

# 踝关节磁共振成像

解放军总医院磁共振成像中心  
姜昕

## 讲课内容

踝关节韧带损伤  
踝关节其他病变  
踝关节骨损伤  
踝关节软骨损伤  
踝关节肌腱损伤

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## 概论

- 3T 可以增加图像信噪比，增加图像分辨率，减少扫描时间
- 从0.5T到3T，信噪比基本呈线性增长

1.5T, FSE, T1WI      3T, FSE, T1WI

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## 概论

经第二跗骨矢状位

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## 踝关节的MR成像

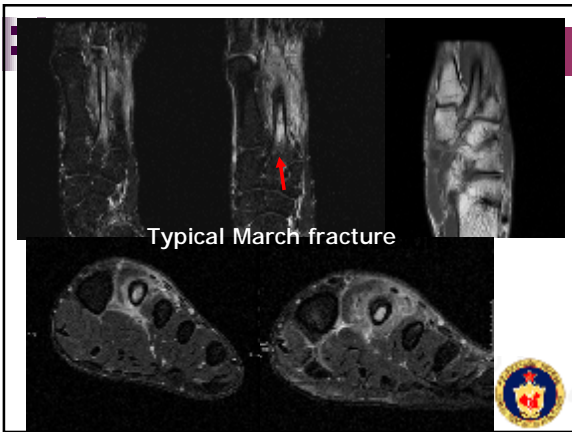
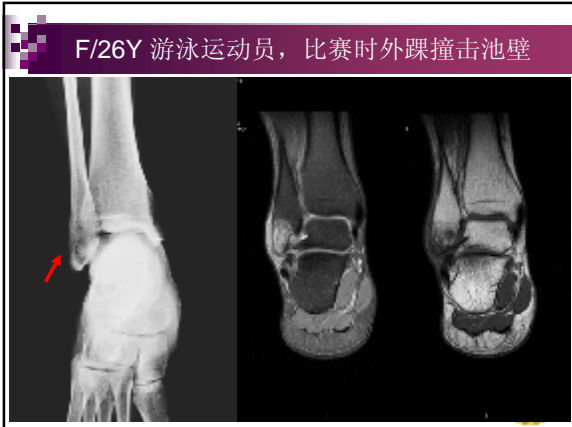
- 踝关节骨创伤
- 踝关节软骨损伤
- 踝关节肌腱损伤
- 踝关节韧带损伤
- 踝关节其他病变

