

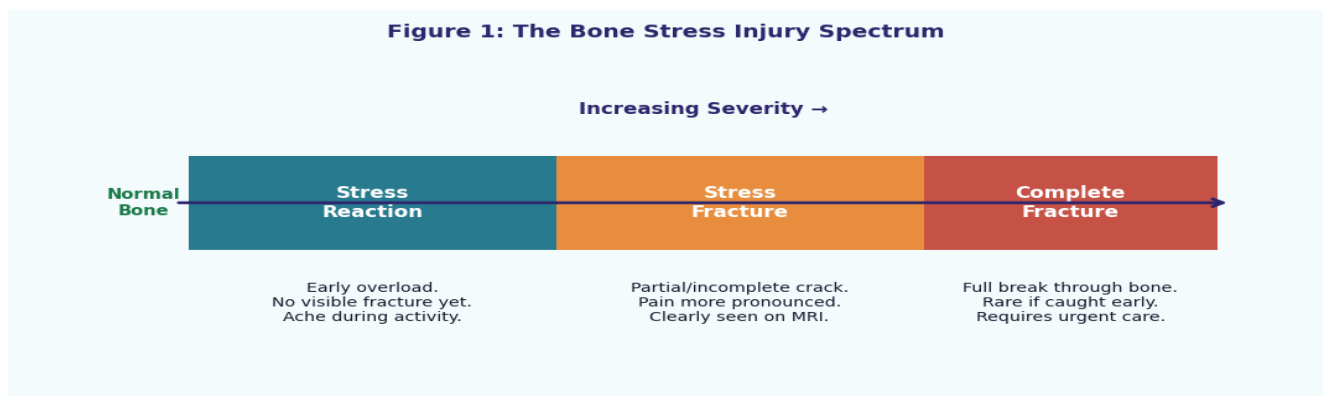
Understanding Bone Stress Injuries

Stress Reactions, Stress Fractures and Safe Return to Activity

A bone stress injury (BSI) builds gradually when bones are asked to do more than they can currently handle. Unlike a sudden break from a fall, these injuries develop through repeated loading — running, jumping, walking — that outpaces the bone's repair capacity. Bone is living tissue that constantly renews itself: when demand outpaces renewal, micro-damage accumulates. Caught early, BSIs heal well; left untreated, they can progress to a complete fracture.

1 What Is a Bone Stress Injury?

BSIs exist on a spectrum — a sliding scale from early warning signs to a full break:



Catching this early makes a big difference. The earlier a BSI is identified, the faster the recovery and the less likely it is to progress to a complete fracture.

2 How They Develop + Risk Factors

When Loading Outpaces Repair

- Training volume or intensity increases too quickly — the "too much, too soon" pattern
- A new activity type is introduced without gradual adaptation (e.g., hill runs, harder surfaces)
- Returning to full training after a break without a progressive build-up

Key Risk Factors

Risk Factor	Why It Matters
Training error	Sudden spikes in load overwhelm bone's repair cycle before adaptation occurs
Low bone density	BMD Z-score ≤ -1.0 significantly increases fracture risk in weight-bearing athletes

Poor nutrition	Low calcium (<800 mg/day) and vitamin D deficiency impair bone formation and repair
RED-S	Insufficient energy availability redirects resources away from bone maintenance; linked to menstrual dysfunction and low BMD
Biomechanics	High or flat arch, leg length difference, and certain gait patterns increase focal bone stress
Footwear	Worn-out or poorly fitting shoes reduce shock absorption; rapid switch to minimalist footwear without adaptation raises risk

3 Common Sites in the Lower Limb

Around 90% of bone stress injuries occur in the lower limb. Risk level reflects blood supply and mechanical position — high-risk sites need more aggressive management.

Bone	Typical Patient	Risk Level	Notes
Navicular	Runners, jumpers	HIGH	Poor blood supply to central third; slow healing
2nd Metatarsal neck	Runners, military recruits	HIGH	Often longest metatarsal; high compressive load
Anterior tibial cortex	Runners, dancers	HIGH	Tension side; risk of complete fracture
5th Metatarsal base	Court sport athletes	HIGH	Watershed blood supply; non-union risk
Calcaneus (heel)	Military, new runners	LOW	Trabecular bone; good healing potential
Distal fibula	Runners, high-volume athletes	LOW	Smaller bone; responds well to rest

4 Symptoms, Diagnosis + Management

Symptoms

Symptom	What It Means
Localised bony ache during/after activity	Early overload signal — bone is accumulating micro-damage
Pain easing with rest, returning on reload	Classic BSI pattern; distinguish from soft-tissue pain by precise bony location

Point tenderness on firm palpation	Strong clinical indicator; hop test positive at tibia, metatarsals, calcaneus
Pain worsening with everyday weight-bearing	Indicates progression — seek prompt clinical review

⚠ WARNING: Night Pain Is a Red Flag

Night pain or pain at rest indicates a more advanced injury — the bone is under enough stress to cause pain even without loading. This is a red flag requiring prompt clinical review. Do not wait and hope it settles on its own.

Diagnosis

MRI is the gold standard — it detects bone marrow oedema and fracture lines at the earliest stages, and X-ray misses up to 85% of early BSIs (signs may not appear for 2–3 weeks after onset). Your clinician will select imaging based on site, severity, and whether a high-risk lesion is suspected.

Management: 3-Phase Approach

Phase	Timeframe	Key Action
1 — Protection	Weeks 0–6+	Stop impact activity; high-risk sites require moon boot or crutches; maintain fitness via swimming, cycling, pool running
2 — Graduated Reload	Weeks 6–12	Begin pain-free walking; progress walk/jog intervals every other day; never increase pace and distance in the same week
3 — Full Return	3–7 months (high-risk sites)	Address root cause — training error, nutrition (calcium/vitamin D), RED-S screen, biomechanical assessment as indicated

5 Key Takeaways

KEY TAKEAWAY 1

Bone stress injuries are a spectrum — caught early, they heal well. Localised bone tenderness, pain that doesn't warm up, and worsening with load are early signs. Do not wait for pain to become severe. Night pain or rest pain is a red flag — seek prompt review.

KEY TAKEAWAY 2

Rest alone is not enough — addressing the root cause is essential. Training errors, low energy availability, poor nutrition, and bone health issues must all be identified and corrected to prevent recurrence.

KEY TAKEAWAY 3

Return to activity must be gradual — pain-free is a starting point, not a finish line. A structured, progressive return guided by your clinician is the safest path. Rushing recovery at high-risk sites risks complete fracture.