Case Discussion
Stress fractures

- What is **Fatigue fractures** ?

- What is **Insufficiency fractures** ?

- Fatigue fractures: Fracture due to repetitive forces with **abnormal load on a normal bone**.

- Insufficiency fractures: Fractures **on abnormal bone with normal forces** as osteomalacia and osteoporosis.

Case scenario :

- A 22-year-old male military recruit presents with progressive pain in his right shin.

  The pain started after a sudden increase in physical training intensity
  over a 4-week period.

  No history of trauma, but the pain worsens during weight-bearing and improves with rest.

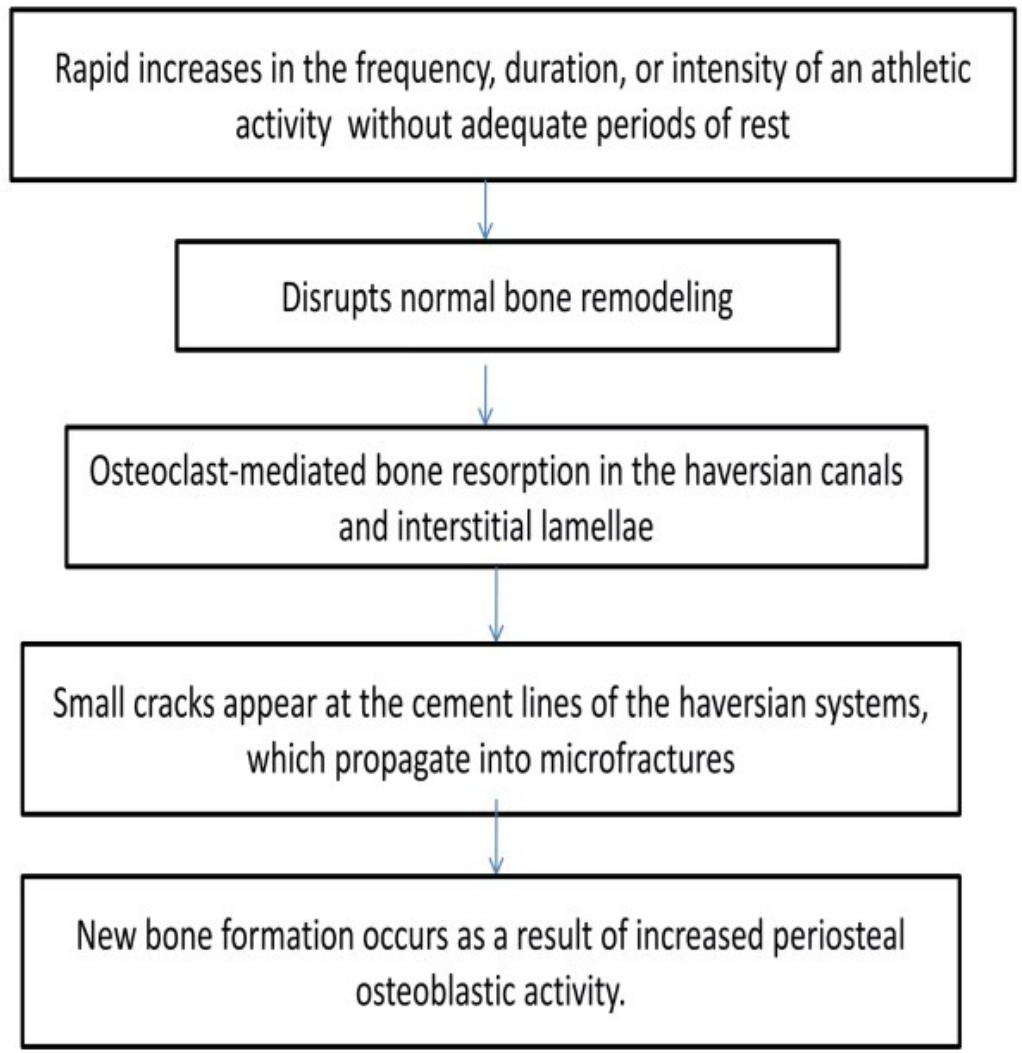
  Physical exam: tenderness along the tibial shaft
  no swelling. Vitamin D level is 18 ng/mL.


