# Talus Fracture

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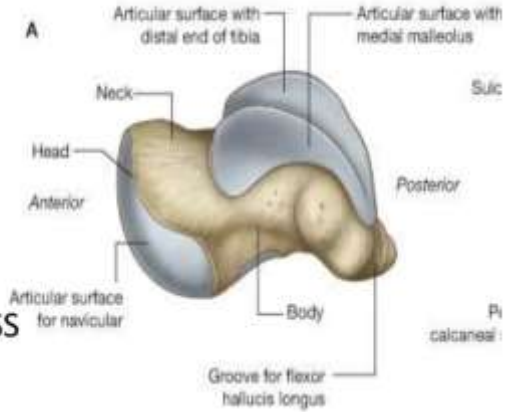
# ANATOMY

- Second largest tarsal bone.
- Ossification – from one centre which appear in 6th month of intrauterine life
- 60 % is covered with articular cartilage

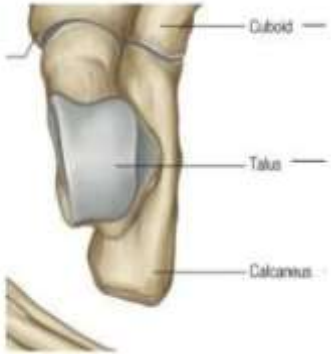
- PARTS OF TALUS

1. HEAD
2. NECK
3. BODY
4. LATERAL PROCESS
5. POSTERIOR PROCESS




**BODY OF TALUS**

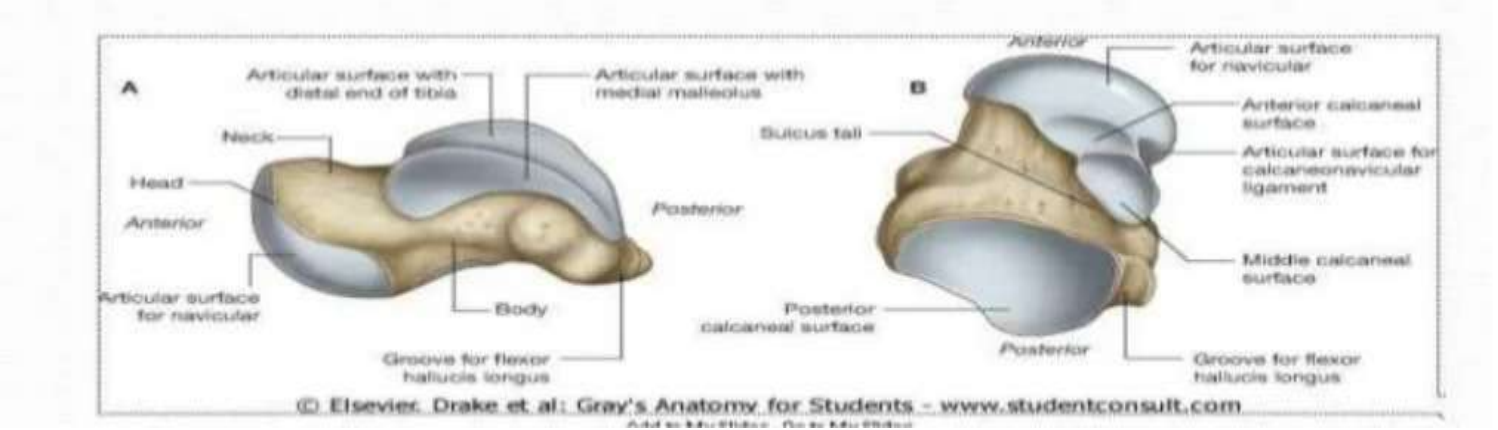
- 5 surfaces:-
- 1. superior surface
- 2. Inferior surface
- 3.medial surface
- 4. lateral surface
- 5.posterior surface



- **NECK OF TALUS**
- Constricted potion of bone between the body and the oval head .
- Directed forward , medial word , downward
- Angle of medial deviation is 15 to 20 degree in adults
- Plantar deviation is 24 degree approx
- Neck body angle is 150 degree in adults
- Relatively thin diameter makes it weaker area and hence more vulnerable to fractures

# HEAD OF TALUS

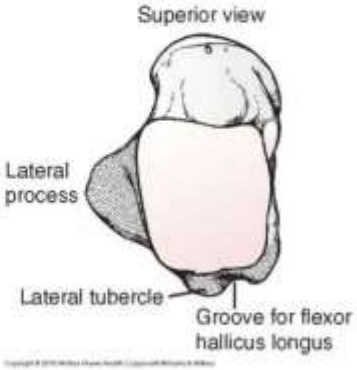
- Anterior articular surface is large , oval and convex articulating with navicular bone
- Inferior surface have two facets medial and lateral for articulation with calcaneum



- **TARSAL CANAL**

- Formed of sulcus of inferior surface of talus and superior sulcus of calcaneum
- **Contents-** artery of tarsal canal and talocalcaneal interosseous ligament


- Posterior process has a medial and lateral tubercle separated by a groove for the flexor hallucis longus tendon



