

FEMORAL NECK STRESS FRACTURES (FNSF) IN MILITARY RECRUITS

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ABSTRACT

Objective: To identify patterns of Femoral Neck Stress Fractures (FNSF), its presentation and outcome of its treatment in PMA (Pakistan Military Academy) cadets. These findings would help suggest guidelines for their appropriate management.

Study design: Case Series

Place and duration of study: CMH Abbottabad & CMH Rawalpindi from May 2005 to January 2008.

Materials and Methods: Twenty cases (20 hips in 18 patients) of FNSF were included in the study. Only male cadets from Pakistan Military Academy (PMA) were included. Diagnosis was made clinically and was confirmed by radiographs or bone scan. Incomplete fractures were managed conservatively where as complete fractures were fixed surgically.

Results: All compression fractures healed conservatively where as tension fractures needed surgical fixation in all the cases, except one where fracture remained incomplete. Rest of tension fractures converted from incomplete fractures to complete fractures and hence needed surgical stabilization. There was no problem of avascular necrosis of femoral head (AVNFH) in any patient.

Conclusion: FNSF are uncommon injuries with potentially serious complications and are difficult to diagnose clinically. When diagnosed early and managed appropriately, they carry good prognosis.

Keywords: Avascular necrosis of femoral head, Femoral neck stress fractures, Military recruits.

INTRODUCTION

Stress fractures are a common problem in military trainees whereas femoral neck stress fractures (FNSF) are uncommon injuries.

Stress fractures at various sites can occur in 15% of military trainees¹. Of these patients of stress fractures, only 5-10% would develop femoral neck stress fractures². Delayed diagnosis of FNSF results in a delay in proper management of these injuries. This can result in propagation of an incomplete fracture into a complete fracture which can get displaced. This displacement may result in serious complications like avascular necrosis of femoral head³, non union or malunion resulting in varus deformity (AVNHF)⁴.

FNSF are classified into two types (Fig. 1):

Compression fractures:

They occur on the inferior aspect of the femoral neck; and radiograph shows internal callus at the inferior femoral neck.

Tension fractures:

They occur on the superior aspect of the femoral neck and cause a transverse fracture across the femoral neck. This fracture type is more likely to progress and displace⁵.

Objective:

The study was aimed to help make guidelines for an early diagnosis and treatment in cases of FNSF. This would not only help in reducing the time wasted from training schedule but will also help prevent catastrophic complications like AVNFH, non union and malunion, arising from the displaced fracture segments.

PATIENTS AND METHODS

This case series was conducted at CMH Abbottabad and CMH Rawalpindi, the referral hospitals for the patients from Pakistan Military Academy (PMA) Kakul from year 2005 to 2008. FNSF were studied in male cadets of PMA. Recruits from other military training centers in and around Abbottabad were excluded because of different training program from PMA. Female cadets from PMA were excluded because of different training program and

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gender related anatomical and physiological differences from male cadets.

All patients with clinical diagnosis of FNSF, based on history and clinical examination, were admitted to the hospital. Plain radiographs of hip were obtained in all patients. Two views were requested i.e. AP view of the femoral neck (antero posterior view of hip in 15⁰-20⁰ of internal rotation, to adjust for the femoral ante version) and a frog leg lateral view. In patients with equivocal or non diagnostic radiographs, urgent bone scans were done to confirm the diagnosis.

Bone scans were done at Department of Nuclear Medicine, Institute of Nuclear Medicine, Oncology and Radiotherapy (INOR) Abbottabad. The bone scans were carried out using a large field view of gamma camera and a parallel hole, high-resolution collimator, 3 to 4 hour following IV injection of 20 mCi technetium-99m methylene diphosphonate. The scans routinely included spot images of anterior and posterior views of the pelvis, anterior and lateral views of lower extremities and anterior and posterior views of axial skeleton. For each view 750 K counts were collected with single head gamma camera loaded with Low Energy General Purpose (LEGP) collimator⁶.

Patients with incomplete fractures were managed conservatively in the following way:

Confinement to bed till the achievement of clinical and radiographic evidence of union. Some of the non compliant patients had to put skin traction, to confine them to the bed.

No weight bearing was allowed on the affected hip. Crutch walking was allowed.

