

Emergency Radiology 2023  
May 8th - May 11th, 2023  
8th Nordic Course in Emergency Radiology, Aarhus, Denmark

# The Limping Child

Michel Bach Hellfritsch  
Dept. of Radiology,  
Aarhus University Hospital

1

## The Limping Child

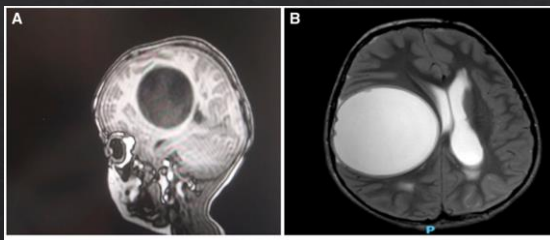
- ◇ An asymmetrical gait caused by pain, weakness or deformity.
- ◇ In toddlers and young children refusal to walk and stand
- ◇ Limp is never normal and a cause must be established

2

# Case 1

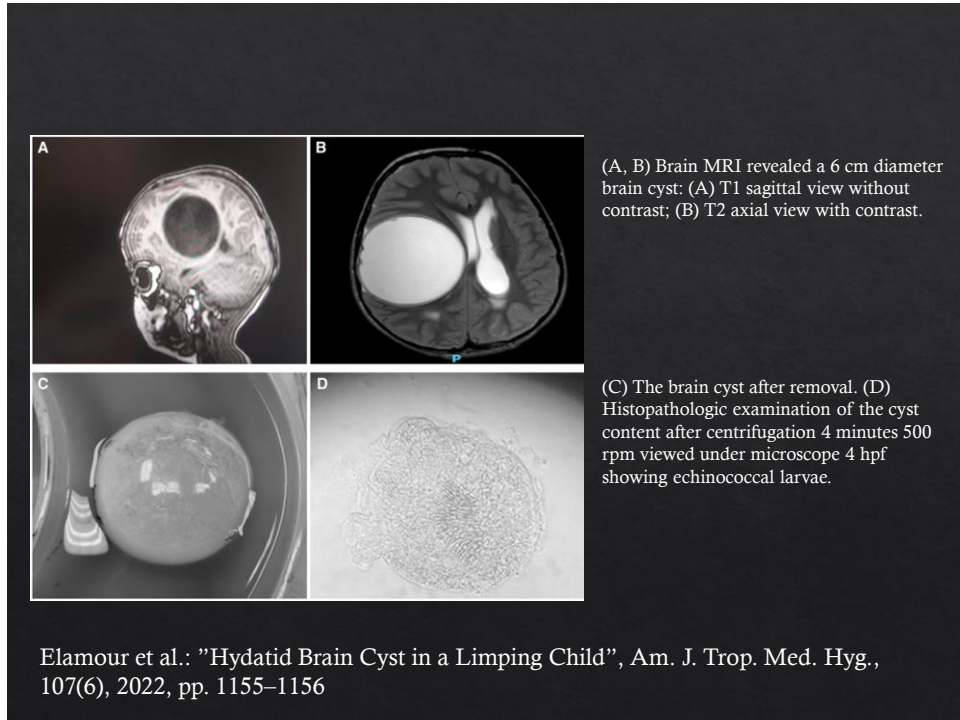
- ◇ 6-year-old boy
  - ◇ Limp
  - ◇ Headache
- ◇ Physical examination
  - ◇ Bradycardia
  - ◇ Left facial nerve palsy
  - ◇ Left hemiparesis.

3



Elamour et al.:

