Femoral and tibial stress fractures associated with vitamin D insufficiency

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ABSTRACT
We describe a case highlighting the need to consider hypovitaminosis-D when investigating background causation and treatment of femoral and tibial stress fractures. The case also suggests that prescribing calcium and vitamin D supplementation may help with fracture healing in soldiers presenting with stress fractures who may have unrecognised hypovitaminosis-D which if left untreated may delay fracture healing.

INTRODUCTION
When under constant load, normal bone remodeling is a balance between osteoclastic resorption and osteoblastic reconstruction; as loading increases, additional bone resorption occurs.1 Local weakening and micro-damage may be caused by increased osteoclastic activity at sites of stress which may progress to complete fractures.2 Stress fractures occur when muscle becomes fatigued and unable to absorb added force as eventually the fatigued muscle transfers impact forces to bone which causes overload and stress fractures. Femoral and tibial stress fractures are a recognised cause of lower limb pain and the chronic, repetitive activity that is common to military personnel may predispose the associated pain can be both irritating and disabling to these individuals. While the treatment of stress fractures is often straightforward, undetected stress fractures can lead to serious complications3 and also negatively affect military readiness.4 The prevalence of stress fractures in UK military personnel is 15 per 1000,5 but femoral stress fractures are relatively uncommon (12 per 10 000)5 and if left undiagnosed can lead to significant morbidity.5 Furthermore, the rate of femoral stress fracture is also dependent upon cap badge (attributed to the more strenuous training) with stress fracture rates for recruits in the Parachute regiment reported as 1 in 250 (40 per 10 000) compared with recruits in the Guards (1 in 1228).3 Vitamin D is essential for bone healing6 and its role in the pathogenesis of stress fractures may be overlooked. Hypovitaminosis-D may predispose bone to stress fractures by decreasing tolerance to structural overload and by complicating recovery in certain individuals.7 We present a case which highlights the need to consider hypovitaminosis-D when investigating background causation and treatment of femoral and tibial stress fracture.

CASE REPORT
A 19-year-old UK-based Caucasian male soldier reported the onset of progressively worsening bilateral lower limb pain during paratrooper selection training (UK winter months) during a loaded eight mile tactical advance to combat (‘tabbing’) with alternating boot runs. He reported pushing himself to complete the course but was taken off a run due to severe left leg pain. Initial management with entonox and oral non-steroidal anti-inflammatory drugs provided some relief, but symptoms generally worsened over the following few days with an inability to weight bear. Radiographs of the pelvis, left hip and both lower legs were unremarkable. However, pelvic, left hip and bilateral lower limb MRIs demonstrated an evolving stress fracture of the proximal left femoral diaphysis with subcortical bone marrow oedema and periosteal oedema medially and laterally (Figure 1) and a probable chronic stress fracture of the left tibia with bilateral mid-

Key messages
► Stress fractures or multiple fractures over a life time may be a marker for low vitamin D levels and should prompt investigation.
► Low vitamin D levels if not treated may interfere with recovery from bony injury in military personnel.
► A dramatic reduction in lower limb stress fracture visual analogue scale scores with restoration of biomechanical function may occur with even minimal vitamin D supplementation.

analgesic medication, resumed work and returned to pain free once daily (20 μg, colecalciferol equivalent), the patient stopped 

Thus, for geographic reasons UK-based military personnel may become seasonally dependent on bodily stores of vitamin D via cutaneous synthesis. Solar ultraviolet radiation varies with latitude, and in winter months at latitudes above and below 37° North or South (London is 51° North) sunlight is insufficient to induce cutaneous synthesis of vitamin D. Vitamin D is essential for normal bone homeostasis. This naturally occurring nutrient is present in few foods with the main source of vitamin D via cutaneous synthesis. Solar ultraviolet radiation varies with latitude, and in winter months at latitudes above and below 37° North or South (London is 51° North) sunlight is insufficient to induce cutaneous synthesis of vitamin D. Hence, for geographic reasons UK-based military personnel may become seasonally dependent on bodily stores of vitamin D.  

Sunlight exposure and dietary intake may be inadequate to maintain normal serum vitamin D levels in some UK-based military personnel. Soldiers presenting with stress fractures may have unrecognised hypovitaminosis-D which, if left untreated, may delay fracture healing. This case suggests that prescribing calcichew or calciferol may help with fracture healing. Furthermore, the vitamin D status of military personnel in the UK is unknown, yet there is evidence to suggest that vitamin D status is low among all age groups in the UK; therefore, large scale intervention studies of vitamin D supplementation to possibly reduce the incidence of stress fractures in military personnel might be warranted.

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