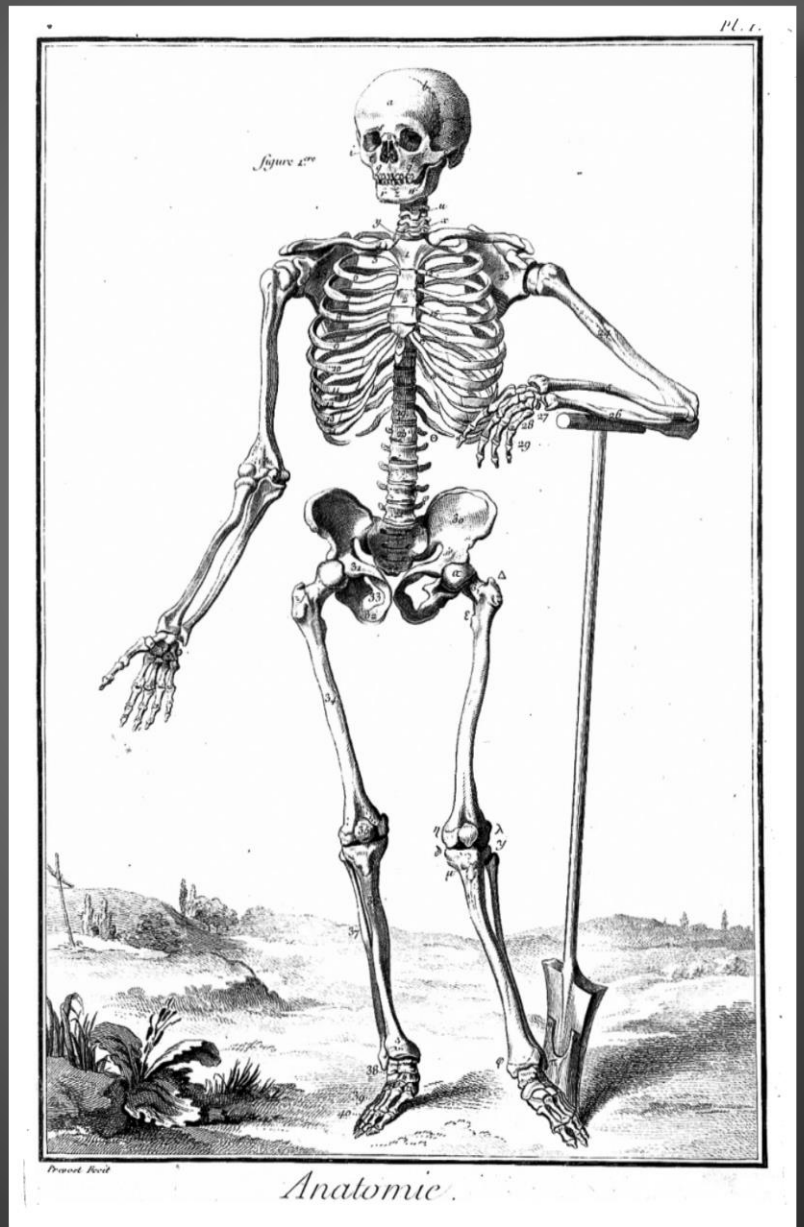
METASTASI OSSEE DA TUMORI SOLIDI A TUMORI PRIMITIVI DELL'OSSO: QUALI NOVITÀ PER IL 2016?



L.ROMANO

I TUMORI OSSEI

- 20% delle neoplasie scheletriche
- 80% lesioni ripetitive
- Incidenza 1caso/100.000 ab
- 500 nuovi casi (I)
- Elevato impatto sociale

✓Range 6-70 aa

✓Età giovanile più aggressivi

✓Elevato indice mortalità e invalidità

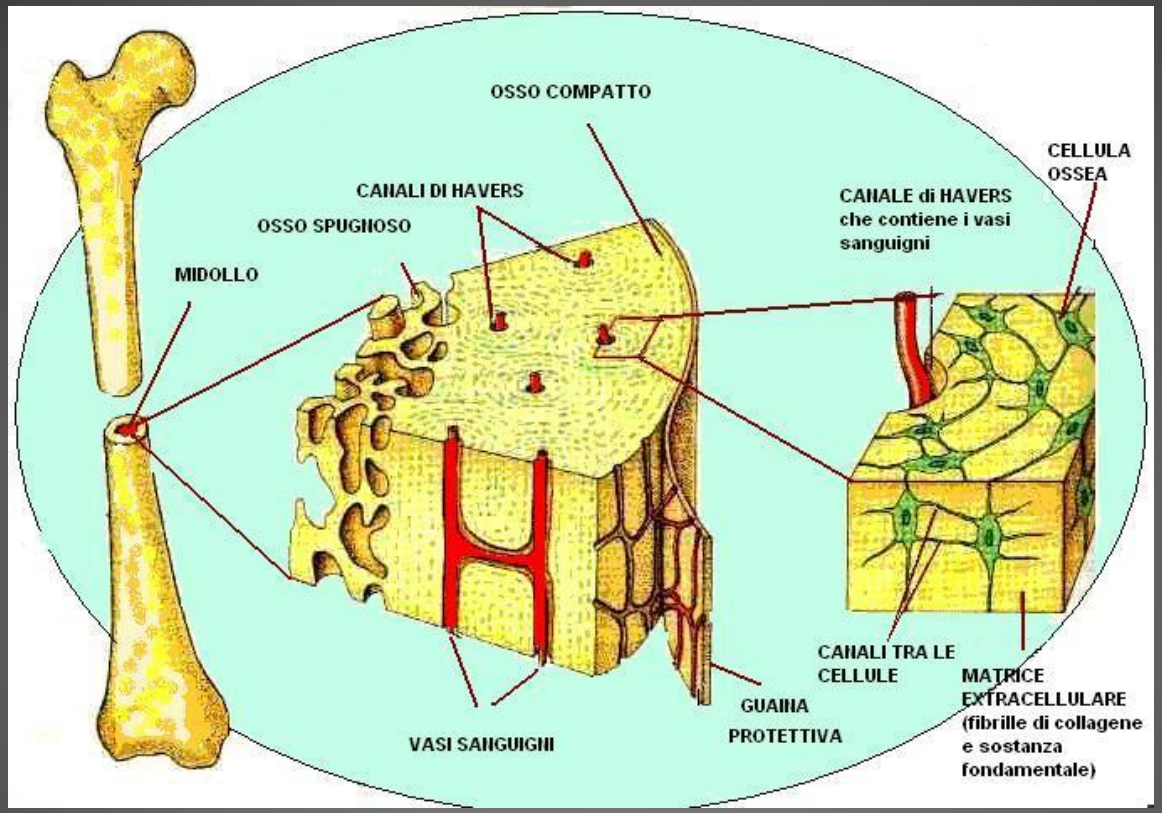
I TUMORI OSSEI

Strategie diagnostiche
- Diagnosi precoce
- Stadiazione

Opzioni terapeutiche
- ✓ Chirurgia
- ✓Chemioterapia

RADICALITA' DEL TRATTAMENTO

IL TESSUTO OSSEO



Tessuto complesso

✓Tipologia cellulare differente (x embriologia)

✓Matrice mineralizzata

✓Componente vascolare e nervosa

Incessante rimodellamento

Funzione strutturale e metabolica

1TUMORI DI ORIGINE OSSEA - BENIGNI: - osteoma o osteoma osteoide - osteoblastoma o (displasia fibrosa) - (fibroma ossificante) - BASSA MALIGNITÀ: - osteosarcoma iuxtacorticale - MALIGNI: - osteosarcoma

2 TUMORI DI ORIGINE CARTILAGINEA - BENIGNI: - esostosi - condromi - fibroma condromixoide - BASSA MALIGNITÀ: - condrosarcoma gr. I - MALIGNI: - condrosarcoma

3 TUMORI DI ORIGINE FIBROSA ED ISTIOCITARIA - BENIGNI: - fibroma istiocitario - istiocitoma fibroso benigno BASSA MALIGNITÀ: - tumore a cellule giganti - fibroma desmoide MALIGNI: - fibrosarcoma - istiocitoma maligno

4 TUMORI DI ORIGINE MESENCHIMALE MIDOLLARE MALIGNI: - sarcoma di Ewing - reticolosarcoma - plasmocitoma - (leucemia, Hodgkin, Linfosarcoma)

5 TUMORI DI ORIGINE VASCOLARE . BENIGNI: emangioma o linfangioma MALIGNI: emangioendotelioma maligno - emangiopericitoma

6 TUMORI DI ORIGINE NERVOSA BENIGNI**: -neurinoma - neurofibroma**

7 TUMORI DI ORIGINE ADIPOSA BENIGNI: - lipoma MALIGNI: - liposarcoma

8 TUMORI DI ORIGINE MISTA - BASSA MALIGNITÀ: - adamantinoma - MALIGNI: mesenchimoma maligno

9 TUMORI DI ORIGINE DALLA NOTOCORDA BASSA MALIGNITÀ: cordoma

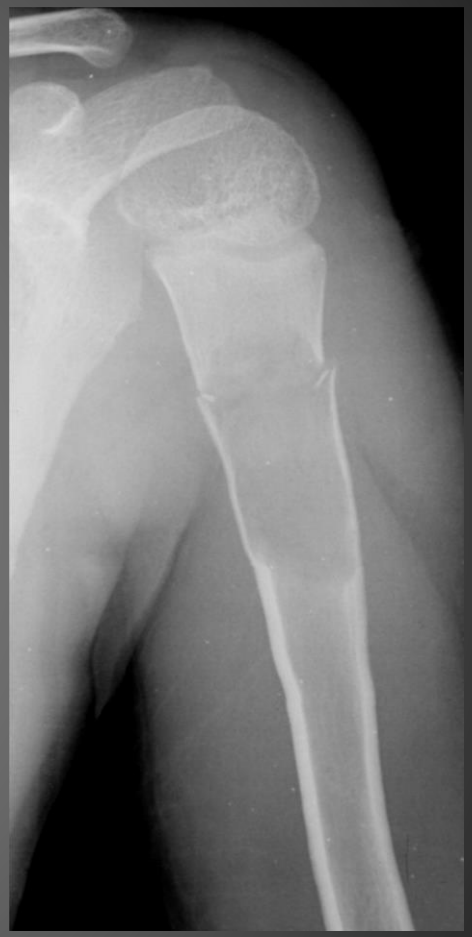
10 ALTRE FORME TUMORALI BENIGNE - cisti ossea solitaria - cisti ossea aneurismatica

Ogni linea cellulare origina neoformazione classificata istogeneticamente

I TUMORI OSSEI

Lesioni iperplastiche

- ✓Atteggiamento aggressivo
- ✓Sintomatologia
- ✓Dubbi di D,D.

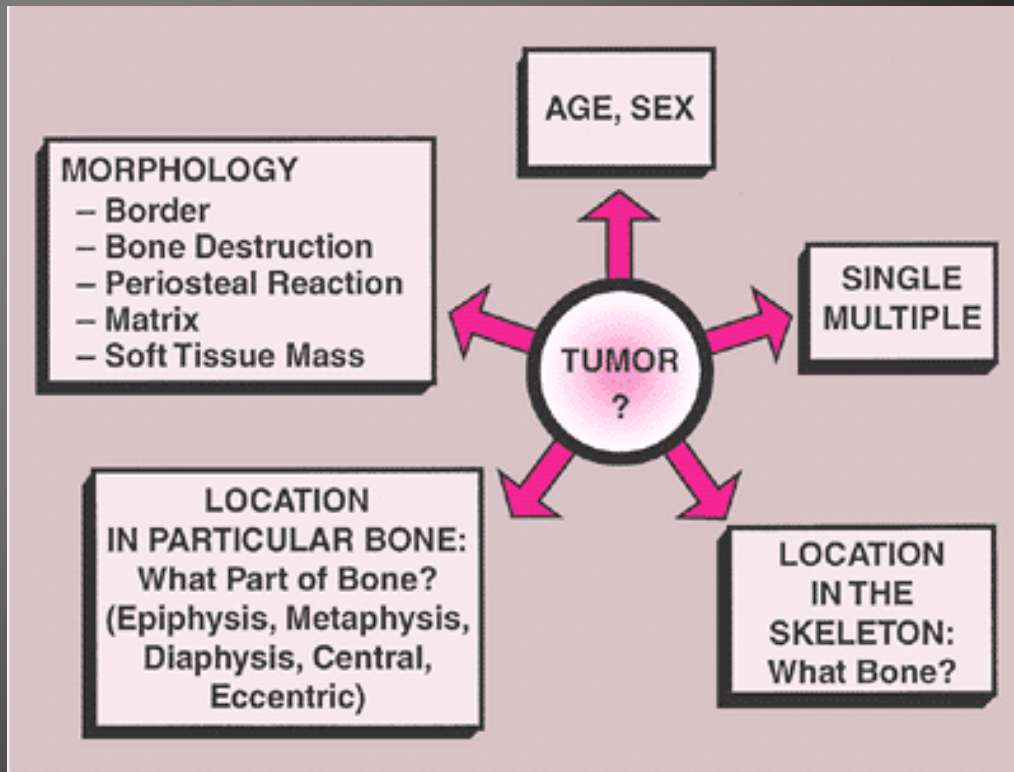


<u>CISTI OSSEE</u>
CISTI ANEURISMATICA
ISTIOCITOSI X (Granuloma eosinofilo)