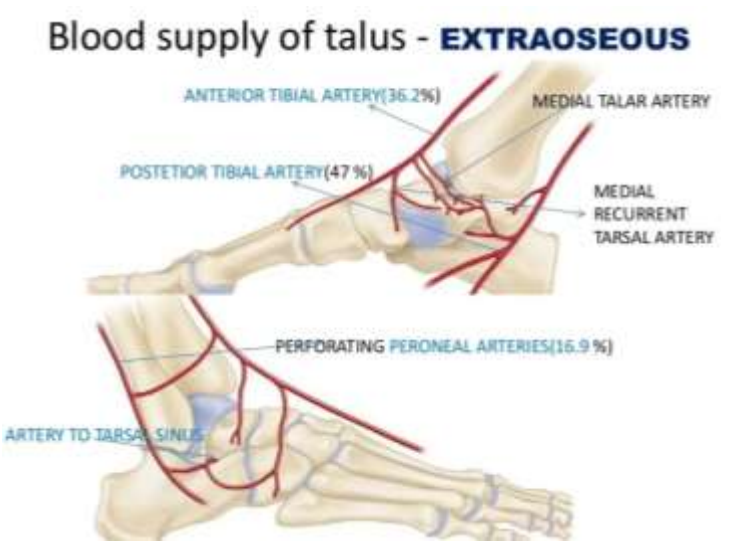
- Talus Articulates with 4 bones
- 1.Tibia
- 2. Fibula
- 3. Calcaneus
- 4. Navicular


- ATTACHMENT
- **Lateral side**
  - ➢ Anterior talo fibular ligament

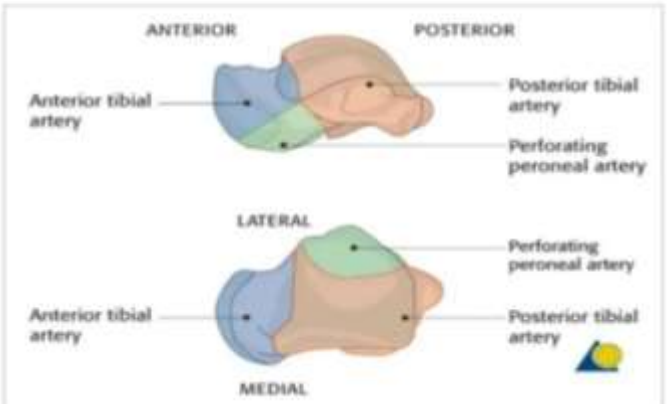

- ATTACHMENTS
- **NO MUSCLE ATTACHMENTS**

- Medial side
  - ➢ Anterior Tibio talar ligament
  - ➢ Posterior tibio talar ligament

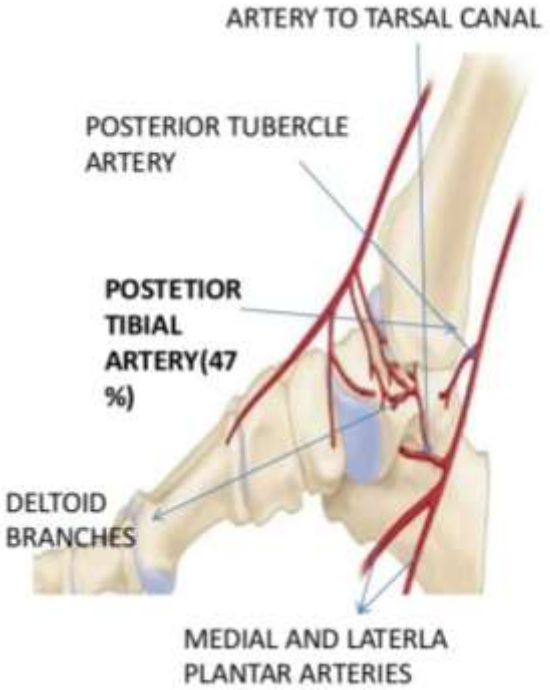
- **Posteriorly**
- Posterior talo fibular ligament




## Sectors of Blood supply of talus




- Extraoseous arteries include Anterior Tibial or Dorsalis Pedis Artery which is Smaller Terminal branch of Popliteal artery.
- Posterior tibial artery which is larger Terminal branch of Popliteal artery.
- Perforating Peroneal artery branch of Posterior Tibial Artery
- These arteries anastomose to form Sling around the talus which is source of Interosseous blood supply of talus.

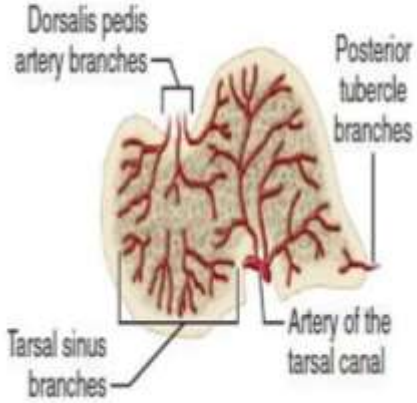



- Posterior tubercle is directly supplied by Posterior Tubercle Artery.
- Artery of tarsal canal which branches around 1cm proximal to Medial and Lateral Plantar arteries is the major Supplier of Head Body of Talus.
- Deltoid artery which is branch of artery of Tarsal Canal directly supply blood to medial half of Talar Body.
- Sinus Tarsi Artery formed by anastomosis between branches of posterior tibial artery and perforating Peroneal arteries in the tarsal canal – it supplies lateral $1/8^{th}$ of tarsal Body.