4



5

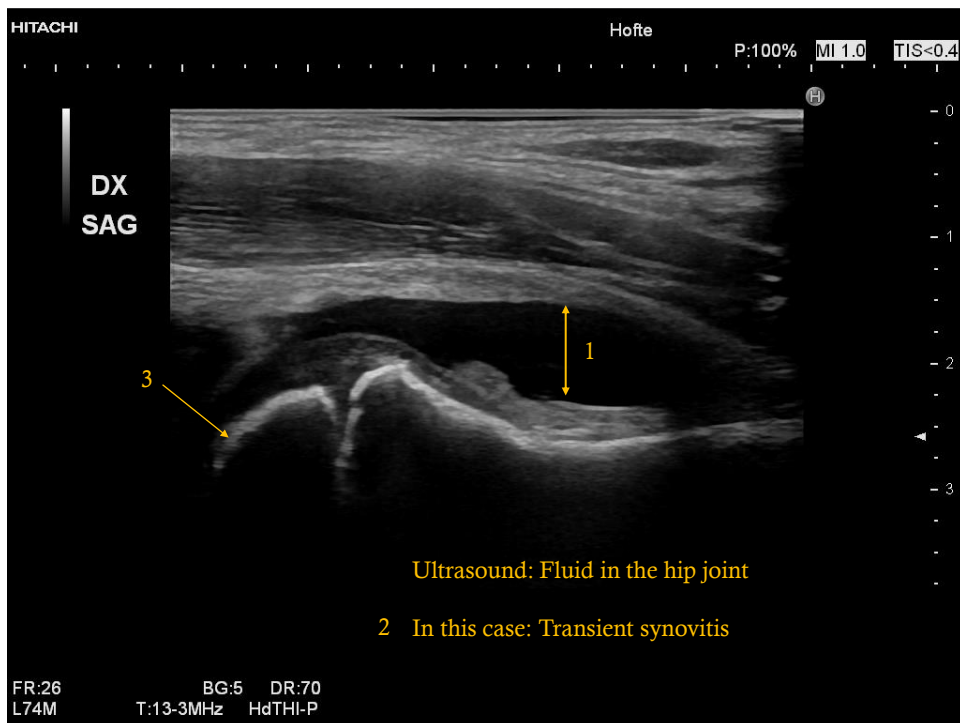
## Case 2

- ◇ 5-year-old boy
  - ◇ Limp
  - ◇ Pain in the right hip region for one day
- ◇ Physical examination
  - ◇ Hip flexed and externally rotated
  - ◇ No fever
- ◇ Imaging?

