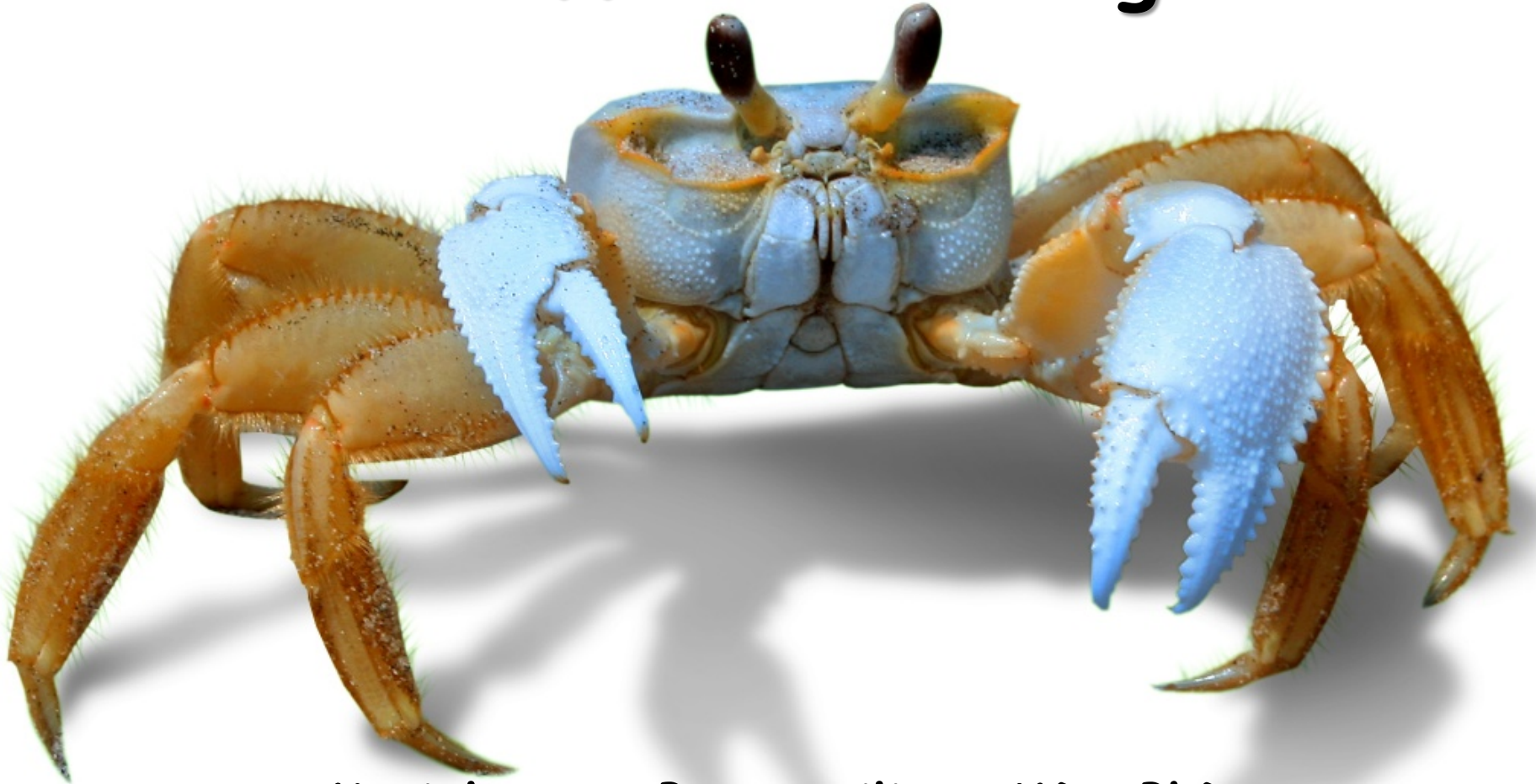


Terminology-Classification-Diagnostic Tools-Differential Diagnosis



Kyriakos A. Papavasiliou, MD, PhD

Sr. Consultant Sarcoma & Orthopaedic Surgeon

3rd Orthopaedic Dept. Aristotle University Of Thessaloniki Medical School

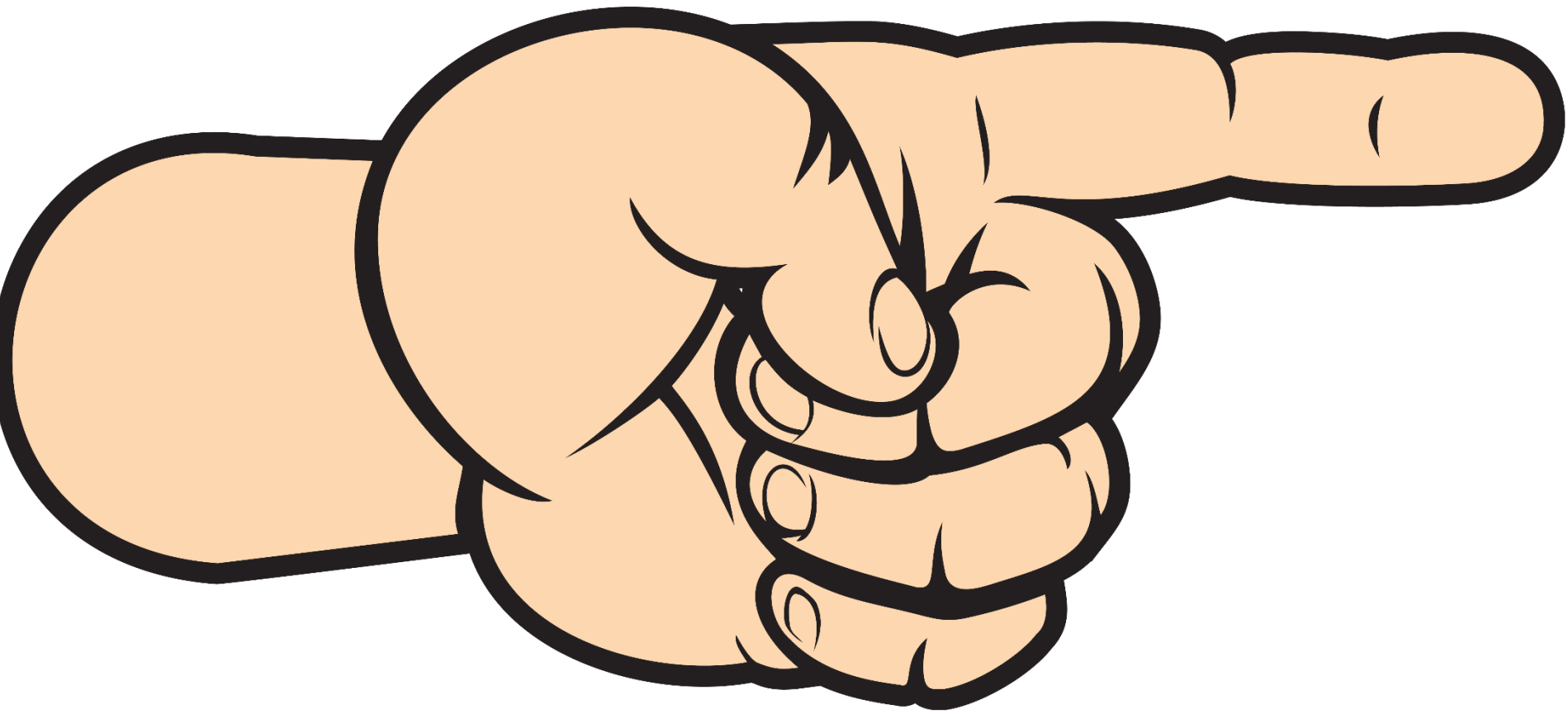
Papageorgiou General Hospital

papavasiliou.kyriakos@gmail.com





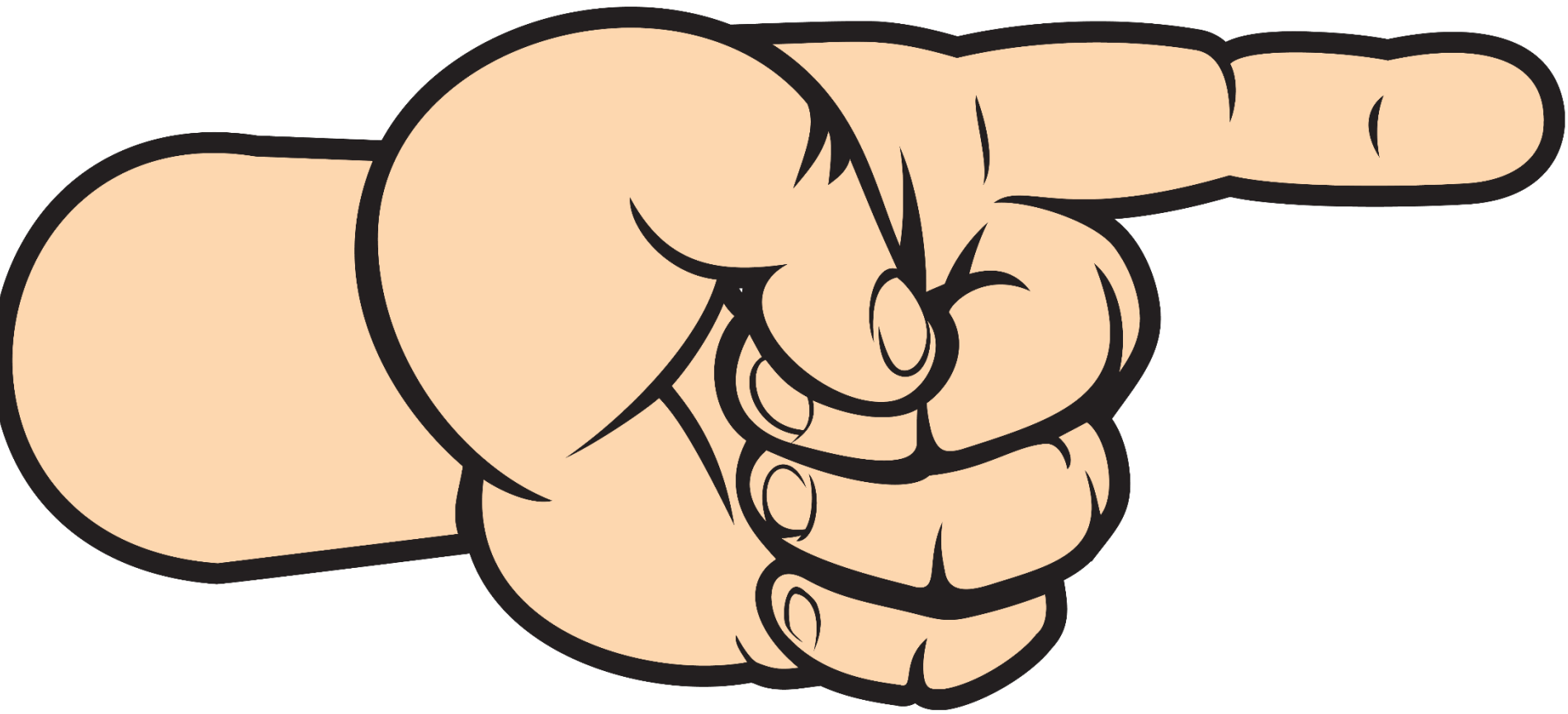


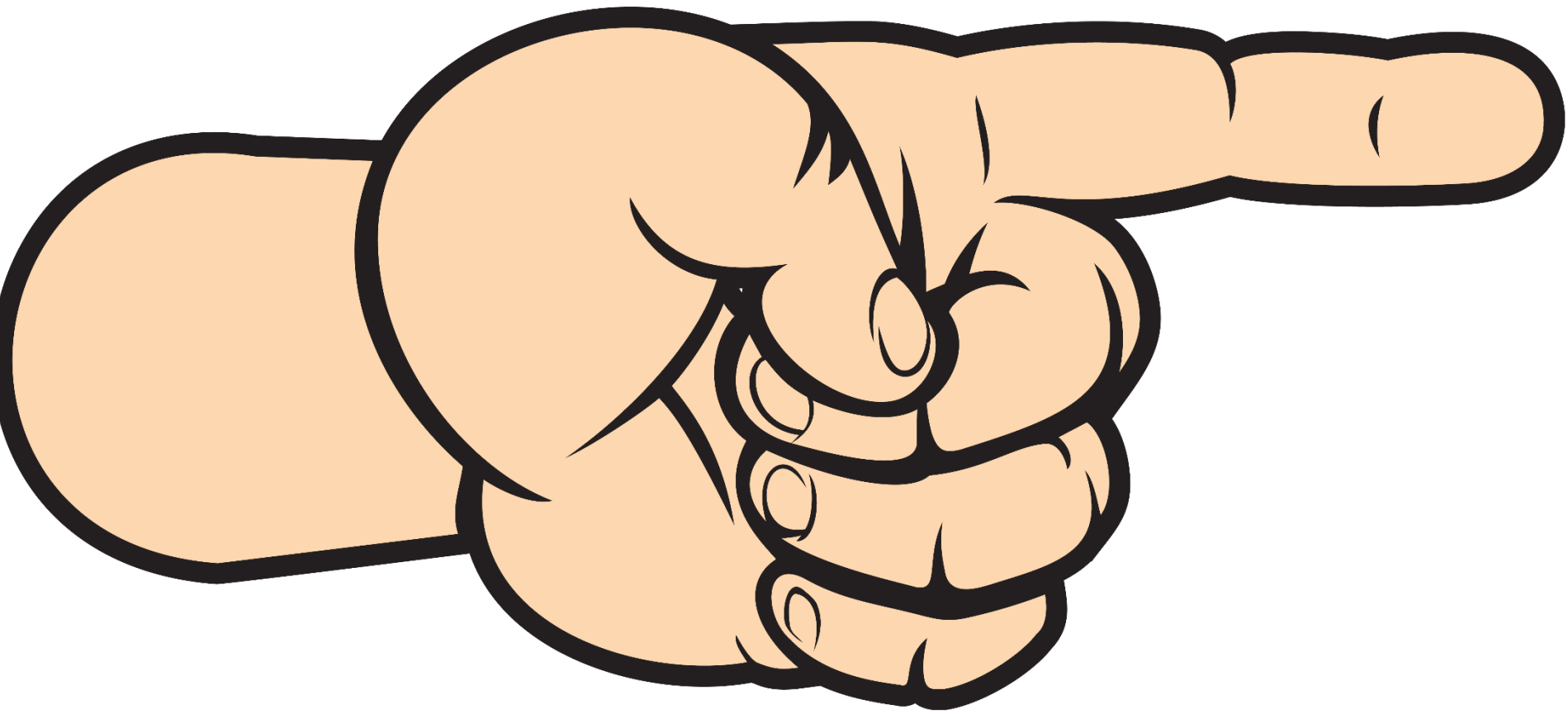








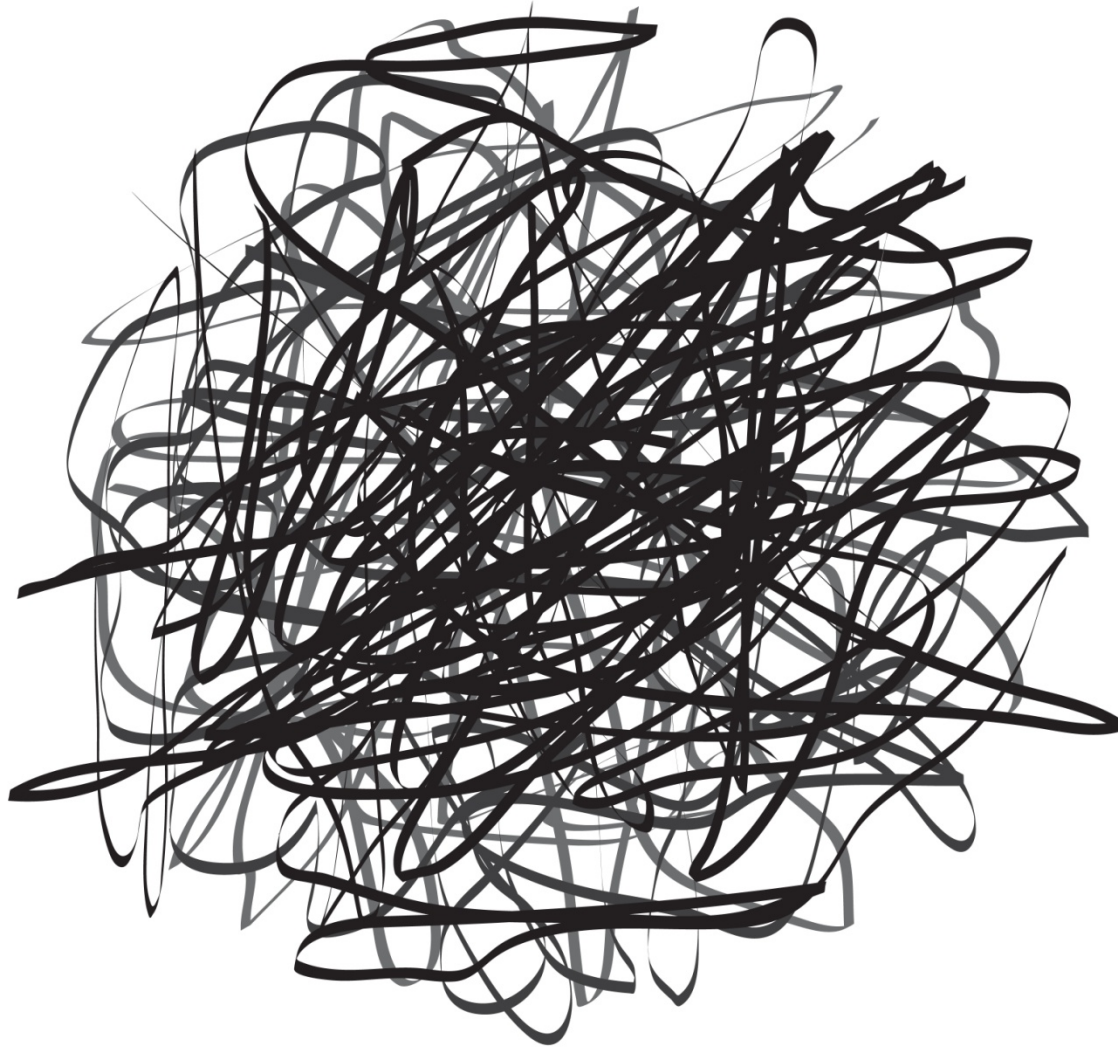






**What Can
Go Wrong?**



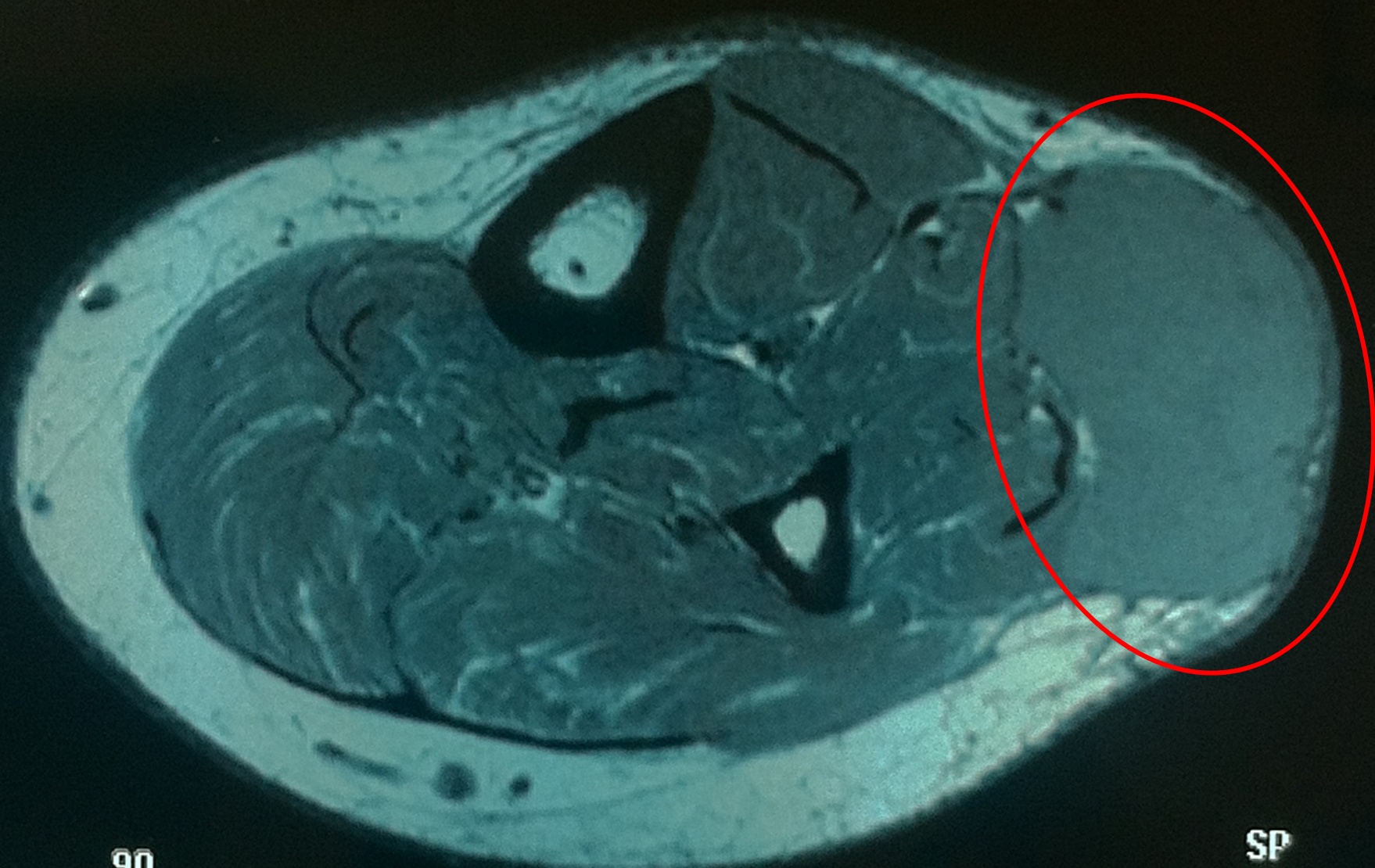


Terminology-Classification-Diagnostic Tools-Differential Diagnosis

Case #1

Medical record file belongs to a patient
treated by the speaker

IMAGE 33
SER 1-4
F 1.54



91 90
D

SP -6
SL 4
FoV 219*2

10:37
26-JUL-2011
IMAGE 61
SER 1-5