# Blood supply of talus- INTERAOSSEOUS

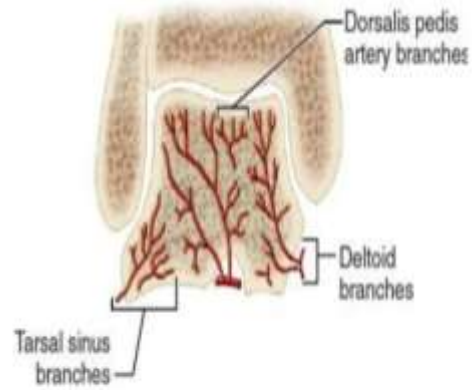
- HEAD IS SUPPLIED FROM TWO SOURCES ....MEDIAL SUPERIOR HALF IS SUPPLIED BY DORSALIS PEDIS ARTERY BRANCHES.....INFERIOR HALF IS SUPPLIED DIRECTLY FROM ARTERY OF TARSAL SINUS

- BODY OF TALUS IS SUPPLIED BY ANASTOMOTIC ARTERY OF TARSAL CANAL....




MIDDLE ONE THIRD OF TALUS CORONAL SECTION

- THE DELTOID BRANCHES WHICH SUPPLIES THE BODY ON ITS MEDIAL SURFACE ,,,IT SUPPLIES MEDIAL ONE THIRD OF BODY OF TALUS




MIDDLE ONE THIRD OF TALUS SAGITAL SECTION

# Talus Fracture

INCIDENCE :

- 0.1 to 0.85 % of all fractures.
- 5 to 7 % of foot fractures.

## ANATOMICAL CLASSIFICATION OF TALUS FRACTURE :-

- 1. Talar neck fracture
- 2. Talar body fracture
- 3. Talar head fracture
- 4. Lateral process fracture
- 5. Posterior process fracture

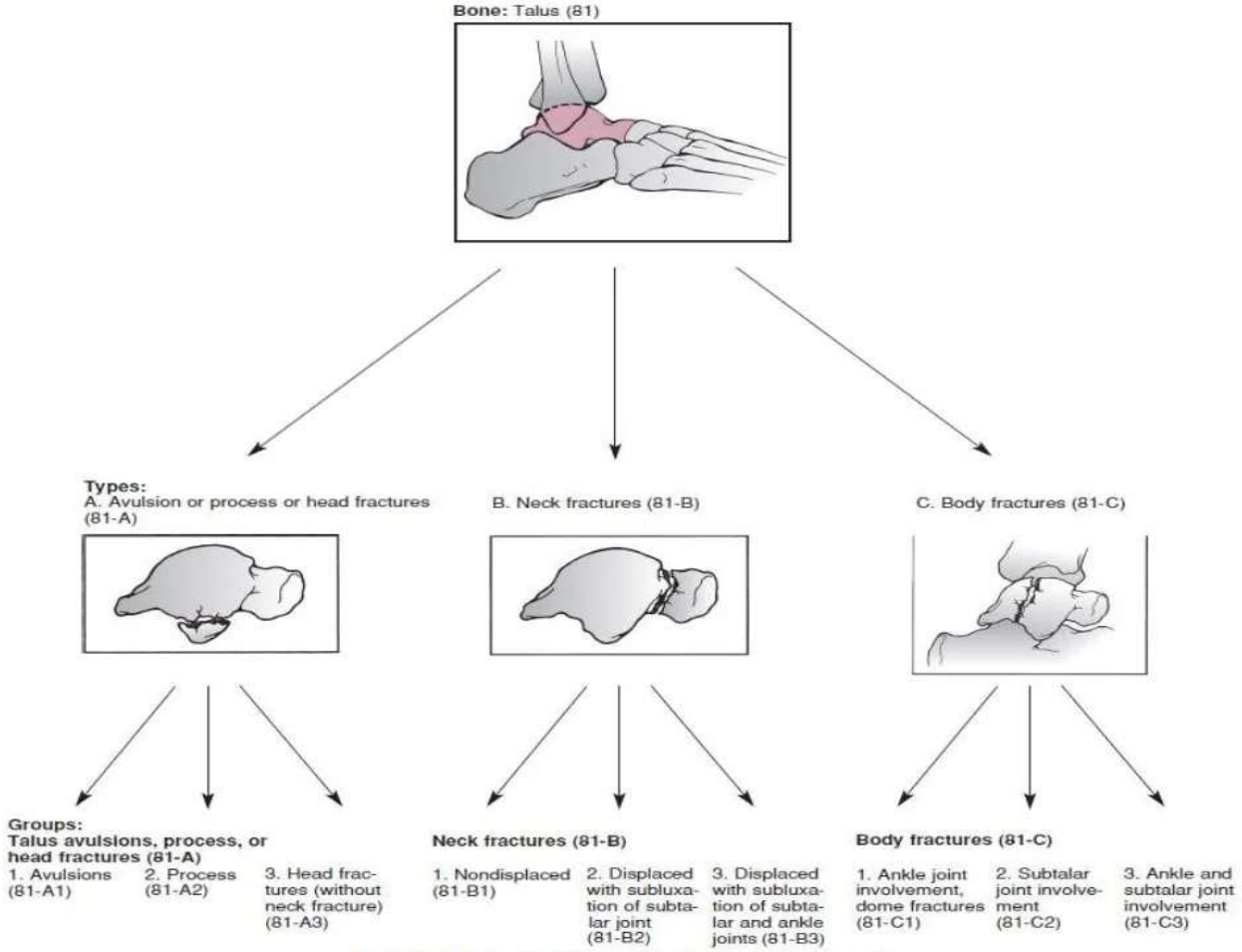



FIGURE 60-8 The AO/OTA classification of talus fractures.[150]

