

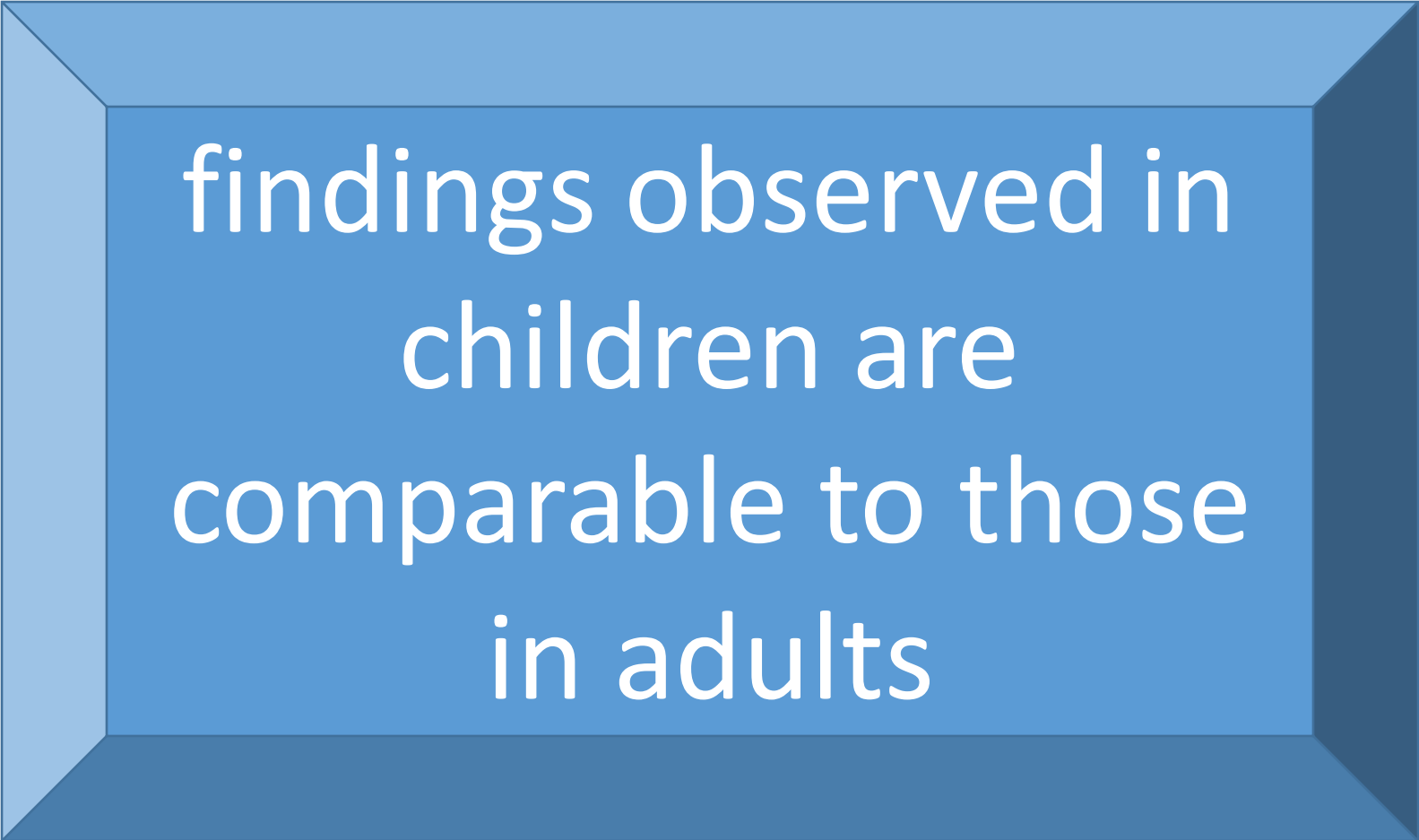
# Floating knee in children ...

