Clinical

Displaced Femoral Neck Stress Fractures in Royal Marine Recruits – Management and Results Of Operative Treatment

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Abstract

Femoral neck stress fractures (FNSF) represent 3.5%-8% of stress fractures in military recruits; potentially resulting in medical discharge and/or complications. The incidence of displaced FNSF in the British Army has been reported as 1.8 in 10,000 recruits. We aimed to review the incidence and outcome of displaced FNSF in Royal Marine recruits.

Retrospective review identified 6 recruits who sustained a displaced FNSF from 2001 to 2011 representing an incidence of 9.3 in 10,000 recruits.

All were treated urgently by internal fixation. There were no cases of avascular necrosis, no surgical complications and no further procedures required. All united with a mean time to union of 11 months. 50% had a union time greater than 1 year.

These fractures are slow to unite but with urgent surgical intervention and stable fixation 100% union was achieved. Awareness of this guides the management and rehabilitation whilst avoiding the risks of unnecessary secondary surgical interventions.

Introduction

Femoral neck stress fractures (FNSF) were first reported by Asal in 1936 and then described radiographically by Devas in 1965. They are divided into 2 types, tension or compression. Compression fractures are localised to the inferior surface of the femoral neck and are unlikely to displace. Tension fractures, however, are localised to the superior surface of the femoral neck, are potentially unstable and, without early operative intervention, can become displaced (1,2).

FNSF represents only 3.5% to 8% of all stress fractures seen in military recruits (4). The incidence of displaced FNSF in the British Army has been reported as 1.8 in 10,000 recruits. Pihlajamaki et al reported a much lower incidence of 0.16 per 10,000 in their study looking at Finnish military conscripts between 1970 and 1990 (6). This severe complication in training results in a 40 to 100% medical discharge rate (3). Philajamaki et al. also showed that 8/21 patients with displaced FNSF went on to develop Grade 3 Tönnis osteoarthritis (4).

The majority of tension FNSF undergo operative fixation and are at further risk of complications, including a 23-33% risk of developing avascular necrosis (AVN) (4), 25% non-union rate, and a 60% reduction in patient activity in sports.

The challenges of early identification of FNSF, in particular, tension fractures have been widely described (3-6). We review the outcomes of displaced FNSF managed at our unit.

Methods

This study was approved by and registered with Joint Medical Command.

A retrospective review of the Princess Elizabeth Orthopaedic Centre (Royal Devon and Exeter Hospital, Wonford) trauma records between 2001 and 2011 was cross referenced against the electronic records of the Commando Training Centre Royal Marines (CTCRM) in Lympstone, UK, to identify all recruits in the previous 10 years who had suffered a displaced FNSF. The review of the hospital records was conducted by running a database search of the clinical codes for stress fracture using the Clinical Data Management system.

A total of 6,452 recruits commenced Commando training at CTCRM during the 10 year study period. All recruits with a displaced FNSF that attended CTCRM during this period were included in the study. The data regarding number of recruits during the study period was taken from the records of the Commando Training Wing CTCRM.

The electronic medical records, radiology and military files of all identified patients were reviewed. Review of these systems identified patient demographics, date of initial injury, operative notes, date of union, whether the recruit completed basic training, whether
this was delayed as a result of the injury and the current deployment of the recruit.

Union was defined in Out-Patient Department clinic by a combination of clinical and radiological factors (10). Once union had been achieved follow up of the patient ceased.

**Results**

6 Royal Marine recruits, aged 17 to 25, sustained a displaced FNSF during the study period. This represented an incidence of 9.3 per 10,000 recruits – Table 1.

All identified patients underwent post-operative rehabilitation in ‘Hunter’ rehabilitation troop at CTCRM.

All patients were non-smokers, with no medical problems and taking no regular medication.

All fractures were treated urgently (<12 hours) by operative fixation with a 2 hole dynamic hip screw (DHS) device and in 3 cases this was supplemented with an anti-rotation screw. There were no cases of AVN, no surgical complications and no further procedures were required.