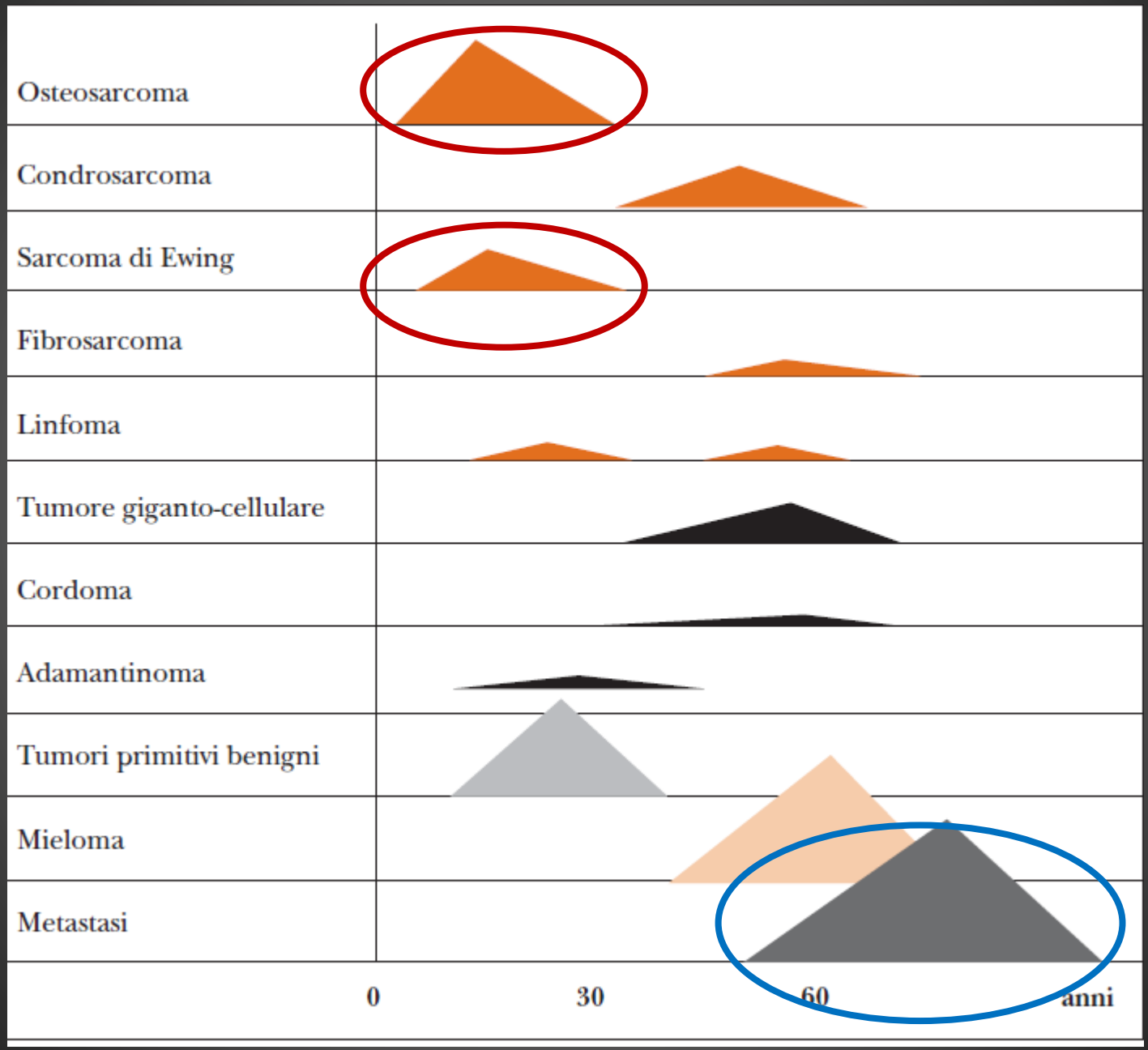
ITER DIAGNOSTICO

1. Indicazioni clinico-anamnestiche
2. Imaging (R.C.,TC,RM)
3. Esame isto-patologico (Gold standard)

- ✓*Sesso*
- ✓*Età*
- ✓*Sede*
- ✓*Sintomatologia*
- ✓*Caratteri del dolore*
- ✓*Segni associati (febbre)*
- ✓*Alterazioni di laboratorio*
- ✓*Masse palpabili*



ETA’


Osteosarcoma
Condrosarcoma
Sarcoma di Ewing
Fibrosarcoma
Linfoma
Tumore giganto-cellulare
Cordoma
Adamantinoma
Tumori primitivi benigni
Mieloma
Metastasi
0
30
60
anni

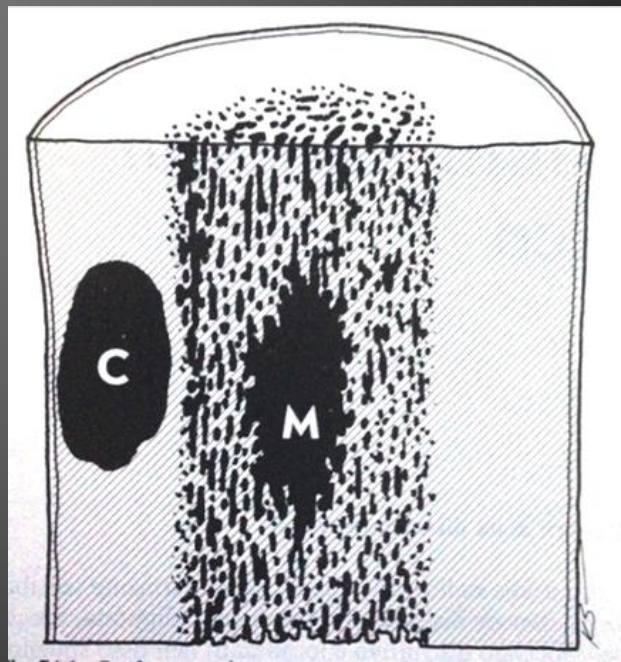
RUOLO DELL'IMAGING

- ✓DETEZIONE DELLA LESIONE
- ✓CARATTERIZZAZIONE
- ✓BILANCIO SPAZIALE

La Radiologia Convenzionale

- Corticale
- Spongiosa (Lisi del 50% del volume interesse)

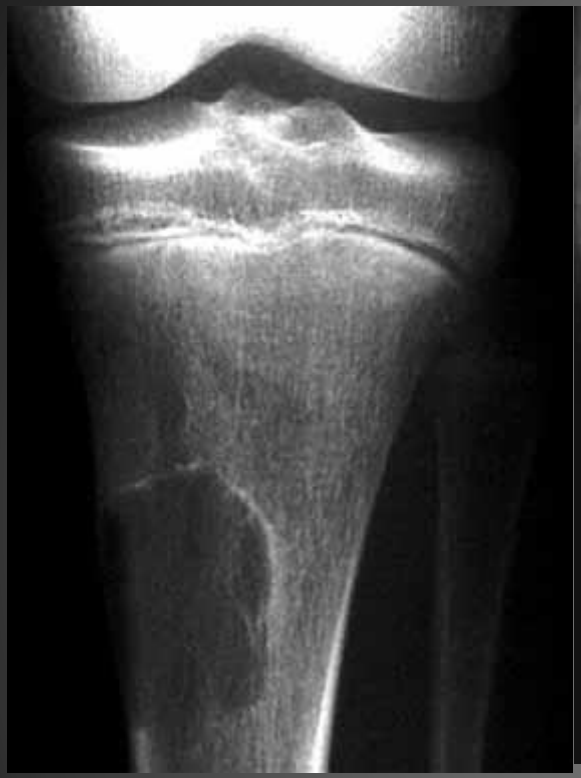
- RMN
- Medicina Nucleare



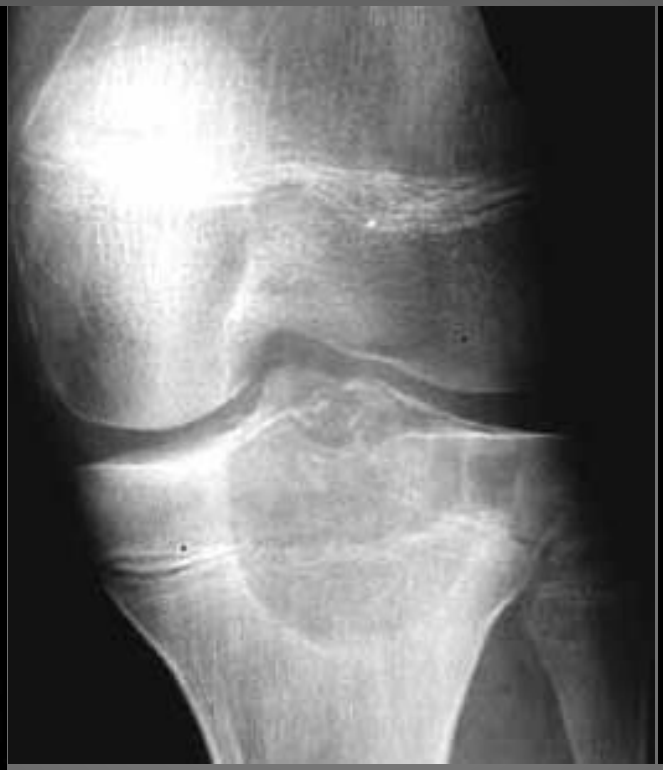
RADIOLOGIA CONVENZIONALE

- ✓*Panoramicità*
- ✓*Sede lesione (epifisaria,metafisaria diafisaria)*
- ✓*Corticale*
- ✓*Sottocorticale*
- ✓*Sottoperiostea*
- ✓*Rapporti con la piastra di accrescimento*

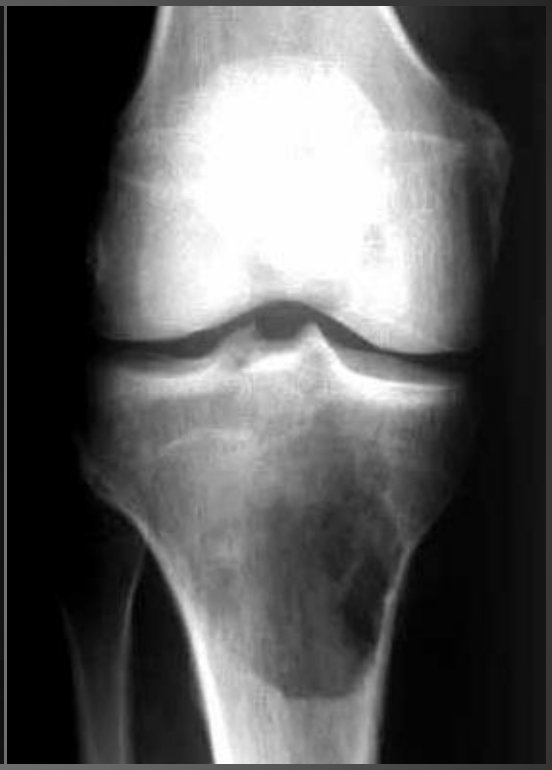
LIMITI DELLA R.C



CISTI OSSEA



CONDROBLASTOMA



META DA K RENE

RUOLO DELL'IMAGING

CARATTERI SEMEIOLOGICI

- *Informazioni dell'Imaging*
- *Caratteristiche clinico-prognostiche*

Codificare i reperti radiologici legati all'attività

Determining Growth Rates of Focal Lesions of Bone from Radiographs[1]

Gwilym S. Lodwick, M.D., Anthony J. Wilson, M.D., Corinne Farrell, M.D., Pekka Virtama, M.D., and Frederick Dittrich, B.S.[2]

Rate of growth divides focal lesions of bone into two classes which are largely mutually exclusive. Not all focal lesions require biopsy, and grading is especially helpful in deciding which should be biopsied and which may be safely followed. The statistical proof and logic of grading as an expression of growth rate are presented with a set of rules establishing each of the five grades in the presence of bone destruction. The radiologic signs necessary to establish rates are described and illustrated.

