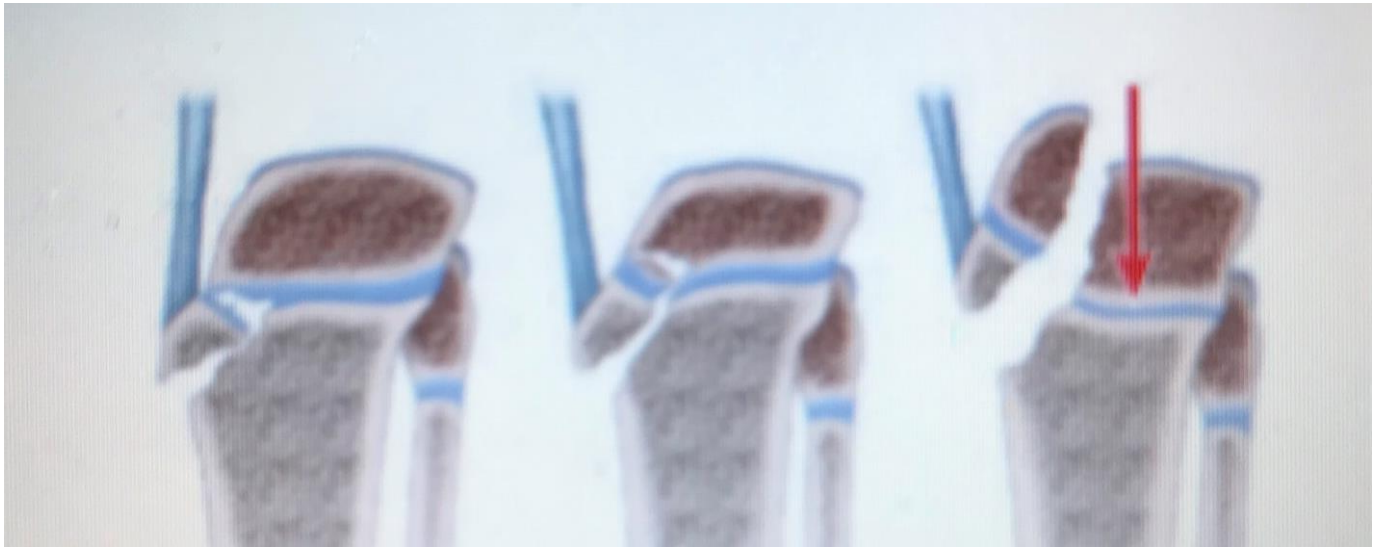

به نام خدا

Tibial Tuberosity (Apophysis) Fracture (T. T. FX.)



Anatomy of Tibial Tuberosity

- At full skeletal maturity, the tibial tuberosity is located approximately one to two fingerbreadths (3 cm) distal to the proximal tibial articulating surface.
- It is in line with the medial patella in flexion and the lateral patella in extension.
- The tibial tuberosity forms the terminal part of extensor mechanism of knee.
- The extensor mechanism of the knee is composed of :

the quadriceps muscle group and tendon, the patella, the patellar ligament, the patellar retinaculum and the tibial tuberosity .

Function of Tibial Tuberosity

- **Extend the leg at the knee joint, and flex the thigh at the hip joint .**
- **Centralizes patellofemoral articulation .**
- **Stabilize the knee joint .**
- **Prevents the knee from collapsing when the foot strikes the ground.**

Mechanism of Injury of T.T.F.

- **Concentric contraction:**

  Strong quadriceps contraction during knee extension, such as jumping .

Concentric contraction

- **Eccentric contraction**

Violent flexion of the knee against a tightly contracting quadriceps such as landing from a jump or forced knee flexion .

Eccentric contraction

Epidmiologyof T.T.F.

- Accounting for less than 1% of epiphyseal injuries and approximately 3% of all proximal tibial fractures .
- Commonly seen in skeletal maturity age (12–14 years) .
- Most common in basketball, football, sprinting and high jump.
- Males > Females .
- Lt side > Rt side ?
- Osgood schelatter disease as predisposing factor ?

Unusual Cases of T.T.FX.

Fracture of tibial tuberosity

in a man aged 62 years,

BMJ Case Report .

