants to Stress Bone Fractures (n=1178)

| | Agree | Disagree |
|--|---------------|--------------|
| Stress fractures occur due to repetitive loading on the bones | 1005 85.3% | 173 14.7% |
| The predominance of stress fractures of the lower extremities, over fractures of the upper extremities | 902 76.6% | 276 23.4% |
| Wearing non-fitting shoes is a risk factor for stress fractures | 981 83.3% | 197 16.7% |
| The most common cause of stress fractures is repetitive weight-bearing activities (such as running and walking) | 899 76.3% | 279 23.7% |
| Pain and swelling a symptom of stress fractures | 910 77.2% | 268 22.8% |
| Stress fractures occur more often in females than in males | 637 54.1% | 541 45.9% |
| Magnetic resonance imaging (MRI) is the most sensitive and specific imaging test for diagnosing stress fractures | 921 78.2% | 257 21.8% |
| Stress fractures can be treated with painkillers, physiotherapy and reduce the risk | 796 67.6% | 382 32.4% |
| Stress fractures can be prevented by wearing appropriate footwear | 926 78.6% | 252 21.4% |

Table 4. The relationship between having knowledge about stress fracture and the sociodemographic characteristics of the studied population

| | | Yes | No | |
|-------------------|-------------------|-------|-------|-----------------|
| Age | Less than 20 | 18 | 18 | 36 0.095 |
| | | 2.9% | 3.2% | |
| | 20 - 30 years old | 332 | 275 | 607 |
| | | 53.6% | 49.2% | 51.5% |
| | 31 - 40 years old | 157 | 128 | 285 |
| | | 25.4% | 22.9% | 24.2% |
| 41 – 50 years old | 72 | 91 | 163 | |
| | 11.6% | 16.3% | 13.8% | |
| 51 - 60 years old | 35 | 44 | 79 | |
| | 5.7% | 7.9% | 6.7% | |

| | | Yes | No | |
|---|--|-------|-------|-------|
| Gender | more than 60 | 5 | 2 | 7 |
| | | 0.8% | 0.4% | 0.6% |
| | Male | 576 | 504 | 1080 |
| | | 93.1% | 90.2% | 91.7% |
| | Female | 43 | 55 | 98 |
| | | 6.9% | 9.8% | 8.3% |
| Residence area | Southern area | 169 | 111 | 280 |
| | | 27.3% | 19.9% | 23.8% |
| | Eastern Region | 105 | 132 | 237 |
| | | 17.0% | 23.6% | 20.1% |
| | The northern area | 86 | 83 | 169 |
| | | 13.9% | 14.8% | 14.3% |
| | Western Region | 145 | 147 | 292 |
| | 23.4% | 26.3% | 24.8% | |
| | Central Region | 114 | 86 | 200 |
| | | 18.4% | 15.4% | 17.0% |
| Education level | primary | 4 | 4 | 8 |
| | | 0.6% | 0.7% | 0.7% |
| | middle school | 15 | 12 | 27 |
| | | 2.4% | 2.1% | 2.3% |
| | secondary | 228 | 182 | 410 |
| | | 36.8% | 32.6% | 34.8% |
| | university | 256 | 218 | 474 |
| | 41.4% | 39.0% | 40.2% | |
| | diploma | 87 | 100 | 187 |
| | | 14.1% | 17.9% | 15.9% |
| | Postgraduate | 29 | 43 | 72 |
| | | 4.7% | 7.7% | 6.1% |
| Military sector | General Intelligence | 51 | 25 | 76 |
| | Presidency | 8.2% | 4.5% | 6.5% |
| | Ministry of National Guard | 82 | 72 | 154 |
| | | 13.2% | 12.9% | 13.1% |
| | Ministry of Interior (Public Security) | 269 | 238 | 507 |
| | | 43.5% | 42.6% | 43.0% |
| | Ministry of Defense | 217 | 224 | 441 |
| | | 35.1% | 40.1% | 37.4% |
| Years of experience in the military sector | trainee | 72 | 91 | 163 |
| | | 11.6% | 16.3% | 13.8% |
| | Employee less than 5 years | 221 | 153 | 374 |
| | | 35.7% | 27.4% | 31.7% |
| | 5-10 years employee | 141 | 94 | 235 |
| | 22.8% | 16.8% | 19.9% | |
| | Employed for more than 10 years | 185 | 221 | 406 |
| | | 29.9% | 39.5% | 34.5% |

4. DISCUSSION

Stress fractures occur when bone, typically in the lower extremities, is subjected to repeated mechanical stress that results in microscopic fractures. They often occur when the frequency or degree of physical activity is significantly increased [11]. The threshold value of stress that places an individual bone at high risk for stress fracture has not been identified. The activities involved in the diverse types of military training

may put personnel at different injury risks. The most frequently reported cause of these fractures is repetitive weight-bearing activities such as running and marching, a recent increase in physical activity, beginning of a new activity or some other change in their routine can also result in increase of these fractures [12].