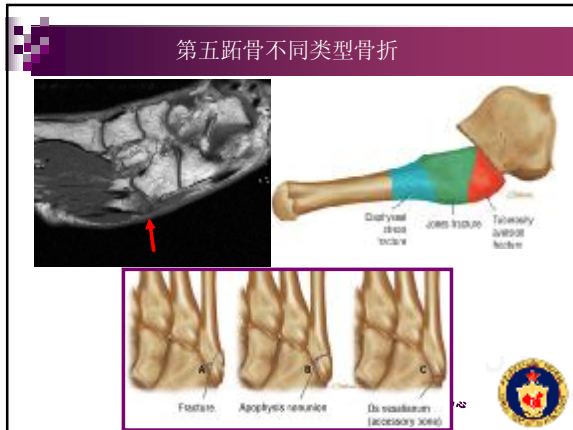
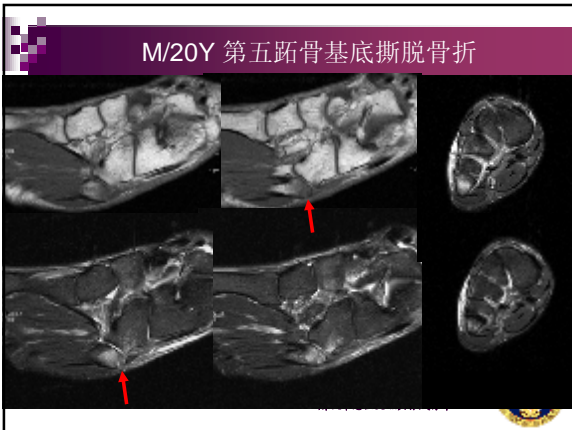
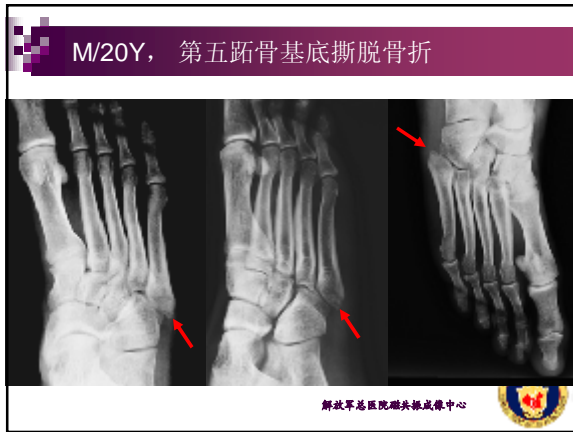
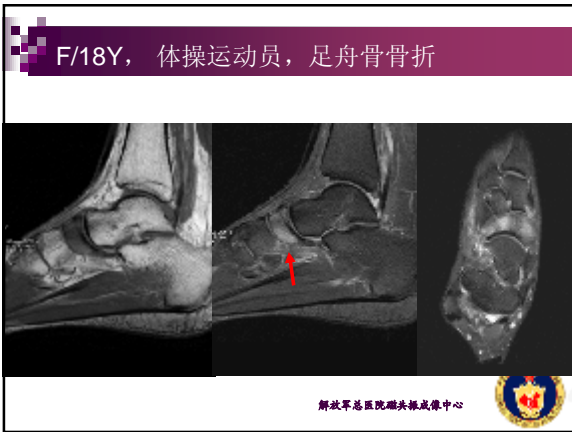
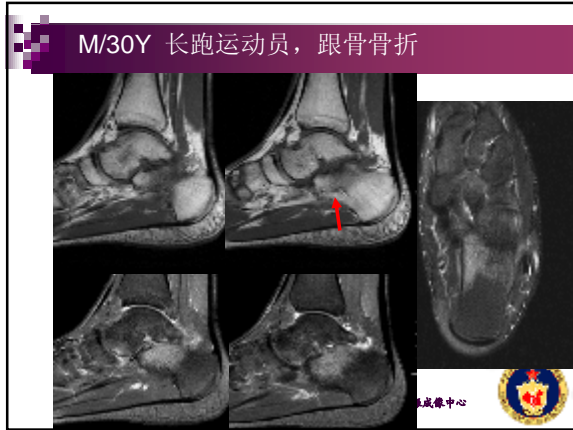
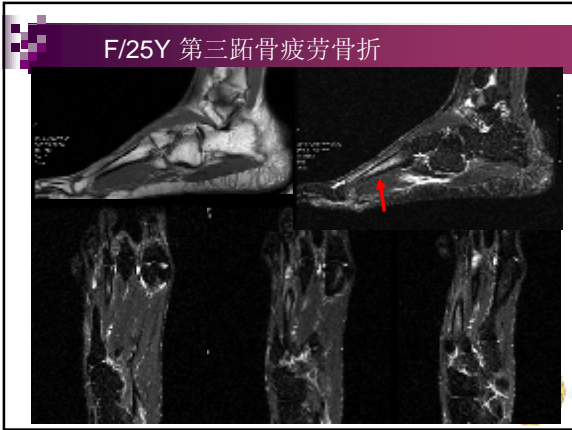
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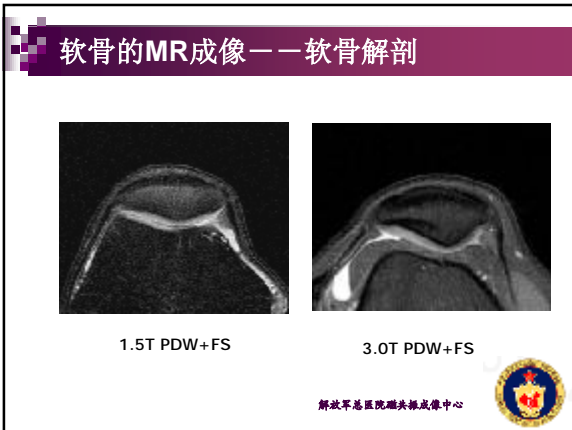
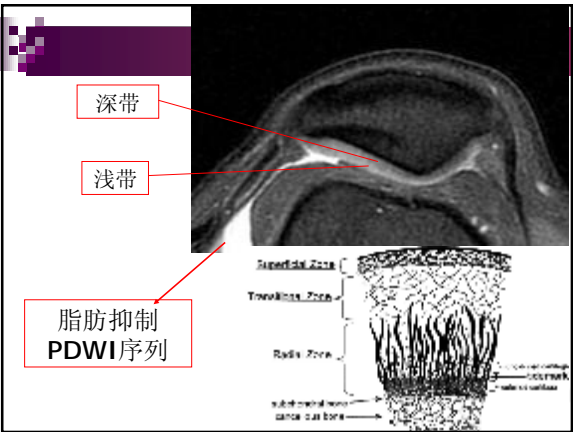
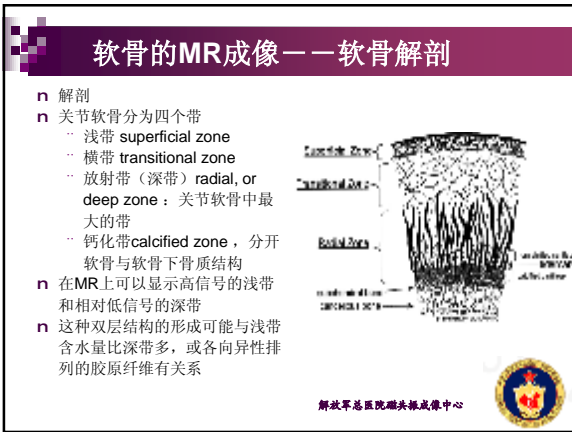
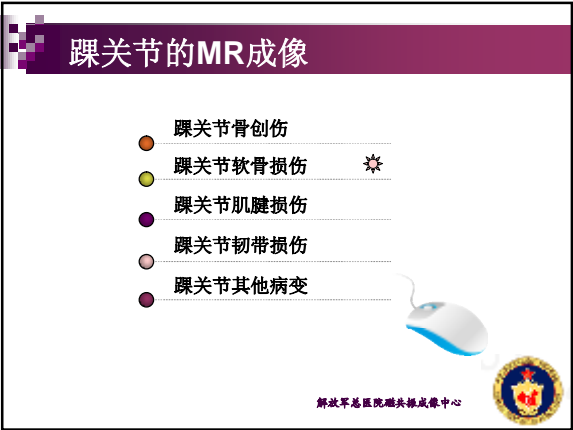
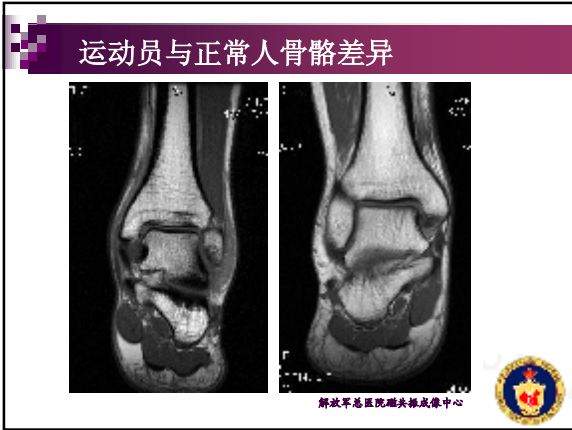
## 骨的MR成像——骨创伤

X线可疑骨折

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**1级 浅表病变：软骨变软**

**2级 浅表病变累及软骨深度约50%**

**3级 软骨病变累及软骨深度>50%但未达软骨下骨**

**4级 软骨破坏并累及软骨下骨**

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### 软骨的MR成像——软骨损伤

- n Osteochondral lesion of the talus (OLT)距骨骨软骨病变
  - o Osteochondral defect/lesion 骨软骨缺损/病变
  - o Osteochondritis dissecans 剥脱性骨软骨炎
  - o Osteochondral fracture 骨软骨骨折
- n Many causes: trauma, ischemic necrosis
- n Can occur with up to 6.5% of ankle sprains
- n Consider if ankle sprains do not respond to 6-8 weeks of conservative therapy
- n Usually seen in the talar dome

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### Staging 分级

Berndt and Harty classification: depending on the integrity of the articular cartilage and the condition of the subchondral bone

- Stage I: subchondral compression fracture with intact overlying articular cartilage
- Stage IIA: subchondral cyst
- Stage IIB: partially detached osteochondral fragment
- Stage III: the osteochondral fragment is completely detached but is not displaced
- Stage IV: the osteochondral fragment is detached and displaced