## Background

- Floating knee is a flail knee joint
- **Blake and McBryde 1975/..51 case**
- soft tissues damage is often extensive
- life-threatening injuries to the head, chest, or abdomen
- appropriate sequence of emergency diagnostic and therapeutic



floating knee is uncommon in  
immature patients ... Few study

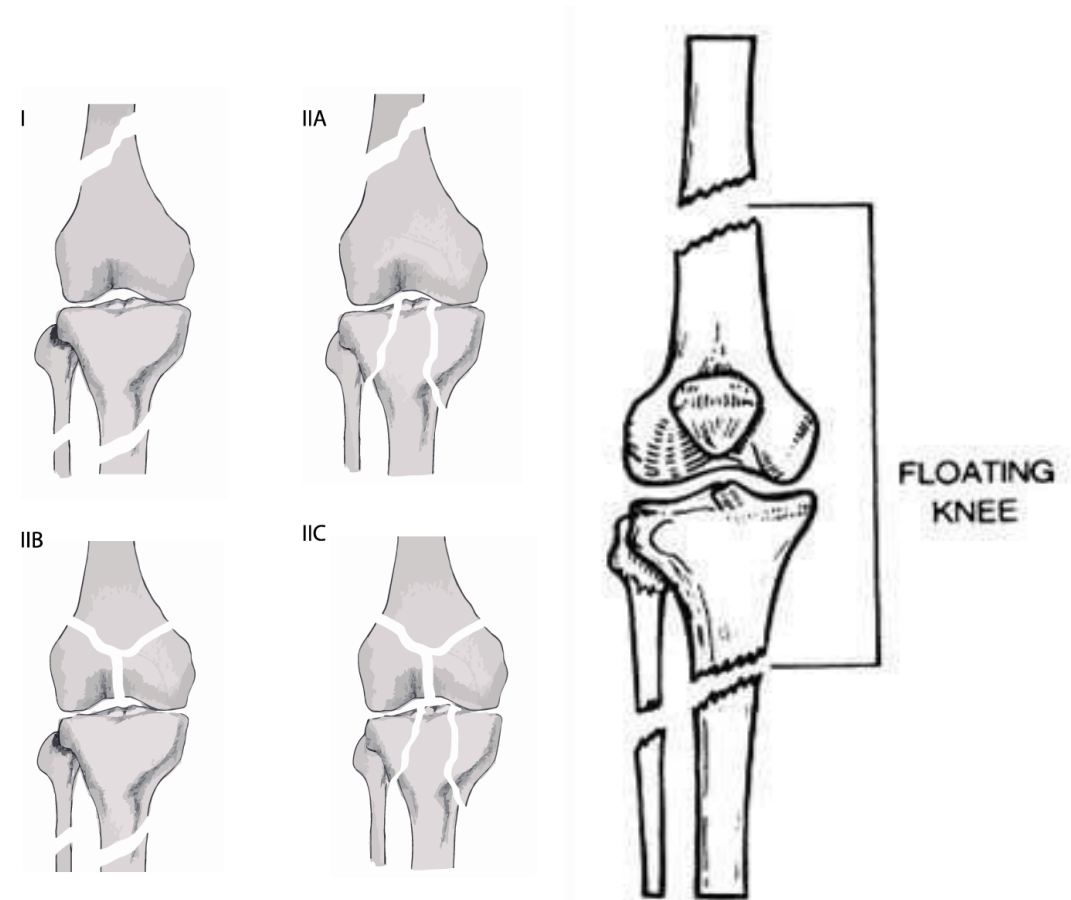


findings observed in  
children are  
comparable to those  
in adults

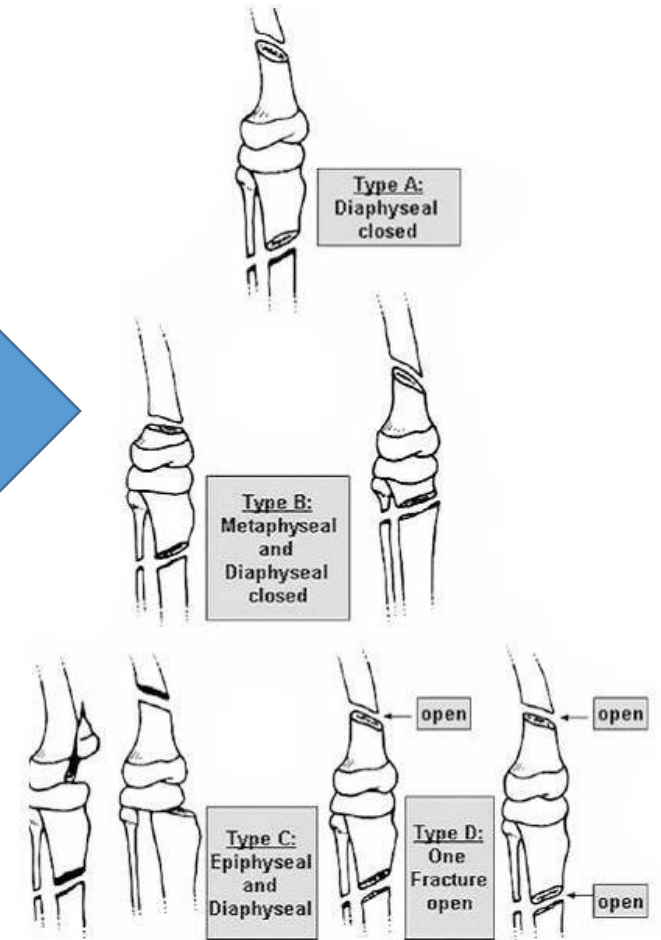
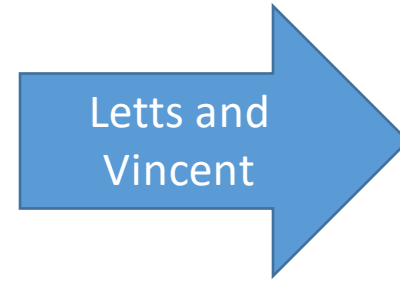
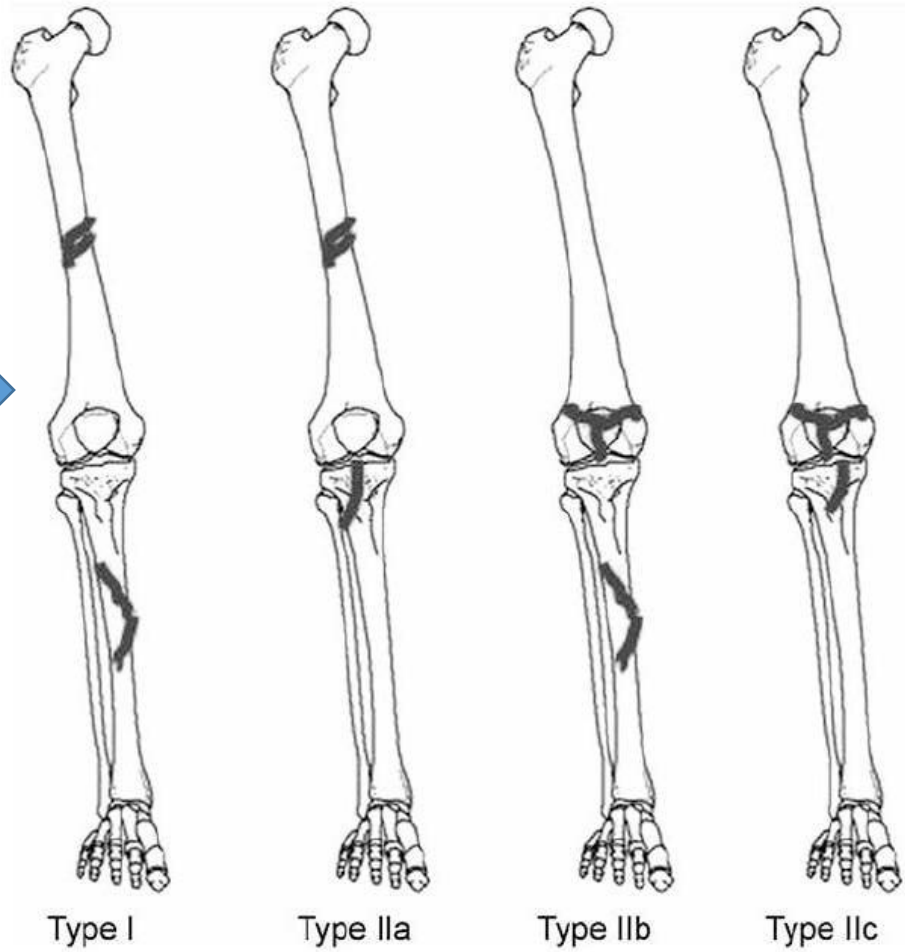
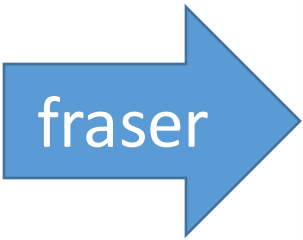
# Classification