MF 1.98

R



ts1_7 180
* D

TR 4000.0
TE 96.0/1
TA 02:29
AC 2

LEFT

SP 59.1
SL 4.0
FoV 170*340
126 *5120
Cor>Tra 3

W 1786
C 957

Case #2

Medical record file belongs to a patient
treated by the speaker

AIL

CONTRAST :

62

01990869

SE:601

23/03/1983

IM:10

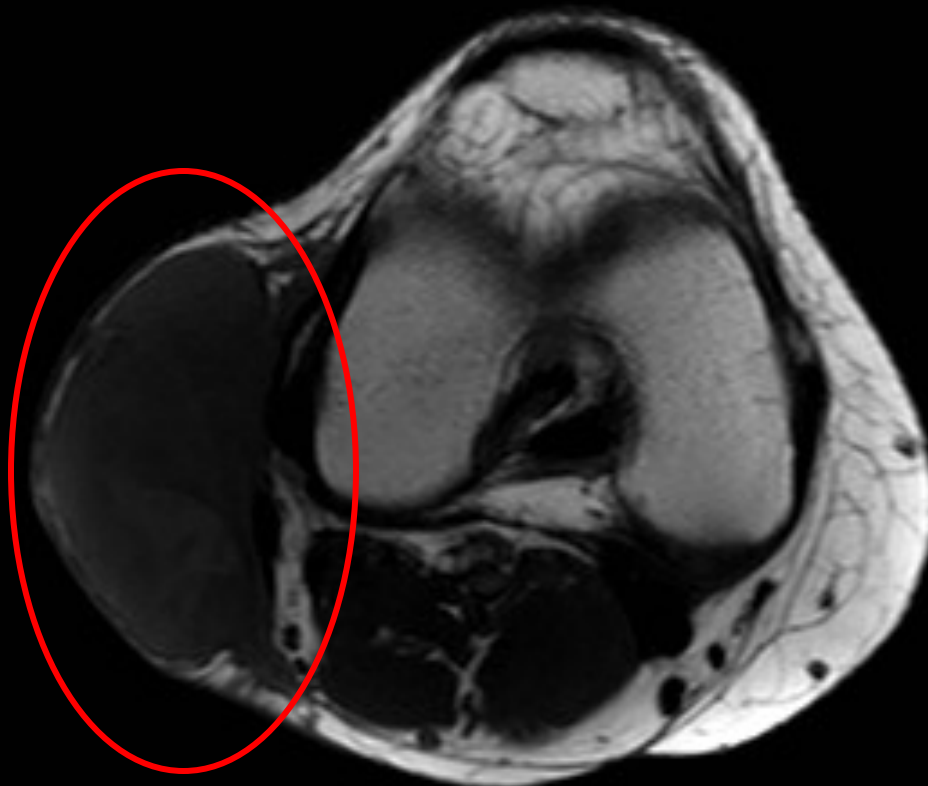
029Y

12:46:26

F

29/01/2013

R
A
S



L
P
I

PAPAGEORGIU HOSPITAL

PSR

EC:1

DFOV:200

4thk/

4.4sp

TE:20

TR:731.3

SA

CONTRAST:

62

01990869
23/03/1983
029Y
F

SE: 301

IM: 14

12:42:52

29/01/2013

R
A
I



EC: 1

DFOV: 220

3thk/

3.5sp

TE: 100

TR: 4882

PAPAGEORGIOU HOSPITAL

IP

Case #3

Medical record file belongs to a patient
treated by the speaker

S125

CONTRAST:

89

01984246

SE:301

02/07/1949

IM:15

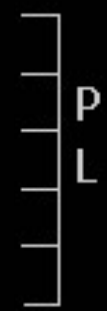
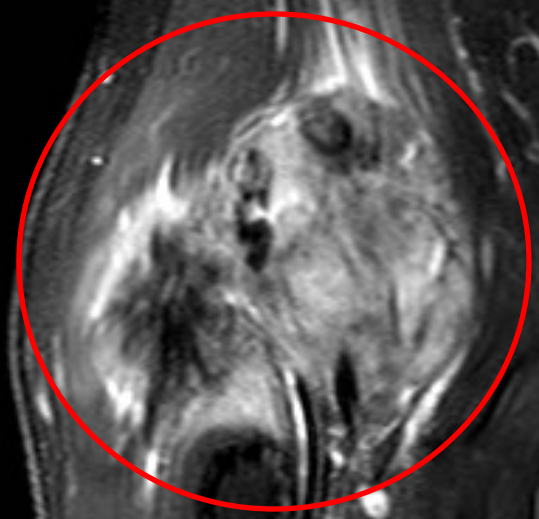
064Y

