



# Non-Union Following Internal Fixation of a Potentially Stable Femoral Neck Stress Fracture in a Young Female Long-Distance Runner - Treatment and Outcome

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## Abstract

Stress fractures in the femoral neck are most often seen in military recruits and long-distance runners. As women's participation in sports increases, their risk of stress fractures most likely increases likewise. This report presents a case of a potentially stable femoral neck stress fracture primarily treated with internal fixation and, due to non-union, secondly successfully treated with implant removal and progressive weight-bearing.

Identifying persons at risk is important to prevent stress fractures in young female athletes; as are early diagnosing to improve outcome and reduce morbidity. Most importantly, careful differentiation between who will benefit from surgery or not must be evidence-based.

**Keywords:** Stress fracture; Femoral neck; Female athlete; Female athlete triad; Case report

## Introduction

Stress fractures are seen in bones exposed to repetitive stress to an extent where osteoclastic activity exceeds the osteoblastic bone formation. The femoral neck fractures represent 1% to 11% of all stress fractures, according to various reports, and are often seen in young athletes or military recruits [1-3]. Fractures on the tension (lateral) side of the neck are considered high risk; they are preferably treated with anatomic reduction and stable internal fixation, while surgical treatment of fractures on the compression (medial) side of the neck remains controversial [4-7]. For both surgically and non-surgically treated femoral neck stress fractures, there is a risk of complications which, in case of failure to preserve the femoral head, might lead to inevitable total joint replacement [1,8,9].

The purpose of this report is to highlight the importance of suspicion of femoral neck stress fracture in young female patients with high activity level. Further, to present an alternative treatment to total hip arthroplasty in patients with non-union following internal fixation.

## Case Presentation

### Medical history

A female long-distance runner in her late 20s had sudden onset non-specific hip pain after a run on a treadmill. Despite the pain, she initially maintained daily life activities as well as continued running. In the following month the pain worsened and she was seen by an orthopedic surgeon. Upon presentation she had to report sick from work as she was not able to walk without a limp. She had previous conservatively treated traumatic fractures in the toes and fingers, and as an adolescent, in the distal femur. She had normal menstrual function and did not take hormonal contraceptive or any other regular medication, besides occasional triptans and Non-steroidal Anti-Inflammatory Drugs (NSAID).

### Physical examination

The patient presented with a normal general appearance. She was 165 cm and weighed 55 kg (BMI 20.2). She had a neutral standing posture and normal passive hip range of motion without rotational pain. The pain was triggered by walking, as well as active straight leg raise.

### Imaging

Conventional X-ray showed possible mild hip dysplasia, no cross-over sign, and no fracture. A Magnetic Resonance Imaging (MRI) scan was performed a week later (Figure 1a, 1b).

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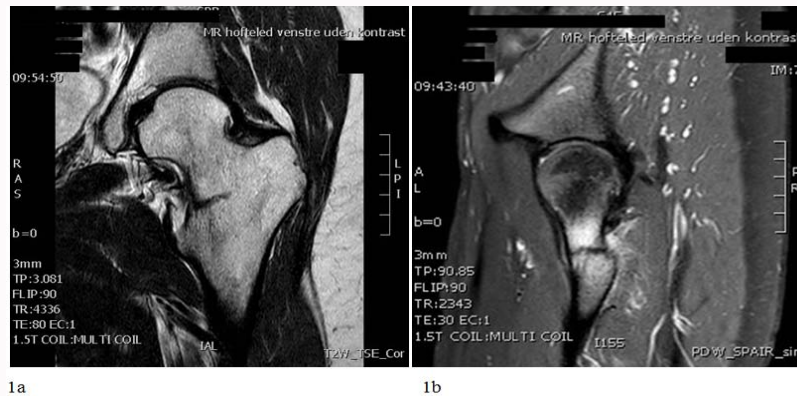
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**Figure 1:** Magnetic Resonance Imaging (MRI) of patient's left hip. a) Coronal view b) Sagittal view.



**Figure 2:** Patient's left hip with Dynamic Hip Screw (DHS) *in situ*.

## Diagnosis

The initial differential diagnoses were stress fracture, iliopsoas tendinopathy and trochanter bursitis. The MRI scan confirmed the diagnosis: A medial basocervical femoral neck stress fracture.