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Stage I

Stage II

Stage III

Stage IV

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Stage I

Stage II

Stage III  
关节腔造影

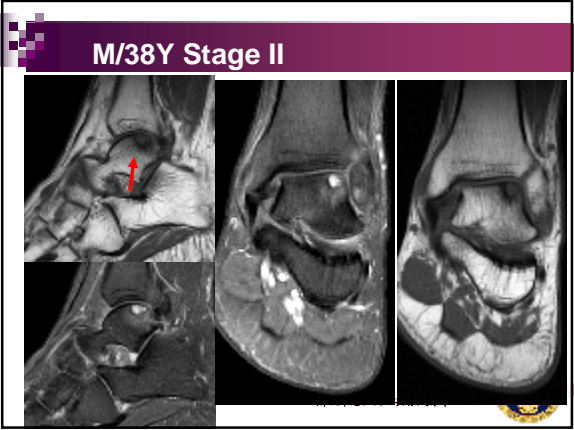
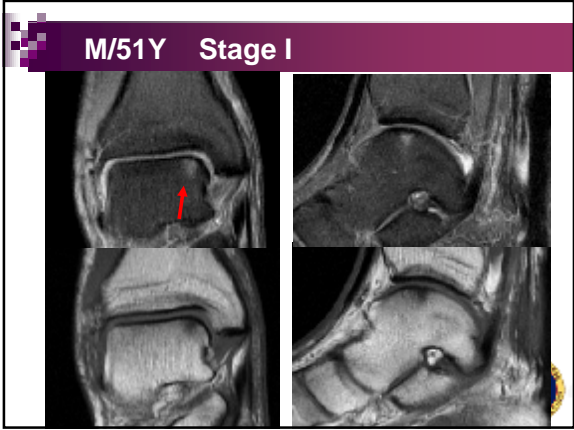
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### 好发部位：前外侧、后内侧

Anterolateral OLT

Posteromedial OLT

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**不稳定性骨软骨病变 Instability of the osteochondral lesions**

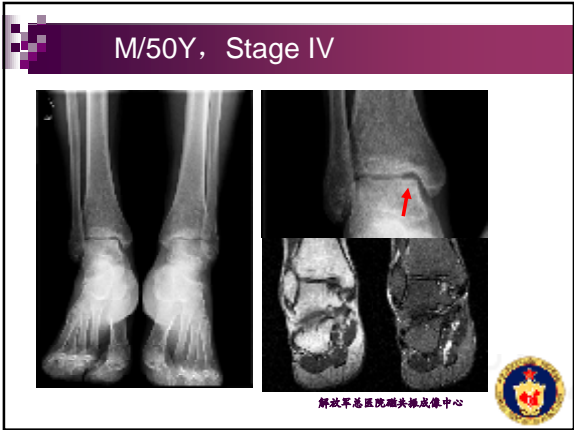
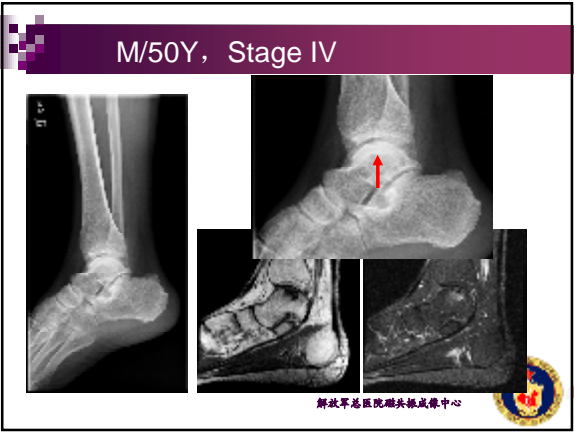
n Four MRI criteria that indicate :

- 1) a high signal intensity line on T2-weighted images measuring at least 5 mm in length at the junction of the osteochondral fragment and the underlying bone (病变长度>5mm)
- 2) a discrete area of homogeneously high signal intensity on T2-weighted images (cyst-like lesion) deep to the osteochondral lesion, measuring at least 5 mm (病变深度>5mm)
- 3) a focal defect in the articular cartilage measuring at least 5 mm
- 4) a high signal intensity line traversing the cartilage and subchondral bone plate on T2-weighted images, which represents an articular complete fracture

n Treatment: **指导治疗**

- Non-operative = immobilization and limited weight bearing for 6 weeks
- Surgery for higher grade lesions

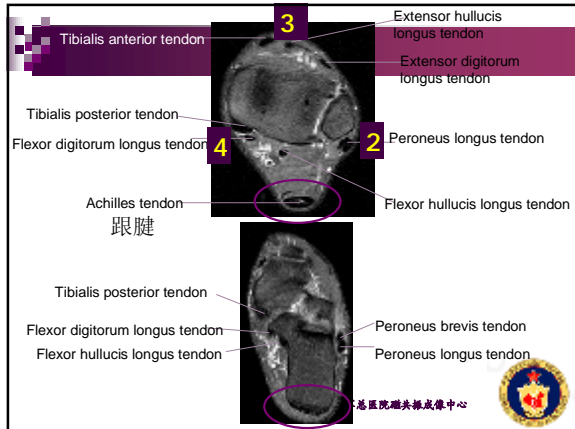
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**踝关节的MR成像**

- 踝关节骨创伤
- 踝关节软骨损伤
- 踝关节肌腱损伤 \*
- 踝关节韧带损伤
- 踝关节其他病变

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### 跟腱 The Achilles tendon

- 跟腱由腓肠肌和比目鱼肌肌腱共同组成，附着于跟骨的后方
- 没有腱鞘被覆，周围环以疏松的连接组织
- MR上为均匀的低信号，呈扁平或轻度前凸状，前后径小于1cm
- 运动损伤容易导致跟腱损伤
- 风湿性关节炎、系统性红斑狼疮、糖尿病、痛风患者也可见跟腱改变

### 跟腱 The Achilles tendon

跟腱运动损伤分以下两种情况：

- 跟腱附着处炎症
- 跟腱部分（完全）撕裂：跟腱最厚处前后径一般小于6mm，在踝关节上方2 - 6cm处跟腱纤维交叉走行，血液供应减少，容易撕裂

### 跟腱附着处炎症 Insertional Achilles Tendinitis

- 跟腱附着处炎症是后跟痛的原因之一
- 由于小腿肌肉过度运动从而产生反复创伤以及微小撕裂所致
- 常见于芭蕾舞演员、从事跑、跳的运动员
- MR表现为跟腱附着处增厚伴信号异常