18:23:32

F

26/11/2013

A
R



EC:1

DFOV:250

3.4thk/

3.74sp

TE:60

TR:5061

PAPAGEORGIU HOSPITAL

I125

01984246
02/07/1949
064Y
F

CONTRAST :
89
SE:601
IM:17
18:30:23
26/11/2013

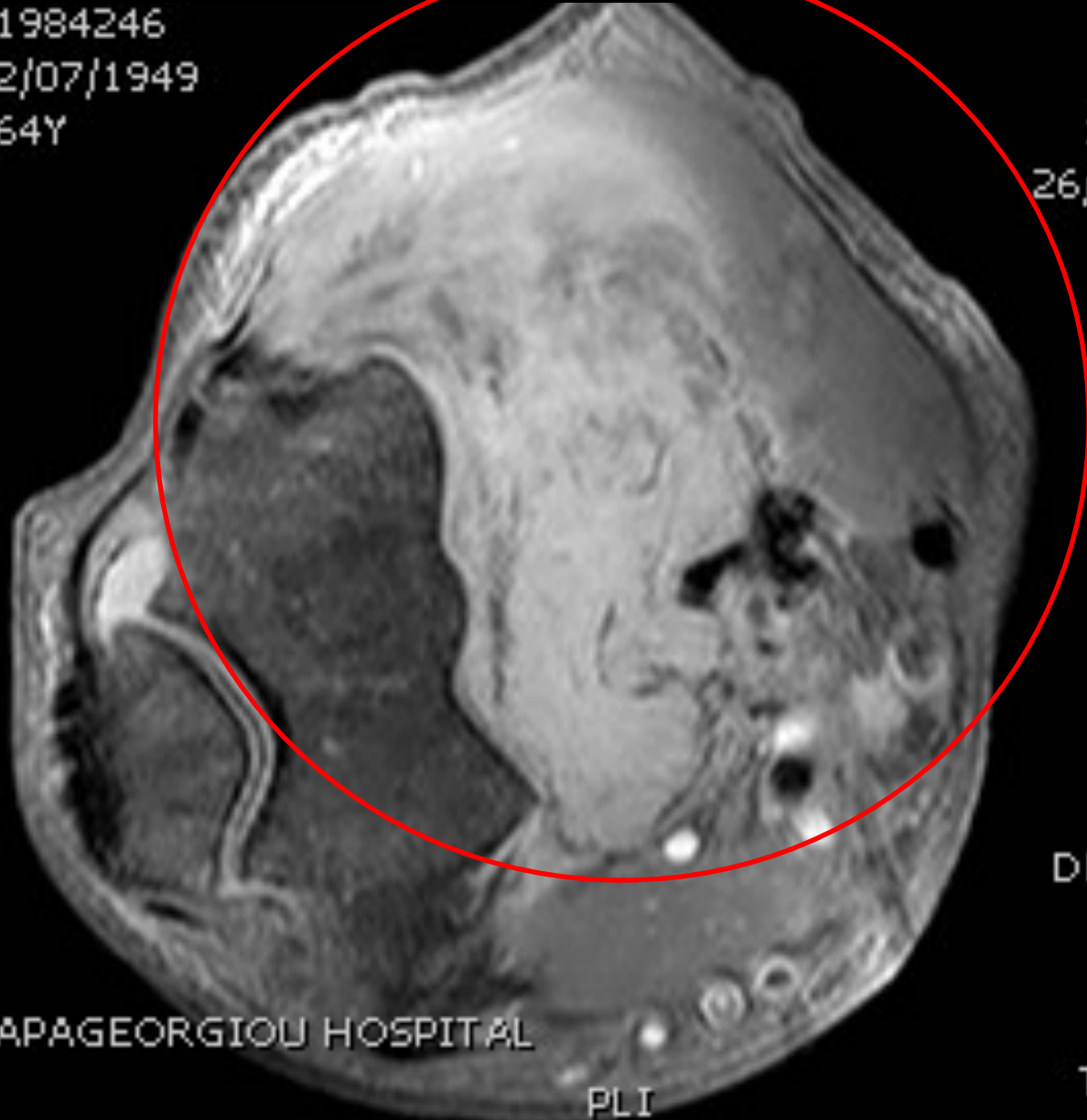
R
P

L
A

PAPAGEORGIU HOSPITAL

PLI

EC:1
DFOV:120
3.6thk/
4.3sp
TE:20
TR:749.1







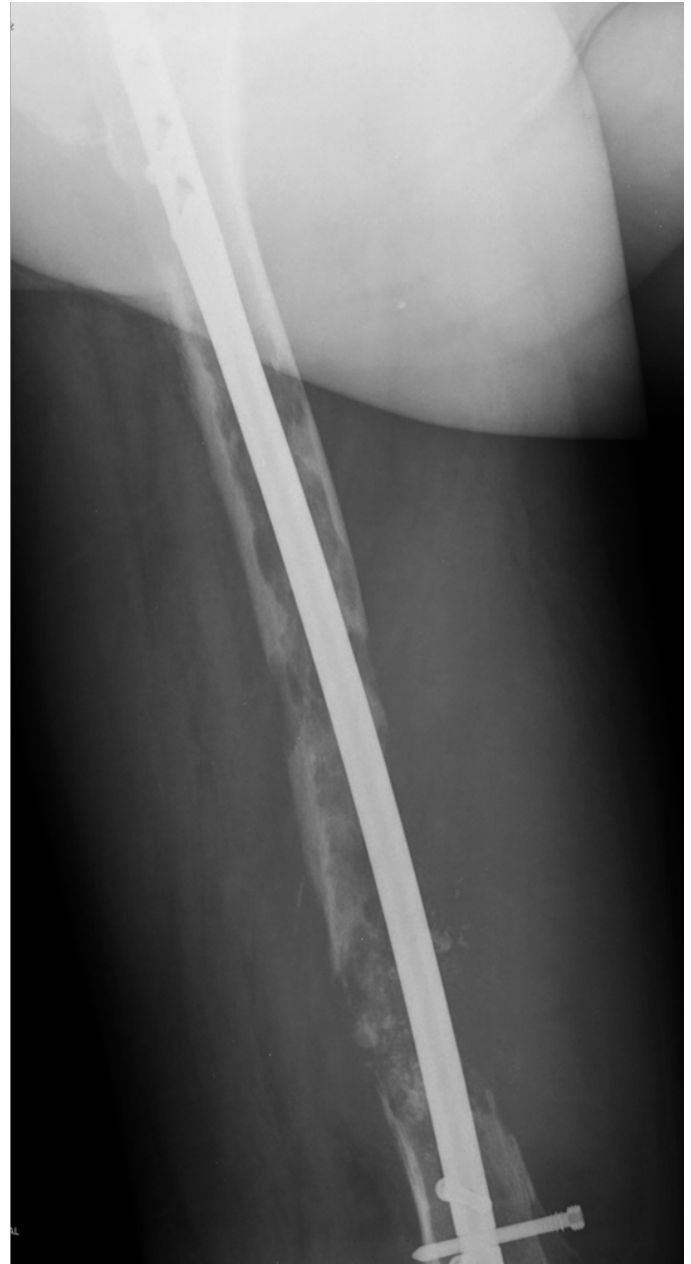
Case #4

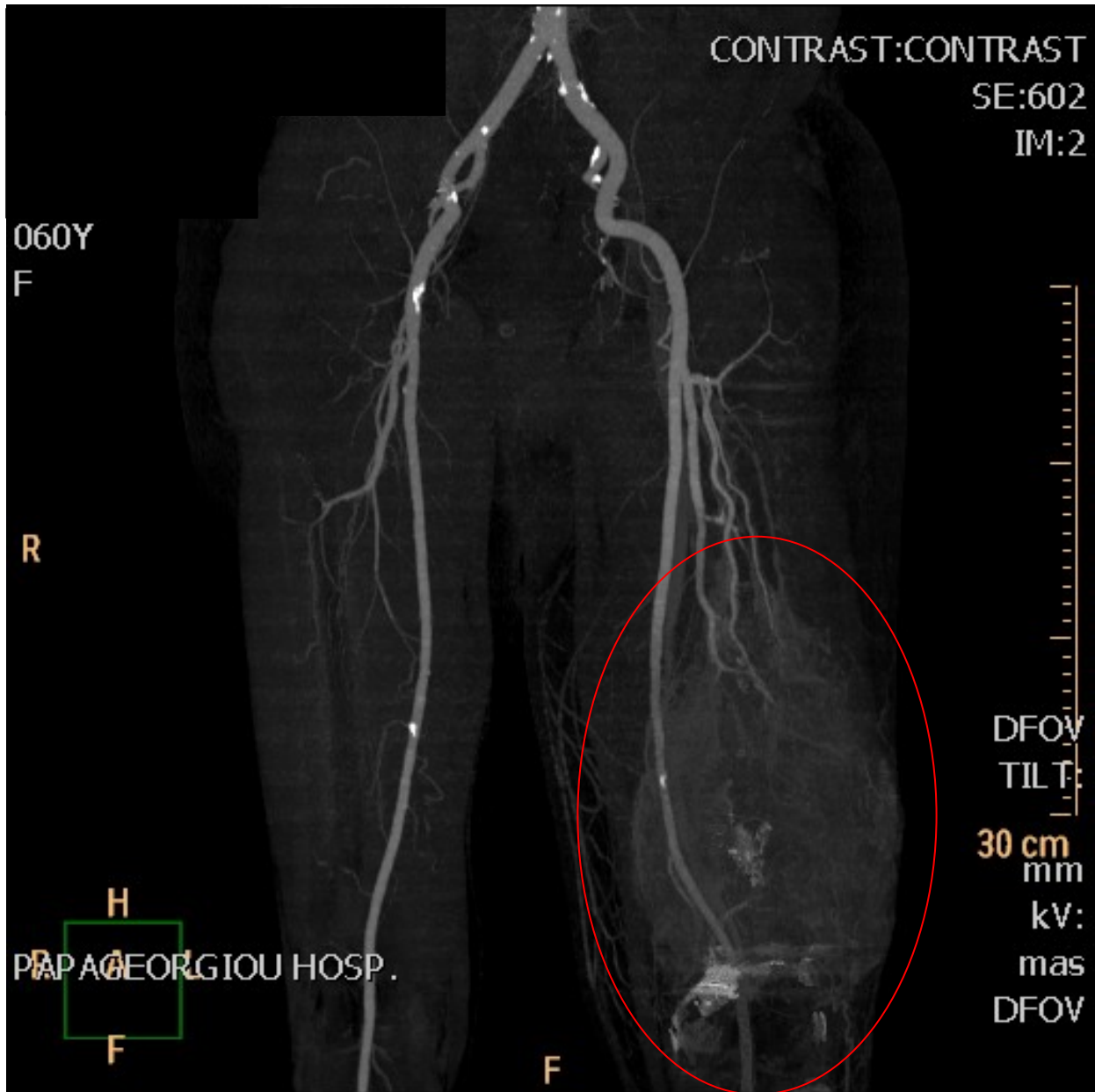
Medical record file retrieved by PubMed



Case #5

Medical record file belongs to a patient
treated by the speaker





CONTRAST:CONTRAST

SE:602

IM:2

060Y

F

R

PAPA GEORGIU HOSP.

H

A

F

F

DFOV

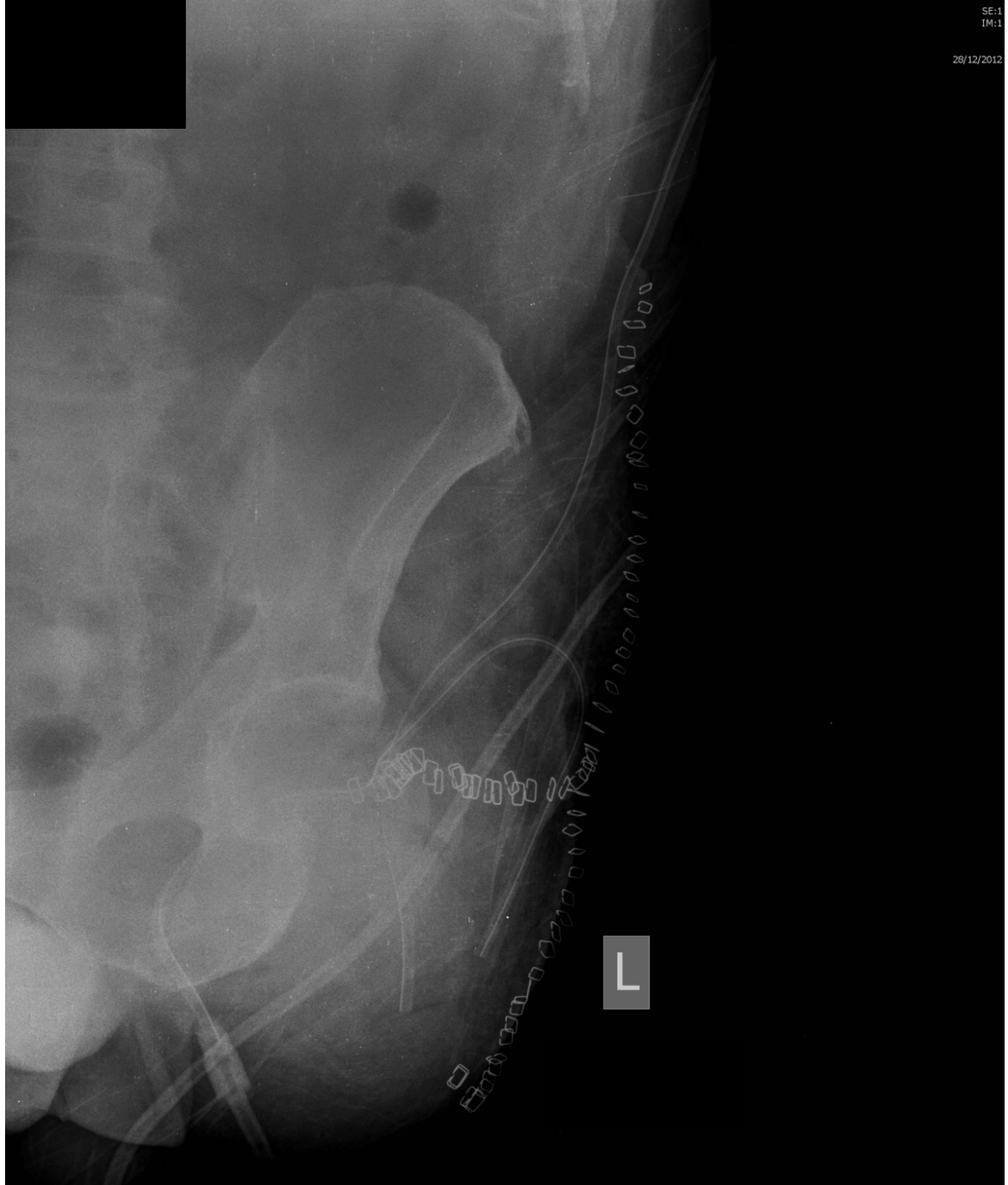
TILT:

30 cm
mm

kV:

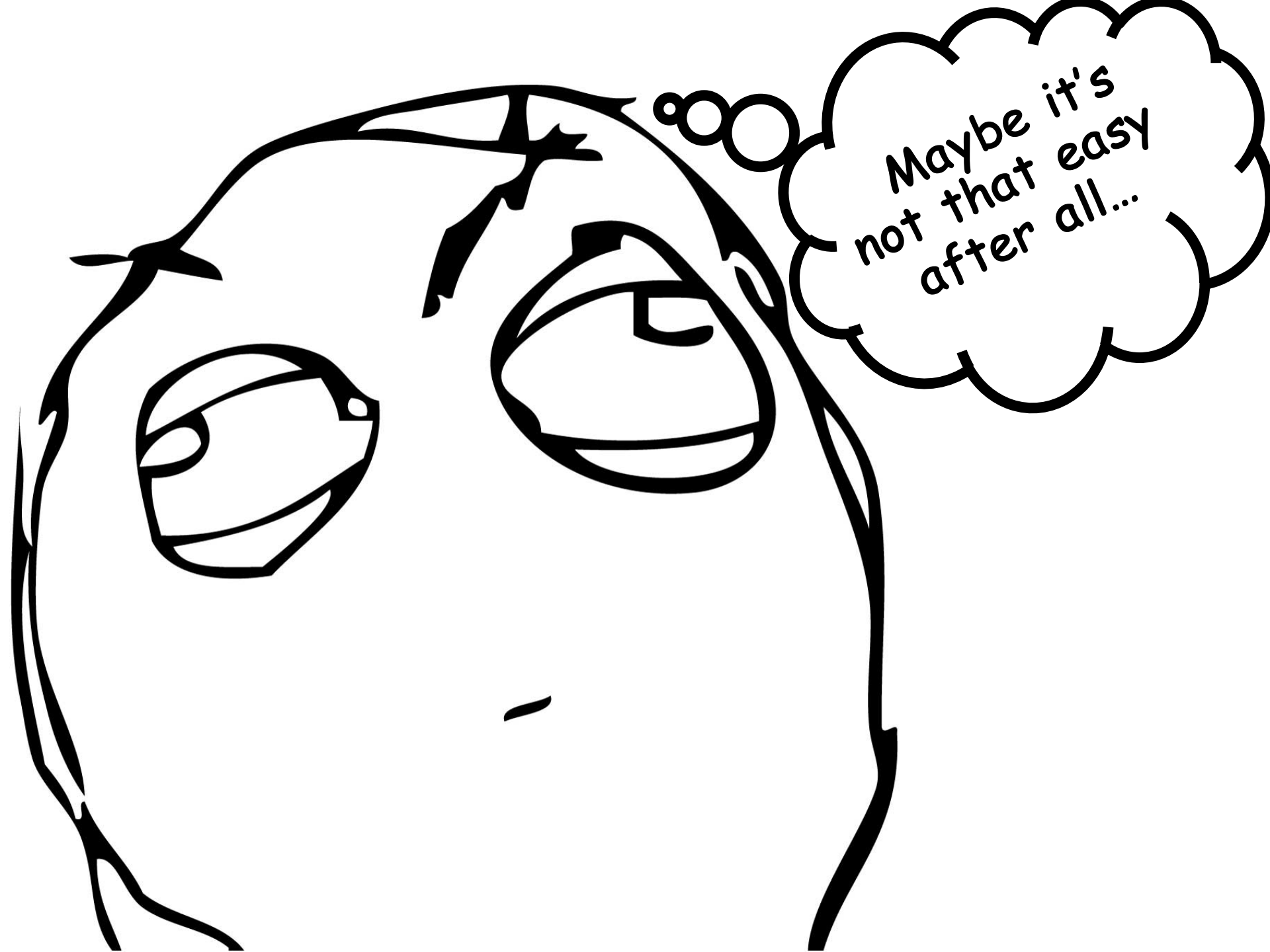
mas

DFOV



R





Maybe it's
not that easy
after all...