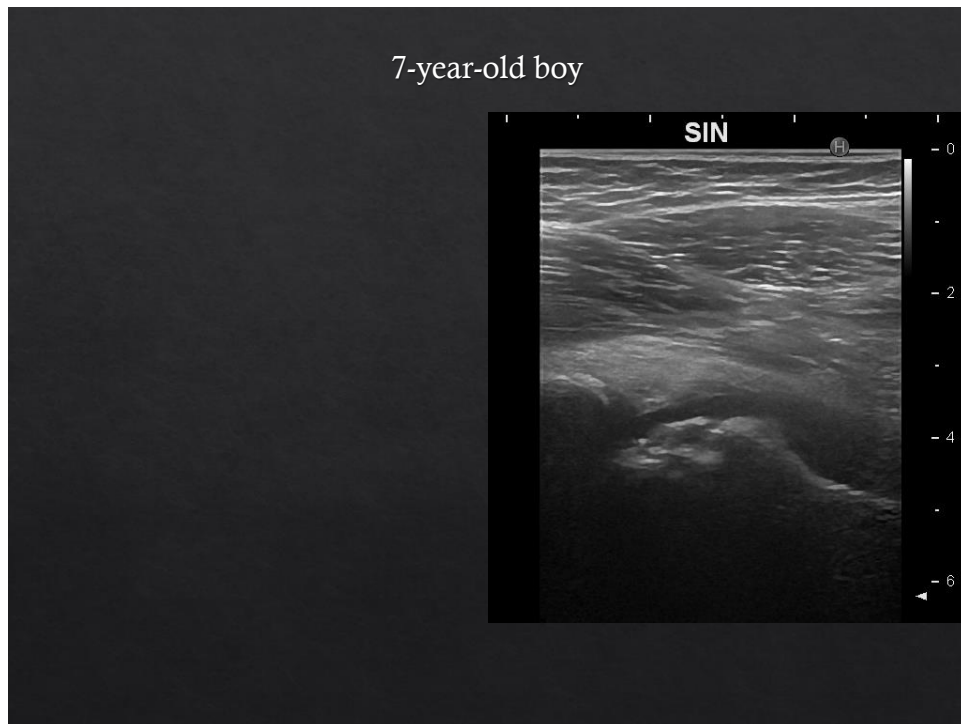
6



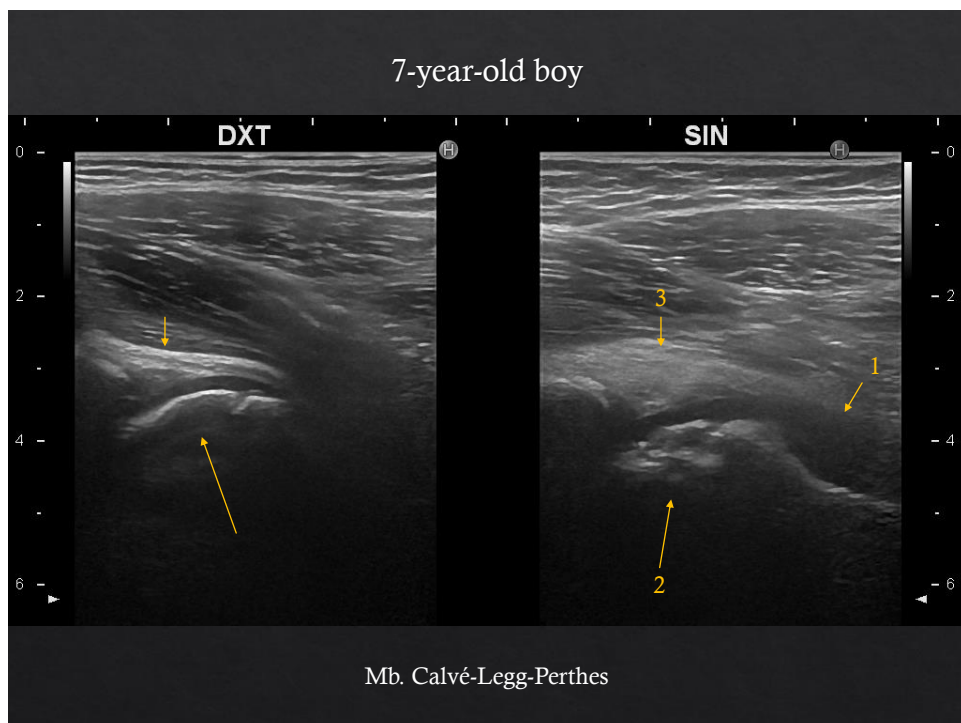
7



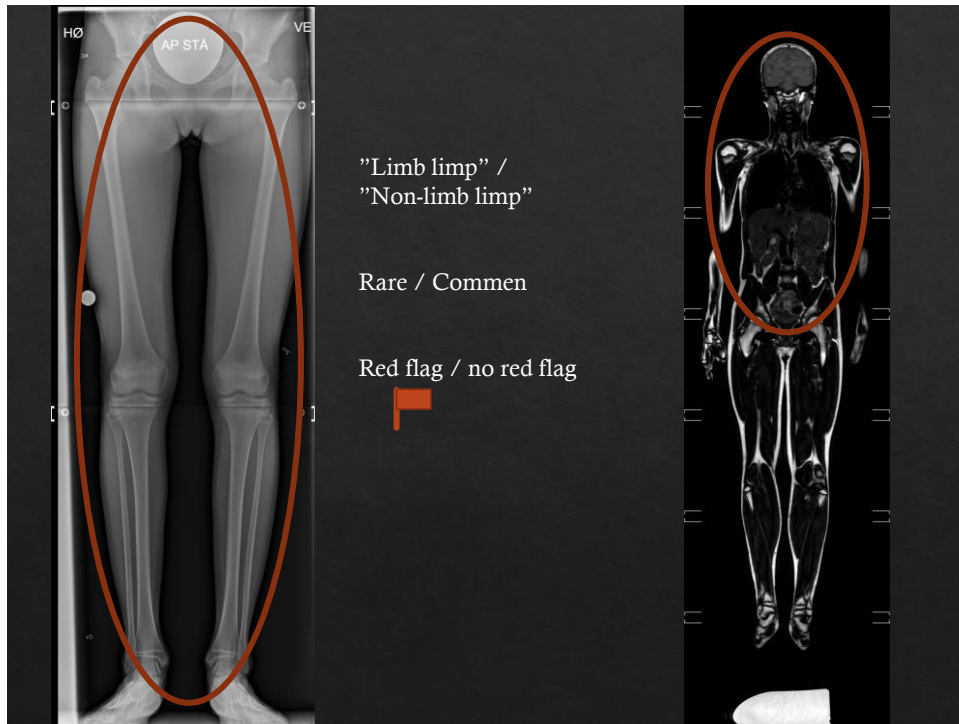
8



9



10



11

"Non-limb  
limp"

- ◇ Cerebral (tumor)
- ◇ Spinal (infection, tumor)
- ◇ Intra-abdominal pathology (e.g. appendicitis)
- ◇ Rheumatological/ immunological disorders
- ◇ .....