### 跟腱滑囊炎---足跟痛的重要原因

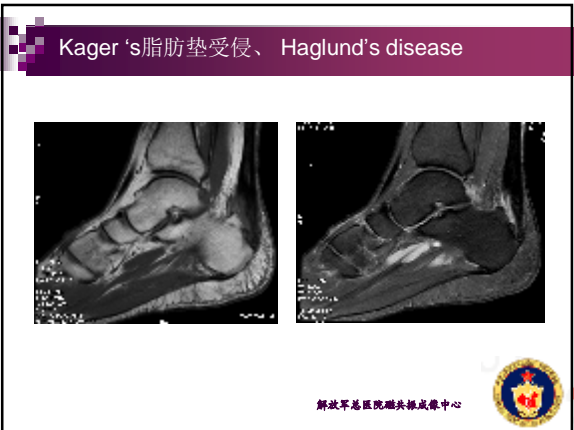
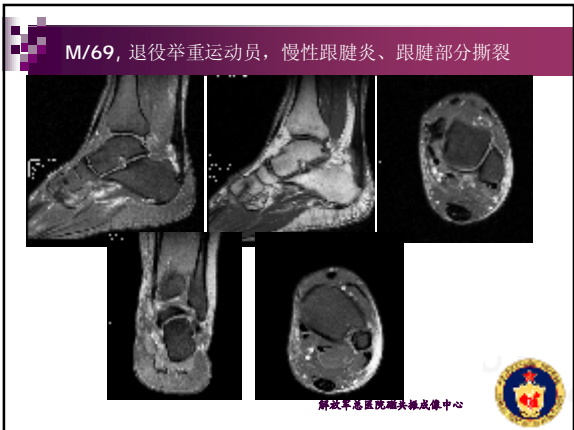
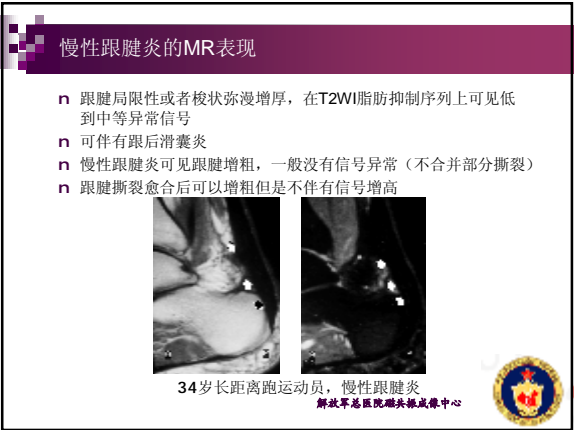
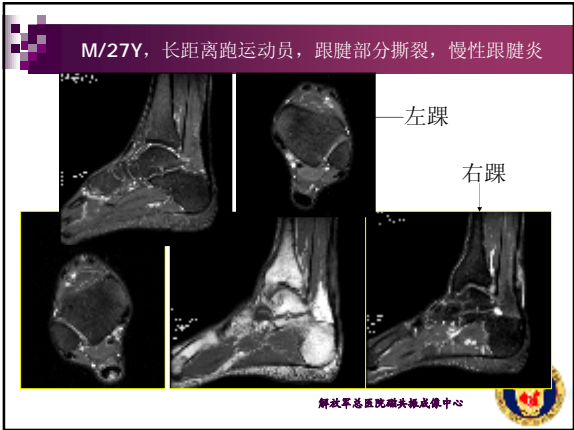
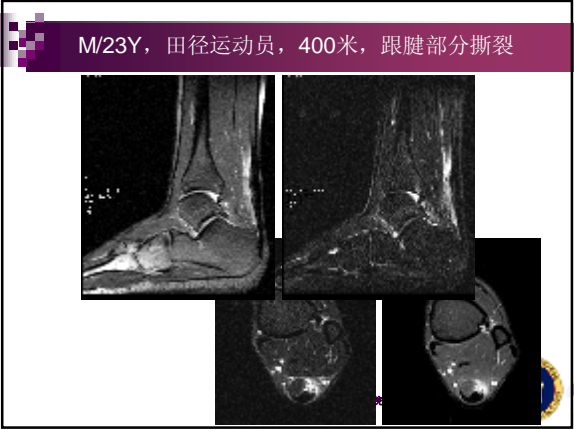
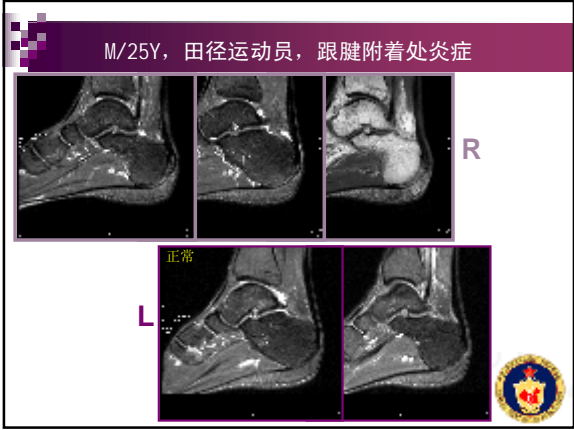
跟腱附着点处有两个滑囊：跟后滑囊、跟腱后滑囊（皮下滑囊）