Maybe there are
more things
endangered this
way...?

Patient Referral

Multidisciplinary Team

Biopsy



Patient Referral

Patient Referral



Treating patients with musculoskeletal tumors is a difficult task...

It is preferable to be done from the beginning in designated tumor services and by specialized physicians



Patient Referral



Every tumor is not easily treated and should not be excised before we know exactly its characteristics...

Many times, initial treatment by physicians who are not familiar with musculoskeletal oncology, may compromise the salvation of a limb, and/or the survivorship of the patient.



Iwamoto Y. Diagnosis and treatment of soft tissue tumors. J Orthop Sci . 1999;4:54-65.

COMMUNICATE



Multidisciplinary Team

Multidisciplinary Team



All musculoskeletal tumors (primary and metastatic) should be evaluated and treated by a team of physicians who are experts on this field.

- **Grimer R et al.** UK Guidelines for the Management of Bone Sarcomas. *Sarcoma*. 2010;2010:317462.
- **Hogendoorn PC; ESMO/EUROBONET Working Group, Athanasou N et al.** Bone sarcomas: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol*. 2010 May;21 Suppl 5:v204-13.
- **Biermann JS et al.** National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. *J Natl Compr Canc Netw*. 2010 Jun;8(6):688-712.
- **Kager L et al.** Cooperative German-Austrian-Swiss Osteosarcoma Study Group. Primary metastatic osteosarcoma: presentation and outcome of patients treated on neoadjuvant Cooperative Osteosarcoma Study Group protocols. *J Clin Oncol*. 2003 May 15;21(10):2011-8.





Multidisciplinary Team

CORE SPECIALTIES

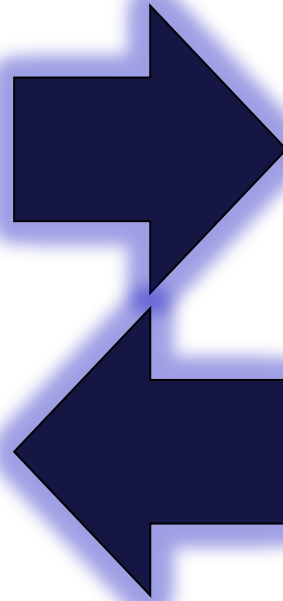
Sarcoma Orthopaedic Surgeon

Pathologist

Oncologist & Pediatric Oncologist

Radiotherapist

Musculoskeletal Radiologist



ADDITIONAL SPECIALTIES

Thoracic Surgeon

Plastic Surgeon

Vascular Surgeon

...

Biermann JS et al. National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.







**Staging
What's that?**



Multidisciplinary Team

It is the procedure by which patients with musculoskeletal tumors are being evaluated for:

- The histology of the tumor
- Local extent of the tumor
- Metastases

Multidisciplinary Team



Surgical staging aims to:

Evaluate patients based on well-known risk factors

Evaluate (if possible) prognosis)

Provide guidance regarding treating modalities

Compare results between patients/treatments





Multidisciplinary Team

Musculoskeletal Tumor Society Staging System

| Stage | Grade | Local Extent | Metastases |
|-------|-------|--------------------|------------|
| I-A | Low | Intracompartmental | None |
| I-B | Low | Extracompartmental | None |
| II-A | High | Intracompartmental | None |
| II-B | High | Extracompartmental | None |
| III | Any | Any | Present |

Multidisciplinary Team



CT & MRI non-existing when it was introduced

Assisting decisions regarding operative options BEFORE the introduction of current neo-adjuvant treatments





Multidisciplinary Team

TABLE 3 Definition of TNM and Grade [G]³

| | |
|--------------------------|---|
| Primary Tumor [T] | |
| TX | Primary tumor cannot be assessed |
| T0 | No evidence of primary tumor |
| T1 | Tumor 8 cm or less in greatest dimension |
| T2 | Tumor more than 8 cm in greatest dimension |
| T3 | Discontinuous tumors in the primary bone site |
| Regional Lymph Nodes [N] | |
| NX* | Regional lymph nodes cannot be assessed |
| N0 | No regional lymph node metastasis |
| N1 | Regional lymph node metastasis |
| Distant Metastasis [M] | |
| MX | Distant metastasis cannot be assessed |
| M0 | No distant metastasis |
| M1 | Distant metastasis |
| M1a | Lung |
| M1b | Other distant sites |
| Histologic Grade [G] | |
| GX | Grade cannot be assessed |
| G1 | Well differentiated—low grade |
| G2 | Moderately differentiated—low grade |
| G3 | Poorly differentiated—high grade |
| G4† | Undifferentiated—high grade |



Multidisciplinary Team

American Joint Committee on Cancer (AJCC)

| Stage | Tumor (T) | Node (N) | Metastasis (M) | Grade (G) |
|-------|-----------|----------|----------------|-----------------|
| I-A | T1 | N0 | M0 | G1,2 low grade |
| I-B | T2 | N0 | M0 | G1,2 low grade |
| II-A | T1 | N0 | M0 | G3,4 high grade |
| II-B | T2 | N0 | M0 | G3,4 high grade |
| III | T3 | N0 | M0 | Any G |
| IV-A | Any T | N0 | M1a | Any G |
| IV-B | Any T | N1 | Any M | Any G |
| | Any T | Any N | M1b | Any G |

Multidisciplinary Team



History (age, co-morbidities)

Physical Examination

- Evaluation of the size of a mass (when palpable)
- Local temperature
- Mobility
- Muscles atrophy
- Neurologic deficit
- Vascularity
- Nodes



Multidisciplinary Team



Plain x-ray

MRI

CT

Bone Scanning

Blood tests (?)

NECESSARILY
before biopsy

DIAGNOSTIC ALGORITHM FOR TUMOR DIAGNOSIS & TREATMENT

History, Physical exam

Lab tests

US

Biopsy
(Grading)

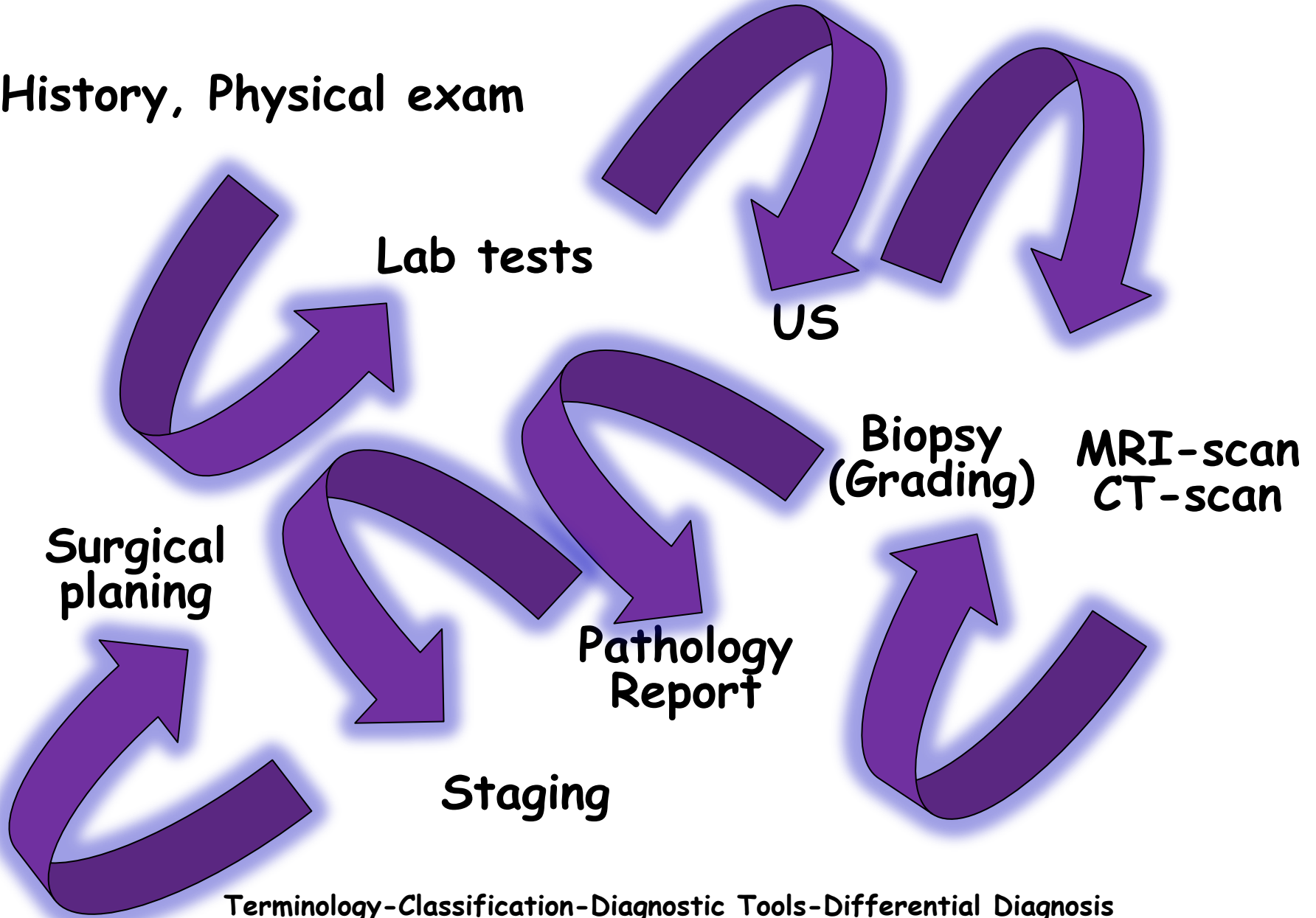
MRI-scan
CT-scan

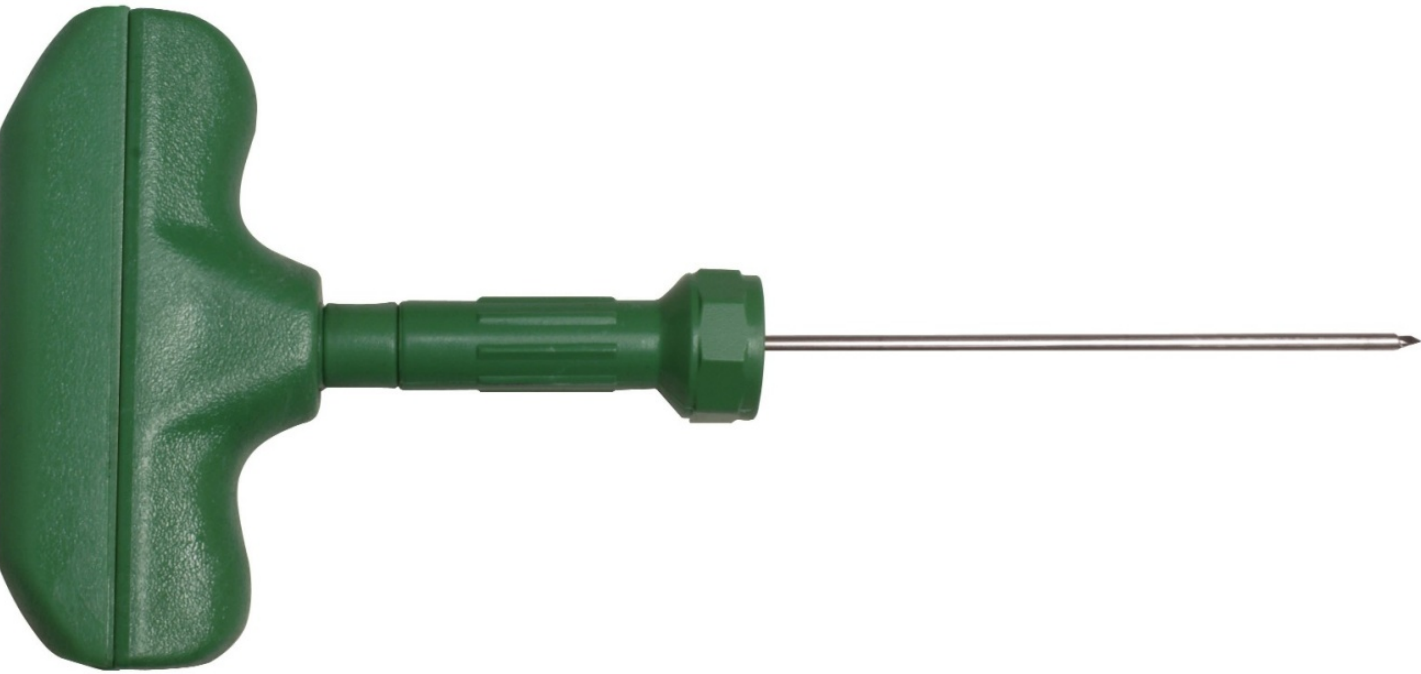
Surgical
planning

Pathology
Report

Staging

Terminology-Classification-Diagnostic Tools-Differential Diagnosis





Biopsy

Biopsy



Diagnosis and histological identification of a lesion before operative treatment is mandatory



Biermann JS et al. National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.



**Differential Diagnosis may
be extremely challenging!**



**Every Infection can mimic
a tumor!**



Every tumor can mimic an infection!

Biopsy



Ideally, this should be performed at the designated Musculoskeletal Oncology Center where treatment will take place



Biermann JS et al. National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.

Biopsy



Proper placing of a biopsy is extremely important.