INDEX TERMS: Bone neoplasms, diagnosis • (Skeletal system, error in diagnosis, 4[0].940) • (Skeletal system, fundamental observation, 4[0].910)

Radiology 134:577–583, March 1980

CRITERI DI CARATTERIZZAZIONE

- ✓*Tipo di osteolisi*
- ✓*Interfaccia reattiva*
- ✓*Matrice*
- ✓*Reazione periosteale*
- ✓*Sede*

OSTEOLISI

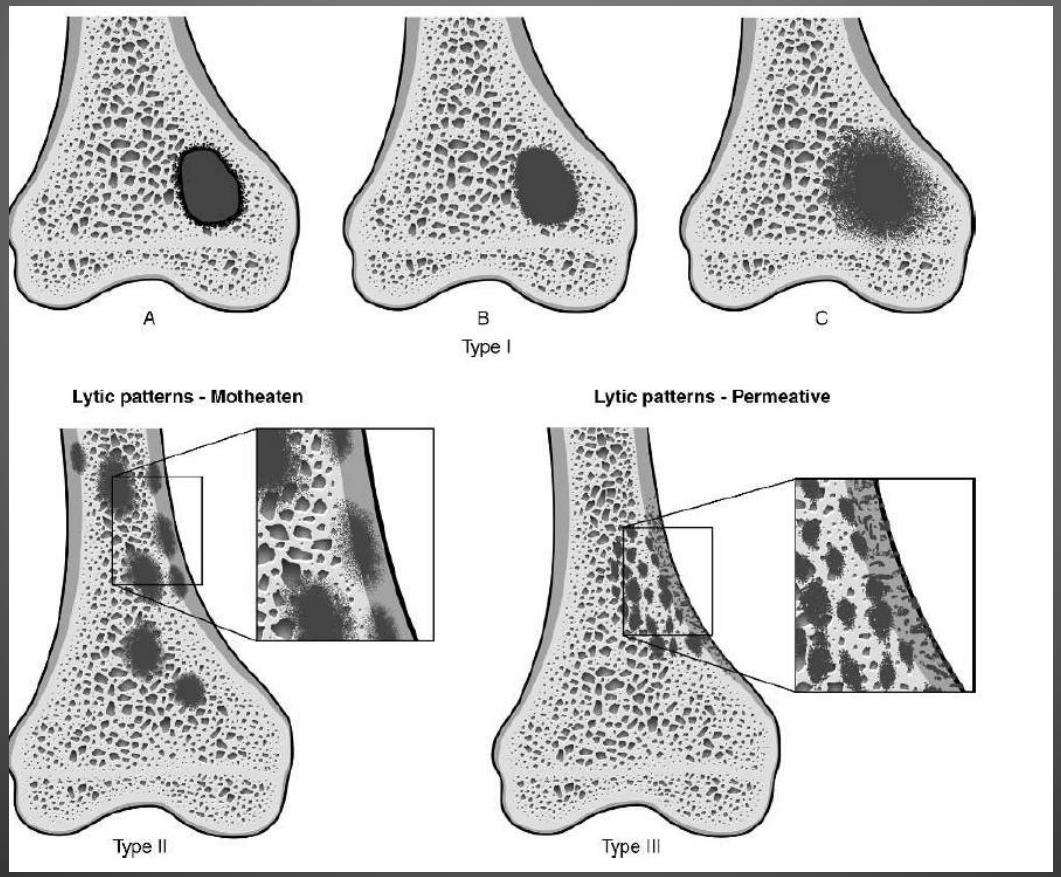
Non tumorale (su base meccanica)

Tumorale (tessuto neoformato)

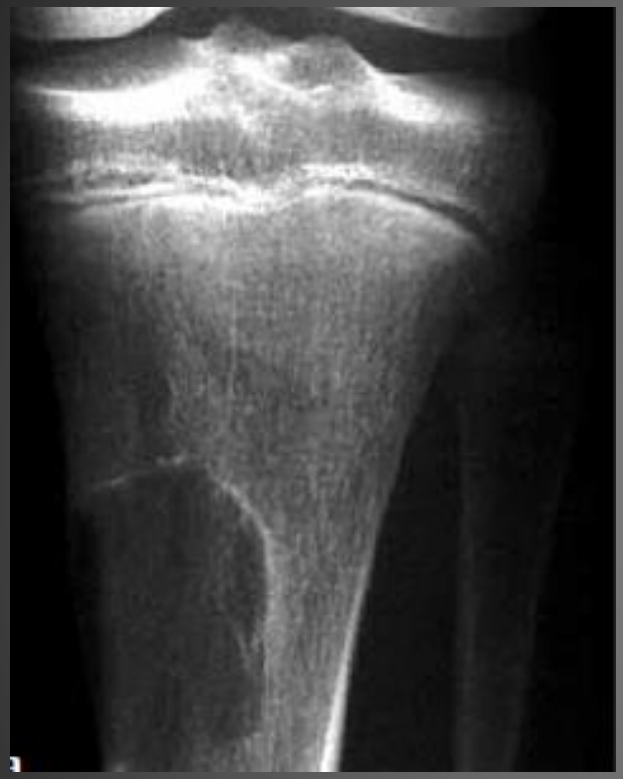
1.Geografica

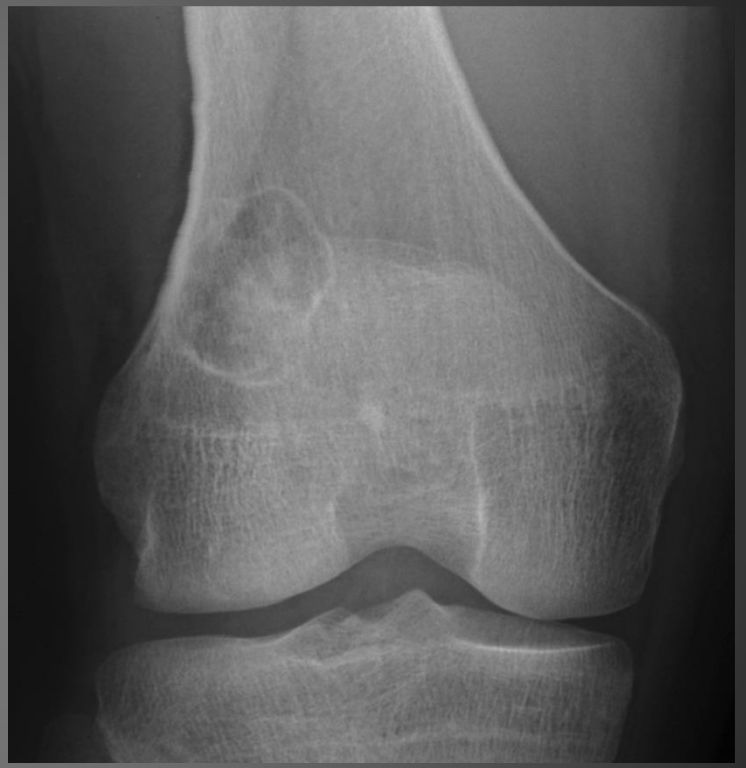
2.Tarlata

3.Permeante



OSTEOLISI GEOGRAFICA



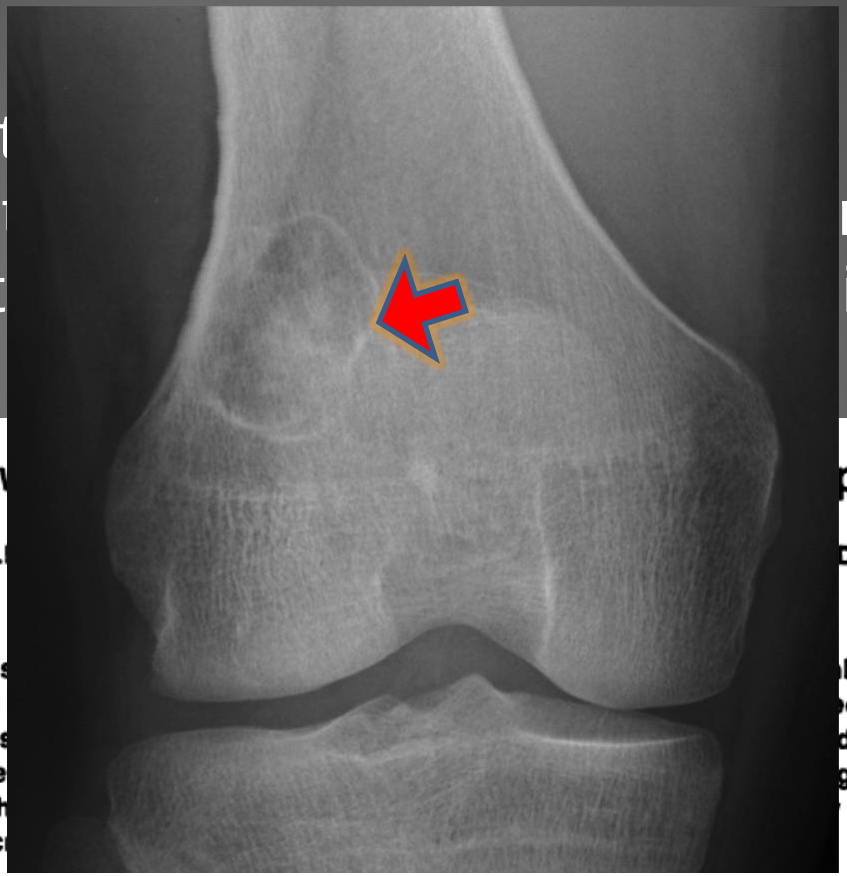


- Limiti netti
- Margini lisci
- Zona transizione scarsa
- Rima sclerotica presente

Pattern di limitata aggressività biologica

OSTEOLISI GEOGRAFICA

TIPO I A: zona di t sclerotico
TIPO I B: zona di t rgine sclerotico
TIPO I C:zona di t ine sclerotico



Determining Grov phs[1]

Gwilym S. Lodwick, M. D., and

Rate of growth divides ily ex-
clusive. Not all focal ciding
which should be biops d logic
of grading as an expre g each
of the five grades in th to es-
tablish rates are desc

INDEX TERMS: Bone neoplasms, diagnosis • (Skeletal system, error in diagnosis, 4[0].940) • (Skeletal system, fundamental observation, 4[0].910)

Radiology 134:577–583, March 1980

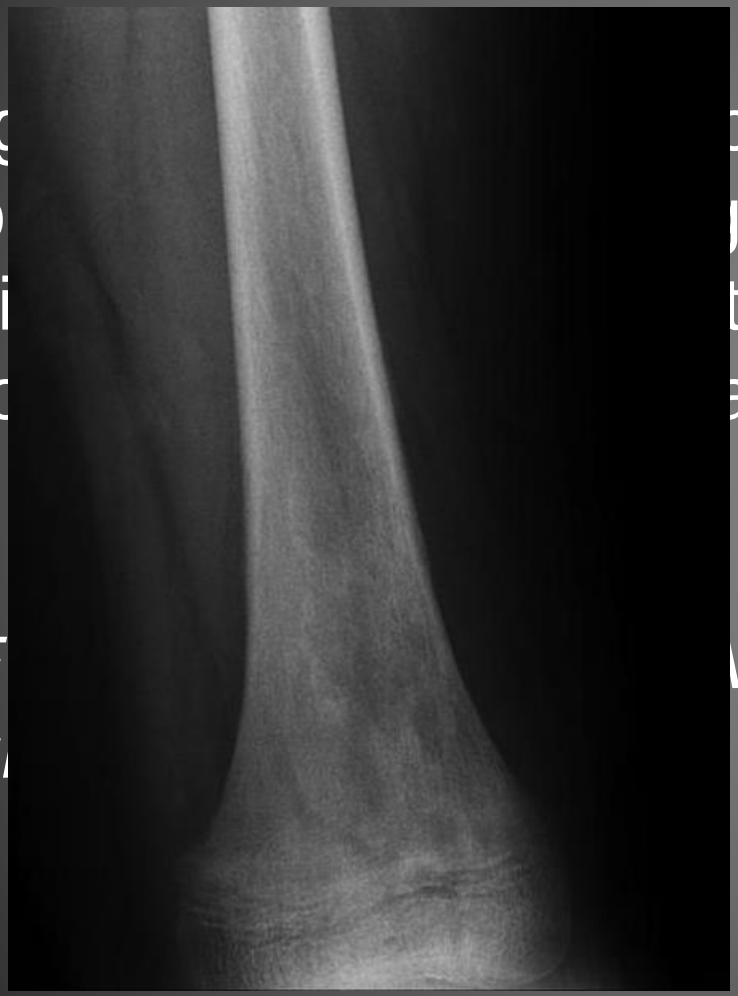
VELOCITA’ DI ACCRESCIMENTO E SCLEROSI MARGINALE