**Blake and McBryde** used the terms true (or type I) injury and variant (or type II) injury to classify the floating-knee fracture pattern, as follows <sup>[3]</sup>:

- Type I is a pure diaphyseal fracture of the femur and tibia
- Type II is a fracture that extends into the [knee](#), [hip](#), or [ankle](#) joint <sup>[6]</sup>



# Classification



# Etiology

- Road traffic
- Falls from heights
- Gunshot wounds
- 

# Epidemiology

Increasing in frequency

Male young adults 20-30 years

Prognosis      excellent + good = 65%      93% ped

### Criteria Karlstrom and Olerud

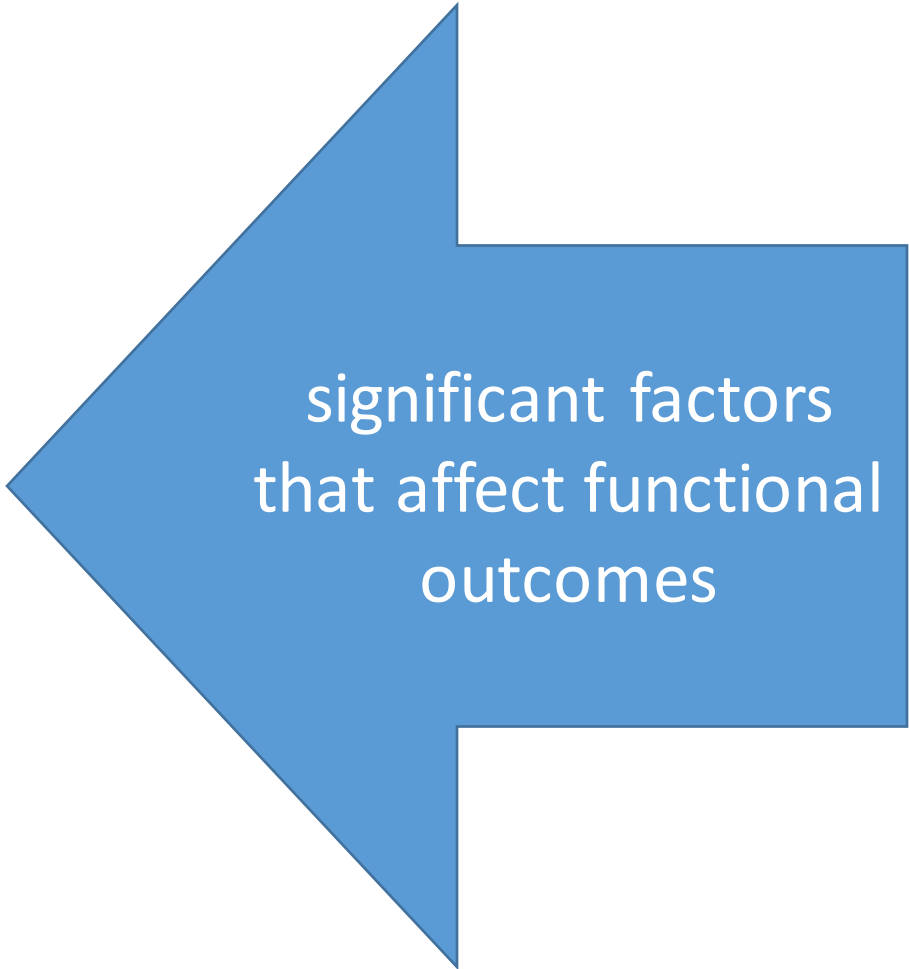
- Subjective symptoms from the knee or ankle joint
- Walking ability
- Participation in work and sports
- Angulation and/or rotational deformity
- Shortening
- Restricted mobility of the hip, knee, or ankle joint