12

## Red flags

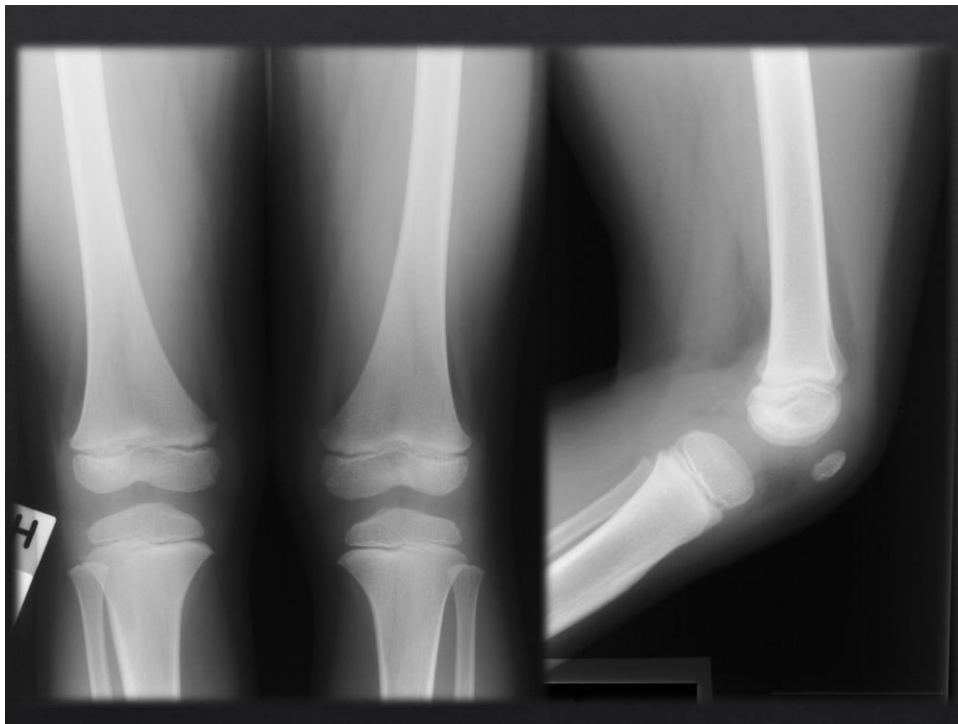
- ◇ Duration of symptoms (> 1 week)
- ◇ Complete inability to walk or weight-bear
- ◇ Severe localised joint pains (septic arthritis)
- ◇ Nocturnal pain and symptoms
- ◇ Systemic symptoms/Constitutional symptoms (fever, night sweats, chills, rigors, rash, weight loss, lethargy/easy fatigue, anorexia)