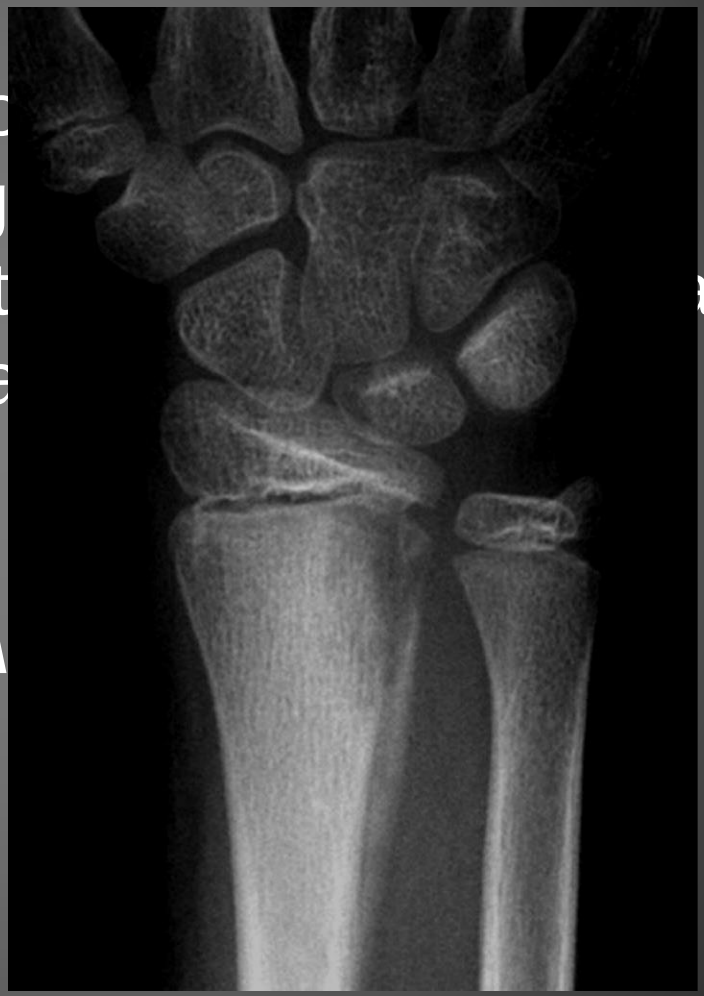
OSTEOLISI TARLATA

- Magg
- Mino
- Ampi
- Picco

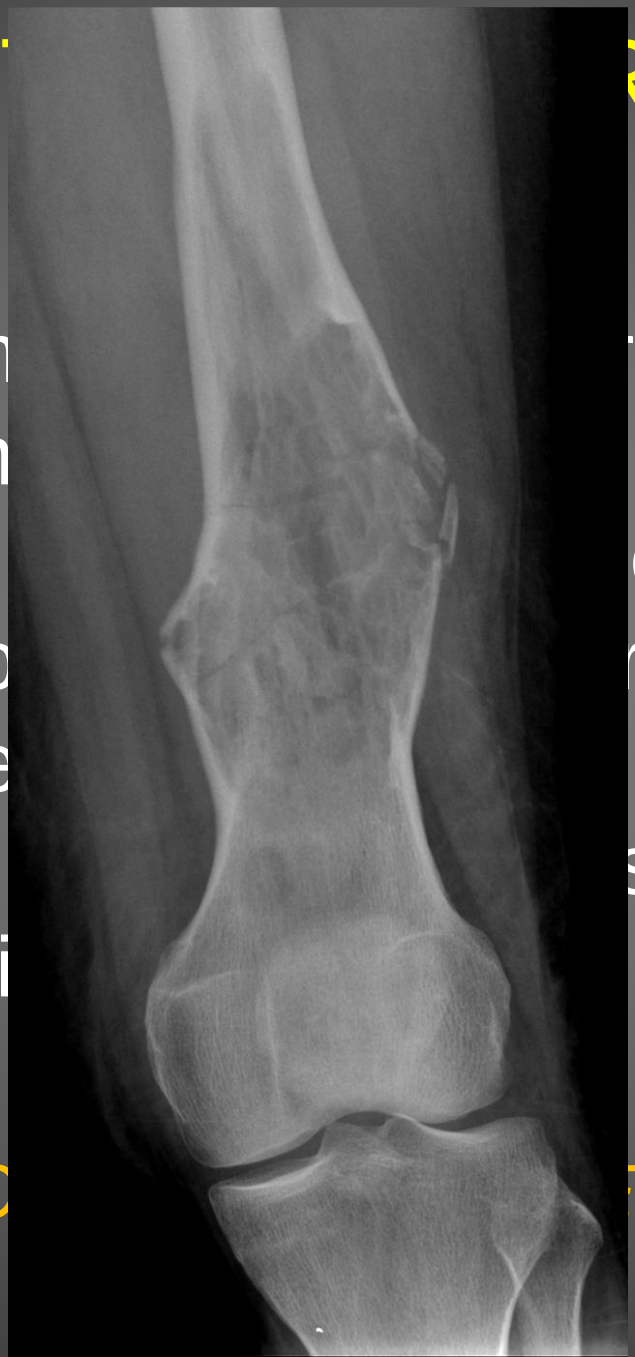
atologico

PATTE
(malig





OST RMEANTE



- Multiple e m dita ossea
- Scarsa dem
- Infiltra osso canale midollare
- Invade la co riostio attraverso canali di Have
- Impossibile sso sano
- Mal valutabi

ATTIVITA' BIC AGGRESSIVE)

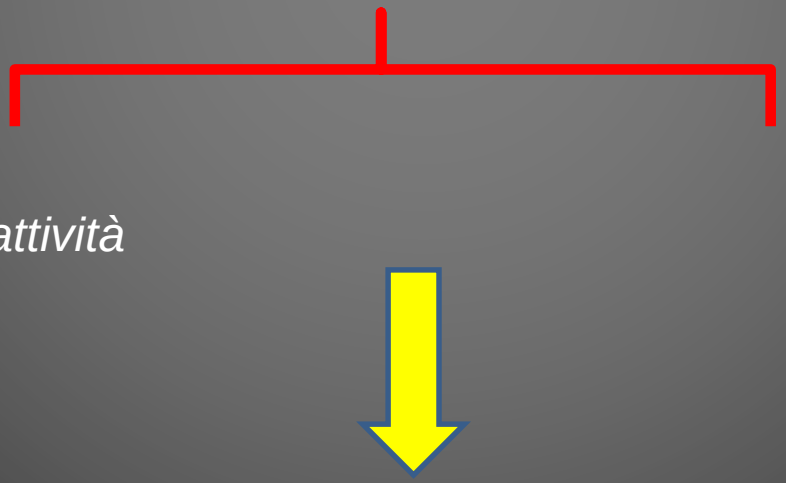
CRITERI DI CARATTERIZZAZIONE

- ✓*Tipo di osteolisi*
- ✓*Interfaccia reattiva*
- ✓*Matrice*
- ✓*Reazione periosteale*
- ✓*Sede*

INTERFACCIA REATTIVA

Confine fra margine della lesione
e tessuto normale (*tentativo di arginare la lesione*)

TERMINI BIOLOGICI

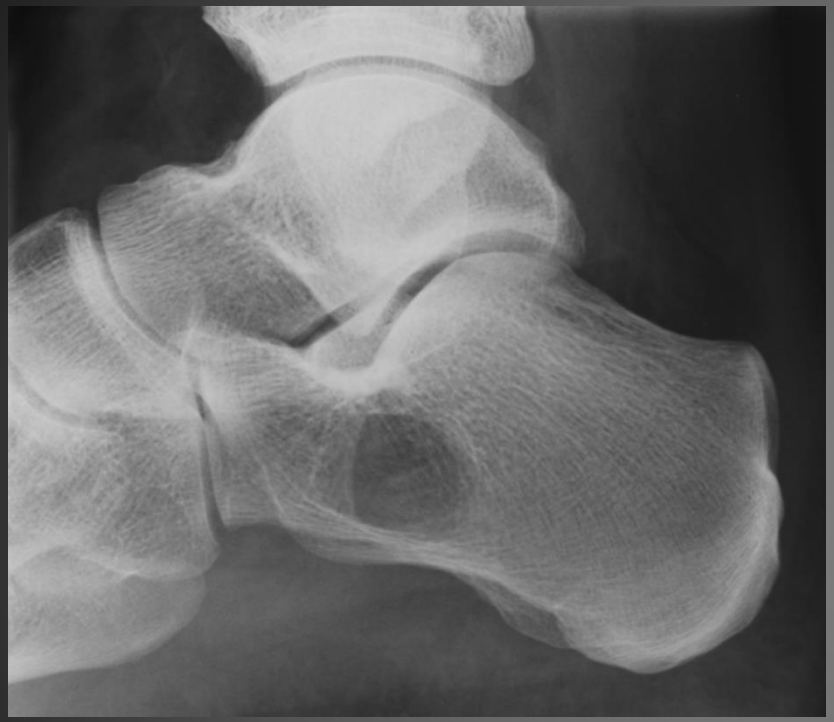


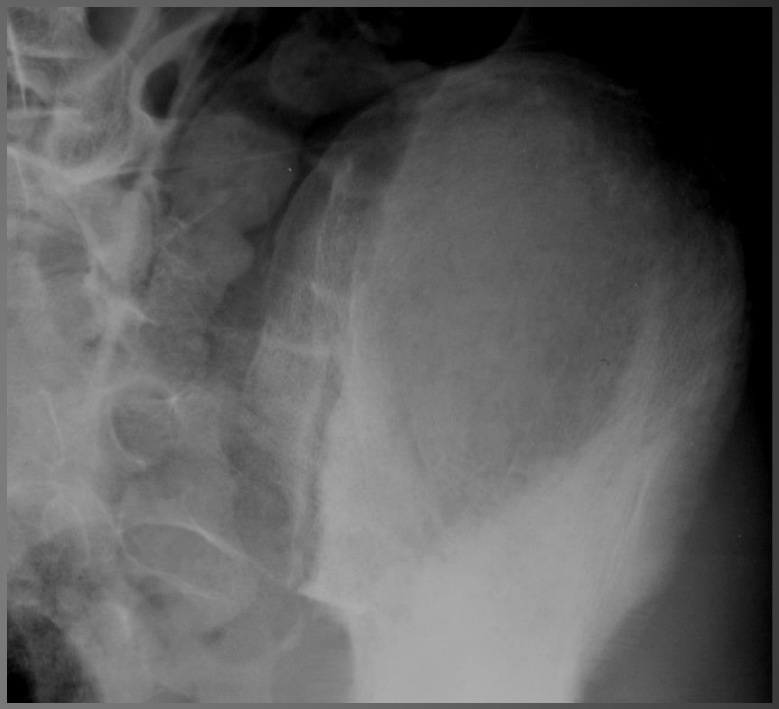
Mancanza di attività

Attivita' esuberante

<u>Assente reazione dell'osso circostante (mancanza di orletto sclerotico</u>)

INTERFACCIA REATTIVA





LIPOMA
- Non ha forza espansiva
- L'interfaccia non è sollecitata
- Bordo sclerotico assente

- SARCOMA
- Distruzione cellule ossee
- X compressione o
- x azione sostanza citotossiche
- Bordo sclerotico assente

PATTERN OSTEOLITICO

INTERFACCIA REATTIVA

GRADING RADIOLOGICO

PROGNOSI

MALIGNITA' E BENIGNITA (ESAME ISTOLOGICO)
ATTIVITA BIOLOGICA (RAPIDITA' CRESCITA E INTERFACCIA REATTIVA)

CRITERI DI CARATTERIZZAZIONE

- ✓*Tipo di osteolisi*
- ✓*Interfaccia reattiva*
- ✓*Matrice*
- ✓*Reazione periosteale*
- ✓*Sede*

MATRICE TUMORALE

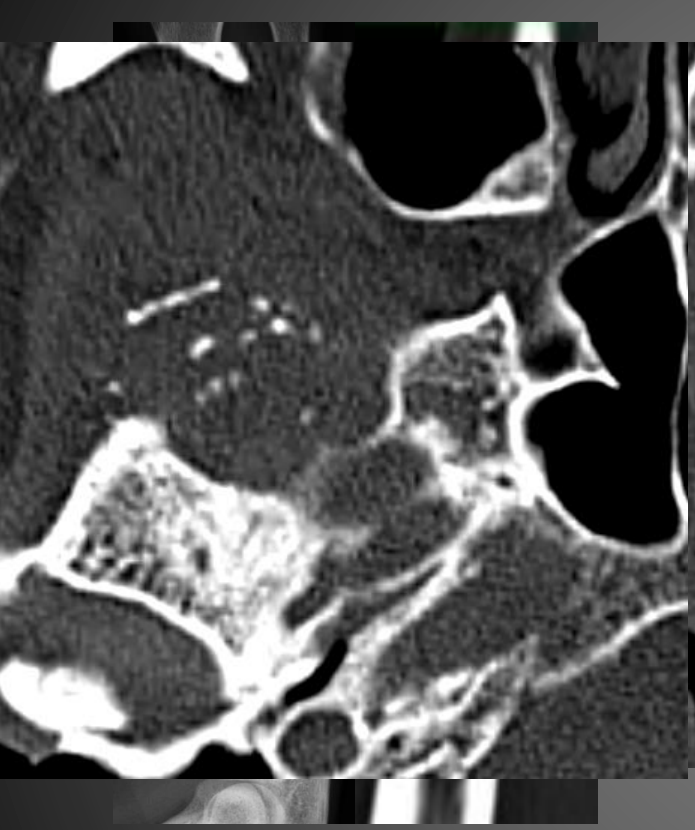
MATERIALE INTERCELLULARE DELLE CELLULE MESENCHIMALI

- OSTEOBLASTI (M.Osteoide)
- CELLULE CART. (M.Condroide)
- FIBROBLASTI (M.Fibrosa)