# Karlstrom and Olerud criteria

# prognosis

Criterion	Excellent	Good	Acceptable	Poor
Subjective complaints from thigh or leg	0	Intermittent slight symptoms	More severe symptoms impairing function	Considerable functional impairment; pain at rest
Subjective symptoms from knee or ankle joint	0	Same as above	Same as above	Same as above
Walking ability	Unimpaired	Same as above	Walking distance restricted	Use cane, crutch, or other support
Work and sports	Same as before accident	Given up sport; work same as before accident	Change to less strenuous work	Permanent disability
Angulation, rotational deformity, or both	0	<10°	10–20°	>20°
Shortening	0	<1 cm	1–3 cm	>3 cm
Restricted joint mobility (hip, knee or ankle)	0	<10° at ankle; <20° at hip, knee or both	10–20° at ankle; 20–40° at hip, knee or both	>20° at ankle; >40° at hip, knee or both

- Involvement of the knee joint
- Severity of soft-tissue injury in the tibia
- Fixation time after injury in the tibia
- AO fracture grade in the femur and tibia
- Fixation time after injury in the femur and severity of open femoral fractures



significant factors  
that affect functional  
outcomes



# History and Physical Examination

protocols  
for patients  
with  
polytrauma

ABCD...p  
rotocol  
Neuro  
vascular  
exam

popliteal  
and  
posterior  
tibial  
arteries,  
peroneal  
nerve

- open fractures 50-70%
- Closed femoral .open tibial fracture is common
- knee ligament injuries
- Anterolateral rotatory instability

# Imaging Studies

- Plain radiography trauma series
- MRI planning management of ligamentous injuries
- CT. metaphyseal epiphyseal fractures. three-dimensional configuration of the fracture fragments.
- .
- **None of the investigations should hinder surgical management in emergency situations.**
- intraoperative examination under anesthesia after stabilization of the fractures may be more appropriate.

# Floating Knee Treatment & Management

- Approach Considerations

increased risk of morbidity and mortality.