English commodes were used.

Patients were monitored daily for their symptoms of hip pain.

Patients were monitored with weekly radiographs of the affected hip.

Any patient reporting aggravation of pain in the hip, was radiographed immediately to assess the fracture.

Following clinical and radiological union, cadets were gradually allowed to return to their training.

Complete but undisplaced fractures (Fig.2) were fixed surgically by cannulated screws (Fig.3). After clinical and radiological union, these cadets were gradually allowed to return to their training.

In patients with displaced fracture segments, bone scan was done to assess the vascularity of the femoral head. These fractures were fixed with DHS (Dynamic Hip Screw) and a derotation screw, after reduction.

RESULTS

A total of 20 hips in 18 patients, aged 18-23 year with mean age of 21 year, with FNSF reported during this period. Average time period between onset of symptoms to the diagnosis of FNSF was 09 days (range 1-30 days). Sixteen (80%) of these patients had prodromal symptoms before being diagnosed with FNSF.

In 17 (85%) fractures, plain radiographs were diagnostic. Three (15%) fractures needed a bone scan for confirmation of diagnosis. Bone scan was also done in 03 (15%) cases of displaced fractures to diagnose Avascular Necrosis of the Head of the Femur (AVNFH). None of these patients were found to have avascular necrosis of femoral head.

Six (30%) patients had tension fractures. Of these, one was incomplete, 02 were complete but undisplaced and 03 were displaced and rest 14 (70%) had compression fracture. All compression fractures healed with conservative treatment, 01 patient with tension fracture healed on conservative treatment (Table).

Five (25%) of the patients of FNSF needed surgery. Three patients with displaced fractures were fixed with DHS and a derotation screw where as 02 patients with complete but undisplaced tension fractures (which had converted into complete fractures from incomplete fractures, on conservative treatment) were fixed with cannulated screws.

Patients fixed with cannulated screw gradually returned and completed their training after union. Patients with DHS were not allowed to return to the training, even after the union of their fractures because of the possible stress riser effect of the DHS.

Table: Management of FNSF in all the cases (n=20).

Mode of treatment	Tension fractures (**n=6)	Compression fractures (**n=14)
Conservative	1	14
Surgery	5*	0

*DHS= 3, Cannulated Screws = 2

**n=number



Fig. 1: Types of FNSF.

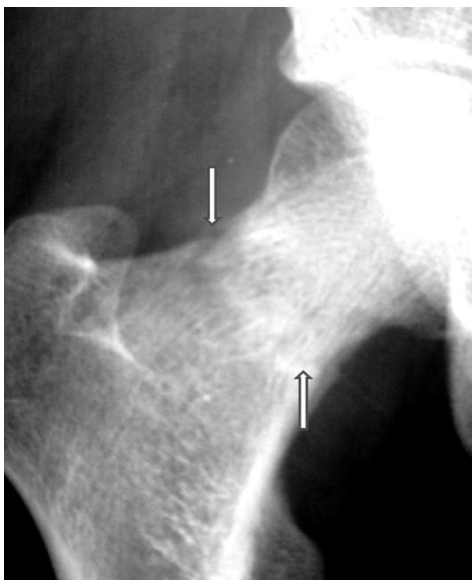


Fig. 2: Complete but undisplaced FNSF.



Fig. 3: Complete but undisplaced fracture fixed with cannulated screws.

Two (11%) patients with tension fractures developed compression fracture in the opposite hip at a later stage and were successfully managed conservatively.

DISCUSSION

FNSF are difficult injuries to diagnose because of vague signs and symptoms. Pain is poorly localized to the hip and may present with prodromal symptoms such as referred pain to thigh, knee or back. Classically, pain

occurs after a training activity and worsens gradually. Examination reveals pain on rotation of hip. Clinical picture, though highly suggestive, is not diagnostic. Radiological investigations have to be carried out to confirm the diagnosis.

Majority (85%) of FNSF were diagnosed on plain radiographs and bone scan was required only in 15% cases. Bone scan was also helpful in cases of stress fractures of pelvic rami and acetabulum by excluding the possibility of

FNSF. Though bone scan is a very sensitive investigation to diagnose FNSF, however cases have been reported in literature where FNSF have been missed on bone scans and were diagnosed on MRI only⁷. MRI is the most specific investigation to diagnose the FNSF, but since the facility of MRI was not present at Abbottabad, MRI could not be used as a diagnostic tool in our study.