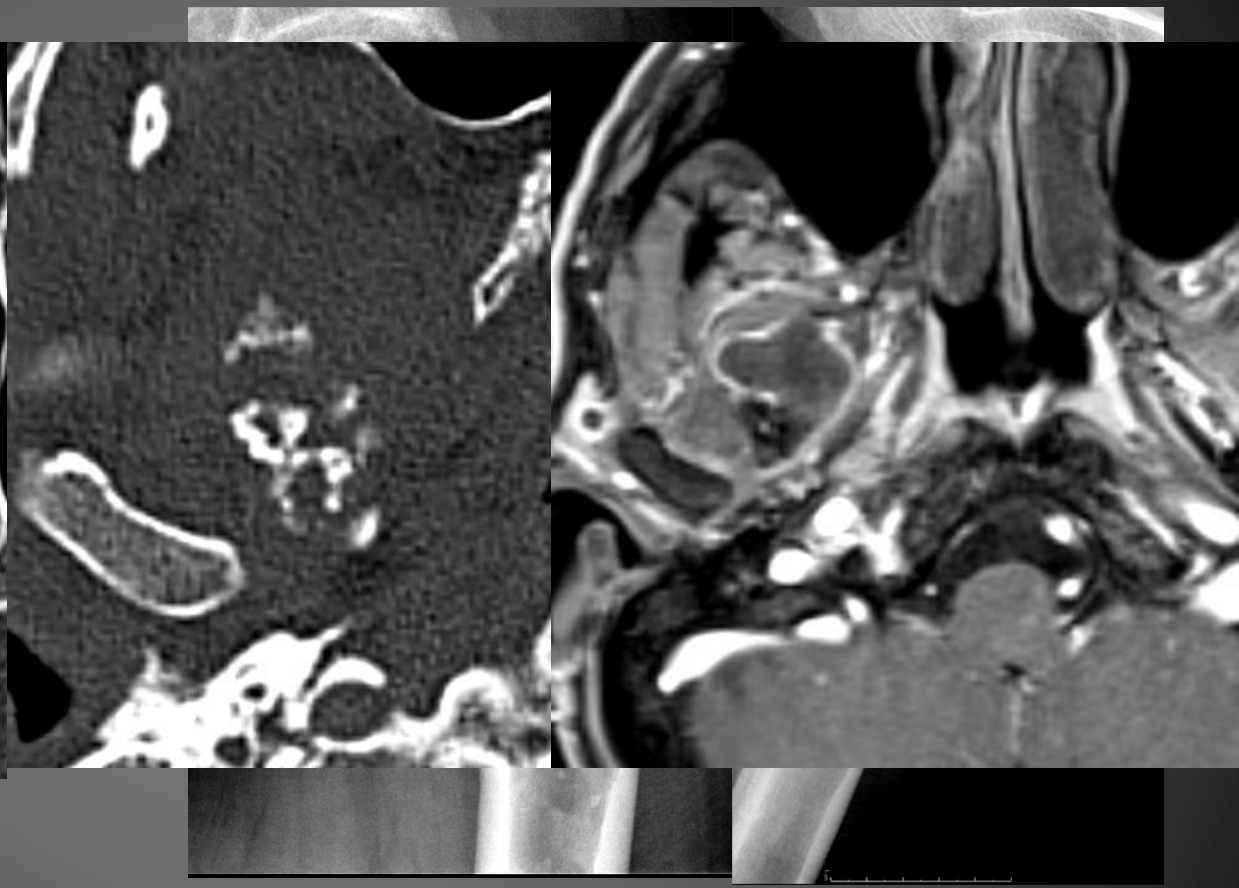
Tumori origine Condrogena (Encondroma e Condrosarcoma calcificazione strutturate con aspetto ad anello o puntiformi disposte intorno ai lobuli cartilaginei)

Tu*mori origine Osteogena* (Osteosarcoma calcificazioni aspetto bizzaro e distrubuzione a zolle)

MATRICE CONDROIDE

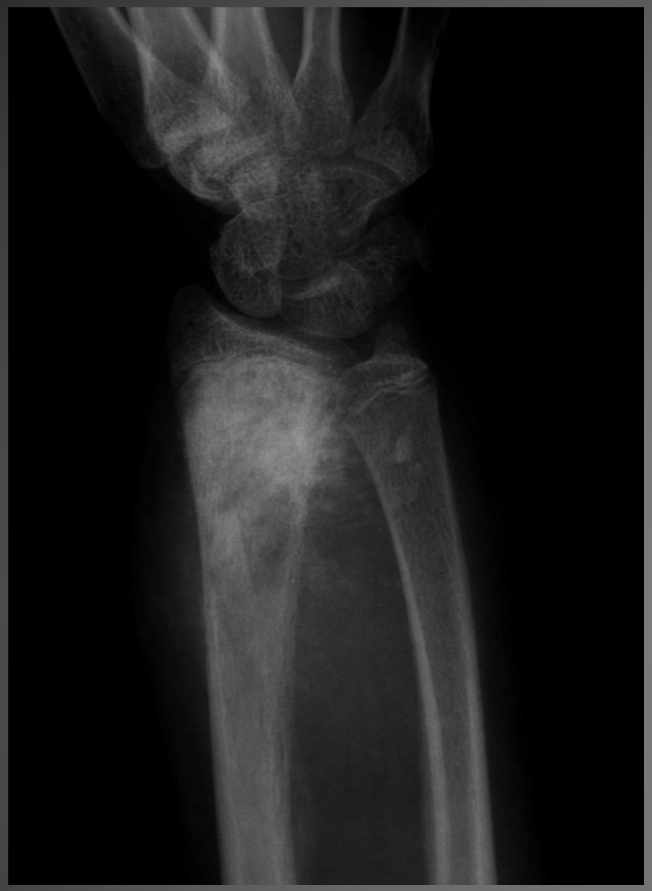


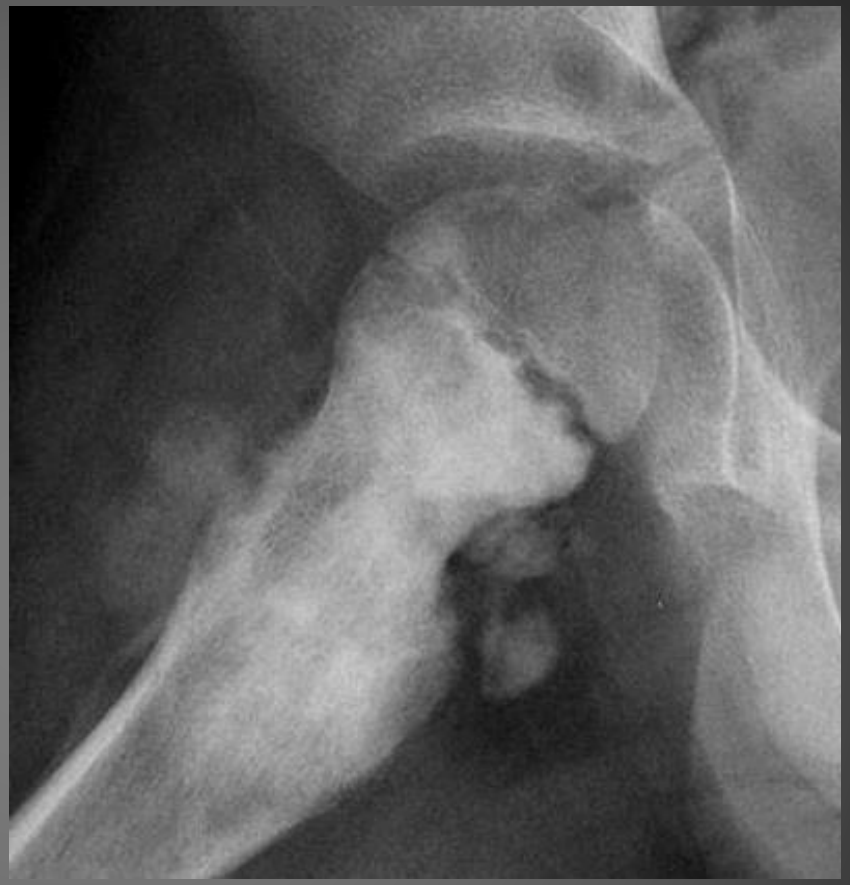
Encondroma: calcificazioni confluenti



Condrosarcoma centrale Grado 1 con spot calcifici

MATRICE OSTEOIDE



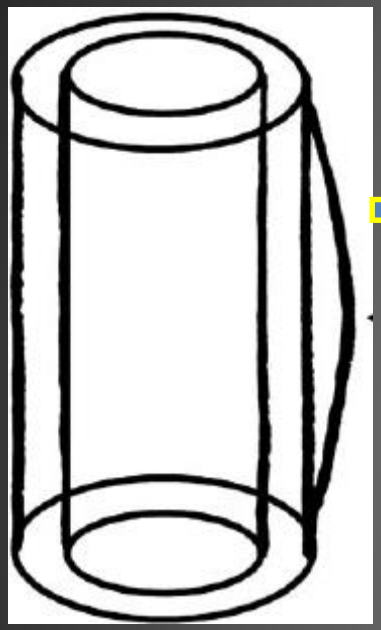


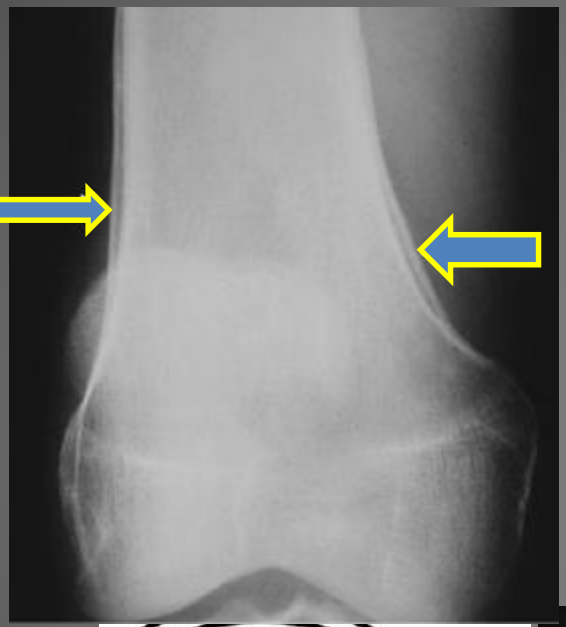
Osteosarcoma: matrice calcifica a elevata densità con aspetto ad avorio per la maturazione della Matrice osteoide

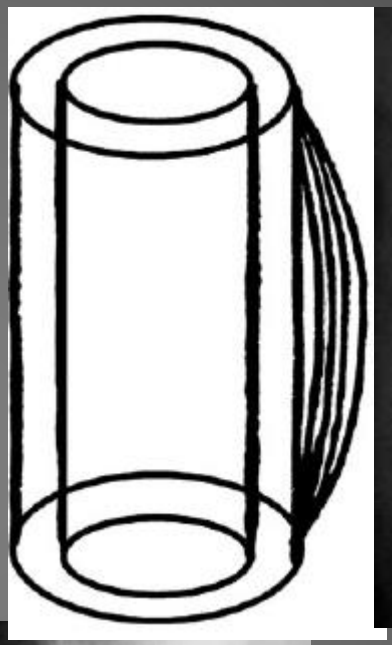
CRITERI DI CARATTERIZZAZIONE

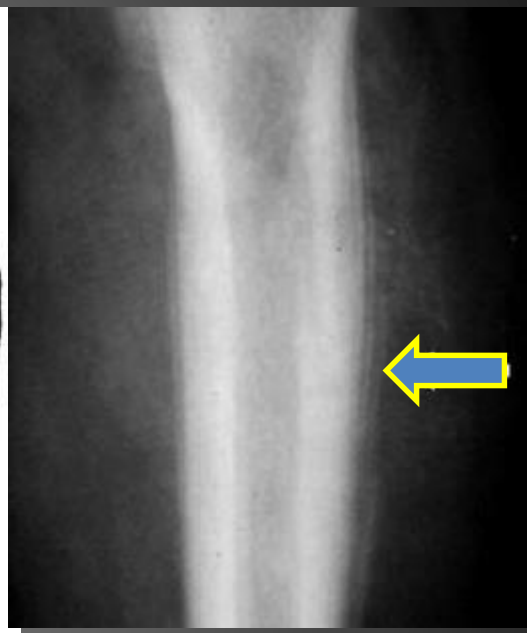
- ✓*Tipo di osteolisi*
- ✓*Interfaccia reattiva*
- ✓*Matrice*
- ✓*Reazione periosteale*
- ✓*Sede*