L
Posterior-Anterior

- **What are the possible causes of this patient's symptoms?**

- **Stress fracture :** Most commonly presenting in the lower limb, a prevalence of these injuries has been reported in the tibia 23.6%, the metatarsals (10- 20%), tarsal navicular (17.6%), femur (6.65%) and pelvis (1.6%) .

PATHOGENESIS



- **What factors contributed to this stress fracture?**

Risk Factors

❖Extrinsic factors

1. type of the sport
2. quality of footwear-military shoe
3. environmental factors, such as the running surface itself
4. An insufficient fitness level or an abrupt increase in the intensity of training regimens

** Studies clearly have demonstrated that high training mileage, for instance, more than 40 miles (about 67 km) per week (*e.g.*, in runners), and long exercise periods, such as more than 5 hours of daily training (*e.g.*, in dancers), increase the risk for stress fracture

❖Intrinsic factors

1. 25(OH)D insufficiency is associated with an increased incidence of stress fractures
2. Female sex with menstrual and hormonal disturbances
3. Low bone density and thinner bones
4. Lower limb deformity, alterations to the plantar arch
5. Prior poor physical activity
6. Systemic medical conditions affecting metabolic and or nutritional status as thyroid dysfunction
7. Smoking and alcohol consumption

Radiological work up

1. Which imaging modality is most appropriate in this case?

Radiological work up

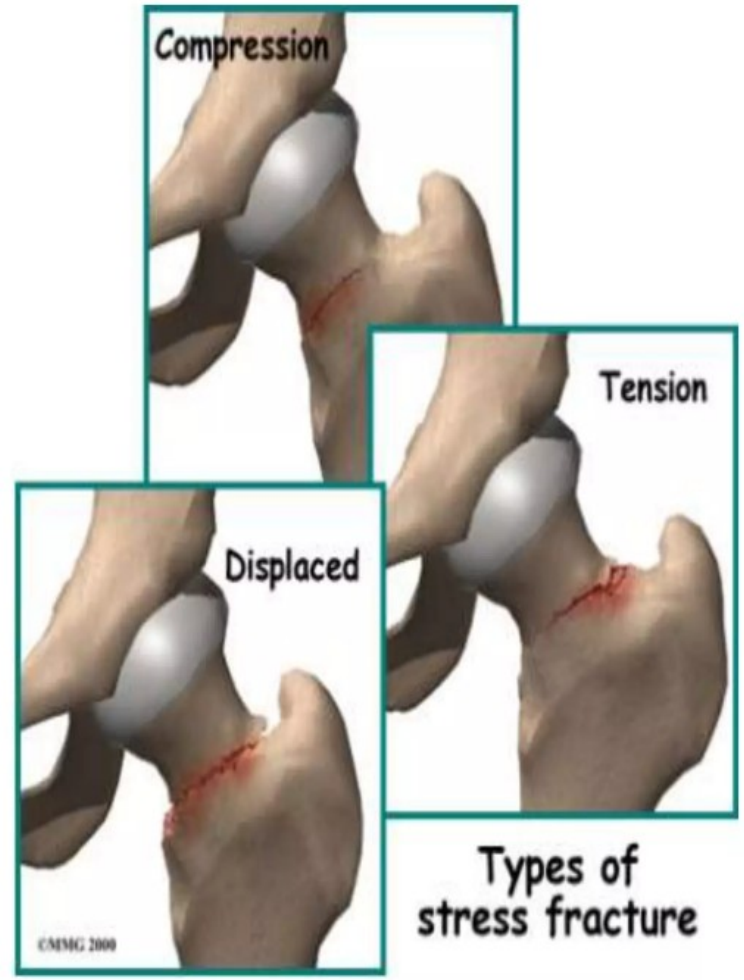
1. X-rays give a high false-negative rate, particularly at the onset of the stress fracture.
2. Ultrasonography was demonstrated to be a sensitive and specific technique in early diagnosis of metatarsal bone stress fractures.
3. Computed tomography (CT) is used when MRI is contraindicated.
4. Technetium-99m is can show signs of fracture as early as 3 to 5 days after the onset of symptoms.
5. **MRI** : is the *most sensitive and specific* diagnostic tool. It is the gold standard, regardless of the location of the stress fracture.