13

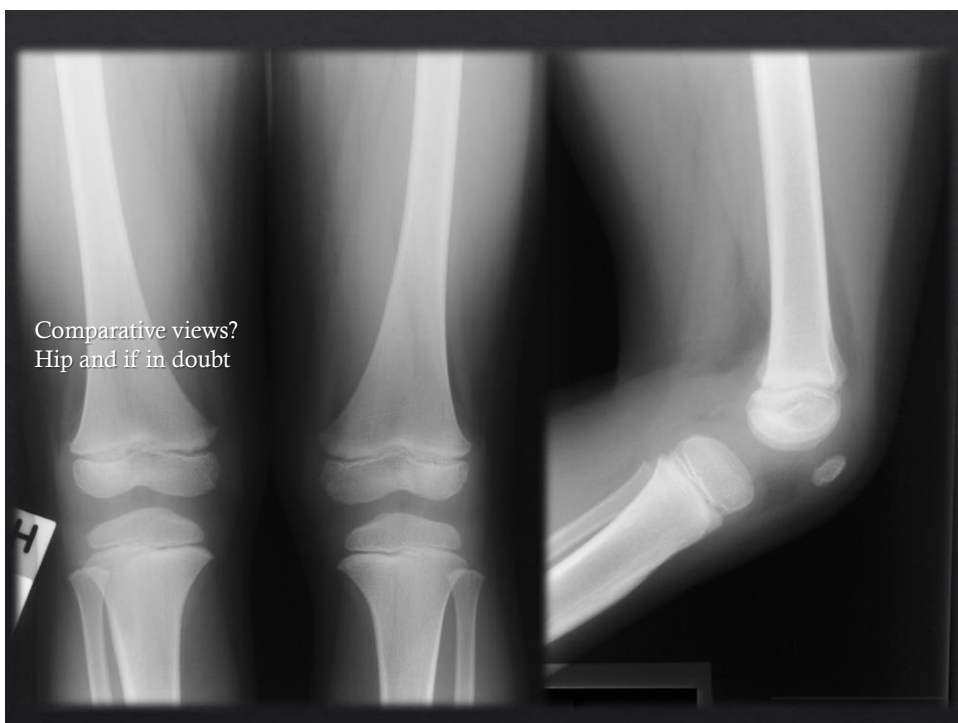
## Case 3

- ◇ 5-year-old boy
- ◇ Pain in the left knee

14



15



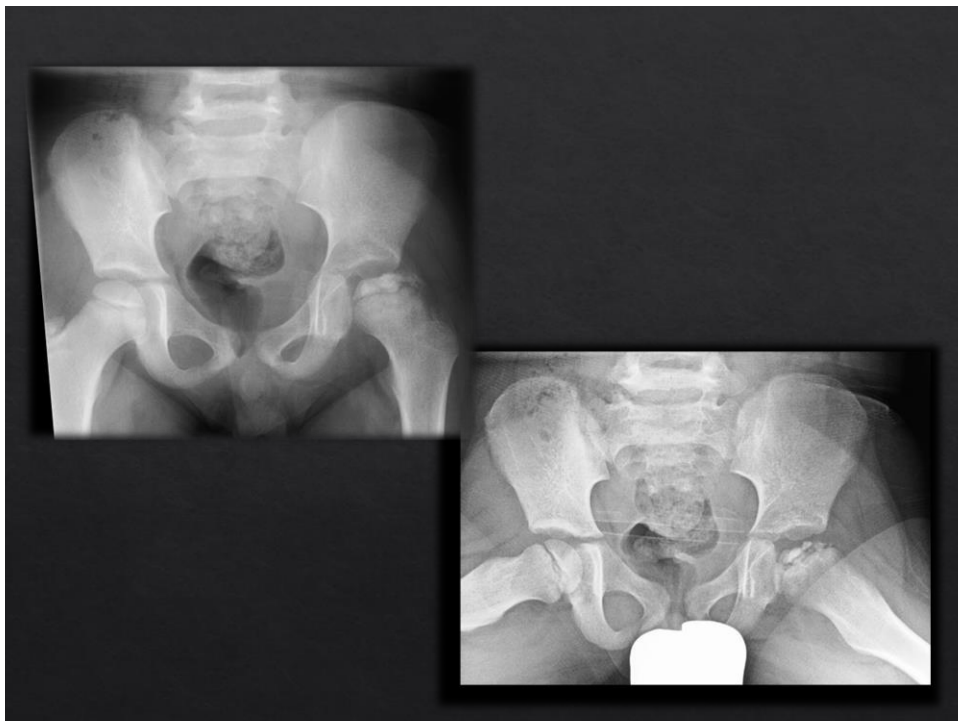
16



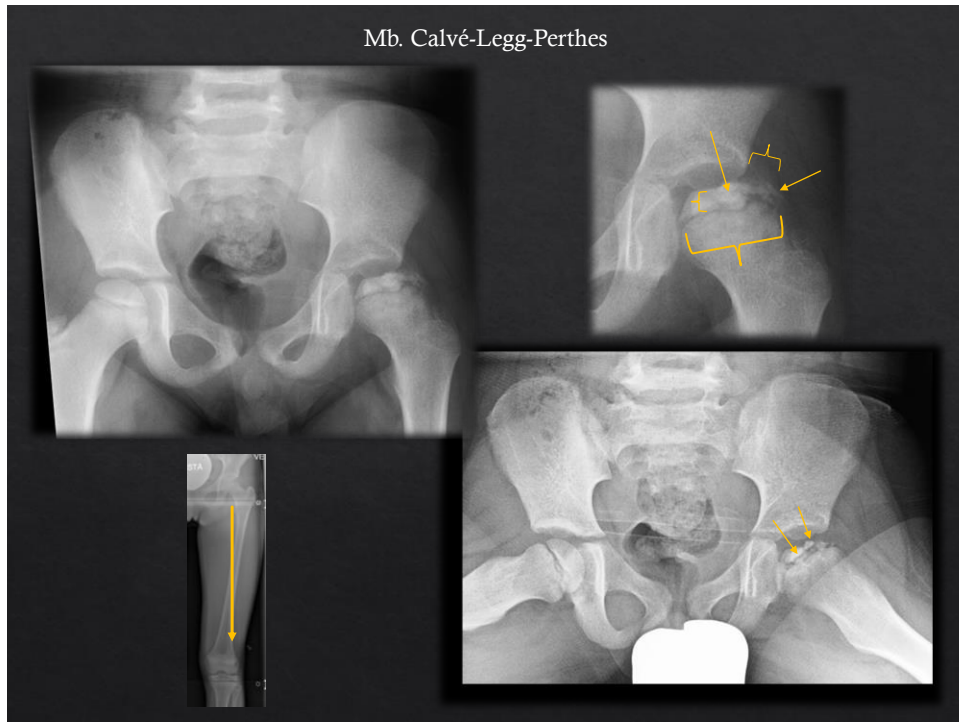
## Case 3

- ◇ 5-year-old boy
- ◇ Pain in the left knee
- ◇ Normal radiograph
- ◇ 11 month later: Pain in the left hip.

