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“Difficult Fractures around the World“

Treatment of Fracture Dislocation of Talus by Primary Tibiotalar Arthrodesis (Blair Fusion)

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Learning outcomes

• Introduction

• Describe the anatomy and different types of blood supply

• Discuss the mechanism of injury

• Discuss the Hawkins classification

• Discuss the surgical procedure of Blair fusion, clinical and functional results

• Conclusion
Introduction

• The fractures of the talus are relatively uncommon injuries

• The fractures of the talus rank second in frequency of all tarsal bone injuries (after calcaneal fractures)

• The fractures can be associated with significant complications
Types of Fractures

• The classification of these fractures is based on their anatomic location within the talus
  – Head
  – Body
  – Neck
• Each type has unique features that affect both diagnosis and treatment.
Anatomy

- Surface 60% cartilage
- No muscular or tendinous insertions
- Supported solely by the joint capsules, ligaments, and synovial tissues
Vascular Supply

Talus supplied by 3 main arterial branches
  – Dorsalis Pedis
  – Arteries of tarsal sinus and canal
  – Deltoid artery

Mulfinger et al., *JBJS Am*, 1970, 160-167
Imaging

• AP, lat, obliques of foot and ankle

• Canale view

Canale and Kelly, *JBJS Am*; 1978, 143-156
Incidence

- 2% of all fractures
- 6-8% of foot fractures
- High complication rates
  - avascular necrosis
  - post-traumatic arthritis
  - malunion
Mechanism of Injury

- Hyperdorsiflexion of the foot on the leg

- Neck of talus impinges against anterior distal tibia, causing neck fracture

- If force continues:
  - talar body dislocates posteromedial
  - often around deltoid ligament
Injury Mechanism

• Previously called “aviator’s astragalus” as reported by Anderson in 1919

• Usually due to motor vehicle accident or falls from height

• Approximately 50 % of patients have multiple traumatic injuries
Hawkins Classification (1970)

- Reviewed 58 cases of # of talar neck and classified into 3 types, later modified by Canale and Kelly

**Group I**
- Nondisplaced vertical fracture of the talar neck

**Group II**
- Displaced fracture of the talar neck with subluxation or dislocation of the subtalar joint

**Group III**
- Displaced fracture of the talar neck with dislocation of the body of the talus from both the subtalar and tibiotalar joints

Canale’s Modification

Type IV

– Hawkins III with subluxation or dislocation of talar head

Canale, *JBJS Am*; 1978, 143-156
Hawkins I

Blood supply to the talus.
Hawkins II

Anteroposterior view

- Dorsalis pedis artery
- Posterior tarsal artery
- Perforating peroneal artery
- Anterior lateral malleolar artery
- Artery of tarsal sinus
- Lateral tarsal artery

Inferosuperior view

- Artery of tarsal sinus
- Deltoid artery
- Artery of tarsal canal
- Medial tarsal artery
- Posterior tibial artery

Blood supply to the talus.
Hawkins III
Type IV

Canale, JBJS Am; 1978, 143-156
Aims and Objectives

To report the end results of primary Blair fusion of lately presented Hawkins’ grade III fractures of the neck of the talus with long term (2 years) follow-up in fourteen cases.
**Methodology**

<table>
<thead>
<tr>
<th>Type of Study</th>
<th>Prospective study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place</td>
<td>Nepal Medical College Teaching Hospital</td>
</tr>
<tr>
<td>Total No. of cases</td>
<td>14 (Jan. 2000- Dec. 2008)</td>
</tr>
<tr>
<td>Age at operation</td>
<td>27 yrs (Avg.)</td>
</tr>
<tr>
<td>Sex</td>
<td>All male patients</td>
</tr>
<tr>
<td>Mode of injury</td>
<td>RTA – 8</td>
</tr>
<tr>
<td></td>
<td>Fall from tree – 3</td>
</tr>
<tr>
<td></td>
<td>Fall from height – 3</td>
</tr>
<tr>
<td>Type of fracture</td>
<td>All Hawkins’ grade III fractures of neck of the talus</td>
</tr>
<tr>
<td>Follow-up period</td>
<td>2 years on average</td>
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</tbody>
</table>
Materials and Methods

The Study included total of 14 patients

• All the patients presented to us quite late (avg. 2 weeks)

• AP and lateral views and oblique x-rays done

• All the patients had sustained type III fractures of the neck of the talus.