# CLINICAL PRESENTATION

- Talus fractures frequently occur in **a young, active, and mobile population**
- History of **high velocity** injury present

- **Clinically :-**

✓ Intense pain , unable to move ankle,

✓ Gross edema and echymosis usually present

✓ When there is subluxation or dislocation the normal contours of ankle and hind foot are distorted

✓ Open injury may occur if there is significant distortment

# Diagnosis

- **RADIOGRAPHIC EVALUATION**
- **XRAYS**

➢ ANTEROPOSTERIOR VIEWS

➢ ANKLE MORTISE VIEW

➢ LATERAL VIEW

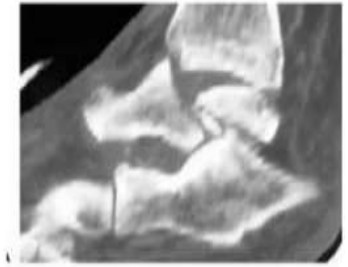
➢ CANALE VIEW

- **CANALE AND KELLY VIEW**
  - ➢ view of the talar neck achieved by internal rotation of the foot by placing the foot plantigrade on an x-ray film and angling the beam at 75 degrees to the perpendicular
  - ➢ Gives best view of talus neck
  - ➢ Useful intraoperatively to check alignment of neck and to confirm that varus misalignment has been avoided


FIGURE 88-31 Canale view of talar neck (see text).

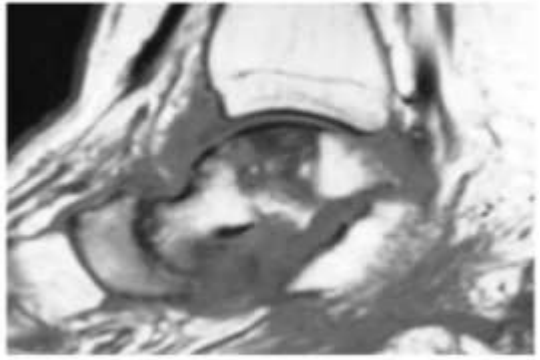
- **CT SCAN**

➢ give excellent visualization of the congruity of the subtalar joint and provide superior details of fracture.



➢ small but significant fractures of the inferior aspect of the talus, are better appreciated on CT scans compared to plain xray films alone.

- **MRI SCAN**
- demonstrates osteonecrosis most effectively.



- Use of titanium screws have been preffered if AVN of bone is suspected

# FRACTURE NECK OF TALUS

- Constitue **30 %** of talus fractures.

- **MECHANISM OF INJURY**
- Forced hyperdorsiflexion of the ankle and impingement of the talar neck on the distal anterior tibia .

- Axial load to plantar foot causes talar neck fracture

# HAWKIN CLASSIFICATION OF TALAR NECK FRACTURE

- Hawkins 1970 - talar neck fractures into three type
- Canale and Kelly added type IV
- Based on displacement of body of talus.
- Useful to perdict long term outcome and development of avn of talar body

## HAWKINS TYPE 1

- Undisplaced fracture of talar neck.

- Here medial blood supply is still assured

## HAWKINS TYPE 2

- Displaced fracture of the talar neck with subtalar dislocation or subluxation.

- The medial blood supply may be preserved.

## HAWKINS TYPE 3

- Displaced fracture of the talar neck with dislocation or subluxation of the talar body from both the tibiotalar and subtalar joints.
- All medial blood supply to the body is disrupted

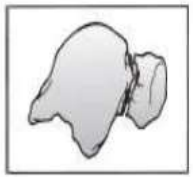
## HAWKINS TYPE 4

- Displaced fracture of the talar neck with dislocation or subluxation of the talonavicular , tibiotalar , and subtalar joints.
- Worst prognosis because of avn of the body and often of the head fragment

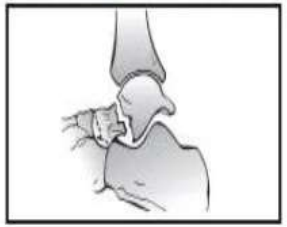
# AO CLASSIFICATION

Groups:
Neck fractures (81-B)
1. Nondisplaced (81-B1)

B



2. Displaced with subluxation of subtalar joint (81-B2)
   1. Noncomminuted (81-B2.1)

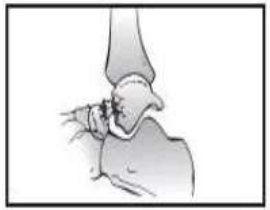


   2. Comminuted (81-B2.2)

   3. Involves talar head (81-B2.3)

3. Displaced with subluxation of subtalar and ankle joints (81-B3)
   1. Noncomminuted (81-B3.1)

   2. Comminuted (81-B3.2)



   3. Involves talar head (81-B3.3)

Groups:

# TREATMENT

- Goals of treatment:

1. Early anatomic reduction of the neck fracture
2. Reduction of dislocated joints
3. Stable fixation
4. Avoidance of complications

# Treatment

- **Hawkins type 1 fracture**
- Nonoperative Management

- Considered for fractures in which there is no displacement of the fracture line and no incongruity of the subtalar joint.

