Physeal Fractures Overview

Physeal fractures are injuries that involve a break in the bone that include the physis or growth plate. They are of great importance, as these injuries can affect subsequent growth and remodeling potential.

The growth plate is responsible for longitudinal growth in long bones. They are usually found on each end of the bone. The typical long bone physis is divided into zones that reflect morphological, metabolic, and functional differences.

Resting Zone

- adjacent to the epiphysis
- contains scanty chondrocytes and abundant extra-cellular matrix

Proliferative Zone

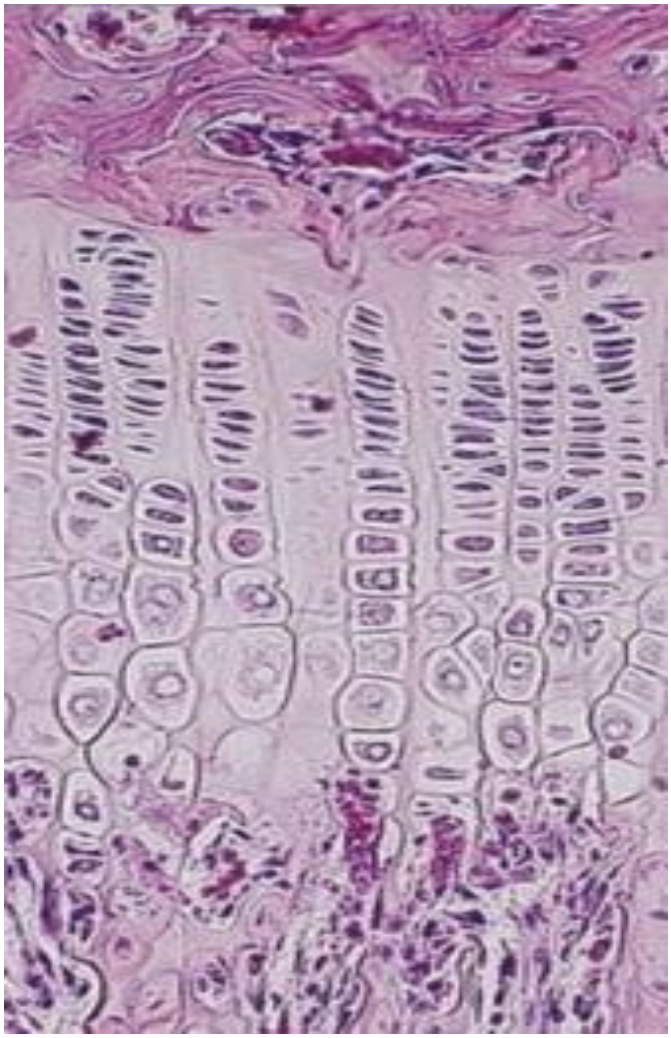
- chondrocytes flatten, divide and organize into columns
- base of columns have increased mitotic activity producing increase or growth in the length of the bone

Hypertrophic Zone

- Enlarged, swollen, and vacuolated chondrocytes
- Contains abundant cells with scanty extra-cellular matrix
- 3 sub-zones: maturation, degeneration, and provisional calcification segments
- Zone where physeal fractures happen

Zone of Endochondral Ossification

- mineralized osteoid is laid down on the calcified cartilage
- where osteoprogenitor cells differentiate into osteoblasts



Classification

The Salter-Harris (SH) Classification is a 5 stage classification system based on pattern or configuration of the fracture.

SH 1

- Transverse fracture through the physis
- Common in infants and toddlers
- Shearing, torsion and avulsion movement
- No osseous fracture in the epiphysis or metaphysis
- Good prognosis

SH 2

- Fracture traverses the physis and exits the metaphysis
- Most common type of physeal fracture
- Good prognosis

SH 3

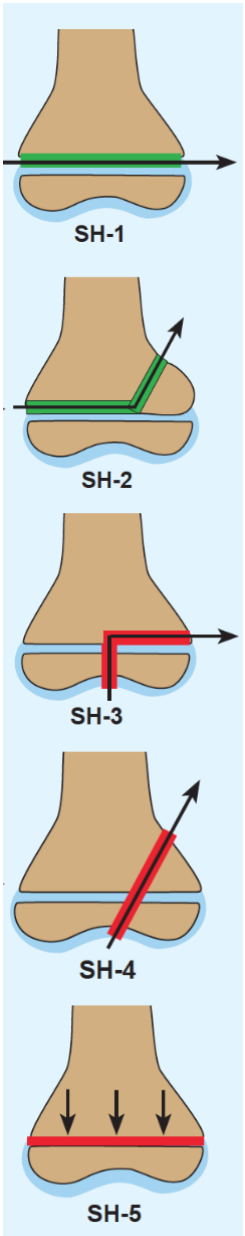
- Fracture from the epiphysis and exits the physis
- Intra articular fracture
- Germinal zone of the physis may be injured
- Guarded prognosis

SH 4

- Fracture from the epiphysis traversing the physis and exits the metaphysis
- Germinal zone of the physis may be injured
- Guarded prognosis

SH 5

- Crushing injury of the physis
- Most rare type of physeal fracture
- Geminal and proliferative zones may be injured
- Poorest prognosis



Physeal Bridge Management

Physeal bridge formation usually follows SH-3, SH-4, or SH-5 injuries. The mechanism is either a crush injury to the germinal layer or a displaced fracture that allows bone to form across the physis.

Avoid physeal injury when placing fixation devices in children. Reaming of the upper femur for fixation of femoral shaft fractures is a common cause of physeal damage when the implant crosses the physis. Use alternative ways of fixation before the end of growth.

Prevention of physeal bridge formation is best achieved by an anatomic reduction of SH-3 and SH-4 fractures. Open reduction and internal fixation that does not traverse the physis is best. If fixation is necessary across the growth plate, use small, smooth wires or pins.

Monitor growth for detection of a physeal bridge. If a bridge is found, make a radiograph of the involved bone and the contralateral side on the same film every 4-6 months. Note changes in relative overall length or angulation of the adjacent joint surface.

Imaging physeal bars may be done by CT scans or MRI studies. Order frontal and sagittal computer reconstruction of 1-mm CT scans. MRIs tend to show more soft tissue information but may be more difficult to interpret. Assess the location of the percentage of the cross sectional area of the physis that the bridge occupies.

References:

1. Tachdjian's Paediatric Orthopaedics 5th Ed
2. https://emedicine.medscape.com/article/1260663-overview