17



18

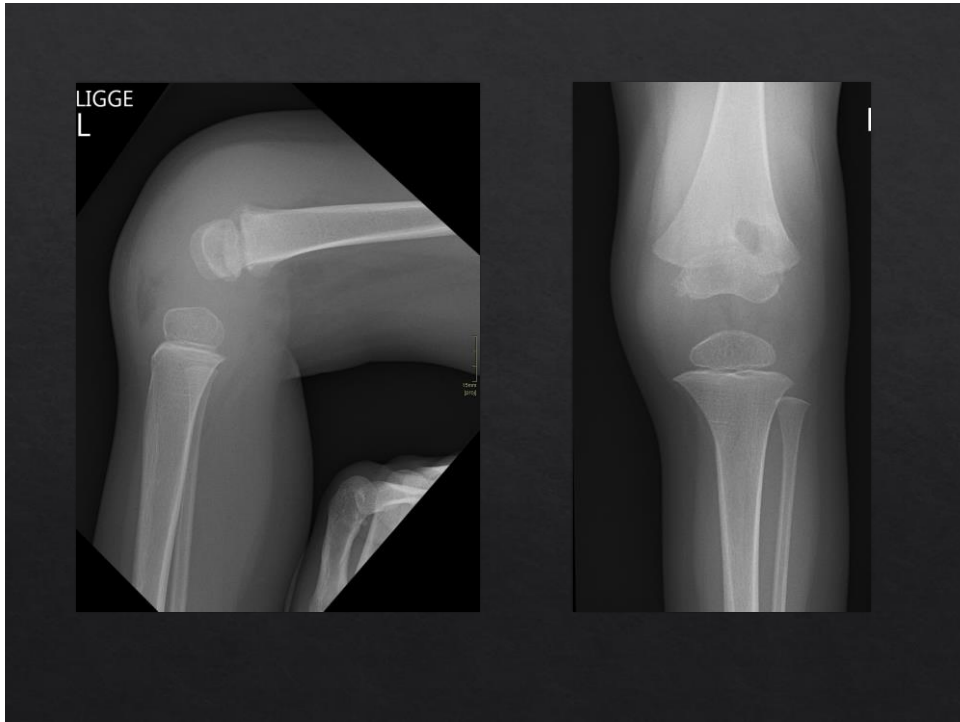


19

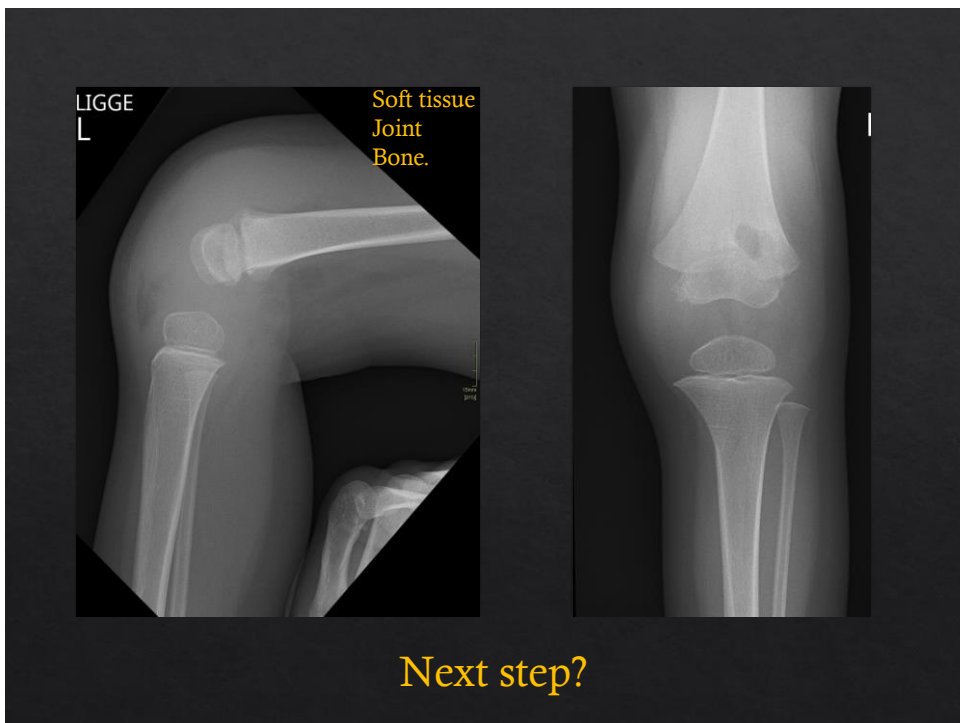
## Case 4

- ◇ 2-year-old boy
- ◇ Varicella two month ago
- ◇ Pain and swelling of the left knee

20

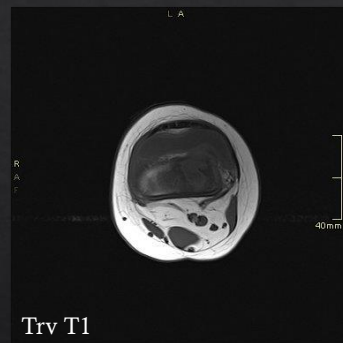
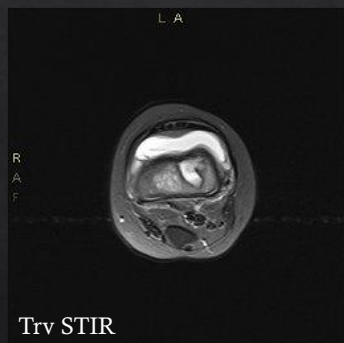