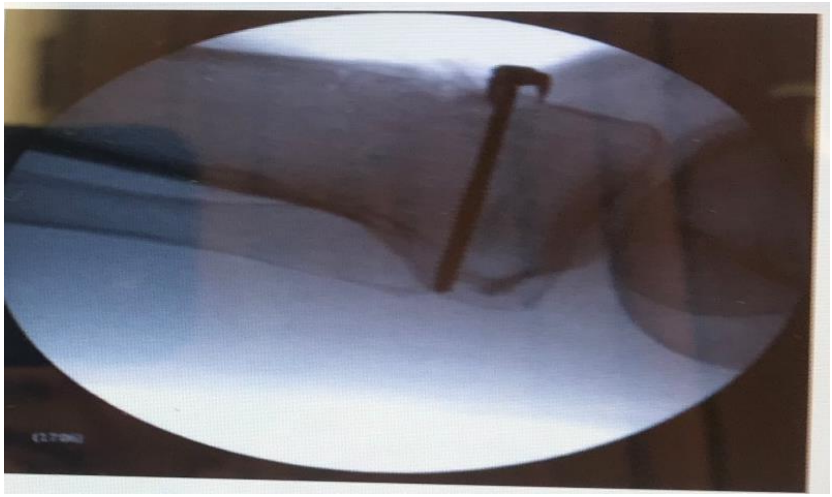
Published online 2013 Nov. 29 .

Tibial Tuberosity Fracture

in an 86-year-old gentleman.

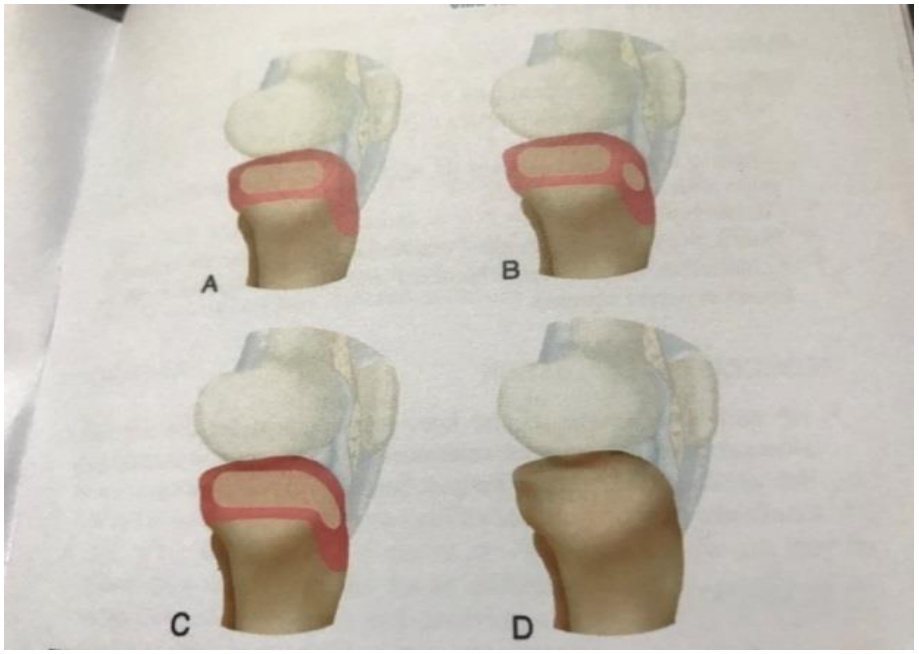
Open Access, Case Report .

Published 16 Mar. 2020.



Pattern of T. T. Fx. will Depend Upon:

1 - The extent of Development of the tibial tuberosity



A - Cartilaginous stage :

No ossification center(OS), (10 years).

B - Apophyseal stage :

Formation of T.T. OS (12 years).

C - Epiphyseal stage :

Coalescence of primary and secondary OS (13 years).