- SHOULD BE CONFIRMED WITH CT SCAN IF DOUBTFULL

# Non operative management

- Treated with below knee non weight bearing cast with ankle in slight equinus for 1 month

- Cast should be removed and short leg walking cast is applied for 2 more months until Clinical and x-ray signs of healing appears.

- Once secure union is achieved active range of motion and progressive weight bearing as tolerated is started

- OPERATIVE HAWKINS TYPE 1

Percutaneous screw fixation

- **HAWKINS TYPE 2**

- **NON OPERATIVE**

➢ Achieving closed reduction is very difficult.

➢ Should be only attempted if surgery is delayed.

CLOSED REDUCTION OF HAWKINS TYPE 2

## HAWKINS TYPE 2 CLOSED REDUCTION

- firstly, adequate analgesia and sedation
- technique involves bringing the foot, including the talar head, to the residual talar body fragment
- requires the talar body to be reduced within the ankle mortise
- the knee is flexed and the foot is flexed plantar ward. This relaxes the gastrocsoleus complex and brings the talar head fragment into proper relation to the body
- At that point, any varus or valgus malalignment can be corrected as well
- reduction is achieved, excessive dorsiflexion will cause a redisplacement of the head fragment, and therefore radiographs to confirm reduction should be performed with the foot in a comfortable position of equinus

## SURGICAL APPROACHES

- Anterolateral approach → Anterolateral approach is usuallyy applied for treatment of talus fracture
- Anteromedial approach → Anteromedial approach is used along with anterolateral approach in order to expose talar neck
- Anteromedial approach combined with medial malleolar osteotomy → Anteromedial approach combined with medial malleolar osteotomy helps the better exposure of talar body.

- **HAWKINS TYPE 3 AND 4**

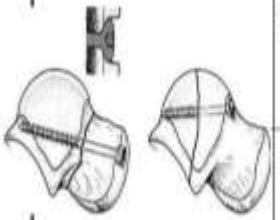
- Most authors agree that group III and IV cannot be reduced and held by closed attempts

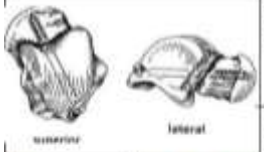
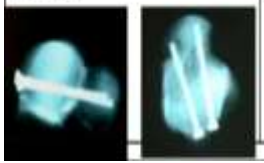
- Almost all require **surgical stabilization.**

  - **SCREW FIXATION**
    - ANTERIOR TO POSTEROR
    - POSTERIOR TO ANTERIOR
  - **DIRECT PLATE FIXATION**

- Most patients require additional surgery for relief of complications resulting from the initial injury

## Screw fixation

| | Advantages | Disadvantages |
|---|---|---|
| **Anterior-to-posterior screw fixation1** | 1. Direct visualization of fracture reduction | 1.Difficult to insert perpendicular to fracture line |
|  | 2. Avoidance of articular cartilage damage | 2.Less strong compared to posterior-to-anterior screws and plate fixation |
| | 3. Use of compression screws where indicated | 3.Inappropriate use of compression may cause malalignment , especially varus |

| | Advantages | Disadvantages |
|---|---|---|
| **Posterior-to-anterior screw fixation** | Stronger fixation compared with anterior screw fixation | Indirect visualization of reduction; may require change in positioning |
|   | Easily inserted perpendicular to fracture line | Some cartilage damage to posterior talus. |
|  | May cause less soft tissue disruption | Risk of iatrogenic nerve damage |

## Plate fixation

| | Advantages | Disadvantages |
|---|---|---|
| Direct plate fixation | 1. Strong fixation | 1. Extensive soft tissue dissection |
|  | 2. Useful to buttress comminuted columns | 2. Risk of hardware prominence |

- **External Fixation**

  Limited roles:

- Multiply injured patient with talar neck fracture in whom definitive surgery will be delayed.
- Temporary measure to stabilize reduced joints

# Complications

**TABLE 60-5 Talus Neck and Body Fractures**

**Common Adverse Outcomes and Complications**

Stiffness

Infection:
- Early infection
- Delayed infection (may have avascular talar body sequestrum)

Osteonecrosis:
- Partial
- Complete

Delayed Union or Nonunion

Malunion
- Dorsal beak
- Varus
- Supination deformity

Posttraumatic Arthritis
- Tibiotalar joint
- Subtalar joint

# AVN OF TALUS

- Most common complication of talar neck fracture.
- Extent of involvement of talar body by osteonecrosis is directly related to degree of vascular disruption

## HAWKIN'S SIGN

- Osteonecrosis is identified based on AP radiograph between 6 and 8 weeks
- Subchondral lucency is indicative of relative osteopenia secondary to bony resorption and an intact blood supply
- Progresses from medial to lateral due to vascular re-establishing from medial side of dome through deltoid ligament
- Indicative of diffuse osteopenia with vascular congestion suggests continuity of blood supply