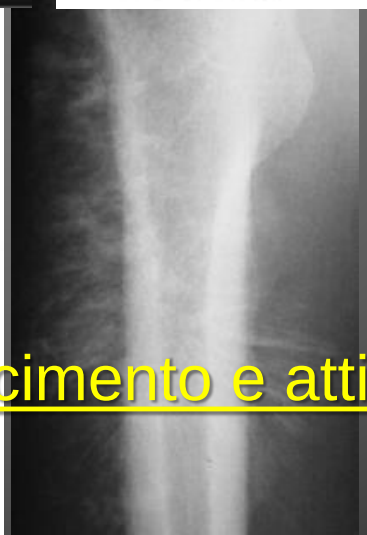
MORFOLOGIA DELLA CORTICALE E REAZIONE PERIOSTEALE



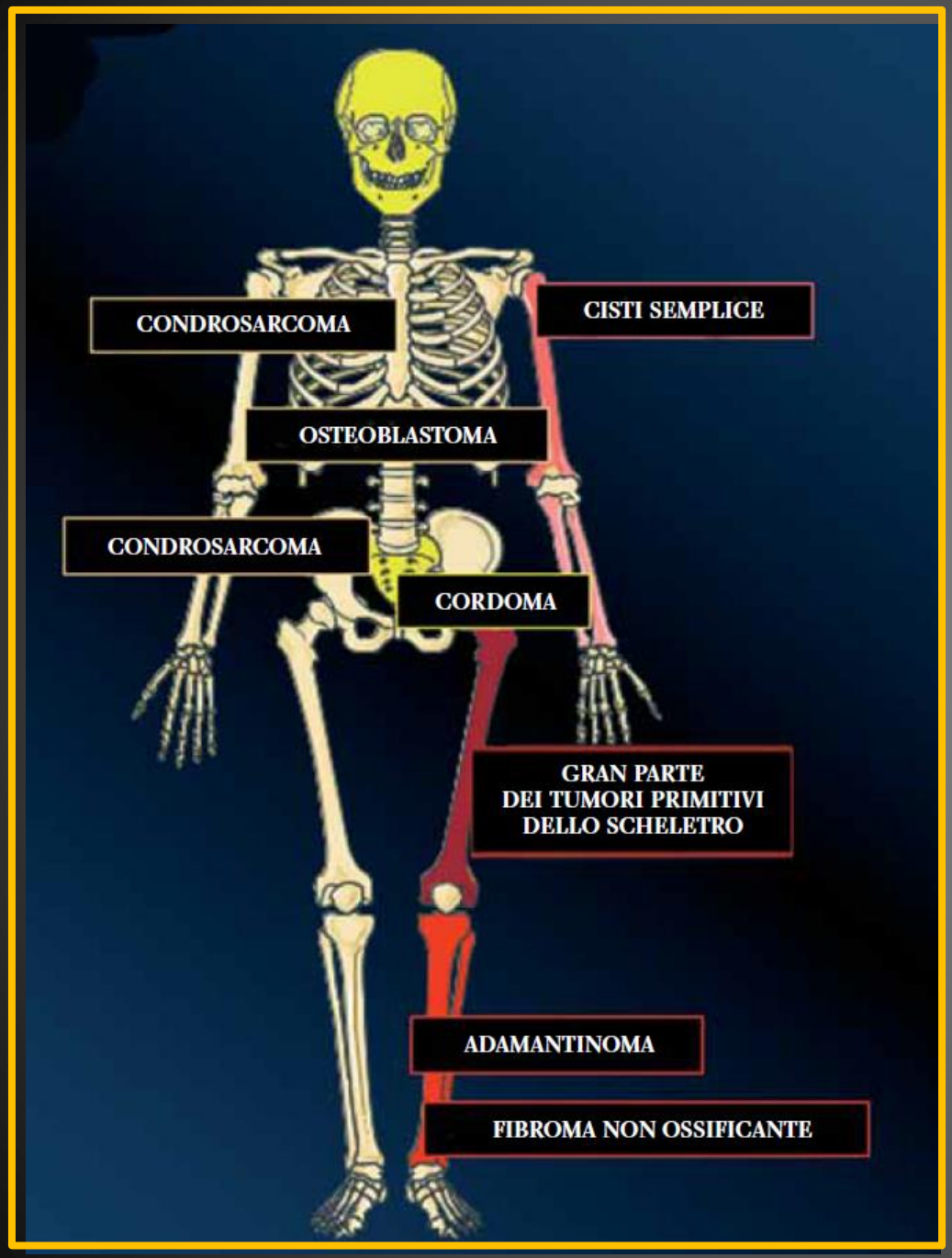








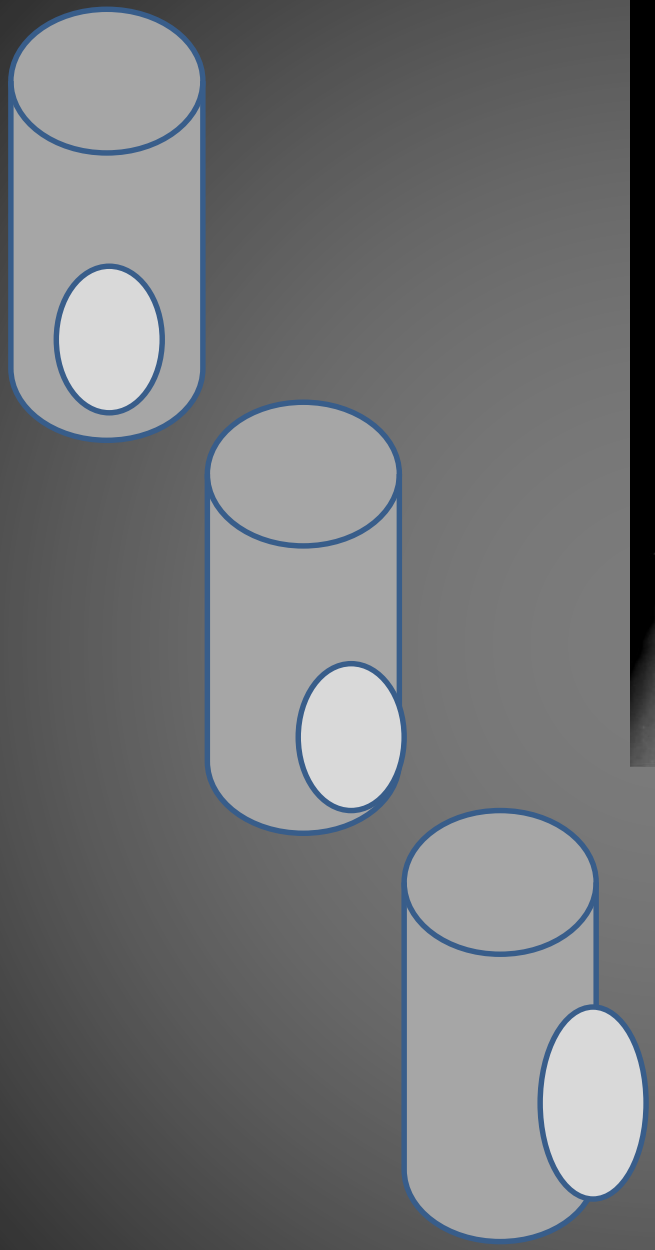
In relazione con velocità accrescimento e attività biologica della lesione.

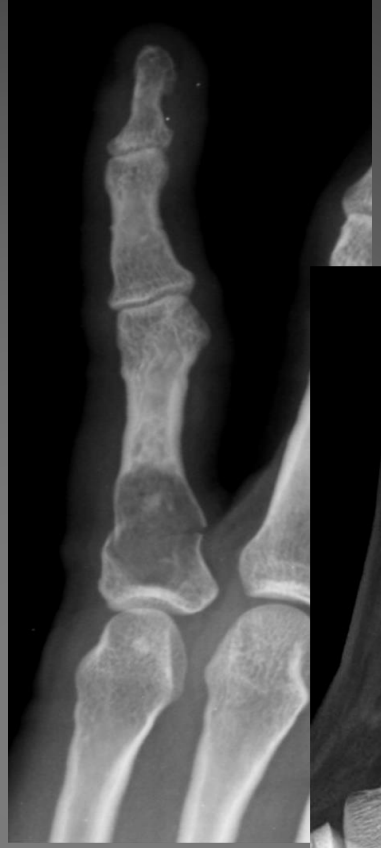


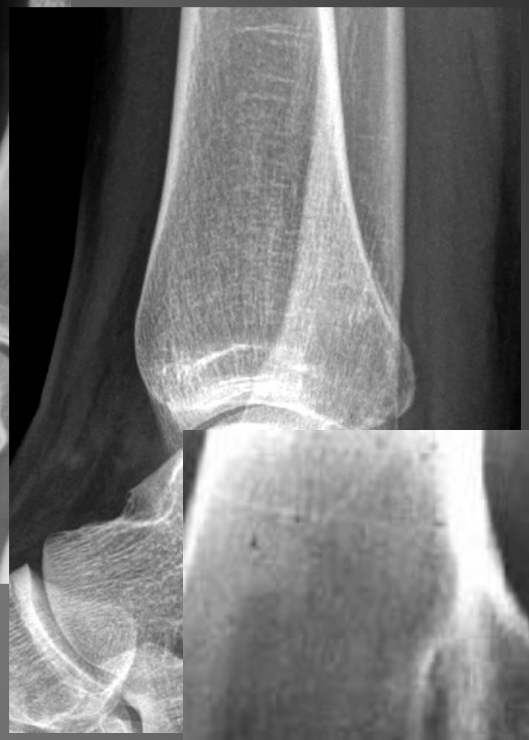
Metafisi ossa lunghe

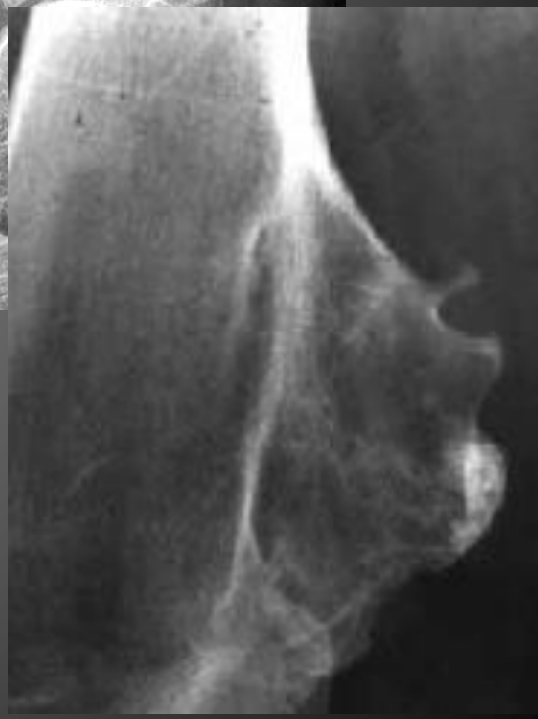
Femore	Dist.
Tibia	Prox
Perone	Prox
Omero	Prox
Radio	Dist.
Ulna	Prox

Cordoma	Sacro
Adamantinoma	Diafisi tibiale
Fibroma non OS	Metafisi dist tibia
Osteoblastoma	Vertebre
Cisti solitaria	Omero prox
Condrosarcoma	Osso iliaco
Osteosarcoma	Arti