21



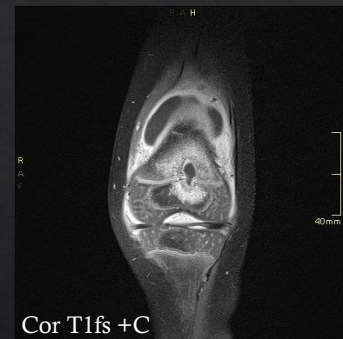
22

# MRI



23

# MRI +C



24

## Normal radiograph



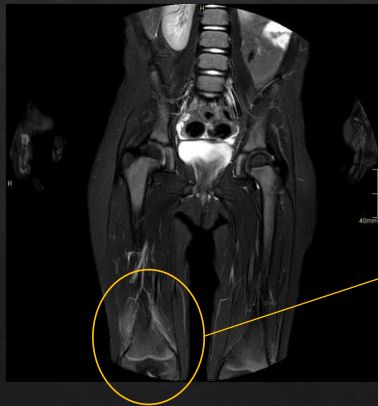
◇ Wait and see



◇ Further imaging

25

## Further imaging



- ◇ Sedation or anesthesia?
- ◇ As few sequences as possible
- ◇ STIR (T2fs) Survey
- ◇ Focused sequences of area of interest:
  - ◇ Trv/Cor/Sag STIR (not all!)
  - ◇ Trv/Cor/Sag T1 (not all!)
  - ◇ T1fs +C

26

## Septic arthritis: Kocher Criteria

- ◇ Fever > 38.5°C
- ◇ Non weight-bearing
- ◇ Leucocytosis > 12.0 x 10<sup>9</sup> /l
- ◇ ESR > 40 mm/h
- ◇ (CRP > 20 mg/l – Caird modified Kocher criteria)

No. of predictors	Probability of septic arthritis
0	Very low
1	Low
2	Moderate
3	Very high
4	Very high

*Caveat:  
Kingella kingae in pre  
school aged children*

27

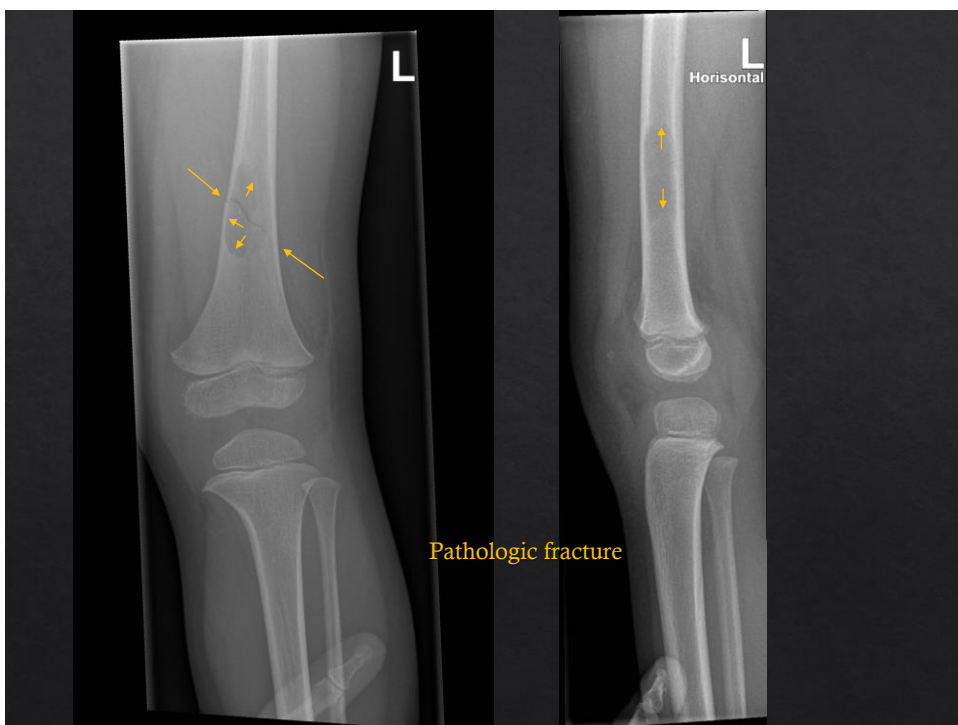
## Case 5

- ◇ 4-year-old boy
- ◇ Acute pain in the knee region without trauma.
- ◇ Not able to walk or stand on his leg.

28



29



30

# Benign findings and normal variants

31

## Benign findings and normal variants



32



## Benign findings and normal variants



Cortical desmoid



Irregularities of the epiphyseal ossification center



The normal apophysis of calcaneus

33

## Conclusion

34

- ◇ Common causes / Rare causes
- ◇ Knowledge of common diseases and their age distribution
- ◇ Red flags
- ◇ Imaging modality
- ◇ Knowledge of the normal anatomy

35

- ◇ Common causes / Rare causes
- ◇ Knowledge of common diseases and their age distribution
- ◇ Red flags
- ◇ Imaging modality
- ◇ Knowledge of the normal anatomy