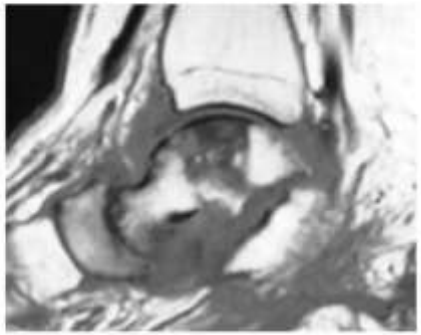
# AVN: Incidence after Talus Fracture

HAWKINS

- I: 15 %
- II: 50 %
- III: 85 %
- IV: 100 %

# AVN: Diagnosis

- Technetium bone scan and MRI are used to evaluate osteonecrosis and also condition of articular cartilage in MRI



Osteonecrosis of talar body after 6 months of fracture

# Treatment

- Precollapse:
  - Modified Weight Bearing
  - Patela tendon brace cast

  Compliance difficult

  Efficacy unknown
- Postcollapse:
  - Observation
  - Arthrodesis if symptomatic

# Malunion

- Mal-union and shortening of talar neck secondary to comminution of dorsal medial bone is common

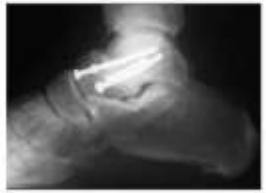



FIGURE 60-29 Reconstruction of talar neck malunion. **A:** Preoperative clinical photograph demonstrates varus deformity. **B, C:** Postoperative clinical photographs following tendo Achillis lengthening and a calcaneal osteotomy demonstrate restoration of neutral alignment.

# TALAR BODY FRACTURE

- **DEFINITION**-fractures of the talar body are intra-articular injuries in which the articular surfaces of the tibiotalar and the subtalar joints are involved.

- **RADIOGRAPHIC –LATERAL XRAY VIEWS**

✓ fractures extending into or posterior to the lateral process of the talus are defined as talar body fractures

✓ whereas fractures anterior to the lateral process are defined as talar neck fractures.

- **MECHANISM OF INJURY**

- AXIAL COMPRESSION OF THE TALUS BETWEEN TIBIAL PLAFOND AND THE CALCANEUS

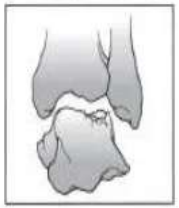
- USUALLY SEEN IN MOTOR VEHICLE ACCIDENTS AND FALLS FROM HEIGHT

# AO CLASSIFICATION

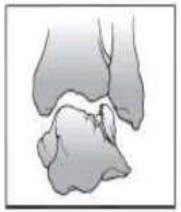
**Groups:**
**Body fractures (81-C)**

1. Ankle joint involvement, dome fractures (81-C1)
   1. Noncomminuted (81-C1.1)

C



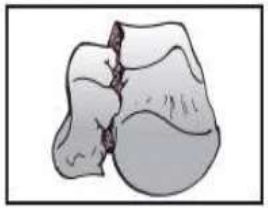
2. Comminuted (81-C1.2)



2. Subtalar joint involvement (81-C2)
   1. Noncomminuted (81-C2.1)

2. Comminuted (81-C2.2)

3. Ankle and subtalar joint involvement (81-C3)
   1. Noncomminuted (81-C3.1)



2. Comminuted (81-C3.2)

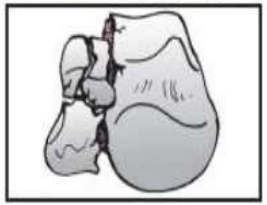


FIGURE 60-8 (*continued*)

- **MULLER AO/OTA CLASSIFICATION**
- fracture are grouped according to increasing severity with increasing treatment difficulty and worst prognosis

- C1- osteochondral injuries with ankle joint involvement

- C2 SUBTALAR JOINT INVOLVEMENT

- C3- ankle and subtalar joint involvement

# TREATMENT

- OPERATIVE
- SURGICAL APPROACH – ANTEROMEDIAL APPROACH WITH MEDIAL MALLEOLUS OSTEOTOMY

- **SURGICAL ORIF-** As surface for fixation is always articular, fixation is done by headless compression screw or bioabsorbable pins

# COMMINUTED FRACTURES OF BODY

- Difficult to treat
- Accurate replacement of fragments is near impossible
- Long term results- bad

- **IN SUCH CASES TALECTOMY ALONG WITH CALCANEOTIBIAL FUSION IS PREFFERRED.**
- ✓ **GIVES PATIENT PAINLESS AND STABLE WALKING FOOT**

# TibioCalcaneal Fusion


FIGURE 89.53 **A,** Four years after tibiocalcaneal fusion by compression arthrodesis and autogenous iliac bone grafting. **B,** Sixteen years after fusion, degenerative changes at midtarsal joints are present but patient is active with mild symptoms.

- **PROBLEMS FACED WITH TALOCALCANEAL FUSION**

➢ **DECREASE IN HEIGHT AND THE RIGIDITY OF ANKLE JOINT**

➢ **BLAIR SUGGESTED ALTERNATIVE PROCEDURE-**

➢ **TIBIOTALAR ARTHRODESIS**

- **TIBIOTALAR ARTHRODESIS**

- PROCEDURE-sliding graft from anterior surface of tibia is inserted into the remnant of head and neck of the talus in an attempt to obtain fusion around the area

- **ADVANTAGES OF TIBIO TALAR ARTHRODESIS OVER CALACANEOTIBIAL FUSION**

- Position of foot is unchanged

- Weight bearing thrust is placed on more or less normal undisturbed joint tissue.
- No shortening

- After surgery- still slight flexion and extention of the foot on leg , the two subtalar facets and talonavicular joint is possible.