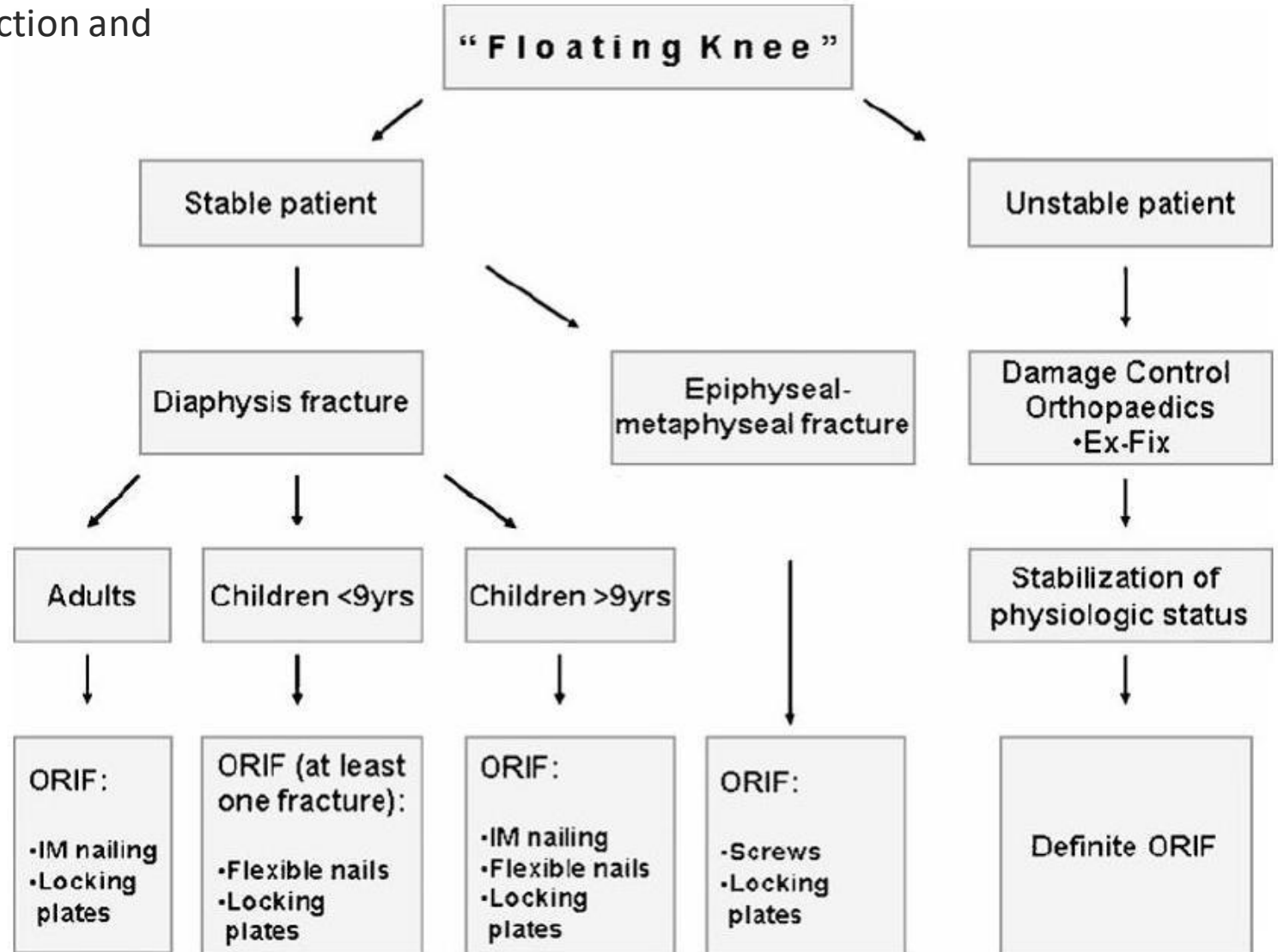
damage-control orthopedics

## Timing of intervention

- Nonorthopedic injuries play a significant role in surgical decision making with regard to timing of the procedures
- Orthopedic management must be integrated with the overall resuscitation and stabilization of the polytraumatized patient
- Damage Control Orthopedics



Treatment protocol for floating knee injuries. Ex-Fix = external fixation; IM = intramedullary; ORIF = open reduction and internal fixation.



# Non surgical treatment in Children

- Skeletal traction for the femoral fracture
- Closed reduction and casting or splinting for the tibial fracture.
- Hip spica cast
- complications is high in older children treated with conservative
- Malunion, nonunion, refracture, limb-length discrepancy in 50% of patients receiving closed treatment.

# Surgical Therapy

## •Adults

- Aggressive treatment with early stabilization . Mobilization. quicker recovery

## •Children

- Femoral fracture ORIF or EX FIX in patients older than 10 years.
- Younger than 9 years, at least one fracture must be rigidly fixed



# Postoperative Care

- Early joint mobilization
- Early weightbearing. 32 and 42
- delayed weightbearing . 33 and 43
-

# Complications

- Delayed union,
- nonunion,
- malunion,
- stiffness of the knee
- infection
- older age, cigarettes smoked .high ISS, open and comminuted fractures

# Complications unique to children

- Overgrowth. femur and tibia are 1.4 and 1.1 cm
- increased younger than 9 years and nonoperatively
- premature closure.
- genu valgum and physeal arrest.
- regardless of the type of fracture, extent of soft tissue injury, treatment method.
- Pediatric patients and their parents must be informed.
- followed up skeletal maturity.

# The Pediatric “Floating Knee” Injury

## A State-of-the-Art Multicenter Study large cohort

### Level III

- **Journal of Bone and Joint Surgery:** [October 2, 2019 - Volume 101 - Issue 19 - p 1761-1767](#)
- 130 floating knees in 129 patients
- average patient age was **10.2 years**, and **63.1% were male**.
- **33%** of the patients presented with **open injuries**, and **83.8%** of injuries were related to **vehicular trauma**
- (OTA/AO 32-A and B femoral ..OTA/AO 42-A and B tibial fractures were most common.
- Intramedullary fixation (**rigid or flexible**) was the most common treatment strategy for **femoral fractures (69.2%)**.
- **Tibial** fractures were treated most commonly with **casting (27.7%)**, followed by flexible intramedullary **nailing (24.6%)**.
- The mean duration of **hospitalization** was **9.7 days**.
- **Outcomes** were **excellent in 66.6%** of cases and **good in 26.4%** of cases.
- Conservative

surgery



- The Floating Knee in the Pediatric Patient: Nonoperative Versus Operative Stabilization.
- Clinical Orthopaedics and Related Research (1976-2007): [July 2000 - Volume 376 - Issue - pp 124-136](#)
- .....
- Twenty-nine consecutive patients with open physes (30 affected extremities) were reviewed
- Non op..16 case traction. manipulation. hip spica cast
- Op. one or both nail or ex fix in 13 p 14 case
- Complication.. 20.1 days versus 34.9.. length discrepancy, angular malunion,