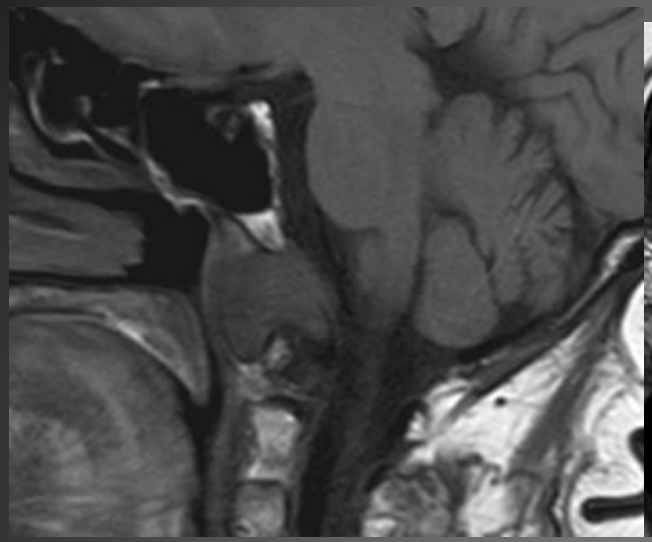


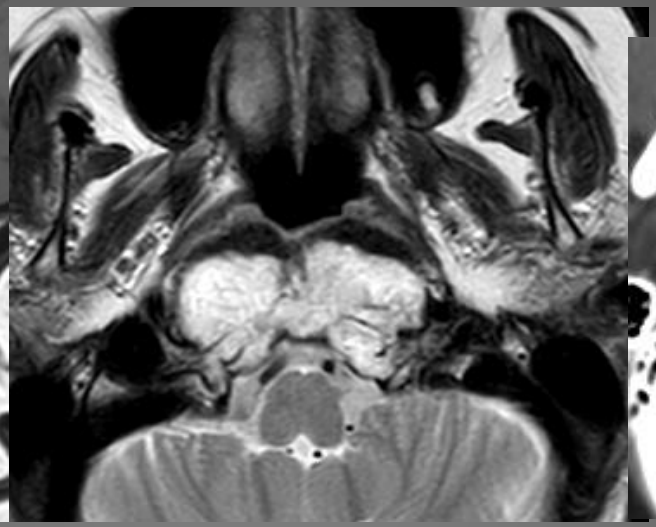


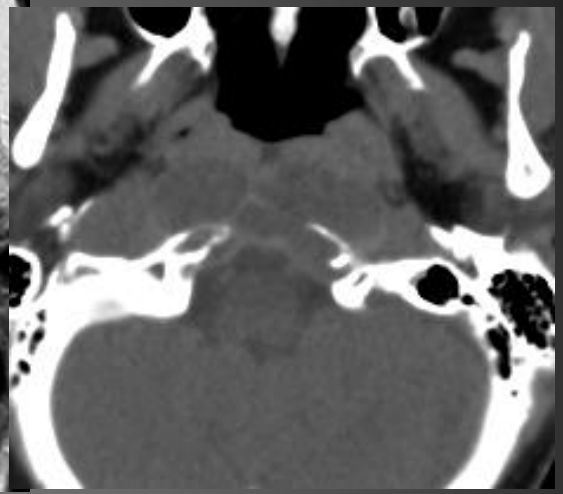


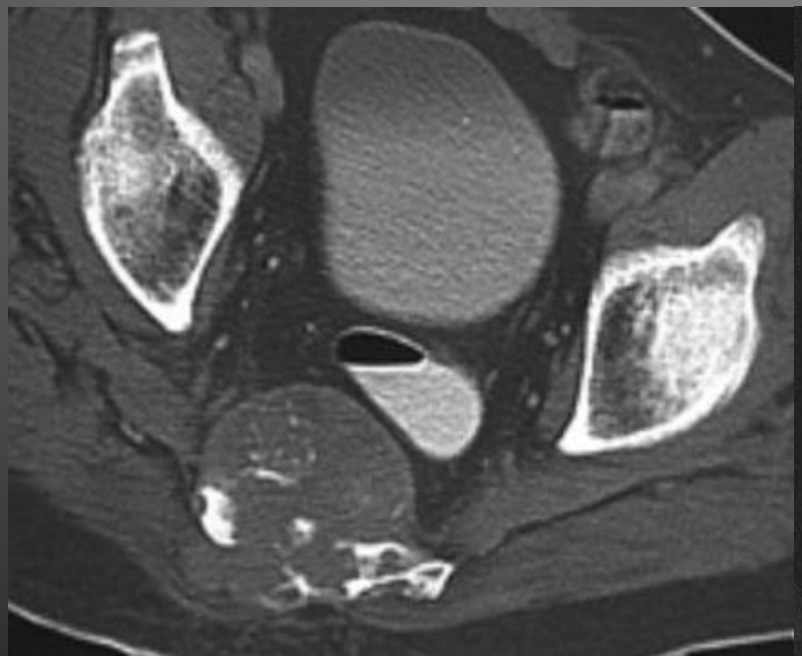


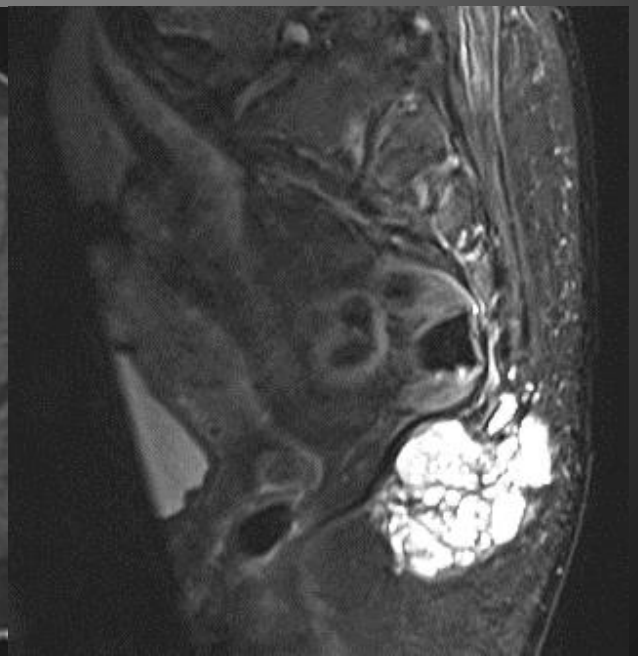
LA SEDE:IL CORDOMA











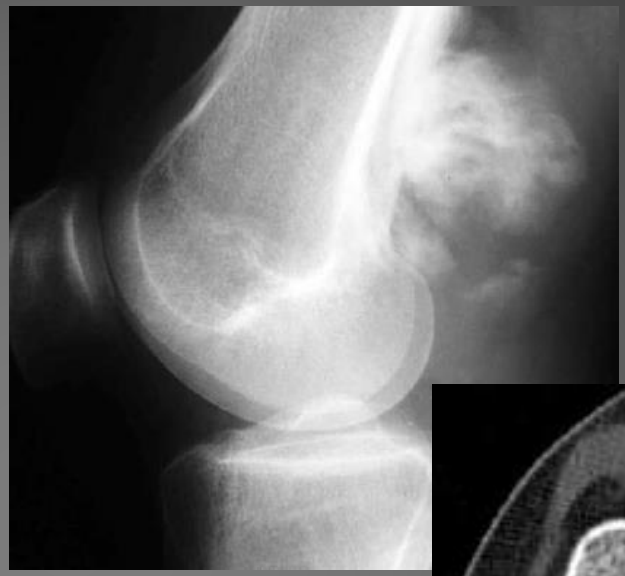
RUOLO DELL'IMAGING

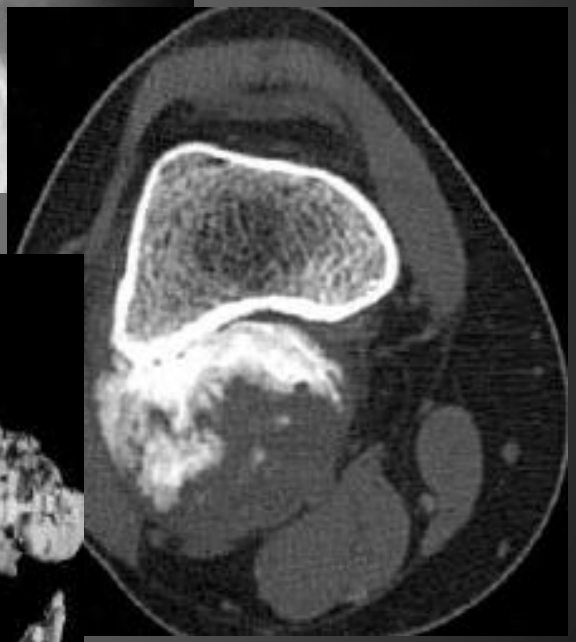
- ✓DETEZIONE DELLA LESIONE
- ✓CARATTERIZZAZIONE
- ✓BILANCIO SPAZIALE

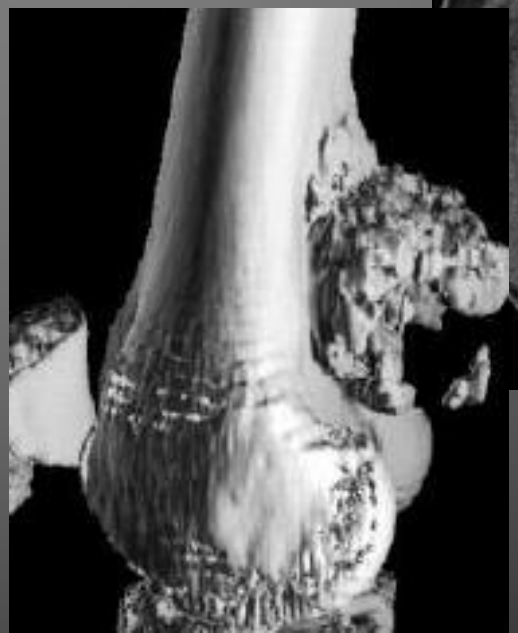
RUOLO DELLA TC

KEY POINTS

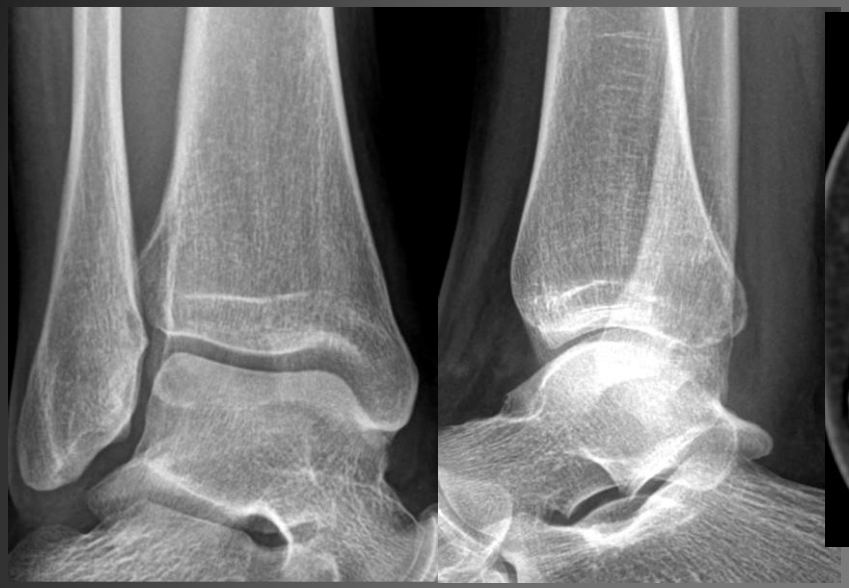
- Computed tomography (CT) is a high-radiation-dose examination, which should therefore be both justified and tailored to the clinical need.
- CT of solitary bone lesions may provide information on tumour mineralization difficult to identify on plain film or MR.
- Non-contrast-enhanced CT of the thorax is appropriate for staging of metastatic bone sarcoma.
- Whole-body CT in older patients should be considered where the "index" bone lesion may be a metastasis.
- CT with CT fluoroscopy is ideal for guiding bone biopsy and interventional procedures. Steps to minimize radiation dose are important for both the patient and operator.
- Ingenuity in patient positioning can produce high-quality scans of limb lesions (by removing unnecessary parts of the patient from the scan plane).