All fractures united with a mean time to union of 11 months (range 5-20). 50% (3/6) had a union time greater than 1 year.

2 recruits (33%) completed training, 2 are still in rehabilitation in Hunter Company and 2 were discharged before completion of training due to being unable to rehabilitate sufficiently. Details of outcome are presented at Table 1.

**Discussion**

In summary we believe these data highlights that sufficient time must be allowed for union to occur after urgent internal fixation of displaced FNSF, thus avoiding further, unnecessary, operative intervention (e.g. subtrochanteric valgus osteotomy).

We have experienced a mean union time of 11 months across a series of 6 displaced FNSF in a 10 year period. An illustrative case example is at Figures 1-3.

It appears that displaced FNSF are slow to unite, compared to non-stress femoral neck fractures managed in a similar way (8). However with urgent surgical intervention, stable

<table>
<thead>
<tr>
<th>Treatment in addition to closed reduction and 2 hole DHS</th>
<th>Time to union (months)</th>
<th>Training outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antirotation screw</td>
<td>20</td>
<td>Still in training</td>
</tr>
<tr>
<td>Nil</td>
<td>12</td>
<td>Completed training but awaiting NMBOS (OA hip)</td>
</tr>
<tr>
<td>Antirotation screw</td>
<td>16</td>
<td>Did not complete training, medically discharged</td>
</tr>
<tr>
<td>Nil</td>
<td>5</td>
<td>Did not complete training, medically discharged</td>
</tr>
<tr>
<td>Nil</td>
<td>6</td>
<td>Completed training and still in service.</td>
</tr>
<tr>
<td>Antirotation screw</td>
<td>7</td>
<td>Still in training</td>
</tr>
</tbody>
</table>

*Table 1. Patients with displaced femoral neck stress fractures included in this study*
fixation and given adequate time, all went on to successful union. All patients, as a minimum, returned to rehabilitation within the Royal Marines with some of them going on to complete their training.

Lee et al’s series of 42 displaced FNSFs (7) showed an AVN rate of 3/17 patients treated with compression screw. However there was a delay of 2.9 days to surgery in this study whereas in our study all patients had their operation within 12 hours.

A higher incidence (9.3 per 10,000) of displaced FNSF was noticed in this study of Royal Marine recruits compared to incidence rates in British Army recruits and Finnish military conscripts, 1.8 per 10,000 and 2.3 per 10,000 respectively (3,4). There is no clear explanation for this higher risk in Commando training compared to Army infantry training, apart from the observation that Royal Marine recruit training, at 32 weeks, is considerably longer and of a more arduous nature than the majority of Army Infantry training.

Stoneham and Morgan (5) and more recently Wood et al (9) described a FNSF incidence of 35 per 10,000 and 40.5 per 10,000 respectively amongst Royal Marine recruits but did not discern between displaced and un-displaced fractures. However, Talbot et al. did provide a comparison amongst British Army Recruits demonstrating a displaced FNSF incidence of 1.8 per 10,000 and an undisplaced incidence of 12 per 10,000 (3). These reports reinforce our findings that FNSF appear to be more common in Royal Marine recruits than British Army recruits.

Our results suggest that clinicians dealing with displaced FNSF in military recruits need to be aware of the potential for delayed time to union. Patients do not need further operations to stimulate union and may solely require the passage of time for the fracture to unite. These results will allow better patient information, reassurance and enable improved management and rehabilitation.

Conclusion

Excellent results in the management of displaced FNSF can be achieved by urgent surgical intervention in addition to being given appropriate time to unite. (See figures 1-3) Awareness of the increased length of time expected for union is invaluable in guiding both treatment and rehabilitation of displaced FNSF. The incorporation of this knowledge into rehabilitation and management programmes avoids the risks of unnecessary secondary surgical interventions for delayed union.

In addition it would appear that Royal Marine recruit training is associated with a higher incidence of displaced FNSF than infantry training in the British Army, the reasons for which are not yet fully understood.

References

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