Due to the repetitive nature of military training, stress fractures common in members of the military. From 2009 to 2012, US military

members had 5.69 stress fractures per 1000 person-years [13]. In our study, 20.8% of all participants had stress fractures before. However, in India two studies by Agrawal PK and Dash N et al., reported high incidence of 11.4% and 7.04% in two different military training centers [14,15]. Another study reported 15% incidence of SFs which far exceeds those figures or those reported from any previous study [15].

In our study, 76.6% of participants agreed that predominance of stress fractures of the lower extremities, over fractures of the upper extremities. Previous studies reported most common stress fractures in decreasing order of occurrence are the tibia (23.6%), tarsal navicular (17.6%), metatarsals (16.2%), femur (6.6%), and pelvis (1.6%) [16]. Another previous study reported that commonest site involved in our cases was tibia (87.66%) followed by fibula and metatarsal [17]. The distribution of sites of SF was similar to the study by Singh SC, et al., [18]. However, in contrast Alexander M Wood et al., reported metatarsals as the most common site for stress fracture [19] The majority (75%) of fatigue fractures detected in another cohort study were located in the tibial shaft or metatarsals [20]. This finding is consistent with those of previous studies of both Finnish athletes and conscripts [21,22]. In a previous study of US Marine Corps recruits, bone stress injuries were less commonly detected in the pelvis, hip, thigh, and knee [23].

The pathophysiology of a stress fracture is usually related to repetitive loading of the bone that leads to an imbalance between the micro damaged bone and the processes of bone remodelling and repair. Several risk factors, including reduced body weight, decreased body mass index, increased height (or tallness), poor physical condition, low bone mineral density and high serum parathyroid hormone levels have been suggested as being associated with the development of stress fractures. In addition, indirect evidence supports the existence of genetic factors in the pathogenesis of stress fractures [24]. This was in agreement with most participants' knowledge as 76.3% agreed that most common cause of stress fractures is repetitive weight-bearing activities.

Symptom includes pain which increases on bearing weight and swelling. Typical findings include localized tenderness, swelling and erythema. Preliminary diagnosis of these fractures is through history assessment and clinical diagnosis. 77.2% of our participants

agreed that pain and swelling a symptom of stress fractures.

Radiological diagnosis provides a reliable confirmation of these fractures and site associated. SFs may heal completely, slowly or incompletely. In our study, of all participants who had stress fracture, 10.4% were diagnosed through x-rays and medical history with the doctor, 4.6% were diagnosed through medical history only, and 2.4% diagnosed themselves.

Regarding knowledge of diagnosis method, half of participants reported medical history, X-ray, MRI, or bone scan, 11.8% reported patient history only, and 33.8% didn't know. Only 73.8% agreed that stress fractures are well recognized in military armies and athletes. Giladi et al. [25] advocate a high clinical index of suspicion and early referral for MRI to enable prompt diagnosis among at-risk populations, though definitive evidence is lacking as to whether early diagnostic MRI has significant effect on rehabilitation time from injury and further research into this is necessary.

According to our results, 67.6% reported that stress fractures can be treated with painkillers, physiotherapy and reduce the risk and 78.6% agreed that stress fractures can be prevented by wearing appropriate footwear. Prevention, however difficult is the best approach for avoiding SFs. Treatment strategies includes early identification of the symptoms, early diagnosis, a sufficiently long training pause and in special cases consultation of experts in the field. Surgical treatment may be needed in some cases [26].

5. CONCLUSION

Participants and relatively good knowledge of stress fractures. Knowledge of stress fracture was significantly associated with years of experience of participants, military sector, and residence area in the kingdom. The cornerstone in avoiding SF is prevention. Education of trainees, trainers and instructors, modification in training procedures, use of better equipments can reduce occurrence of these fractures. Early reporting to hospital and treatment is also necessary as it can help in early return to full activity.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our

area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

Informed consent was obtained from all participants included in the study.

ETHICAL APPROVAL

The was approved from the research ethics committee of Majmaah University, with ethical approval number (MUREC-October.28/COM-2021/9-2).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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