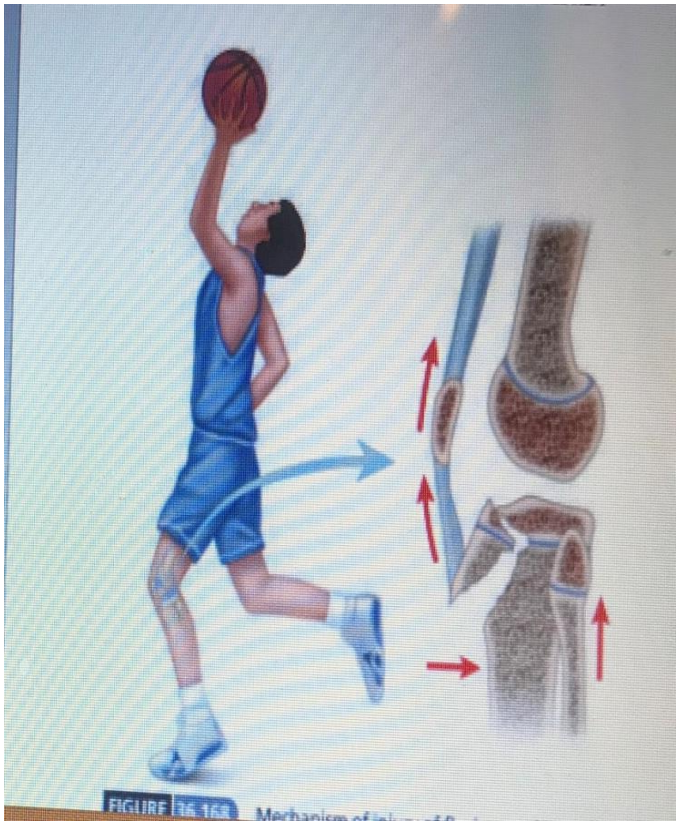
D - Bony stage:

Closure of proximal tibial physis (17 years).

2 - The amount of physeal closure at the proximal end of tibia.

- The proximal tibial physis has been shown to close in a posterior to anterior and medial to lateral direction.
- The tibial apophysis closes simultaneously in a proximal to distal and posterior to anterior direction.

3 - The degree of knee flexion at the time of injury.



- Full extension or close to 30° of flexion, **result in** avulsion FX. of apophysis.
- Flexion more than 30°, **result in** FX. of Apophysis and Epiphysis.

Associated injuries of T. T. FX.

- Overall (4/1%) .
- Most common in San Diego type C fracture (4/7%) .
- Compartment syndrome (3/57%), due to anterior tibial recurrent artery injury, that runs along the lateral border of tibial tuberosity .

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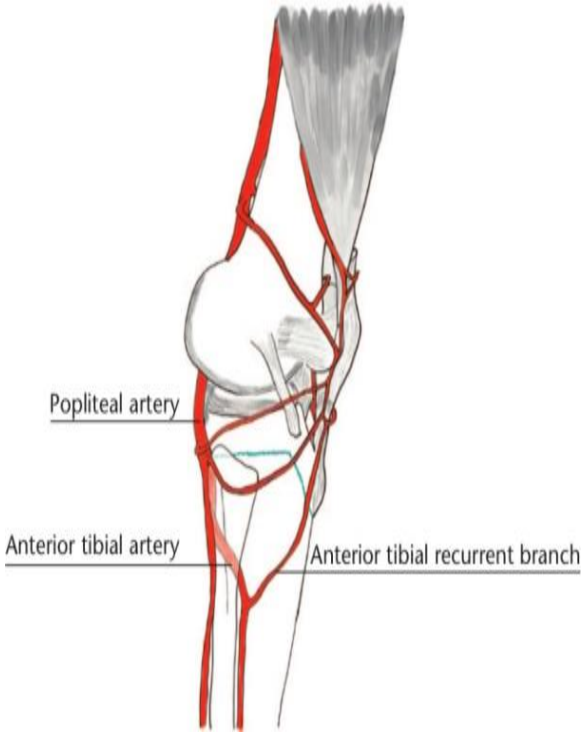


- Meniscus tear (2%).
- Patellar or quadriceps tendon avulsion (2%) .
- Cruciate ligament laxity (1%) .

History and Physical Examination of T.T.F.

Evaluation for Circulation Status and Compartment Syndrome.

Imaging for T.T.FX.

- **Xray**
  - Internally rotated lateral view of knee.
  - Comparison views of contralateral knee.
- **CT**

  To evaluate intra-articular or posterior extension.
- **Arteriogram**

  Arteriogram if concern for popliteal artery injury.
- **MRI**
  - Generally not indicated.
  - Useful for determining fracture extension in a nondisplaced fracture and suspicious ACL injury.