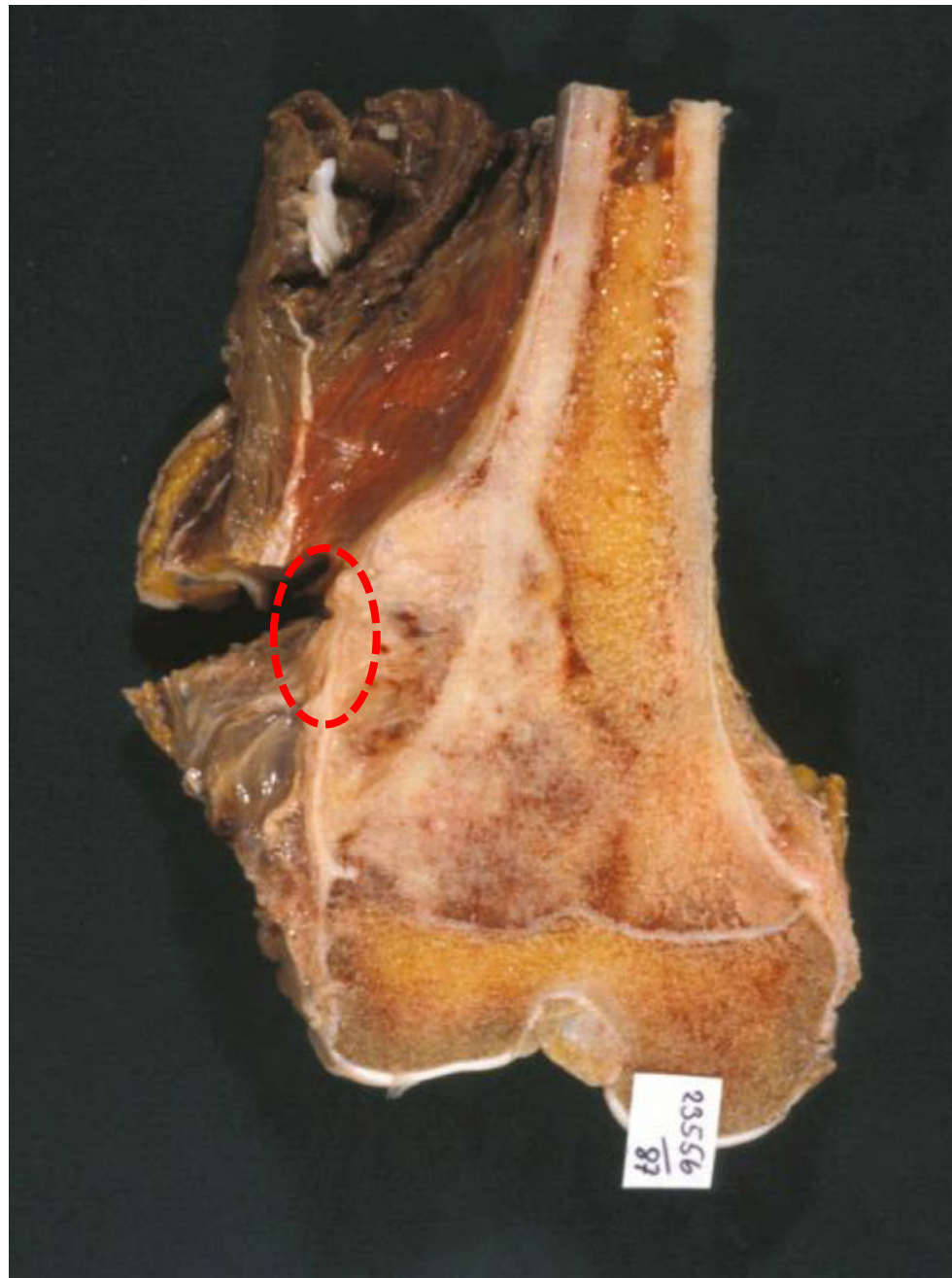


Biermann JS et al. National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.

Biopsy



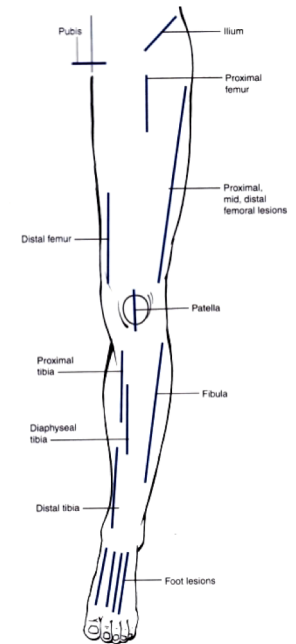
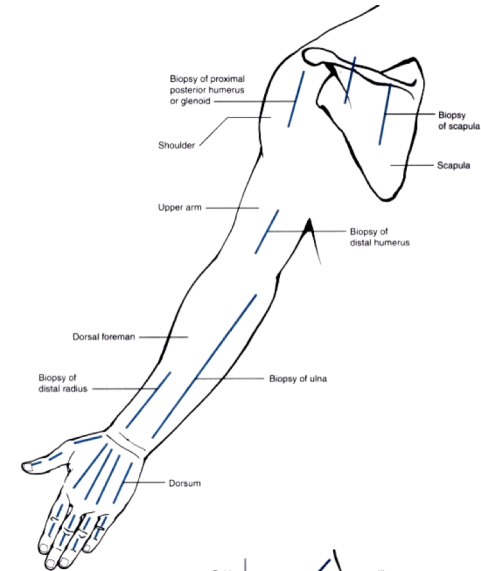
Medical record file
retrieved by PubMed





Biopsy

It can either be Core-Needle or Open



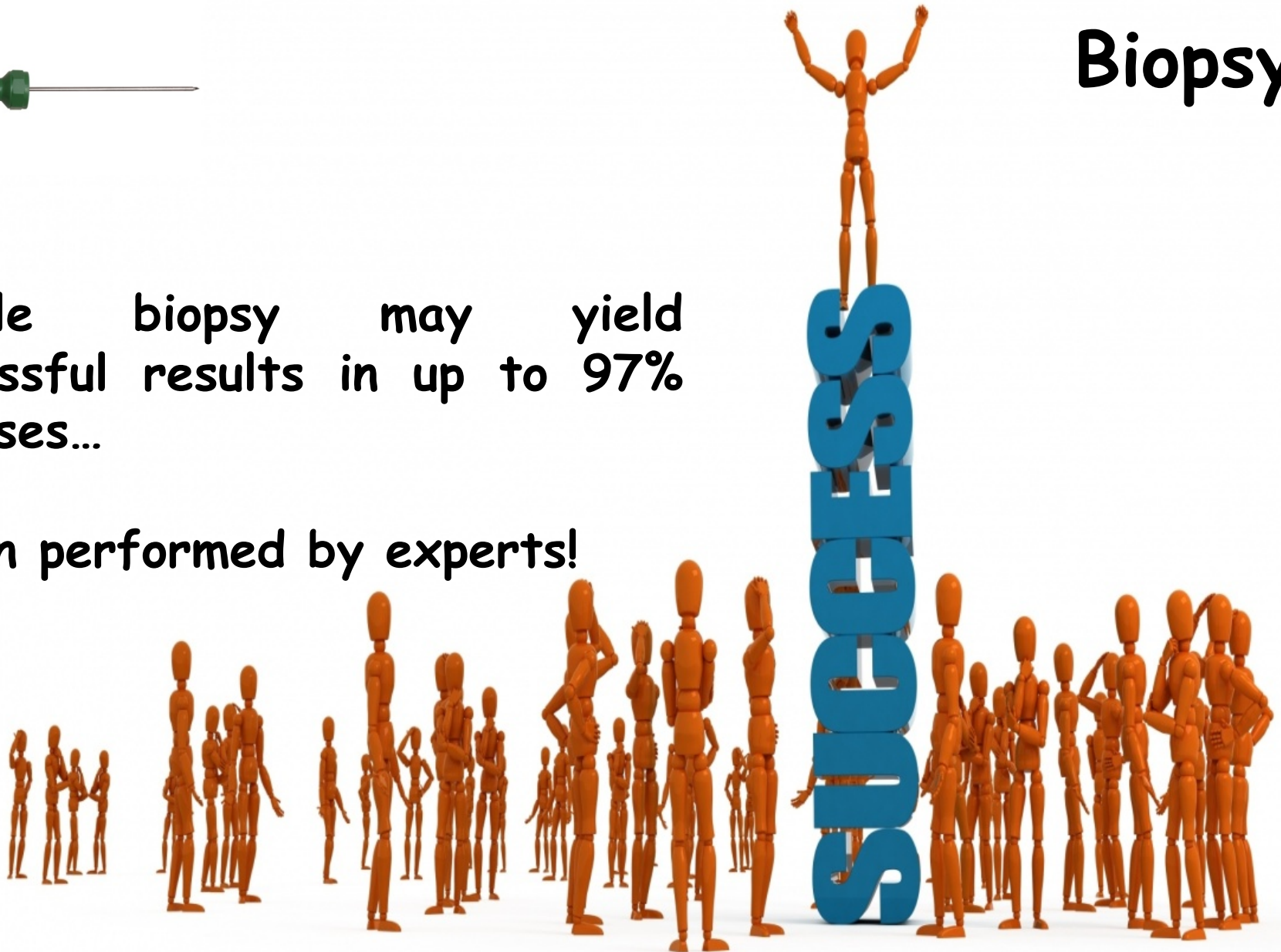
Biermann JS et al. National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.

Biopsy



Needle biopsy may yield successful results in up to 97% of cases...

...when performed by experts!



Stoker DJ et al. Needle biopsy of musculoskeletal lesions: A review of 208 procedures. J Bone Joint Surg Br. 1991;73:498-500.

Terminology-Classification-Diagnostic Tools-Differential Diagnosis

Biopsy

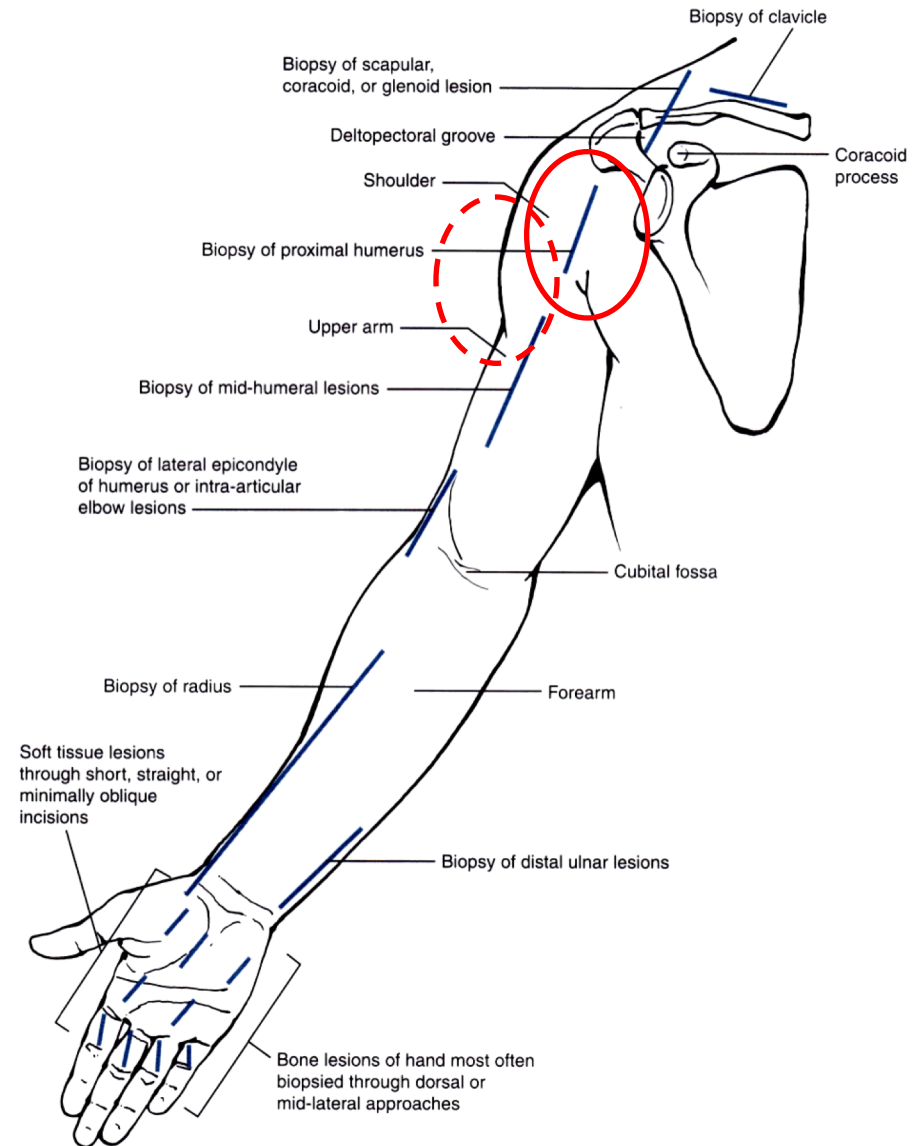
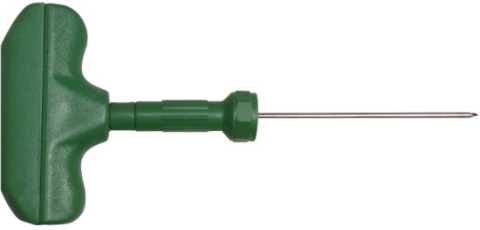


The same rules apply
in both cases.

RULES

Biermann JS et al. National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.

Biopsy

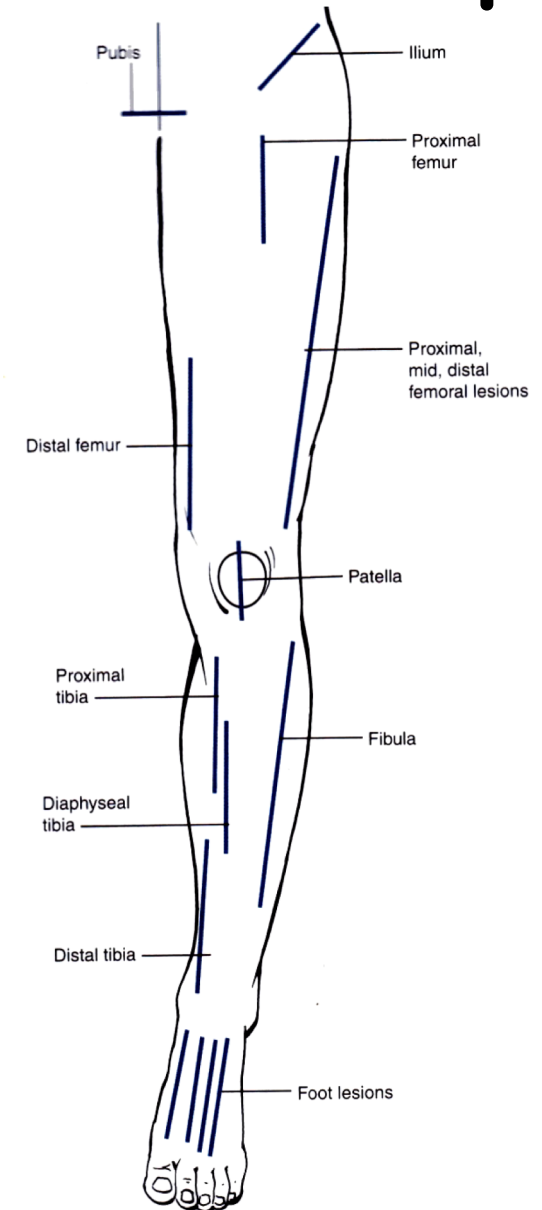




Biopsy

BEWARE!

