Lower Limb Trauma

Cast Application for Common Fractures

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Casting treatment

• An integral part of the armamentarium of orthopaedic specialty in managing musculoskeletal trauma

• Most common method for external immobilization of an injured extremity
  – Temporary immobilization
  – Definitive treatment for undisplaced/minimally displaced fracture

• **Non-operative** treatment does not implies non-functional
Classic Textbook

The Closed Treatment of Common Fractures

John Charnley

Golden Jubilee Edition
Classical References


Common Lower Limb Fractures

- Ankle fracture
- 5th MT base fracture
- Tibial fracture
- Patella fracture
- Distal femur fracture
Closed Reduction Principles

• All displaced fractures should be reduced to minimize soft tissue complications, including those that require ORIF

• Use splints initially (short leg slab/long leg slab)
  – Allow for swelling
  – Adequately pad all bony prominences
Closed Reduction Principles

• Adequate analgesia and muscle relaxation are critical for success
• Reduction maneuver may be specific for fracture location and pattern
• Correct/restore length, rotation, and angulation
• Immobilize joint above and below
Application

- Stockinet and velban application
- Plaster bandage application
- Molding
- Trimming and reinforcement
Common Cast/POP

- Short Leg Cast
- Leg Cylinder Cast
- Long Leg Cast
ANKLE FRACTURE
Non-operative Treatment

• **Indications:**
  – Nondisplaced stable fracture with intact syndesmosis
  – Patient whose overall condition is unstable and would not tolerate an operative procedure

• **Management:**
  – Below the knee cast for 4-6 weeks
  – Follow with serial x-rays and transition to walking boot or short-leg walking cast
Nonoperative Treatment

• Clinical example
  – SER injury
  – Treated in short leg dynacast

  – Films 4 months post injury show healed stable mortise

  – Less than 3 mm displacement of the isolated fibula fracture with a reduced ankle mortise do not require surgery
Short Leg Dynacast

1. Stockinet and velban application
2. Add padding to heel
Support metatarsal heads
Ensure freedom of toes

Avoid impingement over 5th toe
Moulding medial arch

Make sure ankle at neutral
Proximal to tibial tuberosity

Smoothen the surface
Walking sandal

Weight bearing is not allowed until cast is dry
Ankle Fracture
Padded fibular head

Flexed knee

Neutral ankle position

Toes free

Assistant or foot stand required to maintain ankle position
Wedge technique
Cast Wedging

- Early follow-up x-rays are required to ensure reduction is not lost
- Cast may be “wedged” to correct reduction
- Deformity is drawn out on cast
- Cast is cut circumferentially
- Cast is wedged to correct deformity and the over-wrapped

Leave a hinge
FRACTURE 5TH MT BASE
Jones fracture

- Metaphyseal diaphyseal junction of 5th MT
  - Vascular watershed area
  - Relatively high healing complication if weight bearing protocols

- Short leg cast for 4-6 weeks
Not a good cast!
Not 90 degree over ankle joint
UNDISPLACED FRACTURES AROUND THE KNEE
Flex knee 5 - 20 degrees
Mold supracondylar femur for improved rotational stability
Apply extra padding anterior to patella
Anterior padding

Support lower leg / cast

Extend to gluteal crease

Figure from: Browner and Jupiter: Skeletal Trauma, 2nd ed, Saunders, 1998.
Long Leg Dynacast
Wedge technique
Indication for conservative treatment

1. Undisplaced fracture
2. Extensor mechanism intact
3. Articular surface no step

Patella Fracture
Long Leg Cylinder

Full weight bearing allowed
Cast at least 5 layers for walking
**Indications:**
Low-energy fractures
Shortening less than 1 to 2 cm
Cortical apposition greater than 50%
Angulation maintained with cast
Varus—valgus less than 5 degrees
Flexion—extension less than 10 degrees
General Principles – Tibia Fracture

• Degree of **shortening and translation** seen on injury radiographs can be expected to be present at union with nonoperative management.

• **Angular and rotational** alignment well controlled with cast

• Timely and thorough soft tissue management critical to outcome

• Restore **limb length, alignment, and rotation**.

• Stable fixation

• Early ROM of knee and ankle

• Non–weight bearing for 4 to 6 weeks
Sarmiento Short Leg Cast

- **Weight bearing** casting technique
- Dr. Augusto Sarmiento. 1963
  - rigid immobilization is unnecessary—in fact actually retard the healing process
  - It free joints adjacent to fracture and demonstrated motion at # site enhanced osteogenesis
  - Below knee cast, molded like the patella tendon bearing prosthesis.
  - Stabilize the # and prevent shortening by
    - transfer weight bearing stress from the floor to patella tendon and tibial flares.
    - Force distributed throughout the soft tissue surrounding fracture site
Sarmiento Cast
Patella bearing

In 1989 Sarminento report on 789 cases selected tibia fracture treated with functional bracing
Nonunion rate 2.5%
Average healing time 17.4 weeks isolated tibia
21.5 weeks tibia & fibula
Functional Bracing

Functional treatment:

- tight fitting brace
- weight-bearing and walking — *functions*
- pressure generated helps to splint the fracture

Brace: not the major load bearing structure
The effect of brace was to encapsulate the soft tissue so that the HYDRAULIC pressure can be maintained
Principle

• Continued function is part of the normal process of healing and desirable for osteogenesis

• **Motion** between the fracture fragments may assist in producing an environment that is conductive to osteogenesis

• **Muscle activity** also stimulate the development of a new blood supply for the production of peripheral callus

• Not for severe **shortening & angulation** cases
When the cast failed, why?

**PATIENT**
- Noncompliance
- Systemic medical conditions
- Obesity
- Substance abuse

**FRACTURE CHARACTERISTICS**
- Instability
- Soft tissue damage
- Soft tissue interposition

**TREATMENT TECHNIQUE**
- Inadequate closed reduction
- Poor casting and molding
- Improper type or duration of immobilization

**CLINICAL FOLLOW-UP**
- Infrequent
- Inadequate radiograph
- Indecision about change of treatment
Practical

Questions?