# BLAIR FUSION/ TIBIO TALAR ARTHRODESIS

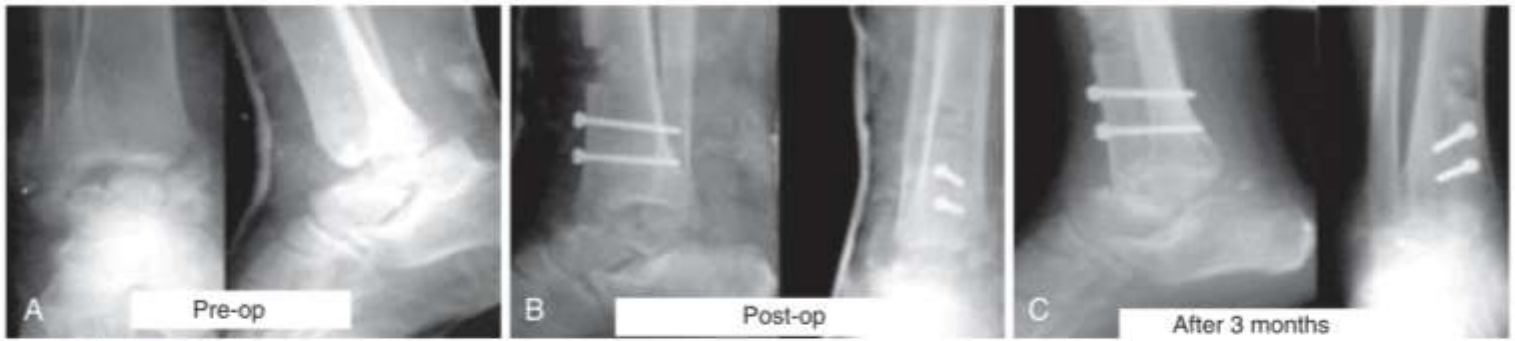



**FIGURE 89.54** Results of Blair fusion. **A,** Type III fracture-dislocation of talus. **B,** Immediately after Blair fusion. **C,** Fusion at 3 months.
(From Shrivastava MP, Shah RK, Singh RP: Treatment of fracture dislocation of talus by primary tibiotalar arthrodesis [Blair fusion], *Injury* 36:823, 2005.)

# Talus head fracture

- **Incidence**- 5 to 10 % of talar injuries

- **Mechanism of injury-**
  - axially directed loading and compression of talar head
  - Dorsal compression fracture of anterior tibial plafond

- injuries to calcaneocuboid and subtalar joint are common with these injuries

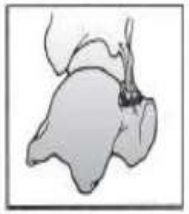
# AO CLASSIFICATION

**Groups:**
**Talus avulsions, process, or head fractures (81-A)**

1. Avulsions (81-A1)

1. Anterior (81-A1.1)

A

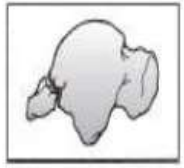


2. Other (81-A1.2)

2. Process (81-A2)

1. Lateral (81-A2.1)

2. Posterior (81-A2.2)



3. Head fractures (without neck fracture) (81-A3)

1. Noncomminuted (81-A3.1)

2. Comminuted (81-A3.2)

# TREATMENT

- PRINCIPLES

- Maintainance of alignment of dorsomedial arch of foot.
- Prevention of talonavicular joint incongruity and instability
- Reduction of displaced talar head fragment

- Fracture without displacement

➢ Well molded short leg cast for 6 weeks

➢ Weight bearing is started at 6 weeks

- Displaced fractures and those associated with joint subluxation or dislocation

➢ ORIF

➢ Small comminuted segments can be excised

➢ Larger fragments are reduced with screws ranging from 2.0 to 3.5 mm

# COMPLICATIONS AND PROGNOSIS

- **TALONAVICULAR ARTHRITIS IN DISPLACED FRACTURE**
  - Conservatively managed with longitudianal arch support shoe
  - If conservative fails then talonavicular arthrodesis releives symptoms

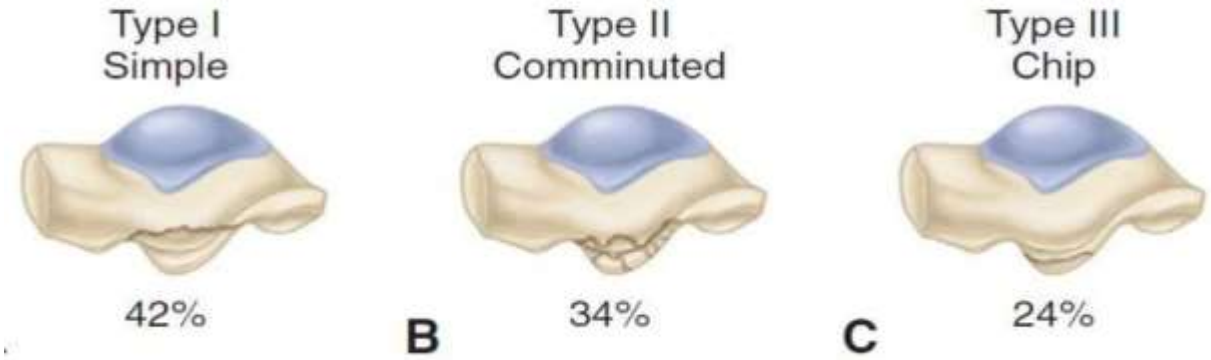
- **NONUNION- UNCOMMON**
- **MALUINION - TALONAVICULAR JOINT SUBLUXATION**

# FRACTURE OF LATERAL PROCESS OF TALUS

- RADIOGRAPHIC XRAYS
- VON KNOCH ET AL described v sign
- V SiGN- it is the contour of lateral process over lateral view xrays
- V sign positive- any disruption in contour of V indicating fracture lateral processs