跟后滑囊 Retrocalcaneal bursae  
跟腱后滑囊 (皮下滑囊) Retroachilleal bursae

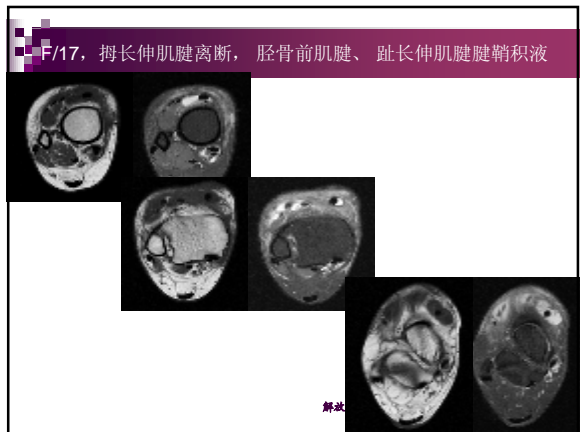
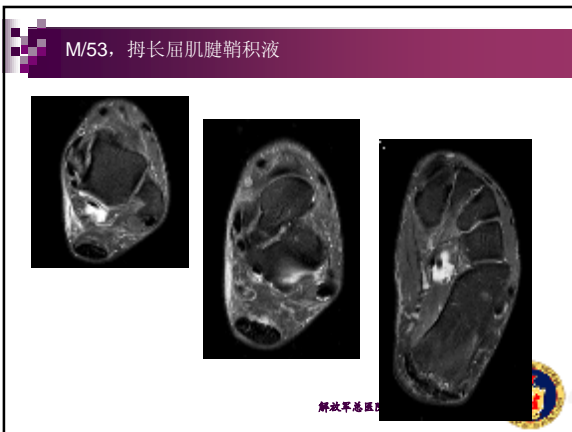
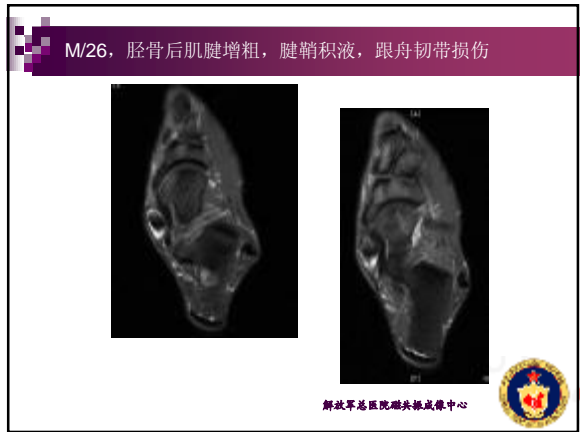
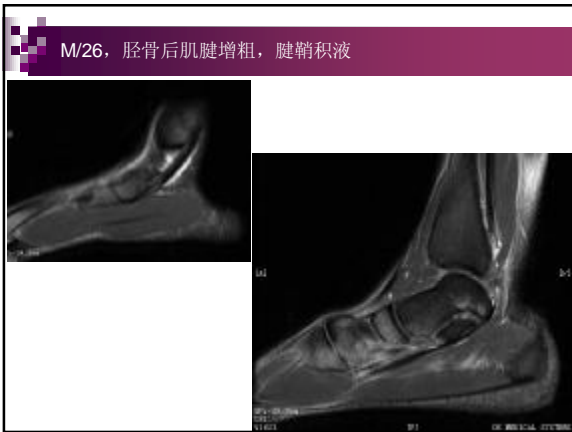
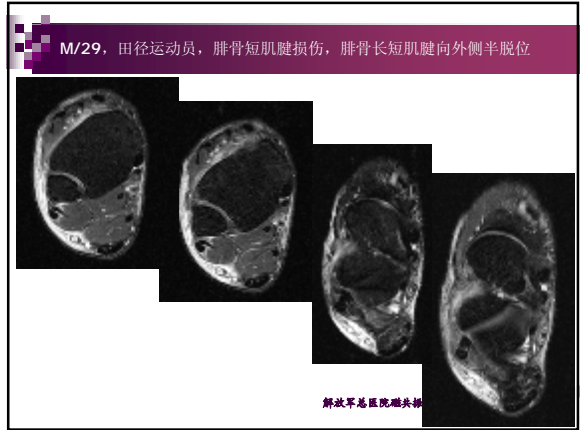
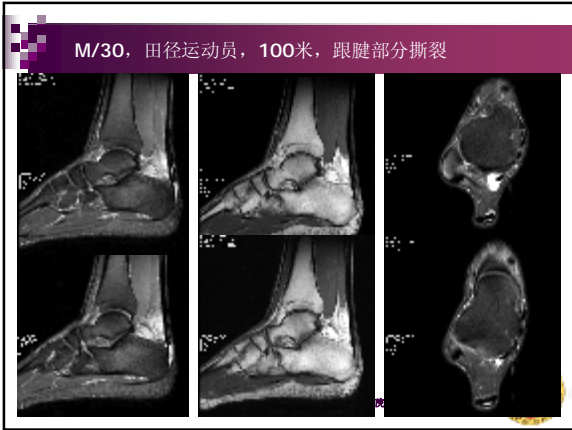
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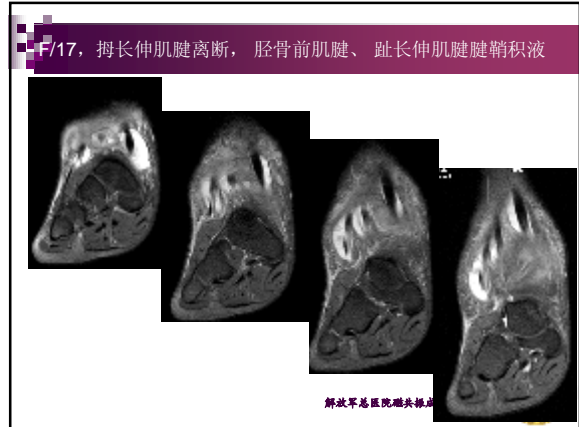
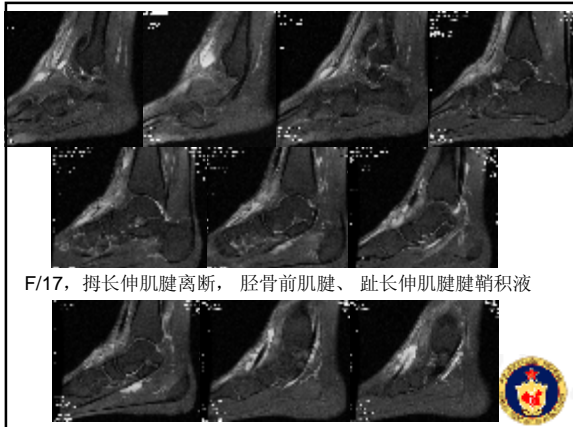
### M/25Y, 跟后滑囊炎

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### 踝关节的MR成像

- 踝关节骨创伤
- 踝关节软骨损伤
- 踝关节肌腱损伤
- 踝关节韧带损伤 ✨
- 踝关节其他病变

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### 踝关节三组韧带 3, 3, 3

- n Syndesmotom ligamentous complex (联合韧带)
  - Anterior tibiofibular ligament 胫腓前韧带
  - Posterior tibiofibular ligament 胫腓后韧带
  - Inferior transverse ligament 胫腓横韧带
- n Lateral collateral ligament
  - Anterior talofibular ligament 距腓前韧带
  - Posterior talofibular ligament 距腓后韧带
  - Calcaneofibular ligament 跟腓韧带
- n Deltoid ligament (三角韧带)
  - Anterior tibiotalar ligaments and 胫距前韧带
  - Posterior tibiotalar ligaments 胫距后韧带
  - Tibiocalcaneal and tibionavicular ligaments (superficial) 胫跟和胫舟韧带

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### 联合韧带

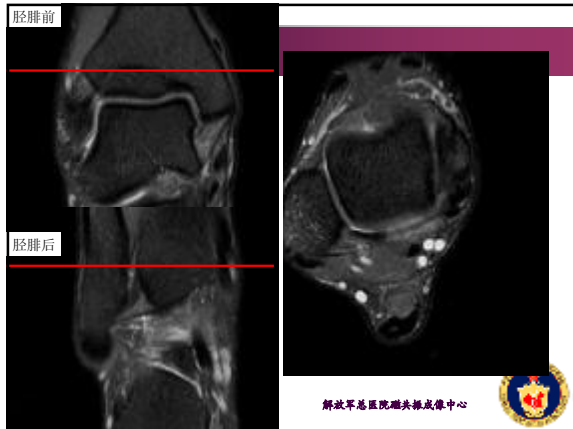
- n 胫腓前、后韧带:
  - 位于胫距关节上方, 连接外踝前、后面与胫骨前、后结节, 起支持作用
- n 胫腓横韧带:
  - 位于胫腓后韧带前方, 后外踝延伸至胫骨关节面后缘, 恰好位于内踝的外侧