# Ipsilateral femur and tibia fractures in pediatric patients: A systematic review

- [World J Orthop.](#) 2017 Aug 18; 8(8): 638–643.
- Published online 2017 Aug 18. doi: [10.5312/wjo.v8.i8.638](https://doi.org/10.5312/wjo.v8.i8.638)
- **AIM**
- To better understand how pediatric floating knee injuries are managed after the wide spread use of new orthopaedic technology
- 97pat/ 9.3 years a age / mostly male (73)/ 25% open . tibia (27) femur (10)/ 75% diaphysis./ (52) treated non-operatively/32 (33%) length discrepancy, 24 (25%) lengthening 8 (8%) had shortening / Infection 9/ 3 had premature physeal closure .
- **CONCLUSION**
- Given the predominance of non-operative management in published studies, the available literature is not clinically relevant since the popularization of internal fixation for pediatric long-bone fractures
- There is not a consensus regarding treatment of this fracture pattern in children and adolescents

# Floating knee injuries – An analytical study using a **conglomerated comprehensive classification**

- Published: July 10, 2021 DOI: <https://doi.org/10.1016/j.injury.2021.06.032>
- Floating knee injuries are complex injuries, associated systemic, skeletal, soft tissue injury and fracture pattern influences the outcome.
- This classification is a conglomeration of the existing standard classifications (Fraser, AO, Gustilo and Andersons) along with modifiers like disruption of extensor mechanism M1, avulsion fractures around knee M2 and fractures around hip and ankle joints M3
- Conglomerated comprehensive classification using prognostic factors helps in guiding appropriate treatment protocol and better prognosis.

# Concomitant ligamentous and meniscal injuries in floating knee

- [Int J Clin Exp Med.](#) 2015; 8(1): 1168–1172.
- Published online 2015 Jan 15
- 37 cases of floating knee
- medial meniscal tear 14 (37.8%)
- lateral meniscal tear 11 (29.7%)
- ACL(56.8%) 6- 15    PCL (8.1%) 1- 2    MCL 10 (27.0%)    PCL 7 (18.9%)
-



# Challenges in the management of floating knee injuries: Results of treatment and outcomes of 224 consecutive cases in 10 years [☆](#)

- [Injury](#)
- [Volume 50, Supplement 4, August 2019](#), Pages S30-S38

# ABSTRACT

- 224 cases / 34,480 lower extremities trauma 0.65%
- 16 -- 35 years of age (60.71%)
- male (85.71%)
- traffic accident (92.85%)
- EX FIX (82.14%)
- Early complications included 8 cases, Compars syndr
- 60 open fractures / 24 partially amputated limbs/ 3 total amputation/ most common late complication heterotopic ossifications of the knee ( $n = 68$ , 30.6%)./ Good scores for MCRSQ and KOS were obtained only after patients were sent to a reference center for knee surgery.

# Highlights

- The floating knee is a **devastating traumatic pathology** for the survival and quality of life of the patient.
- Many are the **comorbidities associated** with the floating knee that put the patient's life at risk.
- The **early stabilization** of both fractures improves outcomes.
- Subjective and objective outcomes can be satisfactory after years and numerous trauma surgeries.
- The current Floating Knee classifications in use are not discriminating or prognostic.