## Initial treatment and outcome

Following the MRI-scan, the patient was immediately admitted to the department of orthopedic surgery and the fracture was treated with internal fixation with a dynamic hip screw the same evening (Figure 2). The night following surgery she developed morphine-resistant pain and consequently underwent fasciotomy of the operated thigh, revealing grey muscular tissue that quickly regained color following decompression. Further postoperative period was uneventful and she was discharged after five days with full weight-bearing as tolerated and referred to physiotherapy. A postoperative bone density (DEXA) scan revealed that she had osteopenia (with a Z-score of -2.0 in the spine and -1.5 in the hip), and she was prescribed oral calcium and vitamin D supplements.

Six weeks after surgery the patient walked with aid from a single crutch. She had mild Trendelenburg gait and Circumduction of the affected leg. When able to, she tried running intervals of 500 meters and, following the third run eleven weeks after surgery, the pain returned. When examined, 80 degrees of hip flexion was painful, as was internal rotation at 25 degrees, and combined Flexion, Abduction

and External Rotation (FABER) test was positive. A Computed Tomography (CT) scan revealed a possible non-union and she was prescribed six weeks of no weight-bearing. As there was no reduction of the patient's symptoms after the non-weight bearing period, a Single Photon Emission Computed Tomography (SPECT) scan was performed, confirming a non-union fracture.

## Secondary treatment and outcome

The surgeon chose to remove the implant, six months following the primary surgery, and eight weeks later the patient was relieved of pain and mobilized without any aid. A CT scan showed fracture healing. She could resume running and was back to working full-time. In total, the patient's full or partial sick leave added up to eight months.

## Discussion

This case presents a young female long-distance runner with a femoral neck stress fracture on the compression side of the bone that was primarily treated with internal fixation. Previous reports have shown good results of treating non-displaced compression side fractures with non-weight bearing regimen, while internal fixation with Dynamic Hip Screw (DHS) is the preferred treatment of the displaced compression, or tension, side fractures [10-16]. In this case, choosing operative treatment with DHS was according to the hospital's standard procedure for traumatic basocervical fracture, even though no history of trauma was reported [17]. After a SPECT-scan had confirmed the suspected non-union fracture, choosing not to perform secondary joint replacement was based on a combination of fracture and patient's characteristics. As a result, the fracture healed. Fracture healing is a multifactorial process - no single reason for non-union was identified in this case. However, the postoperative complication with acute compartment syndrome might have been one contributing factor [18].

The case of a young female athlete with a femoral neck stress fracture is not unique [10,11,14,19]. The "female athlete triad" defines the interrelationships between energy availability, menstrual function and Bone Mineral Density (BMD) in women with high activity level. These factors can be affected in a broad spectrum and can clinically appear as, for example, osteoporosis [20]. The current belief is that disturbance of a single factor of the triad is enough to increase the risk of stress fracture [21]. In this case it seems likely that the patient's high activity level was, if not the only, the most important risk factor, and the prolonged immobilization following the second surgery might there for have restored physiological balance leading

to fracture healing.

To summarize, when a young female with high activity level presents with non-specific and atraumatic pain in the groin or hip-region, awareness should be raised towards femoral neck stress fracture. Physicians should know the female athlete triad, and specifically investigate the patient's medical history of previous fractures, known bone mass deficiency and menstrual function, as well as nutritional status with BMI and energy intake, and the amount of training, changes in training intensity, as well as training conditions such as shoes and training surface [5]. The physical examination should focus on general palpation, range of motion, and, more specific, hopping [2]. If conventional X-ray is negative, further imaging such as CT or MRI scan might reveal a stress fracture [22-24]. With this case the authors wish to illustrate the importance of both primary and secondary prevention. Fracture displacement can be avoided, long-term morbidity reduced and outcome improved with early diagnosis and adequate treatment. Furthermore, not all fractures are best served by surgery [7,25-30].

### Lessons Learnt

- Young female athletes might be prone to femoral neck stress fractures despite not having more than one risk factor such as in the female athlete triad.
- Not all femoral neck stress fractures should be surgically treated.
- If first line treatment fails, surgeons must consider the patient's characteristics and needs individually to choose the optimal approach.

### Author's Contribution

CM identified the scientific problem and was responsible for acquisition and interpretation of data. CM was major contributor in writing the manuscript. KWB has been the supervisor and revised the manuscript. All authors read and approved the final manuscript.

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