胫腓前韧带 胫腓后韧带 胫腓横韧带

David W. Stoller. MRI in orthopaedics and sports medicine

胫腓前韧带 胫腓后韧带

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### 踝关节外侧韧带复合体

- 距腓前韧带**
  - 自腓骨向前方行走，止于距骨外侧关节面的前方
  - 是踝关节中最薄弱、最易损伤的韧带
- 距腓后韧带**
  - 自外踝后方横行或水平行走，止于距骨结节后部
- 跟腓韧带**
  - 外侧韧带复合体中最长的一条，自外踝几乎垂直行走延伸至跟骨外侧面

距腓前韧带

距腓后韧带

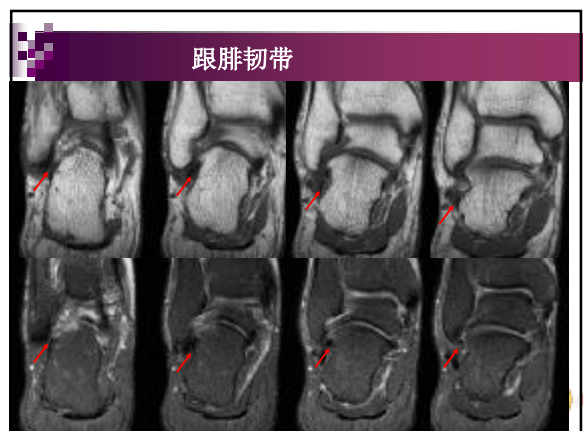
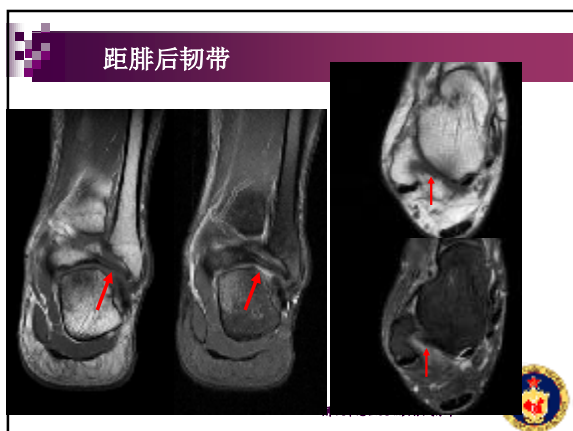
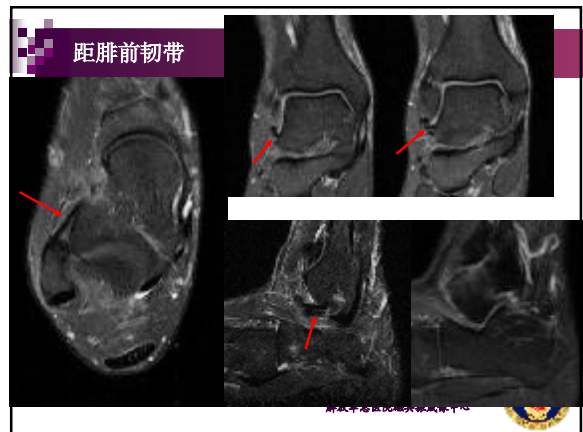
跟腓韧带

David W. Stoller. MRI in orthopaedics and sports medicine

### 踝关节外侧韧带复合体

- 距腓韧带位于胫腓韧带下方
- 可根据距骨、外踝的形态区分胫腓、距腓韧带
- 可在轴位像的同一层面显示全程
- 距腓前韧带表现为线样的均匀低信号结构
- 距腓后韧带呈扇形附着于腓骨外踝，MRI上较粗、信号不均匀

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### 踝关节韧带损伤

- n 联合韧带撕裂
- n 外侧韧带复合体撕裂 (最常见)
- n 内侧韧带复合体 (三角韧带) 撕裂 (少见)



The diagram shows the ligaments of the ankle, including the anterior talofibular, calcaneofibular, and posterior talofibular ligaments. The photograph shows a basketball player with a red circle around the ankle area, indicating the site of injury.

### 外侧韧带撕裂—内翻性扭伤

- n 外侧韧带包括距腓前、距腓后、跟腓韧带，起着防止踝部内翻的作用
- n 当踝关节出现内翻性扭伤时 (85%)，最易出现外侧韧带撕裂
- n 损伤顺序：距腓前 > 跟腓 > 距腓后



The diagram illustrates the lateral ligaments of the ankle: the anterior talofibular ligament, the calcaneofibular ligament, and the posterior talofibular ligament. A red arrow points to the anterior talofibular ligament, which is noted as the most vulnerable.

**距腓前韧带最为薄弱，最易撕裂**

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### 踝关节韧带的扭伤

**根据严重程度分三度：**

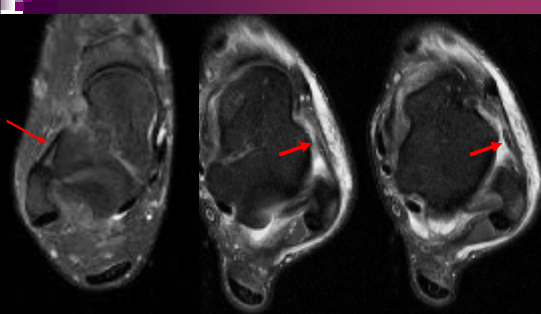
- n Grade I：韧带的牵拉，韧带内撕裂 (影像不可见)，伴局部轻度肿胀、触痛，无或轻微功能受损，无关节松弛
- n Grade II：韧带的部分撕裂，伴局部中度疼痛、肿胀、触痛，轻一中度关节松弛
- n Grade III 韧带的完全撕裂，严重肿胀、出血、触痛，伴明显的踝关节不稳



The diagrams show the anatomical changes from a simple sprain (Grade I) to a partial tear (Grade II) and finally a complete rupture (Grade III) of the lateral ligaments.

解放军

### M/30Y 急性距腓前韧带部分撕裂

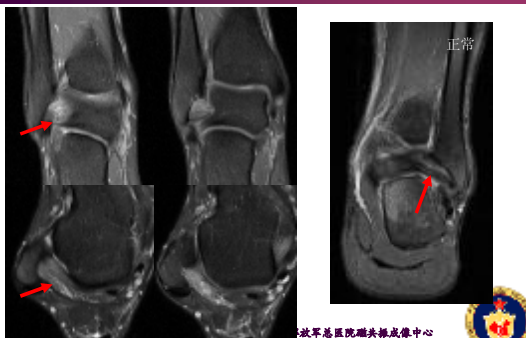


The MRI scans show a thickened and hyperintense anterior talofibular ligament, indicated by red arrows, which is characteristic of a partial tear.