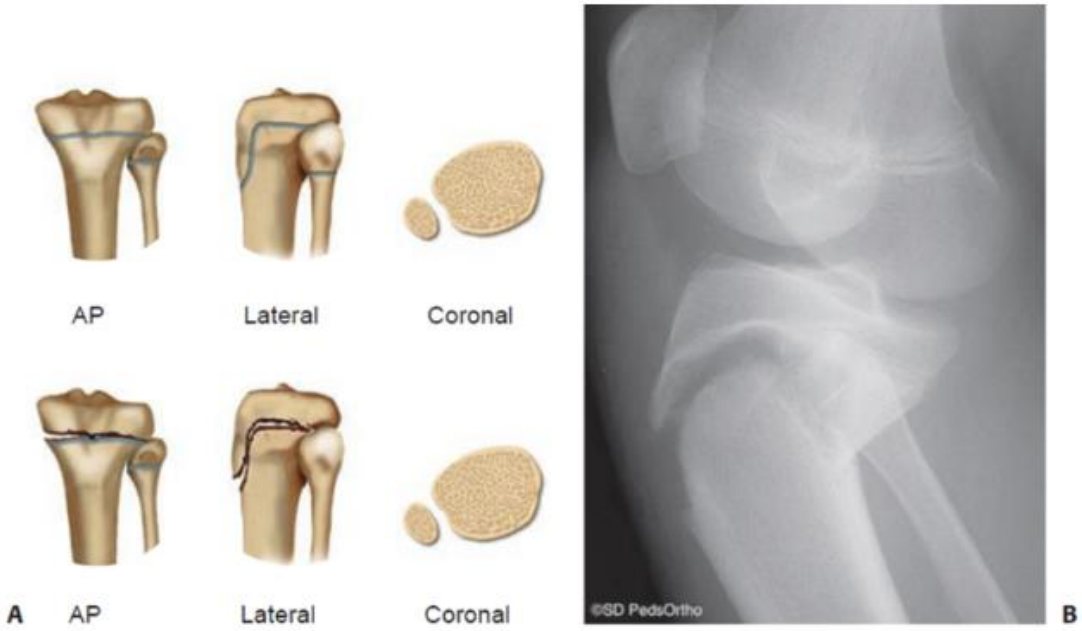
San Diego Classification for T.T.FX.

- A study from San Diego was recently presented by the authors delineating a three-dimensional classification of T.T.F., in order to highlight the risk for associated pathology.
- It is based on skeletal maturity and ossification of the secondary ossification center as it relates to increasing need for surgery and risk for compartment syndrome.

San Diego type A, T.T. FX. (Extra articular)

- Occur in the youngest population (mean age 12.7 years), with most of the physis and apophysis open.
- Resulting in a largely cartilaginous fracture that is seen as a fleck of bone at the distal tibial tubercle.
- These are at low risk for compartment syndrome, but potentially greatest risk for premature physeal closure because of low age.
- They require only sagittal plain radiographs for appropriate diagnostics.

San Diego type B, T. T. FX. (Extra articular)



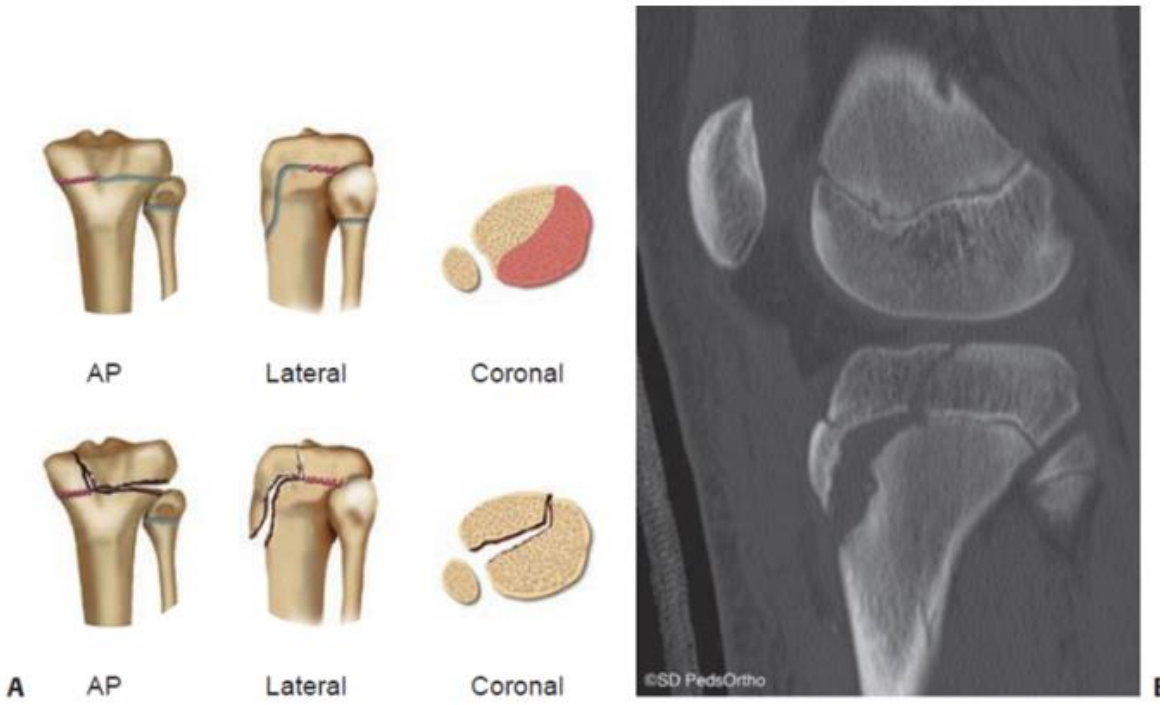
(A) :