Pihlajamäki *et al*⁸ has reported delayed or non union in 6 of their 19 patients. We did not come across either of these complications in our study. They have also reported avascular necrosis of head of femur (AVNFH) with considerable shortening of femoral neck in 06 of their 19 patients resulting in considerable morbidity. We did not encounter any AVNFH in our study. They have also reported almost the same number of patients as in our study, who experienced prodromal symptoms before a unicortical fracture becomes a bicortical fracture.

In another paper Pihlajamäki *et al*⁹ has reported that non-operative treatment, including avoidance of or reduced weight-bearing, gave favorable short- and long-term outcomes. We also have found the same results in our study. They have also found that undisplaced fatigue fractures of the femoral neck neither predispose to avascular necrosis nor the subsequent development of osteoarthritis of the hip.

As these fractures occurred in military recruits, all of them completed their military training except for 03 patients who had displaced fractures and were fixed with DHS.

CONCLUSION

FNSF are uncommon injuries with potentially serious complications and are difficult to diagnose clinically. Following guidelines are suggested for the management of these patients.

A high index of suspicion is required to diagnose these injuries early and prevent catastrophic complications.

All patients suspected of FNSF should be clinically examined and admitted in the hospital.

They should be kept non weight bearing till there is clinical and radiological bone union.

Request for AP (internal rotation of 15⁰-20⁰) and frog leg lateral views of plain radiographs of affected hip are helpful in diagnosis.

In patients with equivocal radiographs, a bone scan should be done. Bone scan is cheaper and more widely available investigation than the MRI. However, MRI is the most specific and sensitive investigation for confirmation of diagnosis of FNSF.

Excellent results can be achieved in compression fracture by conservative treatment.

Tension fractures are more prone to get converted into complete fractures, with risk of displacement. They should be monitored very closely during conservative treatment for any progression to a complete fracture and displacement.

Complete fractures should be fixed surgically with DHS or cannulated screws depending on displacement of fracture segments.

REFERENCES

1. Armstrong DW 3rd, Rue JP, Wilckens JH, Frassica FJ. Stress fracture injury in young military men and women. *Bone* 2004; 35(3):806-16.
2. Egol KA, Koval KJ, Kummer F, Frankel VH. Stress fractures of the femoral neck. *Clin Orthop Relat Res* 1998; 348:72-8.
3. Lee CH, Huang GS, Chao KH, Jean JL, Wu SS. Surgical treatment of displaced stress fractures of the femoral neck in military recruits: a report of 42 cases. *Arch Orthop Trauma Surg.* 2003; 123(10):527-33.
4. Jean JL, LeeGH, Tang HL, Chang GH, Chern TC. Stress fracture of the femoral neck in young adult: report of four cases. *Chang Guang Med J*, 2001; 24(3): 188-95.
5. Wheelless' Textbook of Orthopaedics [Internet]. North Carolina: Orthopaedic Specialists of; c 1996-2011. [updated July 24, 2010]. Stress Fractures of Femoral Neck; [single screen]. Available from: http://www.wheellessonline.com/ortho/stress_fractures_of_femoral_neck
6. Khan K, Khan AA, Ahmad S, Jeilani S, Zahid RK. Bone stress injuries in the army cadets of Pakistan Military Academy. *J Ayub Med Coll Abbottabad* 2008;20(4):55-58
7. Dennis Y. Wen, MD, Tim Propeck, MD, and Amolak Singh, MD. Femoral neck stress injury with negative bone scan. *JABFP* 2003; 16; 2: 170-4.
8. Pihlajamäki HK, Ruohola JP, Kiuru MJ, Visuri TI. Displaced femoral neck fatigue fractures in military recruits. *J Bone Joint Surg Am.* 2006; 88 (9):1989-97.
9. Pihlajamäki HK, Ruohola JP, Weckström M, Kiuru MJ, Visuri TI. Long-term outcome of undisplaced fatigue fractures of the femoral neck in young male adults. *J Bone Joint Surg Br* 2006; 88(12):1574-9.