**征象：韧带增粗，其内出现高信号，邻近软组织信号异常**

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### F/27Y 急性距腓后韧带部分撕裂

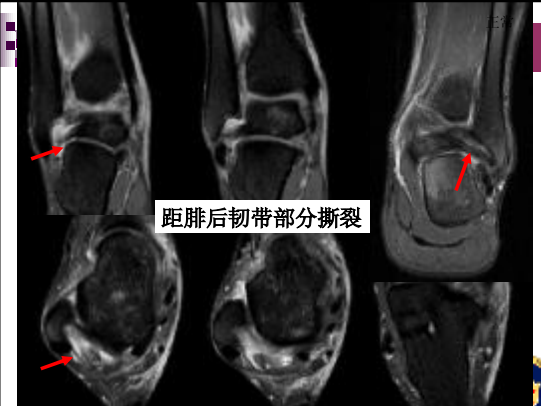


The MRI scans show a hyperintense signal in the posterior talofibular ligament, indicated by red arrows, consistent with a partial tear. A normal scan is shown for comparison.

**正常**

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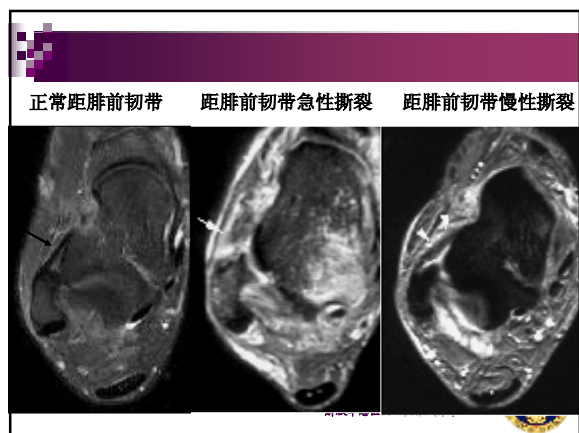
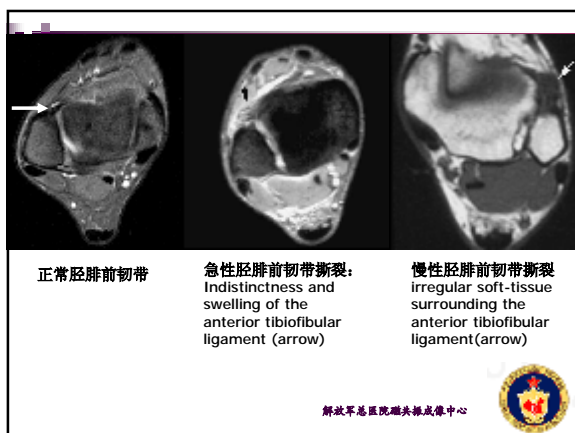
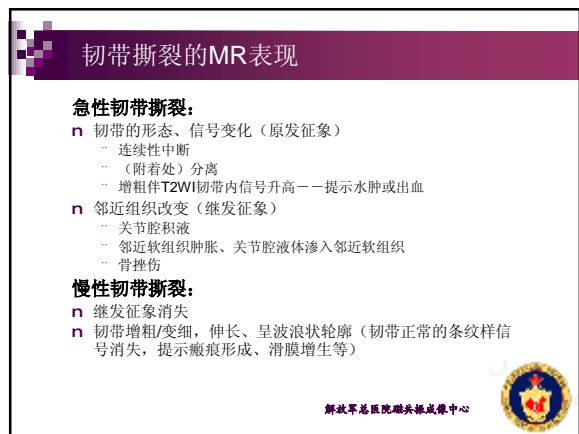
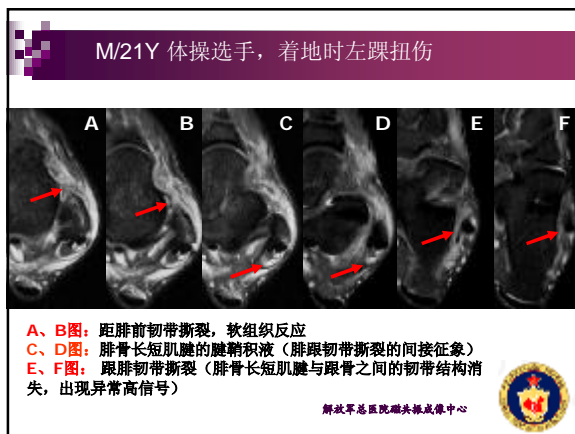
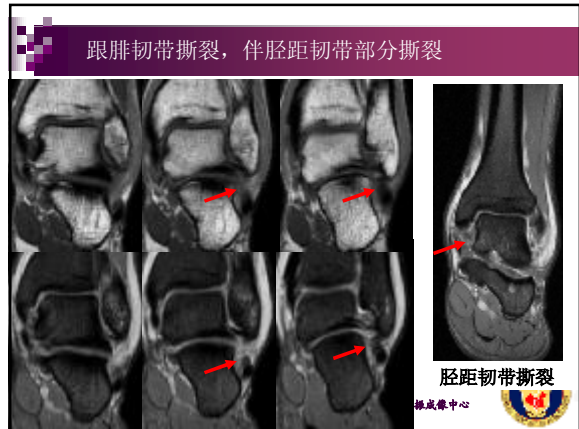
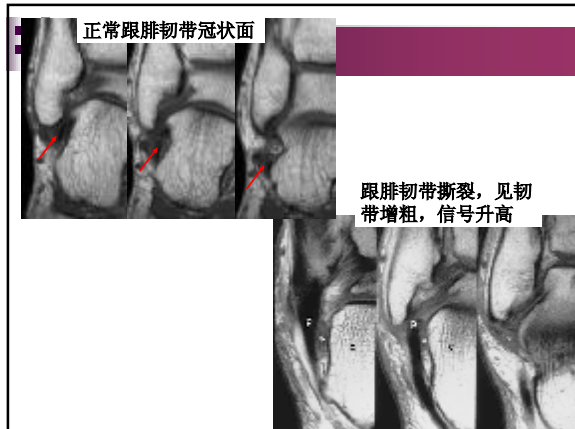
### 距腓后韧带部分撕裂



The MRI scans show a hyperintense signal in the posterior talofibular ligament, indicated by red arrows, consistent with a partial tear.