# FRACTURE OF LATERAL PROCESS OF TALUS

- Hawkins classification



# treatment

- **Type I fractures** can be treated in a non weight-bearing cast for 6 weeks, unless they are displaced or involve a significant portion of the talar side of the posterior facet, in which case they should be treated by ORIF.
- **Type II fractures** benefit from débridement of frature fragments
- **Type III fractures-** treated conservatively with cast application
- **If non union occurs the debridement of fragments is advised**

# POSTERIOR PROCESS FRACTURES

- These include the medial and lateral tubercle fractures
- Fracture occurs in a severe ankle inversion injury where posterior talofibular ligament avulses the lateral tubercle
- Undisplaced fracture treated with a short leg cast for 4 weeks
- Displaced fracture treated with primary excision of small fragments or ORIF when entire posterior process is fractured

## TABLE 60-4 Talus Fractures: Potential Pitfalls and Preventions

| Pitfalls | Preventions |
|---|---|
| Difficult reduction of the dislocated talus | Joint distractor(s)<br>Schanz pin<br>Malleolar osteotomy |
| Fracture misalignment | Dual approaches<br>Intraoperative fluoroscopic views |
| Bone defects | Excise small fragments and graft as necessary |
| Impinging hardware | Countersink articular screws<br>Careful plate application<br>Range joints prior to closure |
| Determining weight-bearing status | Restrict until union |

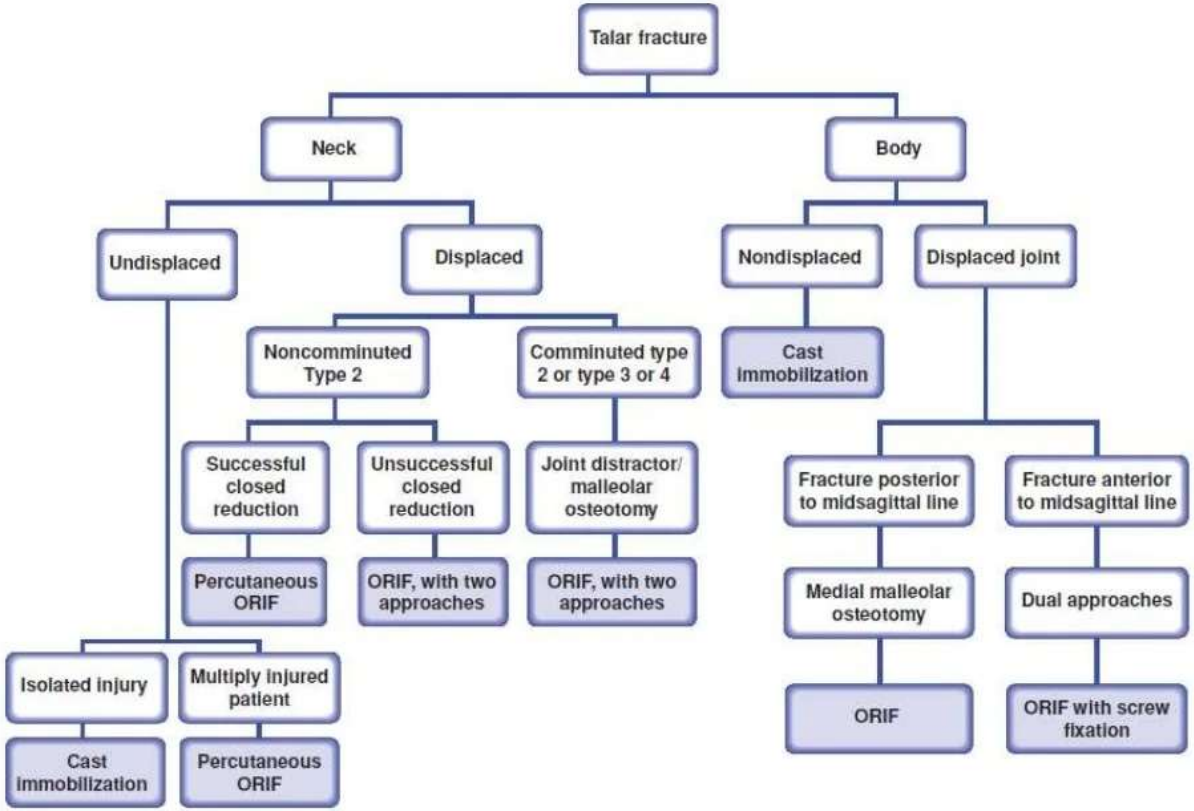



FIGURE 60-31 Author's preferred treatment algorithm for talar neck and body fractures.