

## Pelvic Stress Fracture among Naval Cadets in Bangladesh

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### Abstract

Stress fractures are often found in military recruits. Most involved bones are tibia, metatarsals, calcaneus and fibula. Pelvic stress fracture especially at pubic ramus is relatively rare; however, it is found more in females in comparison to its male counterpart. A prospective study was carried out to investigate demographic features of pelvic stress fractures among the Naval cadets in Bangladesh. A total of 18 patients with pelvic stress fractures reported at the Department of Orthopedics of Bangladesh Naval Ship (BNS) Patenga Hospital at Chattogram, Bangladesh, between January 2021 and December 2022. Naval trainee officers both male and female undergo physical and military training during their courses. Most of the cadets reported with pain in their groin. Routine investigation was done. Plain radiograph of pelvis revealed fracture lines sometimes periosteal elevation and sclerosis. The mean age of the patients was 18.94 years (ranging between 18 and 20 years). Out of 18 patients, 17 were female and 1 was male. All the cadets were treated conservatively. Post trauma pain developed in 3(16.67%) cases, while the rest 15(83.33%) recovered completely.

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### Introduction

Stress fracture have been a documented problem in the military recruit near about 170 years,<sup>1</sup> occurring in 1 to 30% of trainees.<sup>2,3</sup> During demanding military training, bone is subject to large mechanical stress.<sup>4,5</sup> If this stress occurs repeatedly and with sufficient magnitude, leading to cyclical overload of the bone. Such an overload can cause stress fracture.<sup>6</sup>

Stress fractures most frequently affect the lower extremities, most commonly involved bones are tibia, metatarsals, calcaneus and fibula.<sup>7,8</sup> Pelvic stress fractures, however, are relatively rare, representing only 1 to 10% of all stress fractures reported.<sup>9,10</sup> Stress fractures of the pelvis can be particularly devastating because of the increased healing time required compared with stress fractures at other sites.<sup>11-13</sup> The 6 to 12 months of convalescence required by many individuals who suffer a pelvic stress fracture is much longer than the 4 to 8 weeks of rehabilitation required for stress fractures at other sites.<sup>14</sup>

Pelvic stress fractures, females have a much greater incidence compared with males engaging in similar activities.<sup>13,15,16</sup> Military training is a very uniform experience, there was something intrinsically different about the recruits who developed the pelvic stress fractures compared with females who completed recruit training without injury.<sup>17</sup> The proposed reasons for the gender disparity include female have lower bone density, poor musculoskeletal fitness, wider

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pelvic girdle, and shorter legs compared with male.<sup>3,13,15,18</sup> The purpose of the study was to investigate the demographic characteristics of pelvic stress fractures among the Naval cadets in Bangladesh.

## Methods

This prospective study was done on a total of 18 patients with pelvic stress fractures who reported at the Department of Orthopedics of Bangladesh Naval Ship (BNS) Patenga Hospital at Chattogram, Bangladesh, between January 2021 and December 2022. Trainee officers both male and female undergo physical and military training in formation marching, running, and military drill. Stress fracture diagnoses were based on subjective complaint of atraumatic, insidious onset of pain and tenderness consistent with positive radiographic findings like periosteal elevation, sclerosis, or fracture line on plain film of pelvic x-ray of the naval cadets (as seen in Fig. 1 & 2).



**Fig. 1:** Digital radiograph of a female patient (aged 20 years) demonstrating the typical location (pubic ramus) and appearance of a pelvic stress fracture (arrow mark)

All stress fracture subjects were evaluated at the BNS Patenga Hospital. All radiographic findings

were interpreted by the radiologists. Conservative treatment is being given to all the patients in the form of rest, analgesics, vitamin D and calcium supplements.



**Fig. 2:** Digital radiograph of a female patient (aged 19 years) showing the narrowest part of pubic bone (pubic ramus) which is the typical site of pelvic stress fracture (arrow mark)

Data was expressed as frequency and percentage in a tabulated form. The study was approved by the Institutional Review Board of the Bangladesh Naval Ship (BNS) Patenga Hospital, Chattogram, Bangladesh.