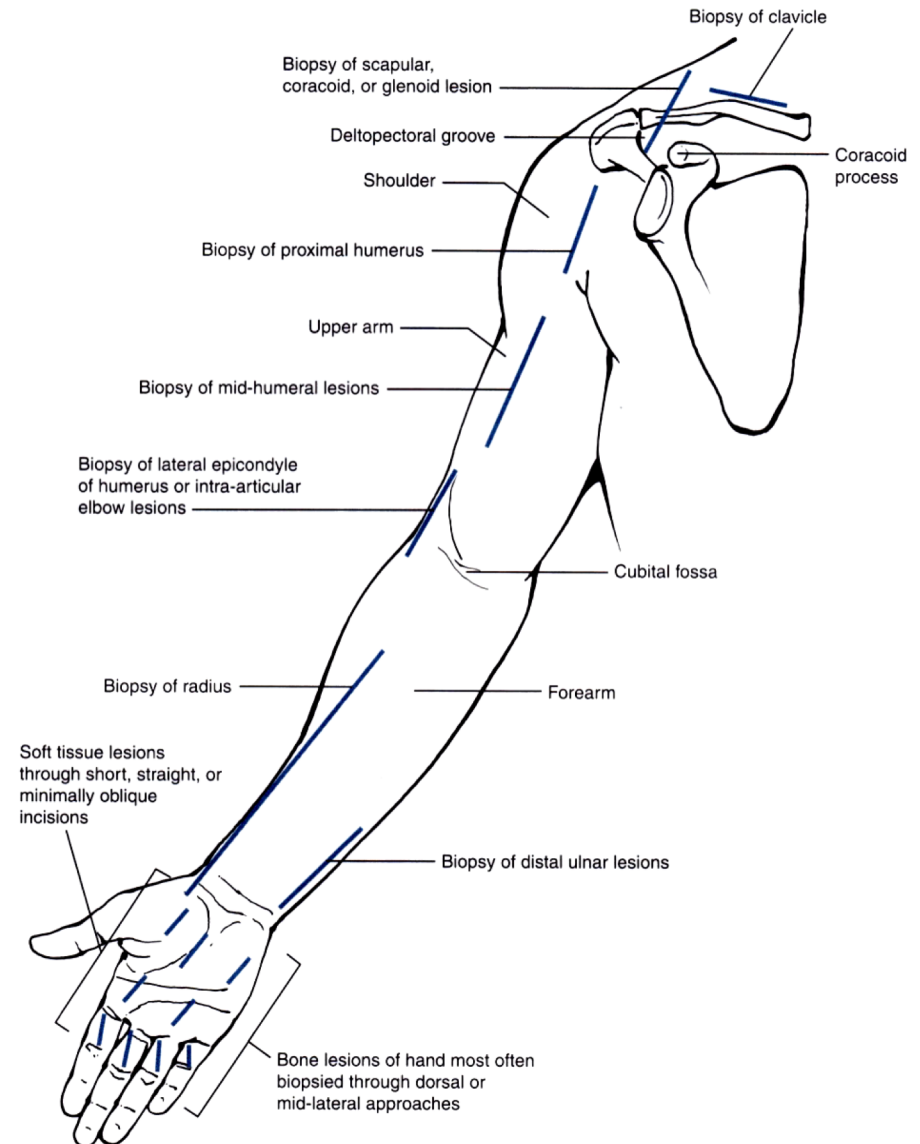
Improper placement of a biopsy may compromise result and later lead to amputation in 18% of patients.



Biopsy



Biopsy incision should be made along the definite surgical incision which will later follow.



Biopsy



COMMUNICATE!

- Surgeon
- Radiologist
- Pathologist



Biermann JS et al. National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.

Biopsy



We perform biopsies even on pathological fractures after performing an MRI-scan.



- **Biermann JS et al.** National Comprehensive Cancer Network Bone Cancer Panel. Bone Cancer. J Natl Compr Canc Netw. 2010 Jun;8(6):688-712.
- **Hogendoorn PCW on behalf of the ESMO/EUROBONET Working Group.** Bone sarcomas: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. Ann Oncol 2010;21 Suppl 5:204-13.

Biopsy



In patients at risk to sustain a fracture following biopsy, non-weight bearing walking is highly advised.



Hogendoorn PCW on behalf of the ESMO/EUROBONET Working Group.
Bone sarcomas: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. Ann Oncol 2010;21 Suppl 5:204-13.