• No open fracture
Sex

0%

100%

Male
Female
Joint involved

- Right ankle : 8
- Left ankle   : 6
Mode of injury

- RTA : 8
- Fall from tree : 3
- Fall from height : 3
Blair Fusion

In 1943, Blair described a technique of ankle fusion to treat **osteonecrosis** of the talus

• Excision of the avascular talar body

• Placement of the sliding corticocancellous graft from anterior distal tibia

• Into the residual, viable head and neck of the talus and secured with two cortical screws

• Morris et al in 1971 modified the procedure slightly
Operative procedure

Fig 1A: Approach to the ankle
Fig. 1-B: Excision of the body of the talus

1-C: The sliding bone graft
Fig. 1- D : The graft in its final position
Primary Blair fusion was done in all the patients with type III fracture of the neck of the talus with late presentation (2 weeks average)

• Considering the difficulties of ORIF in severely displaced fractures with late presentation

• Complications of late surgical procedures

• Considering the poor economical status of the patients (to avoid more surgery)
Results

• All the fourteen patients were followed and evaluated after surgery

• Mean age of the patients was 27 years.

• Roughly 4 months required for bony union

• Clinical and functional results were evaluated
Clinical results

• Result was graded with Denis et al criteria of 2 years follow up.
• Radiological bony fusion was obtained in thirteen patients in 12-14 weeks of time with one pseudoarthrodesis which healed after 10 months.

<table>
<thead>
<tr>
<th>Our result</th>
<th>Criteria - Denis et al</th>
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</thead>
<tbody>
<tr>
<td>Good</td>
<td>Asymptomatic, was able to carry out full activities.</td>
</tr>
<tr>
<td>Fair</td>
<td>Occasional discomfort or restriction of activity.</td>
</tr>
<tr>
<td>Poor</td>
<td>Pain causing restriction or requiring analgesics.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Denis’ result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
</tr>
<tr>
<td>Fair</td>
</tr>
<tr>
<td>Poor</td>
</tr>
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</table>

Functional results:

- 20 degrees of tibiopedal motion is necessary for normal gait
- Functional results **correlated more clearly** with tibiopedal motion than anatomical restoration.
- **Tibiopedal motion** is arc of motion between maximum dorsiflexion and maximum plantar flexion, the angle being those subtended by the long axis of the tibia and of the foot in the lateral projection.

<table>
<thead>
<tr>
<th>Tibiopedal motion</th>
<th>Range</th>
<th>Result</th>
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<tbody>
<tr>
<td>Good</td>
<td>16- 20 degrees</td>
<td>10</td>
</tr>
<tr>
<td>Fair</td>
<td>11- 15 degrees</td>
<td>3</td>
</tr>
<tr>
<td>Poor</td>
<td>&lt; 10 degrees</td>
<td>1</td>
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Waugh  T. Joe King Visiting Lectureship, Baylor College of Medicine, Houston, Texas, Dec. 1977.
Grade III - fracture of the neck of the talus

Case - 1
Immediately after Blair fusion
3 months – after Blair fusion
Morris modification of Blair procedure
Discussion

• There has been very little mention in the literature of Blair fusion as a treatment of fractures of AVN of talus.

• In 1971, Morris et al reported on 10 cases, with excellent results in seven, and good results in three.

• In 1980, David Dennis et al reported on seven patients with good results in five patients, fair in one and poor in one.
So far very few results have been published specially about primary Blair fusion for grade III fracture of the neck of the talus.

In 2010, A. Bhattacharya et al reported primary modified Blair Arthrodesis for type III fractures of the neck of the talus with good results in four cases and poor in one.

We performed primary Blair fusion in all those patients who presented to us quite late with type III fractures of the neck of the talus with good results in ten cases, fair in three cases and poor in one.
Blair fusion provided some distinct advantages:

1. Normal appearance of the foot was retained.

2. Normal alignment of the foot to the ankle and the leg was retained.

3. No shortening was produced.

4. Solid fusion allowed motion at talonavicular and anterior subtalar joints, thus maintaining physiological relationship between foot and ankle.
Take-home messages

1. Displaced talar fractures with late presentation are challenging to treat.

2. Fourteen cases of grade III fractures of the neck of the talus are presented.

3. Results were uniformly good to fair in this small series of cases except in one case.

4. From our limited experience, we recommend primary Blair fusion as possible solution especially in poor groups of patients for whom secondary procedures will not be possible.
Thank you