## Results

A total of 18 patients were treated during our study period. The mean age of the patient was 18.94 years (ranging between 18 and 20 years) (Table-I). 17 were female and 1 was male (Table-II). All the cadets were treated conservatively. Complete recovery was observed in 15(83.33%) patients, while 3(16.67%) patients developed post trauma pain (Table-III).

**Table-I:** Distribution of patients according to age group (n=18)

Age (in years)	Frequency	Percentage
18	5	27.78
19	9	50
20	4	22.22
<b>Total</b>	<b>18</b>	<b>100</b>

**Table-II:** Distribution of patients according to sex (n=18)

Sex	Frequency	Percentage
Male	1	5.56
Female	17	94.44
<b>Total</b>	<b>18</b>	<b>100</b>

**Table-III:** Outcome of conservative treatment (n=18)

Rating	Frequency	Percentage
Discharge with full recovery	15	83.33
Post trauma pain	3	16.67
<b>Total</b>	<b>18</b>	<b>100</b>

## Discussion

Pelvic stress fractures have been reported in civilian athletes, most often afflicting long-distance runners.<sup>11,13</sup> Pelvic stress fractures were described in medical records of military professionals as early as in the 1940s.<sup>10,19</sup> The cause of a pelvic stress fracture has been attributed to the pull of the adductor muscles on the narrow pubic rami.<sup>10,19-21</sup> The muscular pull theory is supported by the fact that stress fractures of the pelvis most frequently occur at the ramus (Fig.1), which is the narrowest area of the pubic bone (Fig. 2) as well as the site for the origin of the adductor magnus.<sup>22</sup> During the normal gait cycle, the medial portion of the

adductor magnus acts with the other adductor muscles to flex the hip, whereas its lateral fibers act with the hamstrings to extend the hip.<sup>10,22</sup>

Researchers proposed that it was the interplay between the adductor muscles, which originate medial aspect of the pubic rami, and the hamstrings, which originate from the lateral site of the pubic rami, acting as antagonists during gait, that create a shear stress at the narrow isthmus and produce a fracture.<sup>20,22</sup>

A study done by Ozburn & Nichols<sup>16</sup> reported that many of the female Army recruits suffering pelvic from stress fractures were short and also marched at the back of the company. They also suggested that the recruits needed to run or take giant steps to keep up with the taller males at the front of their training division. Hill *et al.*<sup>23</sup> reported that they were able to eliminate the occurrence of pelvic stress fractures in female British Army recruits by decreasing the stride length of a marching training to 27 inches from the standard 30-inch pace. Jones *et al.*<sup>24</sup> also noticed a similar relationship between shorter female height and the injury rates among military recruits.<sup>24</sup> Milgrom *et al.*<sup>25</sup> and Finestone *et al.*<sup>2</sup> suggested that it is the short narrow bones that are at risk for stress fracture. Beck *et al.*<sup>26</sup> concluded that recruits who developed stress fractures were shorter, lighter, and had smaller anthropometric dimensions than recruits who were injury free. They did not, however, differentiate by site of fracture, nor did they account for possible differences in the activities of recruits who did or did not develop stress fractures. Moreover, short stature is not an independent risk factor for pelvic stress fractures when individuals are allowed to walk, march or run at their natural pace and stride, for example, athletes who run at a natural stride length. Short

stature does become a risk for pelvic stress fractures, when an individual is forced to "overstride," such as when marching in a formation of recruits aligned from tall to short.<sup>17</sup>

Limitations of this study included relatively small number of subjects, data collection procedure, unavailability of radiographs of other asymptomatic individuals. It also lacked specific quantitative measures of bone density, bone morphology or skeletal alignments, which would give more specific information.

## Conclusion

Stress fractures at different anatomic sites may result from different mechanisms. Our data suggests that Naval cadets are prone to pelvic stress fracture during their training. It is more common among the female cadets in comparison to their male counterparts.

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