36

**Box 1 | Primary differential diagnosis of an "traumatic limp" by age\***

**0-3 years**  
 Septic arthritis or osteomyelitis  
 Developmental hip dysplasia  
 Fracture or soft tissue injury (toddler's fractures or non-accidental injury)

**3-10 years**  
 Transient synovitis or irritable hip  
 Septic arthritis or osteomyelitis  
 Perthes' disease  
 Fracture or soft tissue injury (stress fracture)

**10-15 years**  
 Slipped upper femoral epiphysis  
 Septic arthritis or osteomyelitis  
 Perthes' disease  
 Fracture or soft tissue injury (stress fracture)

**Other diagnoses**  
 Haematological disease, such as sickle cell anaemia  
 Infective disease, such as pyomyositis or discitis  
 Metabolic disease, such as rickets  
 Neoplastic disease, such as acute lymphoblastic leukaemia  
 Neuromuscular disease, such as cerebral palsy or muscular dystrophy  
 Primary anatomical abnormality, such as limb length inequality  
 Rheumatological disease, such as juvenile idiopathic arthritis

\*Based on studies of the common diagnoses encountered in atraumatic limps<sup>1</sup> and atraumatic hip disease in children.<sup>2-4</sup> Non-accidental injury is included because of the importance of making a prompt diagnosis. We examined age distribution in the more common diagnoses to allow classification of the diagnosis by age (transient synovitis,<sup>5</sup> Perthes' disease,<sup>6</sup> slipped capital femoral epiphysis,<sup>7</sup> late presenting developmental dysplasia of the hip,<sup>8</sup> osteomyelitis,<sup>9,10</sup> toddler's fracture,<sup>11</sup> and orthopaedic injuries in non-accidental injury<sup>12,13</sup>)

**Table 1**  
**Most causes of limping related to patient's age**

Toddler (1-3 years)	Child (3-10 years)	Adolescent (11-16 years)	All ages
DDH TODDLER'S FRACTURE NAI	Transient synovitis LCP-Perthes JIA Trauma Osteochondritis Malformative diseases CRMO/CNO	SCFE JIA Trauma Osteochondritis Apophyseal avulsions Chronic injuries Malformative diseases CRMO/CNO	Tumour and pseudo-tumour conditions Limb length discrepancy Septic arthritis Osteomyelitis Pyomyositis Metabolic diseases Inguinal hernia/appendicitis/testicular torsion

NAI: Non-accidental injuries, DDH: Developmental Dysplasia of the Hip, LCP: Legg Calvé-Perthes, JIA: Juvenile Idiopathic Arthritis, CRMO/CNO: Chronic Recurrent Multifocal Osteomyelitis/Chronic Non-Bacterial Osteomyelitis, SCFE: Slipped Capital Femoral Epiphysis.

Bartoloni , 2018

**Box 1. Common conditions to consider when assessing a limping child, with age relevance**

All ages		
Fracture/soft-tissue injury	Cellulitis	
Non-accidental injury (NAI)	Neoplasm	
Septic arthritis	Neuromuscular	
Osteomyelitis		
Age 1-3 years	Age 4-10 year	Age 11-16 years
Septic hip	Perthes' disease	Slipped capital femoral epiphysis (SCFE)
Developmental dysplasia of the hip (DDH)	Transient synovitis	Juvenile rheumatoid arthritis
Toddler's fracture		Osteochondritis dissecans
		Osgood-Schlatter disease

Raja, 2020

37

- ◇ Common causes / Rare causes
- ◇ Knowledge of common diseases and their age distribution
- ◇ Red flags
- ◇ Imaging modality
- ◇ Knowledge of the normal anatomy

38

- ◇ Common causes / Rare causes
- ◇ Knowledge of common diseases and their age distribution
- ◇ Red flags
- ◇ Imaging modality
- ◇ Knowledge of the normal anatomy

39

- ◇ Common causes / Rare causes
- ◇ Knowledge of common diseases and their age distribution
- ◇ Red flags
- ◇ Imaging modality
- ◇ Knowledge of the normal anatomy

40

# Litterature and Links

41

## Litterature

- ◆ Bartoloni et al.: "Imaging of the limping child", European Journal of Radiology 109 (2018) 155–170
- ◆ Elamour et al.: "Hydatid Brain Cyst in a Limping Child", Am. J. Trop. Med. Hyg., 107(6), 2022, pp. 1155–1156
- ◆ Perry et al.: "Evaluating the child who presents with an acute limp", : BMJ 2010;341:c4250 doi: 10.1136/bmj.c4250
- ◆ Raja et al.: "The limping child – when to worry and when to refer: a GP's guide", British Journal of General Practice, September 2020.
- ◆ Safdar et al.: "ACR Appropriateness Criteria Acutely Limping Child Up To Age 5". J Am Coll Radiol 2018;15:S252-S262.
- ◆ Stein-Wexler et al: "Pediatric Orthopedic Imaging", Springer 2015.

42