- **Upper line drawing indicating area of closed physis (red).**
- **Lower line drawing demonstrating fracture pattern in three planes.**

(B): Radiographic representation of the fracture.

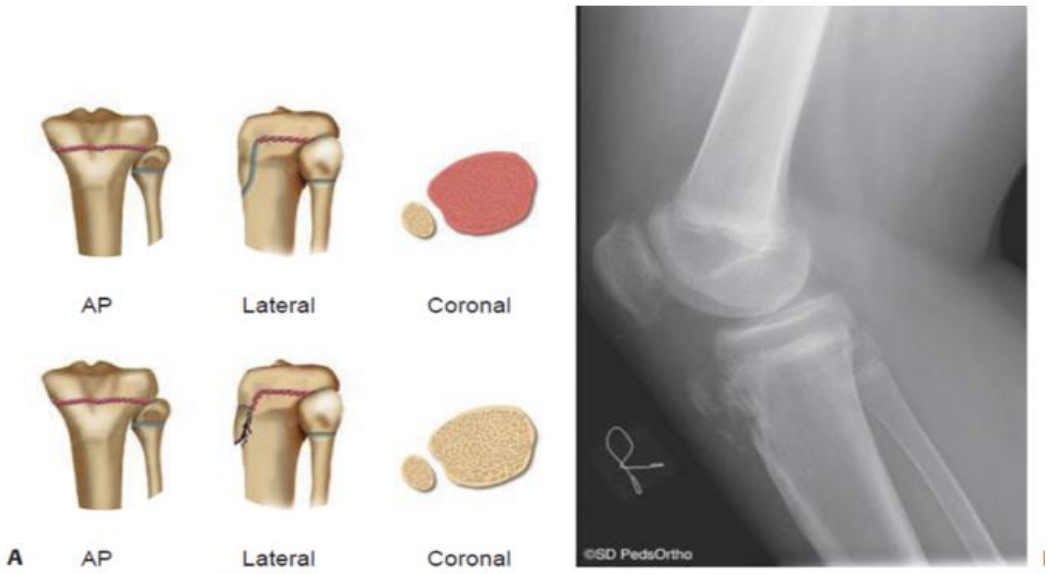
These occur in the younger child and have high risk for vascular injury.

San Diego type C, T.T. FX. (Intra articular)



A: Upper line drawing **indicating** area of closed physis (**red**).
Lower line drawing **demonstrating** fracture pattern in three planes.
(B): Radiographic representation of the fracture.
These occur in young, but maturing children ,
and have high risk for intra-articular pathology.

San Diego type D, T. T. FX. (Extra articular)



(A) :

_ Upper line drawing indicating area of closed physis (red).

_ Lower line drawing demonstrating fracture pattern in three planes.