Case #6

Medical record file belongs to a patient
treated by the speaker

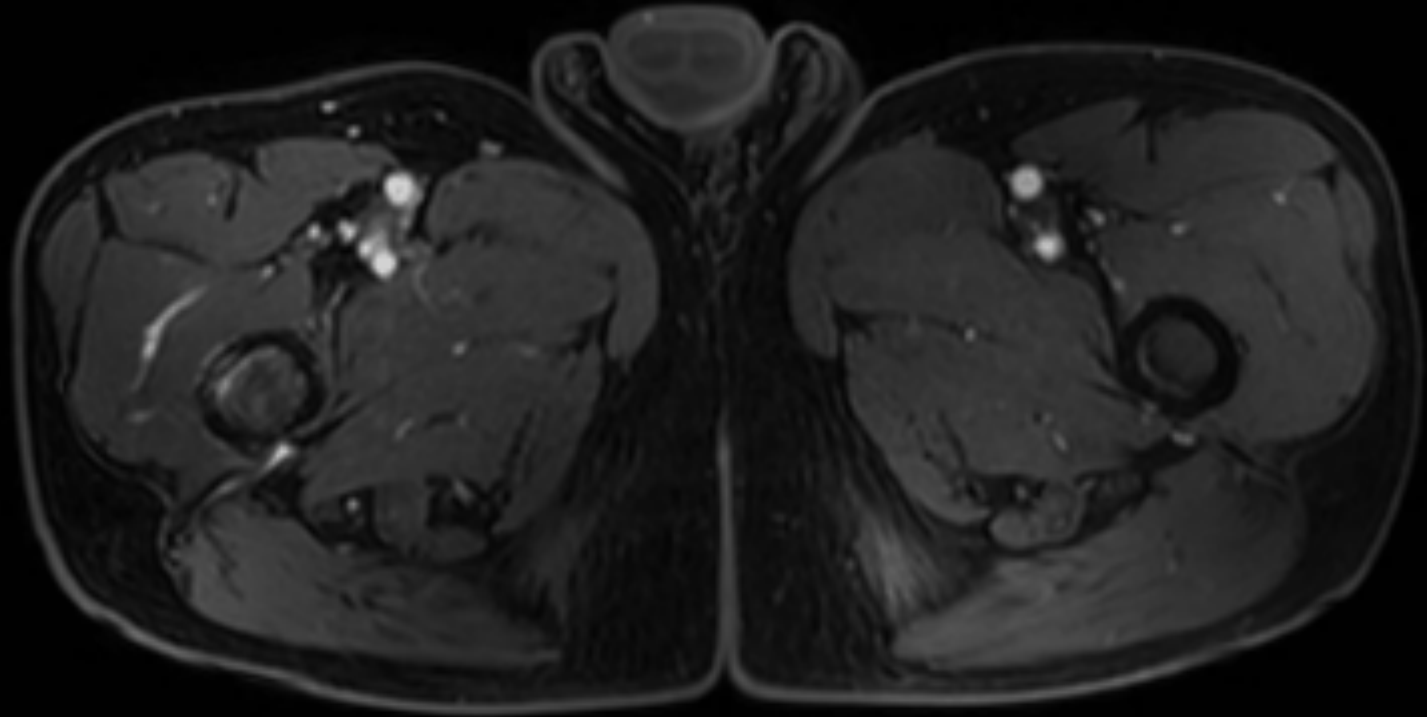


R



L

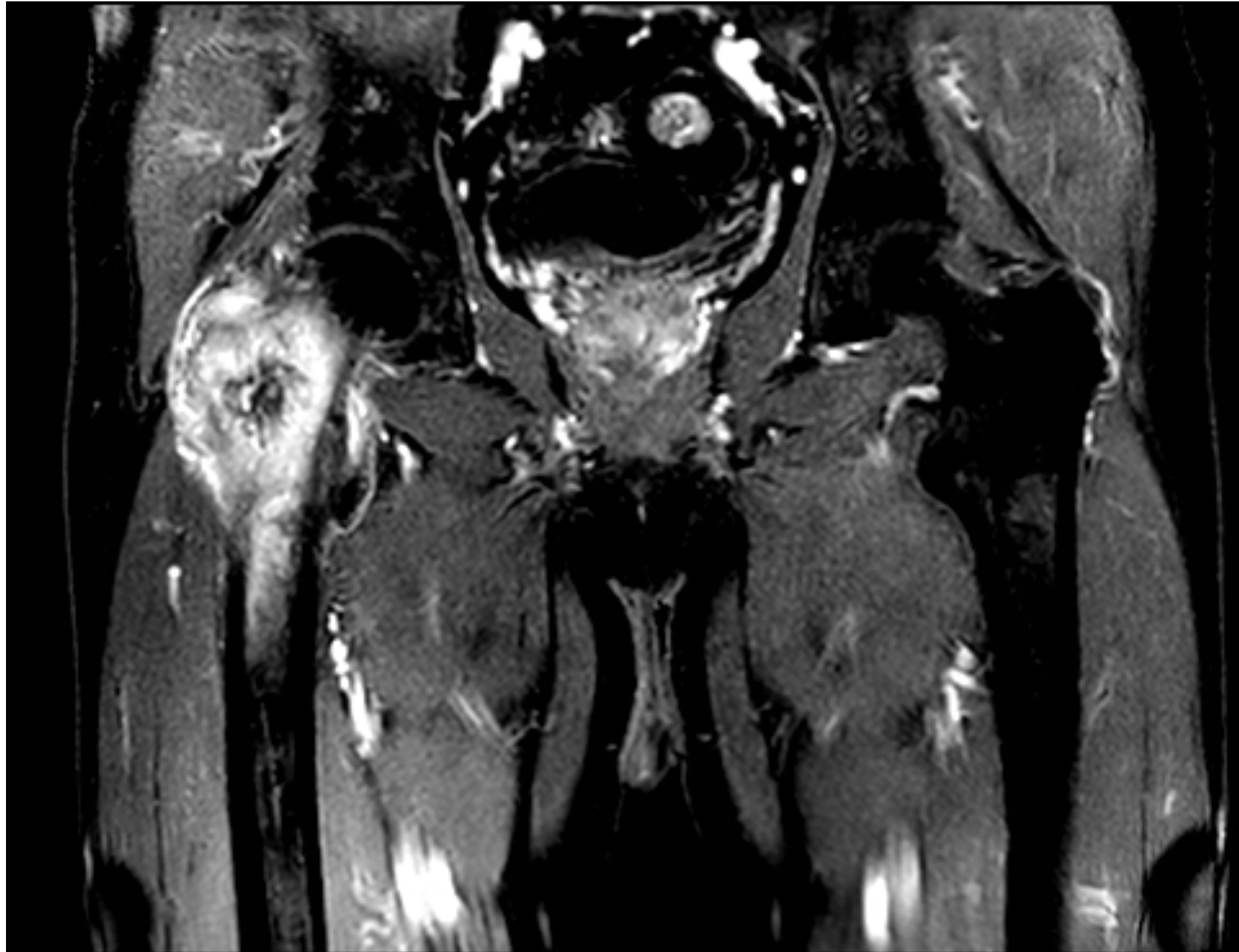
R

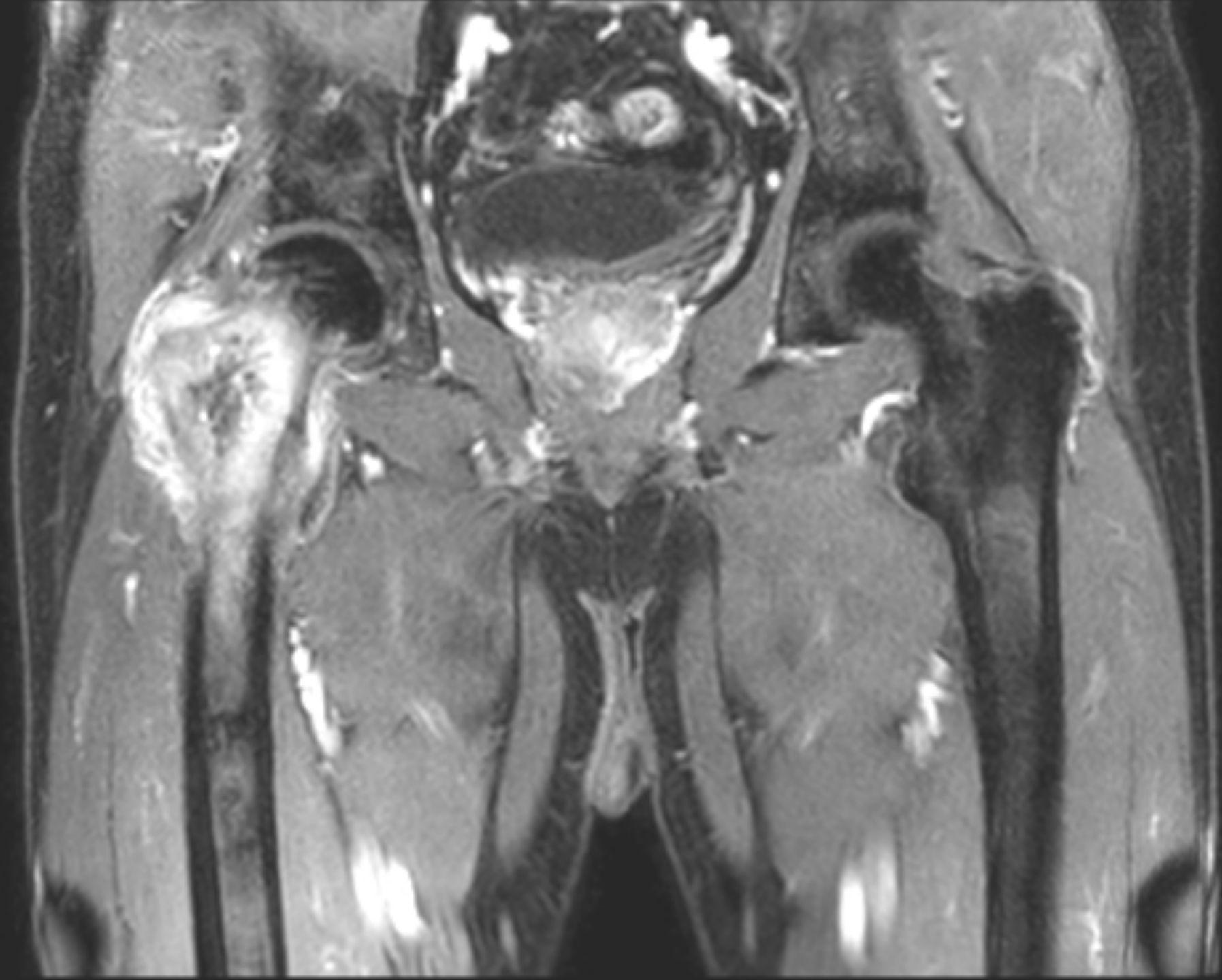


L





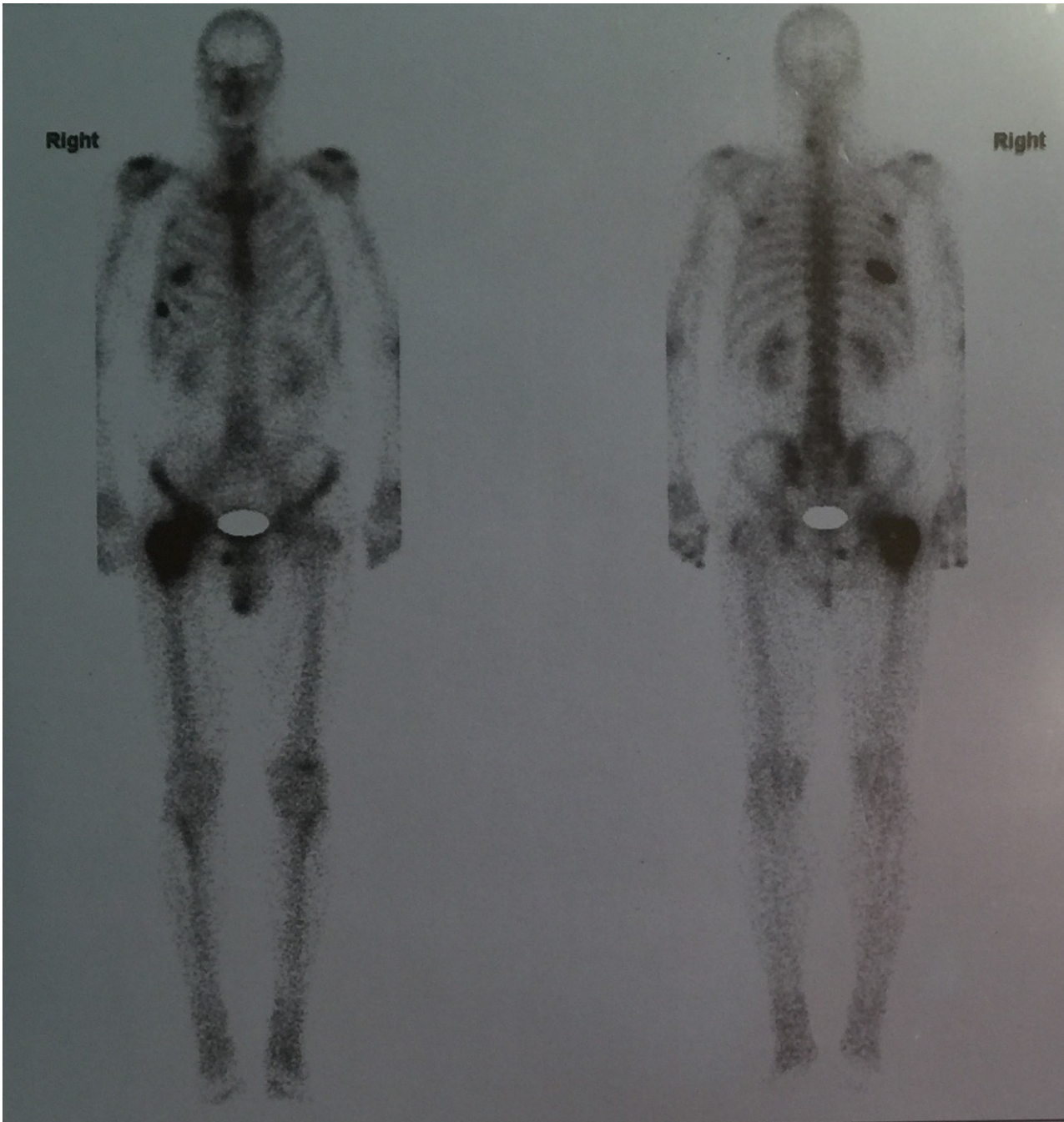




R



L



Case #7

Medical record file belongs to a patient
treated by the speaker

CT guided-core needle biopsy

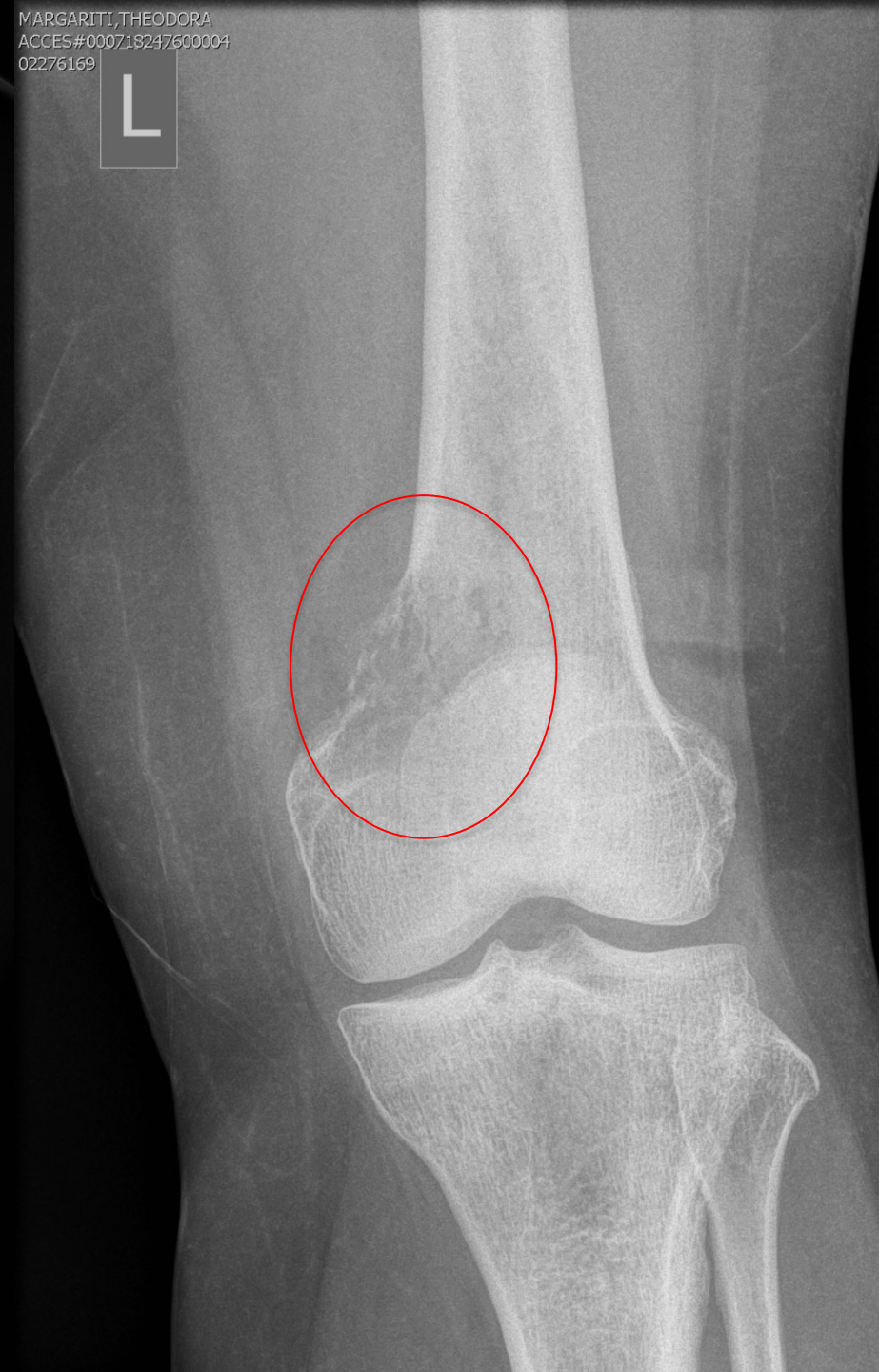


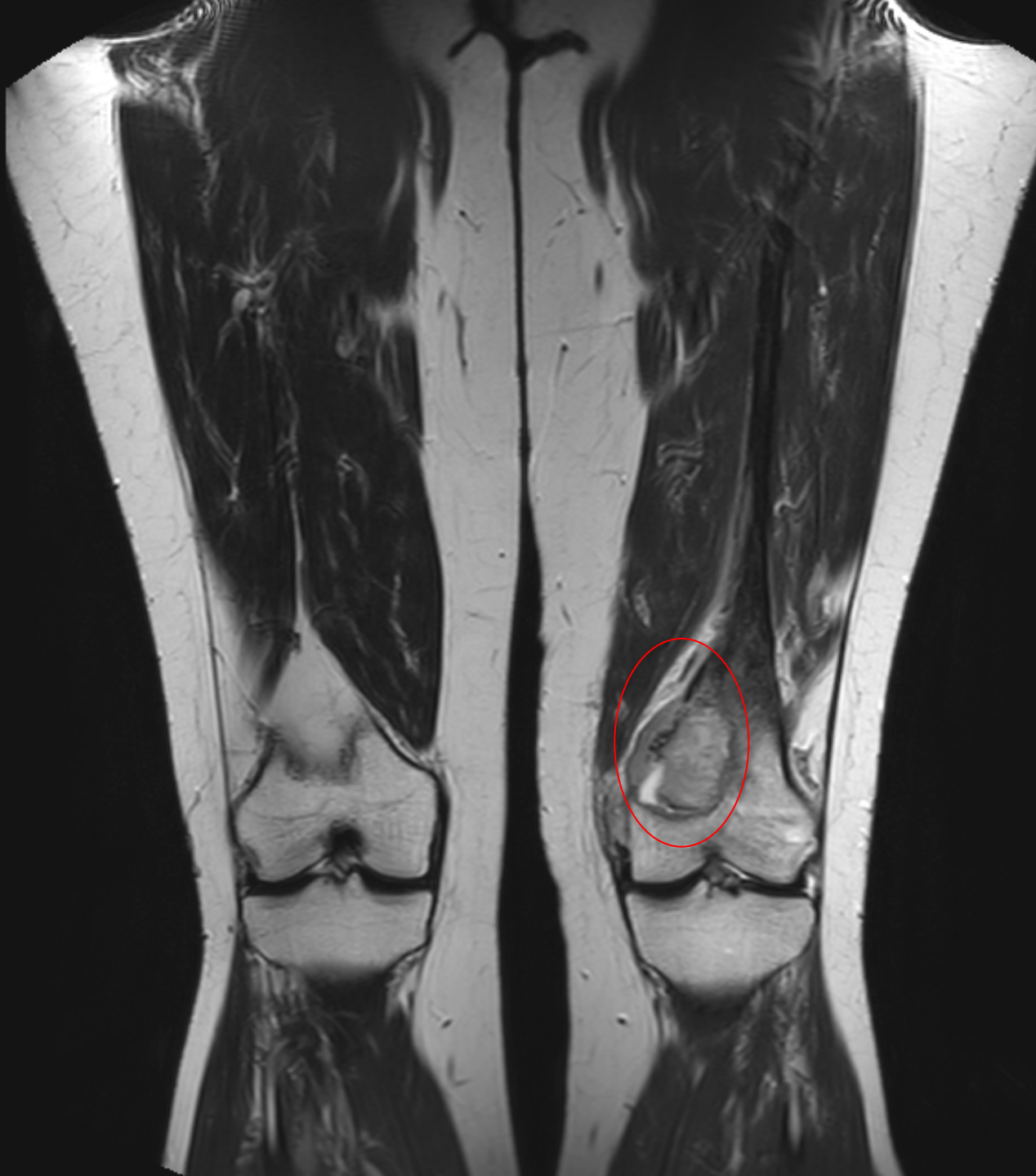
Case #8

Medical record file belongs to a patient
treated by the speaker

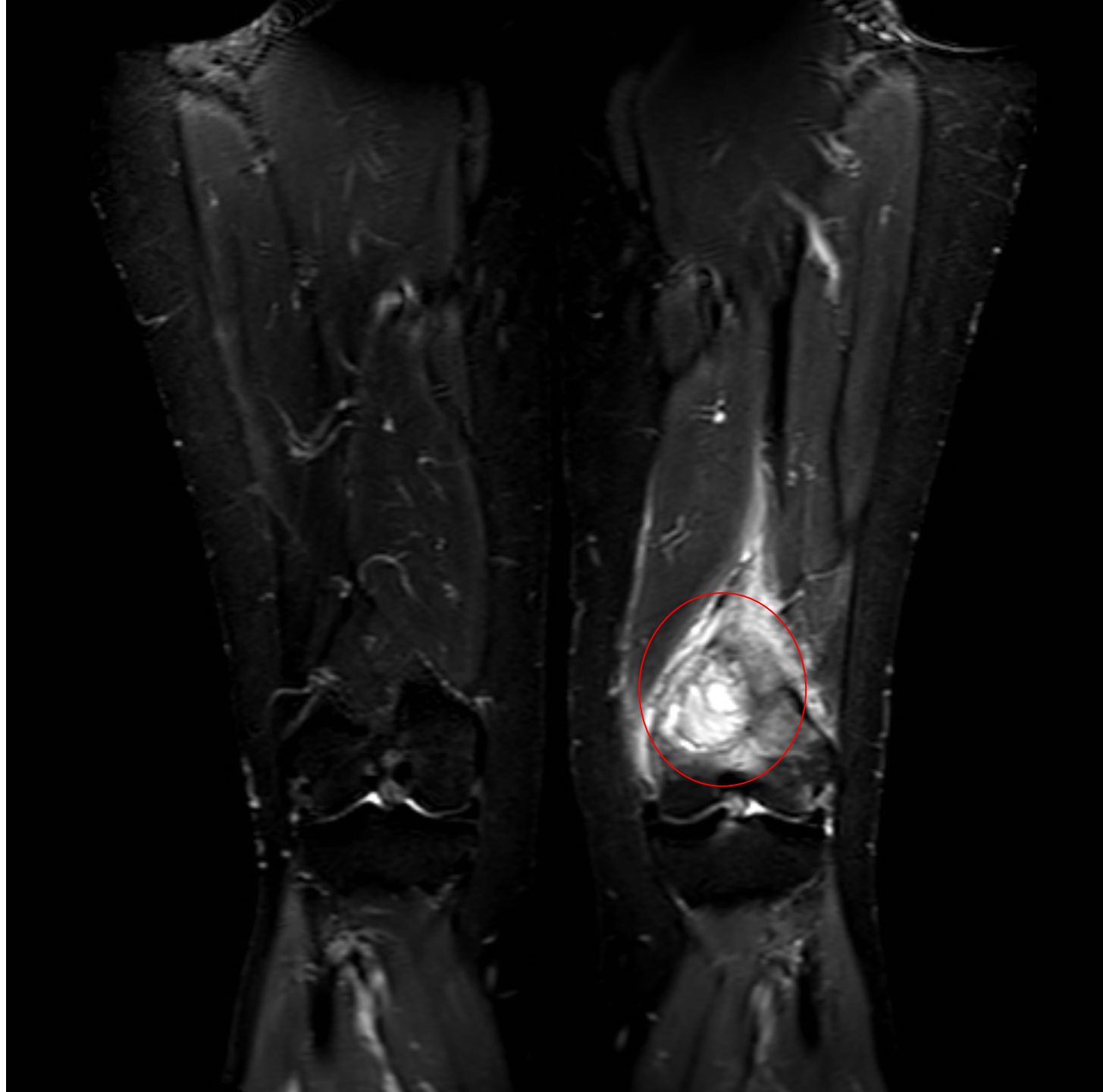
MARGARITI, THEODORA
ACCES# 000718247600004
02276169