# Floating knee injuries: Results of treatment and outcomes.

[Mohammad Hadi Nouraei](#), Alireza Hosseini,<sup>1</sup> [Abolghasem Zarezadeh](#), and [Mohammad Zahiri](#)<sup>1</sup>

- J Res Med Sciv.18(12); 2013 Dec PMC3908531
- **238** cases of **254,620** trauma files -18 died—220---**0.09%**
- 20-29 years (44.5%)/ males (85.5%)/ 38.9%Type (D) Letts and Vincent
- car to motorcycles accidents (48.2%)/The most common associated injury was pelvic fractures (86.8%)./ORIF treatment (70%)/early and late complications were knee hemarthrosis in 31 cases (14%) and knee osteoarthritis in 30 cases (13.6%)/Death during the 5 years follow up was due to circulatory disruption, followed by deep vein thrombosis (61%)./relation between the age and outcomes as it worsens with age ( $P$ -value < 0.05)/. **complication rate associated with floating knee injuries remained high, regardless of the used treatment regimen**

# Floating classification system SJO

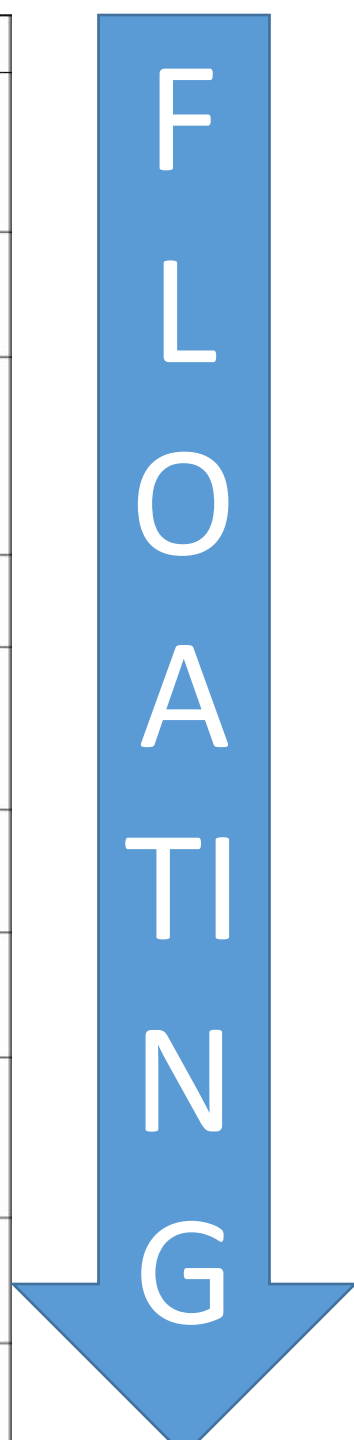
Table II. — Proposed universal classification for floating injuries in extremities

Site (S)	Joint involvement (J)	Open (O) (Gustilo's classification) (8)
<b>0</b> One side fracture only e.g. floating shoulder <b>1</b> Both diaphyseal <b>2</b> One diaphyseal and the other metaphyseal <b>3</b> Both metaphyseal	<b>0</b> Without intraarticular extension <b>1</b> One component intraarticular <b>2</b> Both component intraarticular	<b>0</b> (for closed injuries)  <b>1</b> <b>2</b>  <b>3</b> a, b, c

# FLOATING NAME?

- complex injuries
- high-energy trauma
- associated with major soft tissue injury
- neurovascular complications.
- Often open
- concomitant ligamentous injuries
- imprecise and misleading term
- routine use is not recommended unless standard classifications are proposed
- Letts et al's classification for floating knee injuries in children

No.	Term	Category
1.	Floating Forehead (15)	Operation
2.	Floating pterous bone (17)	Injury pattern
3.	Floating maxilla (6)	Injury pattern
4.	Floating clavicle (5)	Injury pattern
5.	Floating shoulder (9)	Injury pattern
6.	Floating humerus (1)	Functional deformity
7.	Floating elbow (22)	Injury pattern
8.	Floating radius (22)	Injury pattern
9.	Floating index metacarpal (21)	Injury pattern
10.	Floating thumb (10)	Congenital anomaly



No.	Term	Category
11.	Floating sternum (20)	Surgical complication
12.	Floating ribs (18)	Injury pattern
13.	Floating ribs (23)	Normal anatomy
14.	Painful floating ribs syndrome (7)	A painful syndrome
15.	Floating lumbar spine fusions (2)	Segmental spinal fusion procedure
16.	Floating pelvis (13)	Injury pattern
17.	Floating acetabulum (24)	Injury pattern
18.	Floating hip (14)	Injury pattern
19.	Floating knee (12)	Injury pattern
20.	Floating tibial talar complex (19)	Injury pattern
21.	Floating ankle (16)	Injury pattern
22.	Floating metatarsal (11)	Injury pattern