International Emergency Nursing 34 (2017) 51–54

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen

Female athlete triad: At breaking point

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ARTICLE INFO

Article history:
Received 11 November 2016
Accepted 26 March 2017

Keywords:

Female triad
Stress fracture
Advanced practice

1. Initial case presentation

A 29 year old female (Ms. Jones) presented to the Emergency Department (ED) with left lower leg pain which developed while she was out running the previous day. The triage nurse streamed the patient to the Registered Advanced Nurse Practitioner (RANP) (Appendix 1) in the ambulatory care area (ACA) for assessment. The patient was mobilising independently with a fluid gait.

2. Relevant history

Ms. Jones reported that she had been seen in another ED three months previously with a similar pain in the same lower leg. On that occasion, she was diagnosed with 'shin splints', and she reported that the pain had resolved over a number of weeks. Significantly, she also reported a stress fracture in her left femur two years earlier. Against this background, it was important to ask this lady regarding her exercise history. She reported running in excess of 70 km/week, and conceded she rarely took rest days. She admitted that the pain had been ongoing, initially occurring towards the end of her run, but was now occurring throughout her run session. During questioning she became tearful and said that stopping running was 'not an option' for her as she felt that running was intrinsically linked to her mental health.

3. Initial diagnostic thinking and physical examination findings

The RANP immediately felt that Ms. Jones may be a compulsive over-exerciser, and this sense combined with the risk factors of distance running [1], female sex [1] previous stress fracture [2] and lean body type heighted the suspicion of female athlete triad and specifically a stress fracture. She denied a history of disordered eating but admitted she did not drink milk or eat dairy products. She reported normal menses and reported normal bone health from a bone densitometry scan which was performed following her femoral stress fracture. The look, feel, move, special tests approach was used to frame Ms. Jones assessment in the ED with the affected leg being compared to the contralateral side [3]. This lady was observed to mobilise with a mild limp while transferring from the triage room to the ACA. She did not appear to have either a postural or structural lower limb abnormality. She was asked but was unable to perform a single leg squat as a functional test on the left leg due to pain, suggesting a compromised ability to attenuate loads [4] Swelling, erythema and increased heat was observed over the anterior lower leg at the junction of the middle and distal 1/3 of the tibia. Maximal bony tenderness was over the left tibial spine. Neurovascular assessment included assessment of motor and sensory nerves, pulses above and below the areas of tenderness and capillary refill. Full normal active and passive range of movements were preserved at the knees above and the ankle and feet below.

Although a vibrating tuning fork applied to the area of tenderness to aid the clinical diagnosis has been proposed as a specialist diagnostic test this modality is not supported and was therefore not utilised in this case [5].

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http://dx.doi.org/10.1016/j.ienj.2017.03.005
1755-599X/

As part of her clinical assessment, her height and weight were recorded due to her underweight appearance. Her height was 180 cm and her weight was 54.5 kg giving a body mass index of 16.8 (underweight).

4. Overview of female athlete triad and bone stress injuries

The female athlete triad (Box 1) is a serious health concern for the young female athletic population [6–8]. As the name suggests it is made up of three components and the presence of the triad or any of its components increases the risk for bone stress fractures in the female athletic population [9].

Box 1 Female Athlete Triad.
Female Athlete Triad

1. Low bone mineral density or disordered eating
2. Low body mass index
3. Menstrual irregularity or prolonged absence of menses

Bone stress injuries exist on a continuum from stress reactions to stress fractures [4], with the incidence of stress fractures in female athletes reported in the literature being in the range of 1.86–18.7% [10]. Although the incidence of tibial bone stress injury in runners has not been elucidated [11], they are the most common stress fractures seen in active populations [12]. Bone stress injuries can be divided into those that are at high risk and those that are of low risk of malunion (Table 1) [5,10,13–16].

Low-risk stress fractures generally heal without complication and the corner-stone of management is a two-phase process. The initial stage involves activity modification followed by a graduated and step-wise second phase which involves a return to activity [4]. Pain intensity is used as a guide to increase loading.

High-risk stress fractures are a management challenge as they are at risk of non-union and progression to complete fracture. Additionally, more aggressive treatment is required and a return to full activity requires a longer period of time to minimise the risk of injury progression. In tibial stress fractures non-operative management usually takes longer than 6 months [17]. In addition to treating the stress injury, it is also important to address the underlying reasons which predisposed the patient to the fracture. For example menstrual abnormality may occur in as many as 51% of endurance runners [18]

5. Diagnostic tests

Plain X-rays are the first choice of imaging for suspected bone stress injuries due to their availability and low costs. However, they have low sensitivity of between 10 and 50% for detecting these injuries, particularly early in the clinical course [19]. Ms. Jones was cautioned that her normal initial plain X-rays (Fig. 1) did not exclude a bone stress injury as symptoms often precede radiographic changes [20]. Diagnostic musculoskeletal ultrasound has limited utility [5,21] and was not utilised.

Fig. 1. Initial X-ray.

Laboratory tests were requested to determine nutritional or hormonal abnormalities. These included full blood count, inflammatory markers and bone profile which returned with all results within normal parameters.

6. Initial discharge

RANPs interact and care for patients in a manner which extends beyond the medical management of their injury and which results in a clinical encounter sensitive to the patients perspective [22]. In this care episode, it was necessary to modify Ms. Jones activity (i.e. to ensure she did not continue to run due to the possibility of propagating the injury) while recognising the importance of exercise to her. It was emphasized to the patient that a stress fracture was suspected and that high-intensity or prolonged-duration activities such as running would result in repetitive microtrauma that would further weaken the architecture of the bone [23] and exacerbate her symptoms.

Table 1
Low-high risk stress fractures.

Low risk of non-union	High risk of non-union
Fractures of the pubic ramus	Femoral neck fractures (involving the Superior cortex)
Femoral neck fractures (involving the medial cortex)	Tibial shaft fractures (involving the anterior cortex)
Femoral shaft fractures	Fractures of the medial malleolus
Tibial shaft fractures (involving the posteromedial cortex)	Fractures of the talus neck
Fractures of the fibula	Navicular fractures
Calcaneal Fractures	Proximal fractures of the 2nd metatarsal
Cuboid Fractures	5th metatarsal (proximal diaphysis)
Cuneiform fractures	Great metatarsal sesamoids
Lateral malleolus Fractures of the distal 2nd to 4th metatarsals	Patella