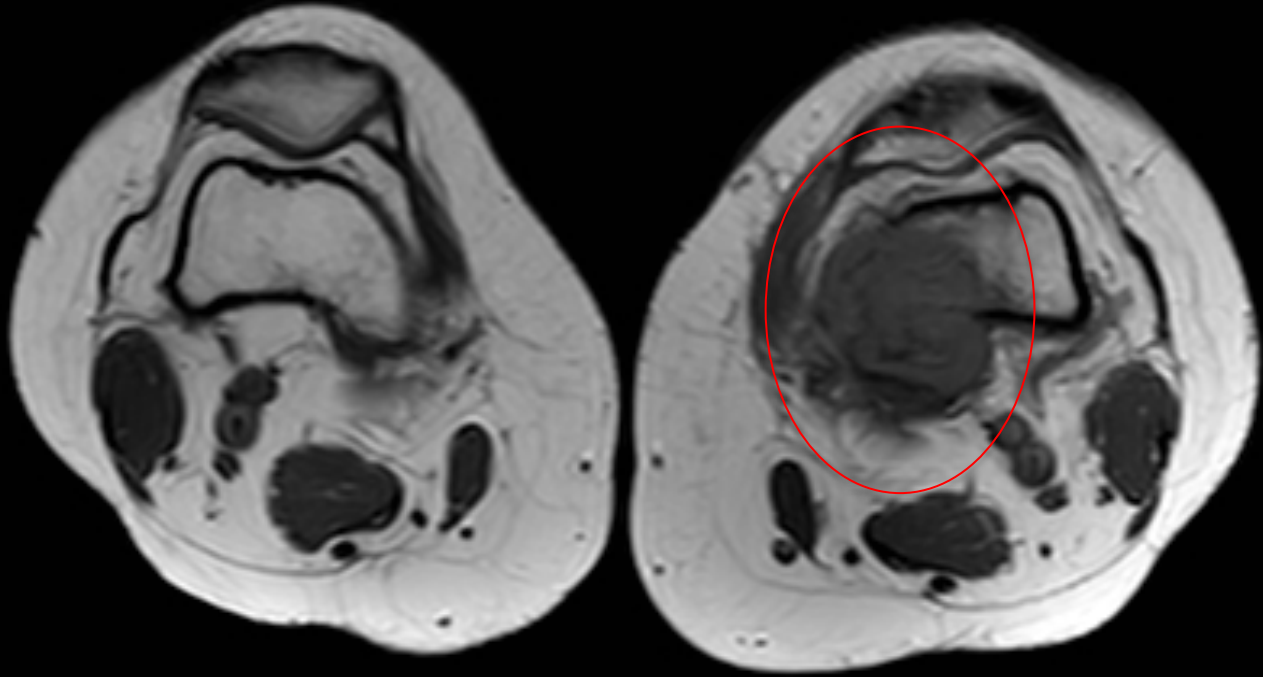
L



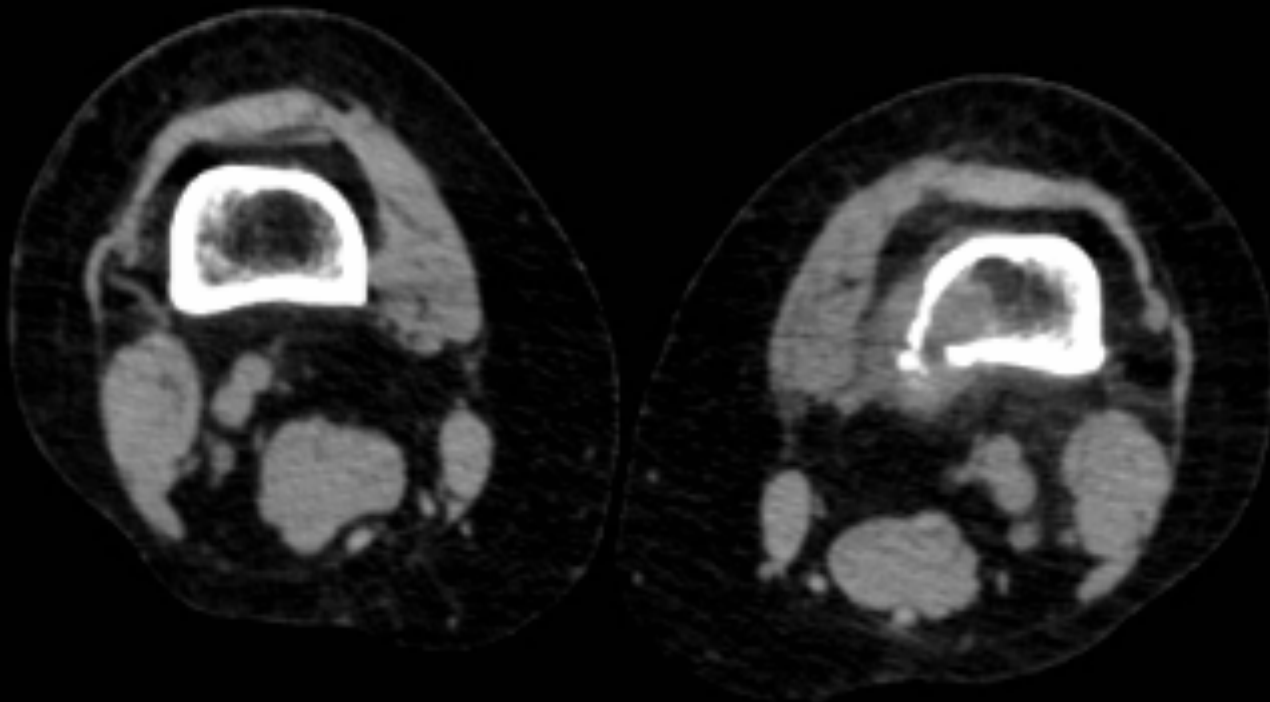








Closed CT-guided core needle biopsy



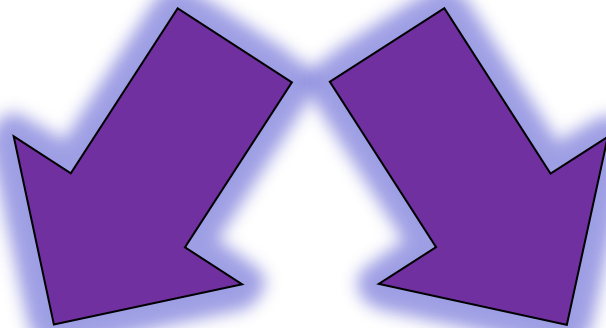
Open biopsy 3/52 after the closed

L





MUSCULOSKELETAL TUMORS

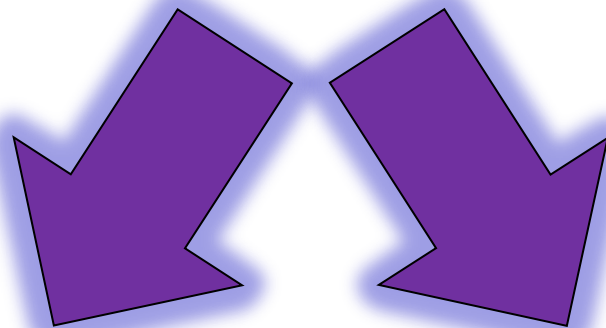


Benign

Malignant



MALIGNANT TUMORS



Primary

Metastatic

PRIMARY



METASTATIC



Mesenchymal Musculoskeletal Tumors

Tumors deriving from:

- Bone
- Cartilage
- Adipose tissue
- Peripheral nerve
- Fibrous tissue



Taylor BS, Barretina J, Maki RG, Antonescu CR, Singer S, Ladanyi M. Advances in sarcoma genomics and new therapeutic targets. *Nat Rev Cancer*. 2011 Jul 14;11(8):541-57.



Mesenchymal Musculoskeletal Tumors

Sarcomas are rare tumors. Their annual incidence is:

- ~6.000-7.000 new cases of soft-tissue sarcomas per annum / per year (USA)
- ~2.500 new cases of bone sarcomas per annum / per year (USA)
- ~200.000 new cases of soft-tissue & bone sarcomas per annum / per year (globally)



Taylor BS, Barretina J, Maki RG, Antonescu CR, Singer S, Ladanyi M. Advances in sarcoma genomics and new therapeutic targets. Nat Rev Cancer. 2011 Jul 14;11(8):541-57.



Mesenchymal Musculoskeletal Tumors

Malignancy Grade

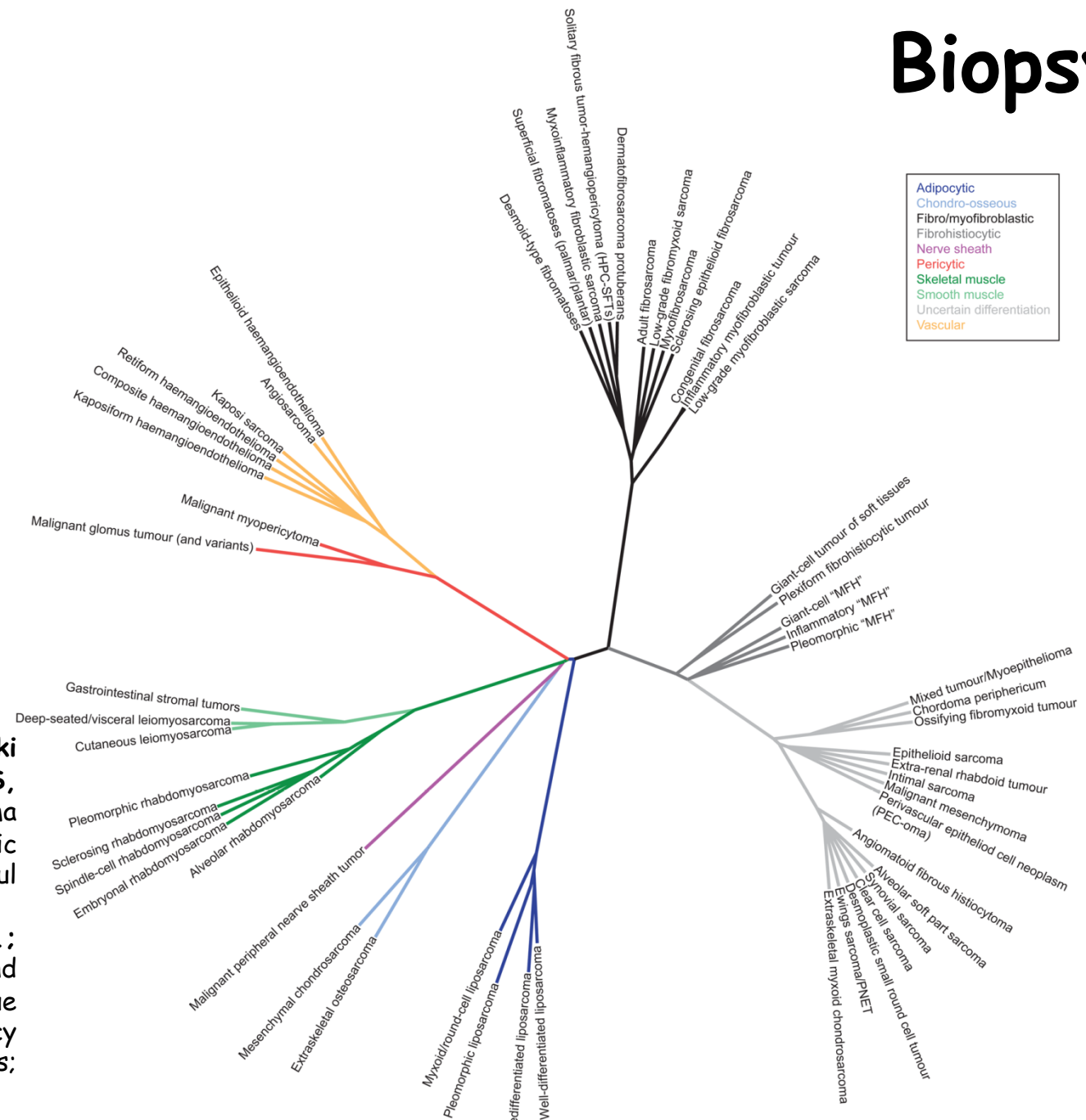
“Indolent”

“Infiltrating”

“Metastasizing”

- Taylor BS, Barretina J, Maki RG, Antonescu CR, Singer S, Ladanyi M. Advances in sarcoma genomics and new therapeutic targets. Nat Rev Cancer. 2011 Jul 14;11(8):541-57.
- Jemal A, Siegel R, Xu J, Ward E. Cancer statistics, 2010. CA Cancer J Clin. 2010; 60:277-300.
- Fletcher, C.; Unni, K.; Mertens, F. Pathology and genetics of tumors of soft tissue and bone. International Agency for Research on Cancer Press; Lyon: 2002.

Biopsy



| |
|---------------------------|
| Adipocytic |
| Chondro-osseous |
| Fibro/myofibroblastic |
| Fibrohistiocytic |
| Nerve sheath |
| Pericytic |
| Skeletal muscle |
| Smooth muscle |
| Uncertain differentiation |
| Vascular |

- Taylor BS, Barretina J, Maki RG, Antonescu CR, Singer S, Ladanyi M. Advances in sarcoma genomics and new therapeutic targets. Nat Rev Cancer. 2011 Jul 14;11(8):541-57.
- Fletcher, C.; Unni, K.; Mertens, F. Pathology and genetics of tumors of soft tissue and bone. International Agency for Research on Cancer Press; Lyon: 2002.

Terminology-Classification-Diagnostic Tools-Differential Diagnosis



Take Home
Messages...

Take Home Messages...



When a patient with a musculoskeletal tumor is treated by expert surgeons, recurrence rate is <10%



Increased local recurrence rates may be expected if:

- The patient is being treated in a non-designated Oncological center
- Excision margins are not "clear"



Clark MA, Thomas JM. Amputation for soft-tissue sarcoma. Lancet Oncol 2003; 4: 335-42

Take Home Messages...



Patients with local recurrence...


- Are in danger to develop metastases
- May need to undergo radical excision and/or amputation



Note to self:

I AM

NOT GOD.

Lydia Loren  belovedlove.org

CECIL B. DEMILLE'S

T H E

TEN COMMANDMENTS





And why's that?







Thank you...