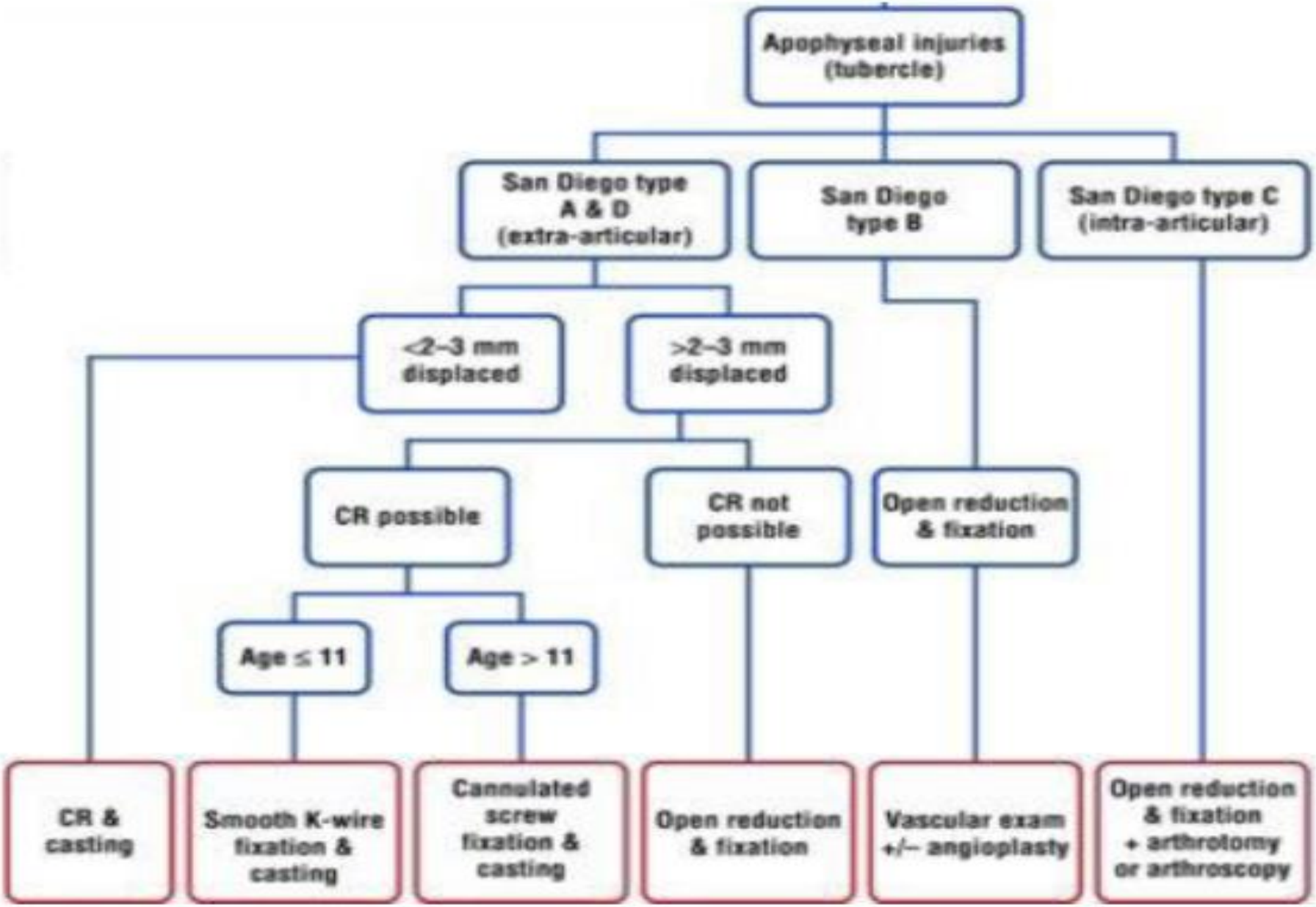
(B) : Radiographic representation of the fracture.

These occur in older children and have low associated risks.

The goal of treatment of T.T. Fx.

- Achieving articular congruency, with open reduction and internal fixation, with arthrotomy +/- arthroscopy, +/- soft tissue repair (periosteum sleeve).
- Restoring the extensor mechanism function .
- Avoiding damage to the proximal tibial physis .
- Avoiding damage to the popliteal artery.
- Restoring the meniscal and ACL anatomy when these are compromised.

Algorithm for T.T. Fx. Treatment



Key points on T.T.FX. Management

- Vascular evaluation and monitorng .
- Using a longitudinal incision just lateral to tibial tuberosity rather than directly over it to minimize scar discomfort over the prominent bone.
- Releasing tourniquet before T.T. fracture reduction and stabilization.
- Accurate reduction and device implantation (Pinning/ Screwing / Tension Band Wiring).
- Univalve, bivalve cast , or place foam in cast to allow for Post Op. swelling.
- 4-6 wks cast immobilization, followed by additional wks protected progressive Extensor mechanism strengthening and knee ROM exercises, with hinged knee brace .
- Extensor mechanism strengthening and rehabilitation 12wk previously to return normal activity.

Complications of T.T.FX.

- **Vascular Injury**
  - **Popliteal artery injury .**
  - **Compartment syndrome.**
- **Recurvatum deformity**

  More common than leg length discrepancy due to anterior growth arrest and decreasing in tibial slope.
- **Extensor lag and quadriceps weakness due to displacement more than 2-3 mm.**
- **Bursitis**

  Most common complication following surgical repair, due to prominence of screws and hardware about the knee, resolved upon hardware removal.
- **Stiffness**

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شما عزیزان