Tibia Stress Fracture

X- RAY

- Normal – 1st 2-3 wks after the onset of symptoms
- Periosteal response – 3 months after onset of symptoms.
- Periosteal bone formation, sclerosis, endosteal callus, and a frank fracture line.

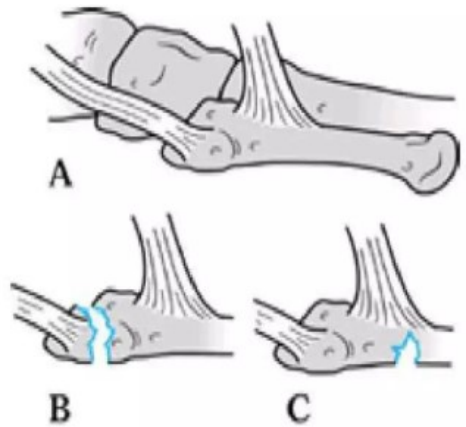
Femur Neck Stress Fracture



March fractures

Typical stress fracture of the distal shaft of the second metatarsal not seen on initial radiograph (left). Callus formation is seen at 4 weeks follow up.

METATARSAL FRACTURES



Treatment:

- Strict avoidance of weight bearing for 6 to 8 weeks.
- Limb elevation
- Ice fomentation
- Cycling / aquatic therapy
- Once healed- increase intensity of exercise gradually (10% per week)

MRI

- Both sensitive and specific
- It is extremely sensitive in the detection of pathophysiological soft-tissue, bone and marrow changes associated with stress fractures
- Soft tissue- collection in infection, mass in tumor can be well visualised

Stress fracture of the femoral neck located on the compression side.

Diagnosis

- Suspicion to diagnose stress fracture is raised when the athlete complains of increased pain and tenderness, particularly at the *onset* and at the *end* of a training period .

- The physical examination shows tenderness over the involved bony area with or without localized swelling.

Laboratory work up

- Serum of 25-hydroxyvitamin D

  - a prospective study evaluating a large number of recruits, a serum 25(OH)D concentration **<20 ng/mL** (50 nmol/L) was associated with a higher incidence of stress fracture than levels >20 ng/mL

Treatment

- Activity modification should be considered as the first therapeutic step

  healing may take about three to six weeks, with avoidance of the precipitating activity and followed by a gradual return to the pre-injury level of participation. More severe injuries require more aggressive treatment and often take two to three months.
- Adequate vit d and ca supplement 800 IU 25(OH)D and 2000 mg calcium
- Medical treatment with biphosphonate was not proved

- What are the the risk factors associated with increasing the risk of occurrence of such fractures ?

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1. Vit D & Calcium level
2. Duration of training before onset of symptoms
3. Type of shoe wear used during training
4. Body mass index of the recruit
5. History of steroid usage, alcohol consumption or smoking

What are the Recommendations for prevention ?

- To prevent or decrease the incidence of stress fracture we recommend the following :

1. Gradual increase in the intensity of training
2. Giving instruction for recruits to keep using suitable sport shoe while training
3. Keep on Vit D & Calcium supplement
4. Avoid smoking, alcohol & steroids.

- ***How to apply those recommendations ?***

1. It is suggested to increase the intensity of training gradually over the first 16 weeks and recruits are to be given a training pause at around the 12th week for 2-3 weeks for healing of stressed bones just before the peak time of occurrence of stress fractures
2. Use of **proper running shoes** ,use of shock-absorbent insoles and use of orthotic shoe inserts rather than the military shoe while performing running and sport activities
3. Adequate daily vit D and ca supplement (800 IU 25(OH)D and 2000 mg calcium)

Conclusion

- Stress fractures is considered a disabling injury which is faced by athletes and newly military recruits.
- The best approach to deal with such fractures is prevention.
- The most common cause which ended in disqualification of newly recruits was femoral neck fractures.