**距腓后韧带部分撕裂**

解放军总医院磁共振成像中心



## 踝关节的MR成像


- 踝关节骨折
- 踝关节软骨损伤
- 踝关节肌腱损伤
- 踝关节韧带损伤
- 踝关节其他病变



解放军总医院磁共振成像中心

## 三角骨综合征 *Os Trigonum Syndrome*

- n 三角骨类似于次级骨化中心，为距骨软骨向后扩展形成
- n 三角骨通过软骨结合与距骨相连
- n 常在骨化形成Stieda突一年内在与距骨融合
- n 7%~14%的病人仍残留有分离的小骨。且多为双侧。成人未融合的骨化中心难以与陈旧性骨折区分



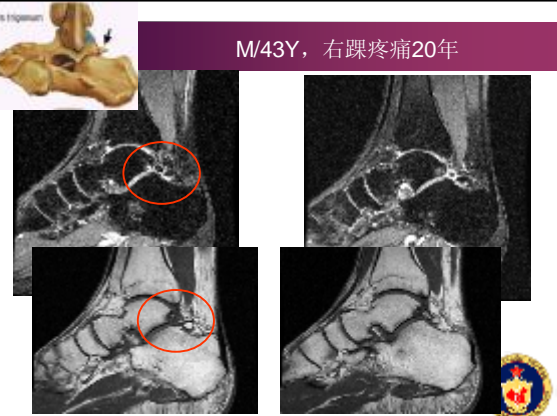
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## 三角骨综合征 *Os Trigonum Syndrome*

- n 三角骨综合征是急性创伤或者使用过度所致
- n 这一综合征包括距骨突骨折、拇长屈肌腱炎和距后撞击
- n 临床上诊断三角骨综合征比较困难，影像学依据至关重要，轴位和矢状位显示清楚
- n 早期治疗可采取制动4~6周，保守治疗效果不理想时，可考虑三角骨切除术，这对于大多数病人来说治疗效果良好。如果合并拇长屈肌腱炎，也可以行肌腱松解术

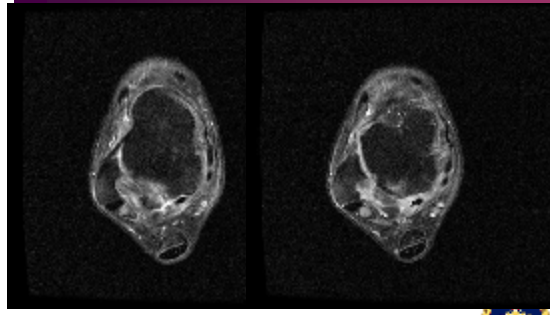
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## M/43Y, 右踝疼痛20年



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## M/43Y, 右踝疼痛20年

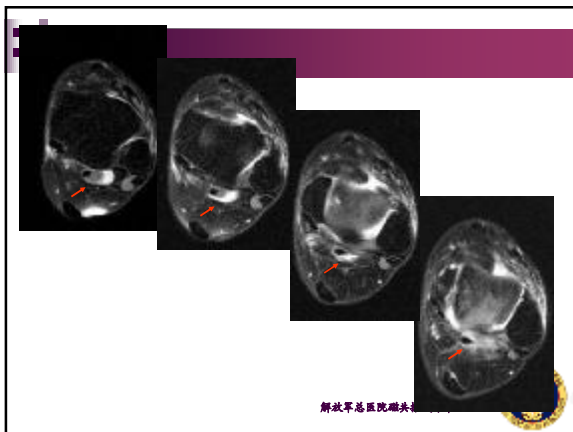
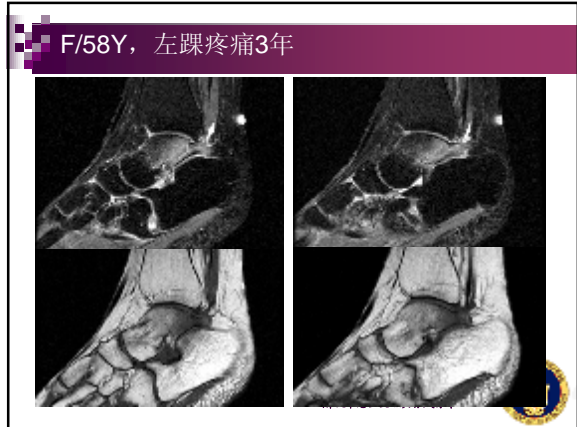
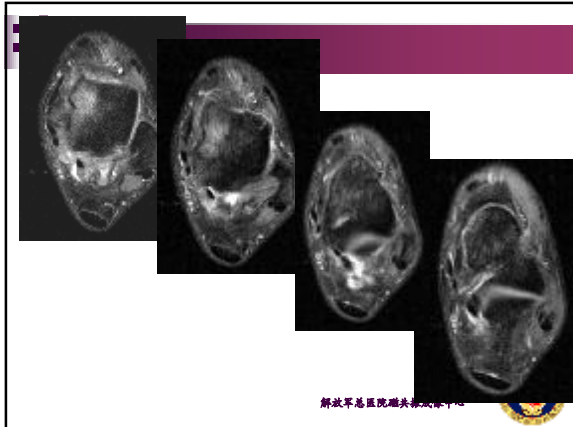


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## M/26Y, 左踝关节疼痛1年



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### plantar fascia 足底腱膜

- n 足底腱膜是一个多层的纤维腱膜，由内层、中间层、外层构成
- n 足底腱膜通常指较大的中间层，起自跟骨内侧结节然后向前延伸，附着于趾短屈肌腱的下方
- n 足底腱膜于中足底分为五束，分别附着于五趾的远节趾骨
- n 足底腱膜在MR上表现为2-4mm带状结构，在所有的序列上为低信号
- n 足底腱膜炎是导致足底疼痛的最常见原因

FDB = flexor digitorum brevis, (*fdb*)  
 FDL = flexor digitorum longus,  
 FHL = flexor hallucis longus, (*fhl*)  
 Abductor hallucis (*ah*)  
 abductor digiti minimi (*adm*)  
 quadratus plantae muscle (*qp*)

### plantar fasciitis 足底腱膜炎

n MR表现

- .. 腱膜增厚呈梭状，通常累及近侧部分并延伸至足跟附着处
- .. 近侧足底腱膜信号增高

**plantar fasciitis 足底腱膜炎**

- 其他MR征象还包括邻近脂肪垫、软组织的水肿，以及跟骨内侧结节的局限性水肿
- STIR序列能较好显示病变

**F/34 Y, 长跑运动员, 足底腱膜炎**

**M/32Y, 长跑运动员, 足底腱膜炎**

**F/49Y, 足底腱膜炎**

**踝关节的MR成像小结**

- 踝关节骨创伤—疲劳骨折、骨挫伤
- 踝关节软骨损伤—分四级
- 踝关节肌腱损伤—跟腱损伤
- 踝关节韧带损伤—外侧韧带损伤
- 踝关节其他病变—三角骨综合征、足底腱膜炎

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