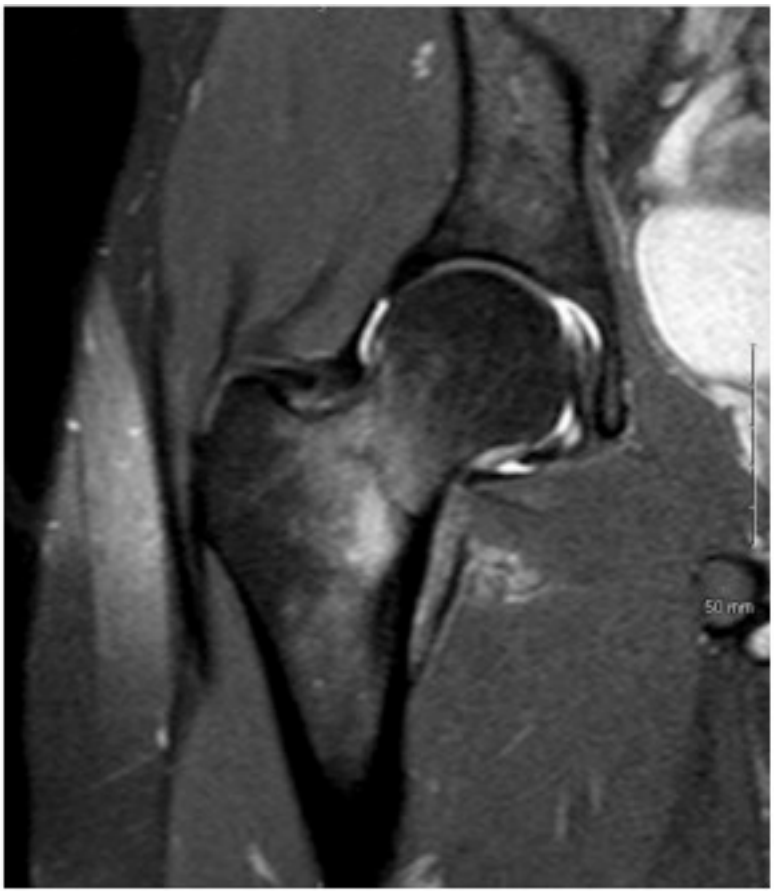
Bone Stress Injuries



An Introduction To Bone Stress Injuries (BSI).

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Definition:

These are typically overuse injuries associated with repetitive loading of bone by vigorous weight-bearing activity (such as running/ jogging/ marching) and inadequate recovery. There is a continuum of bone stress injury ranging from ‘normal’ to ‘bone strain’ to ‘stress reaction’ to eventual development of a ‘stress fracture’.

Bone is constantly remodelling through a balance between bone resorption (osteoclastic activity) and bone synthesis (osteoblastic activity). Both processes are under hormonal control.

BSI occur when micro-fractures associated with repetitive stress on bone cause a periosteal resorption that exceeds the rate of bone remodelling.

Stress fractures:

Stress fractures occur as a result of overuse injuries to bone, either secondary to bone fatigue or bone insufficiency. These are different mechanisms of injury to acute traumatic fractures.

Fatigue stress fractures occur when normal bone is unable to keep up with repair when repeatedly damaged or stressed (consider the concept of 'normal bone, abnormal stresses').

Insufficiency stress fractures occur in bone that is under normal strain but structurally abnormal because of metabolic bone disease or osteoporosis (consider the concept of 'abnormal/ weakened bone, normal stresses').

Epidemiology:

Approximately 10-20% of consultations in sports medicine practice are for BSI. Lower limb stress fractures are much more common than upper limb. Track & Field athletes are said to have the highest incidence.

The tibial shaft is the most frequent site in athletes and constitute about half of all stress fractures. Metatarsal stress fractures are the next most common, occurring in about 10-20% of athletes, particularly runners. Femoral shaft and neck fractures constitute 8% of stress fractures in military personnel and 11% in athletes.

Risk factors:

Risk factors for stress fractures can be broadly divided into extrinsic and intrinsic factors.

Extrinsic risk factors encompass the environment and for a sportsperson, their training regimen.

Consider the mileage covered per session and cumulatively over a week; number of training cycles; inadequate recovery/ rest periods and continued training with fatigued muscles; the running pace and gradient, typically when running downhill.

Type of exercise also makes a difference. There is increased risk of BSI for running, track and field sports, basketball, gymnastics, and dance.

Consider, too, the role of footwear and training surface.

Intrinsic risk factors include a patient's bony anatomy. The following are thought to increase the risk for certain lower limb BSI- Femoral anteversion; leg length

discrepancy; genu varum and valgus; a narrow tibia and small calf girth; external rotation of the lower limb.

Poor nutrition has a role, particularly low calcium intake and low overall energy intake.

Other risk factors include older age (those over 20 years found twice the risk of stress injury as those aged 17-19 years); previous history and family history of BSI and being a smoker.

Female athlete triad and RED-S:

Intrinsic factors may play a greater role for women and girls developing BSI, more so than men and boys. Studies from the 1990s showed that in female subjects with less than 5 periods a year, the risk of stress fractures was 49%; whereas those who had more than 10 periods a year reduced their risk to 29%. Female runners taking the combined oral contraceptive pill had approximately half the risk of stress fractures as those not taking it, although it has been suggested there may be additional reasons for that.

The combination of menstrual disorder, reduced bone mineral density and disordered eating led to the evolution of the phrase '*Female Athlete Triad'*. This has mostly been superseded by the term '*Relative Energy Deficiency in Sport' (RED-S)*, acknowledging the multifactorial complexity involved (more than the initial triad) and the fact that male patients can also be affected. The focus is on energy deficiency relative to the balance between dietary energy intake versus energy expenditure required for health and activities of daily living, growth and sporting activities.

The syndrome of RED-S refers to impaired physiological function including, but not limited to, metabolic rate, menstrual function, bone health, immunity, protein synthesis, cardiovascular health caused by relative energy deficiency.

Psychological consequences (e.g. depression, anxiety, eating disorders, adjustment reactions) can either precede RED-S or be the result of RED-S.

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