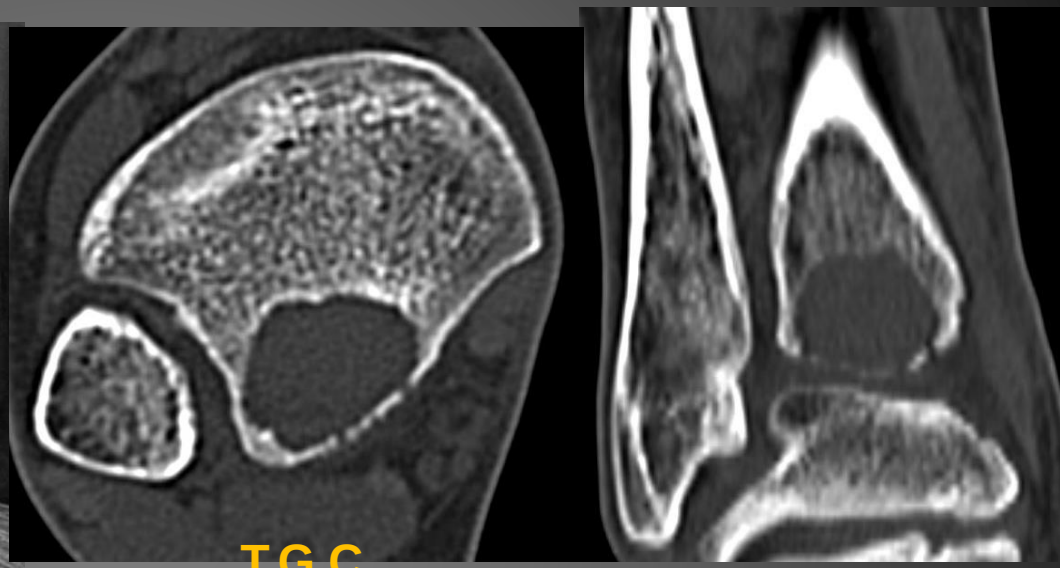




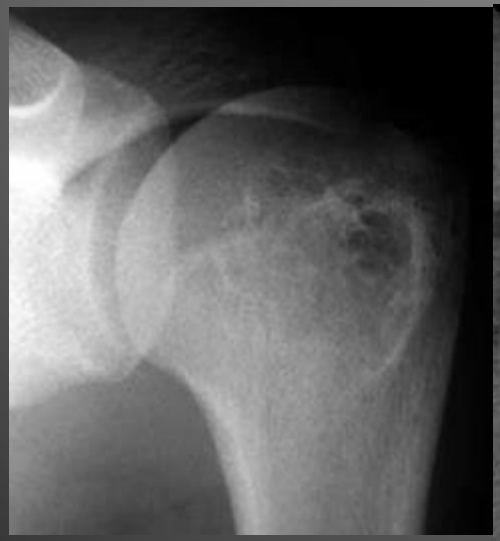


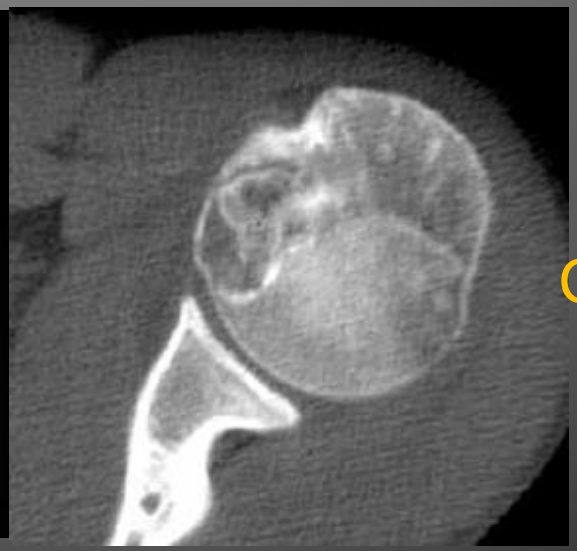
RUOLO DELLA TC





T.G.C





Condroblastoma

RUOLO DELLA RNM

The role of magnetic resonance imaging in the evaluation of bone tumours and tumour-like lesions

Duarte Nascimento · Guilherme Suchard · Maruan Hatem · Armando de Abreu

Received: 20 April 2014 / Revised: 11 May 2014 / Accepted: 20 May 2014 / Published online: 9 July 2014
© The Author(s) 2014. This article is published with open access at Springerlink.com

Abstract
Bone tumours and tumour-like lesions are frequently encountered by radiologists. Although radiographs are the primary screening technique, magnetic resonance imaging (MRI) can help narrow the differential or make a specific diagnosis when a lesion is indeterminate or shows signs of aggressiveness. MRI can extend the diagnostic evaluation by demonstrating several tissue components. Even when a specific diagnosis cannot be made, the differential diagnosis can be narrowed. MRI is superior to the other imaging modalities in detecting bone marrow lesions and tumoral tissue (faint lytic/sclerotic bone lesions can be difficult to visualise using only radiographs). Contrast-enhanced MRI can reveal the most vascularised parts of the tumour and MRI guidance makes it possible to avoid biopsing necrotic areas. MRI is very helpful the high quality of MRI, there are a few pitfalls and limitations of which one should be aware. Applications of MRI in bone tumours will probably continue to grow as new sequences are further studied.

Teaching Points

- *When a lesion is indeterminate or shows signs of aggressiveness, MRI is indicated.*
- *When MRI does not lead to a diagnosis, biopsy is indicated.*
- *MRI is superior to the other imaging modalities in detecting bone marrow lesions.*
- *MRI is very helpful in local staging and surgical planning.*
- *MRI is used in assessing the response to neoadjuvant therapy, restaging and post-therapeutic follow-up.*

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Study of single voxel ^{1}H MR spectroscopy of bone tumors: Differentiation of benign from malignant tumors

Jing Zhang[a], Kebin Cheng[a], Yi Ding[b], Wei Liang[a], Yi Ding[c], Daniel Vanel[d], Xiaoguang Cheng[a,*]

[a] Department of Radiology, Beijing Jishuitan Hospital, Beijing, China
[b] Department of Orthopaedic Oncology, Beijing Jishuitan Hospital, Beijing, China
[c] Department of Pathology, Beijing Jishuitan Hospital, Beijing, China
[d] Rizzoli Institute, Bologna, Italy

ARTICLE INFO

Keywords:
Bone tumor
Proton magnetic resonance spectroscopy
Single voxel spectroscopy

ABSTRACT

Objective: To evaluate the clinical application of single voxel ^{1}H MRS in the discrimination of benign and malignant bone tumors.

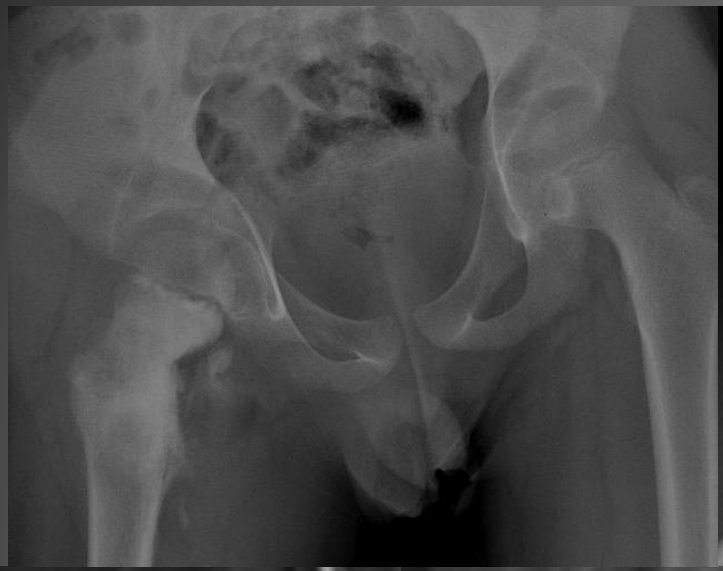
Materials and methods: Eighty-three patients (64 male, 19 female), presenting with a bone tumor, were examined on a 1.5 T MRI scanner. Using pathological results as a gold standard, there were 34 benign and 49 malignant tumors. After plain MRI scans, a 3D fast SPGR sequence was used for dynamic contrast-enhanced scanning. Dynamic images were transferred to the workstation, where the region of maximal enhancement was identified for prescription of the ^{1}H MRS sequence. Single-voxel ^{1}H MRS was then performed with the probe-p sequence, TR/TE = 1500/110 ms, VOI ranging from 14.4 mm × 7.3 mm × 20.2 mm to 27.9 mm × 25.5 mm × 20.1 mm, automatic shimming and water suppression, 15 min post-contrast. For control purposes, the 3rd lumbar spine vertebral body of six patients having lumbar disc herniation (LDH) without systemic disease was examined with ^{1}H MRS of normal bone marrow. The static contrast enhancement scan was used for these LDH patients. Conversion of raw MR signal to an MR spectrum was performed using SAGE 7. Cho/Lip (choline/lipids) peak height ratios were calculated. ROC curve analysis was used to determine the cut-off of Cho/Lip ratio for discrimination.

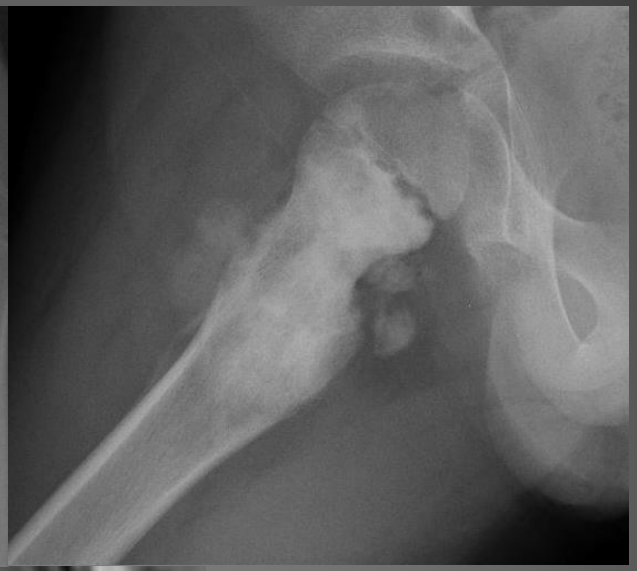
Results: For malignant tumors, one resonance at 3.30–3.19 ppm attributed to choline and another at 1.14–1.55 ppm attributed to lipid were detected. With normal bone marrow and most benign tumors, no choline signal was detected. Choline was only found in six benign lesions. With a threshold for Cho/Lip peak height ratio of 0.2, the area under ROC curve was 0.819. The corresponding sensitivity and specificity of ^{1}H MRS were 76% and 88%.

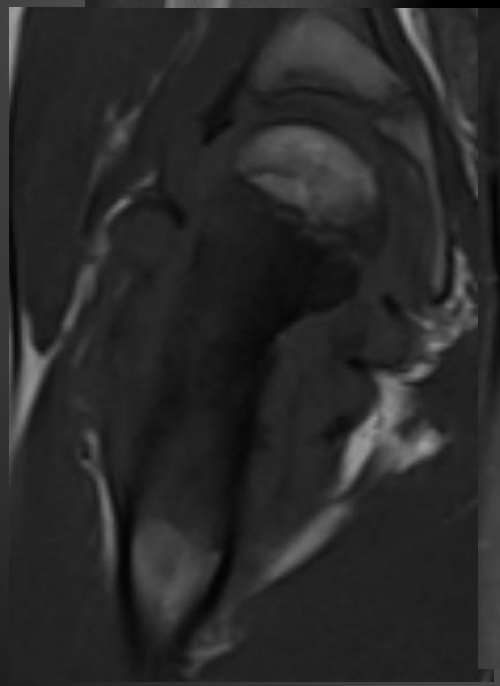
Conclusions: Single voxel ^{1}H MRS can help in discriminating benign and malignant bone tumors.

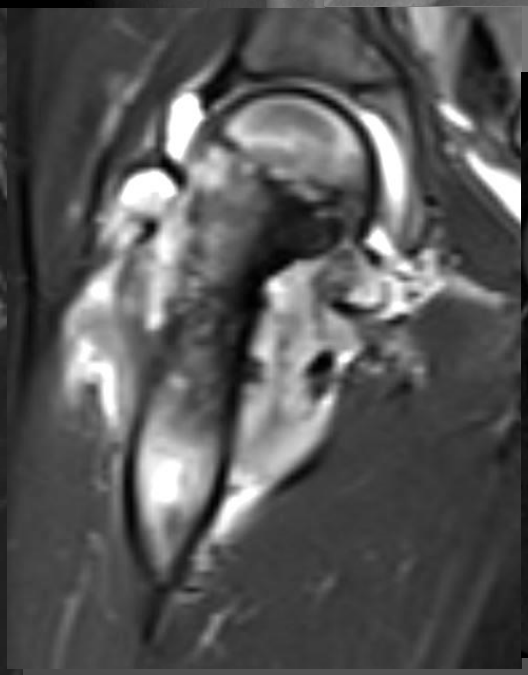
© 2011 Published by Elsevier Ireland Ltd.

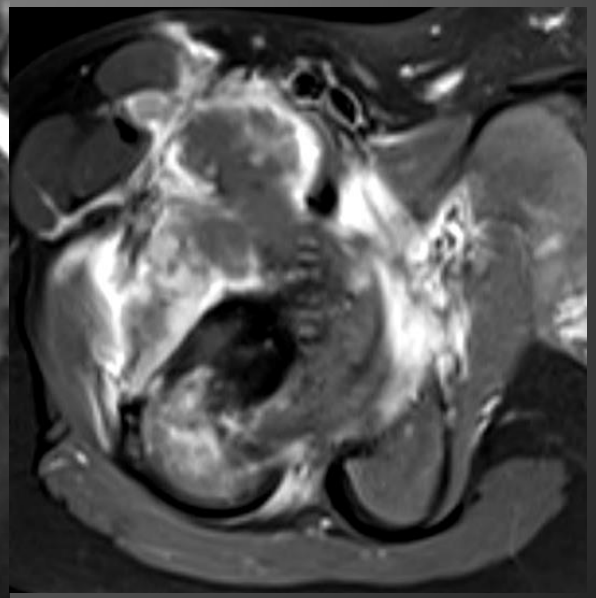
RUOLO DELLA RNM

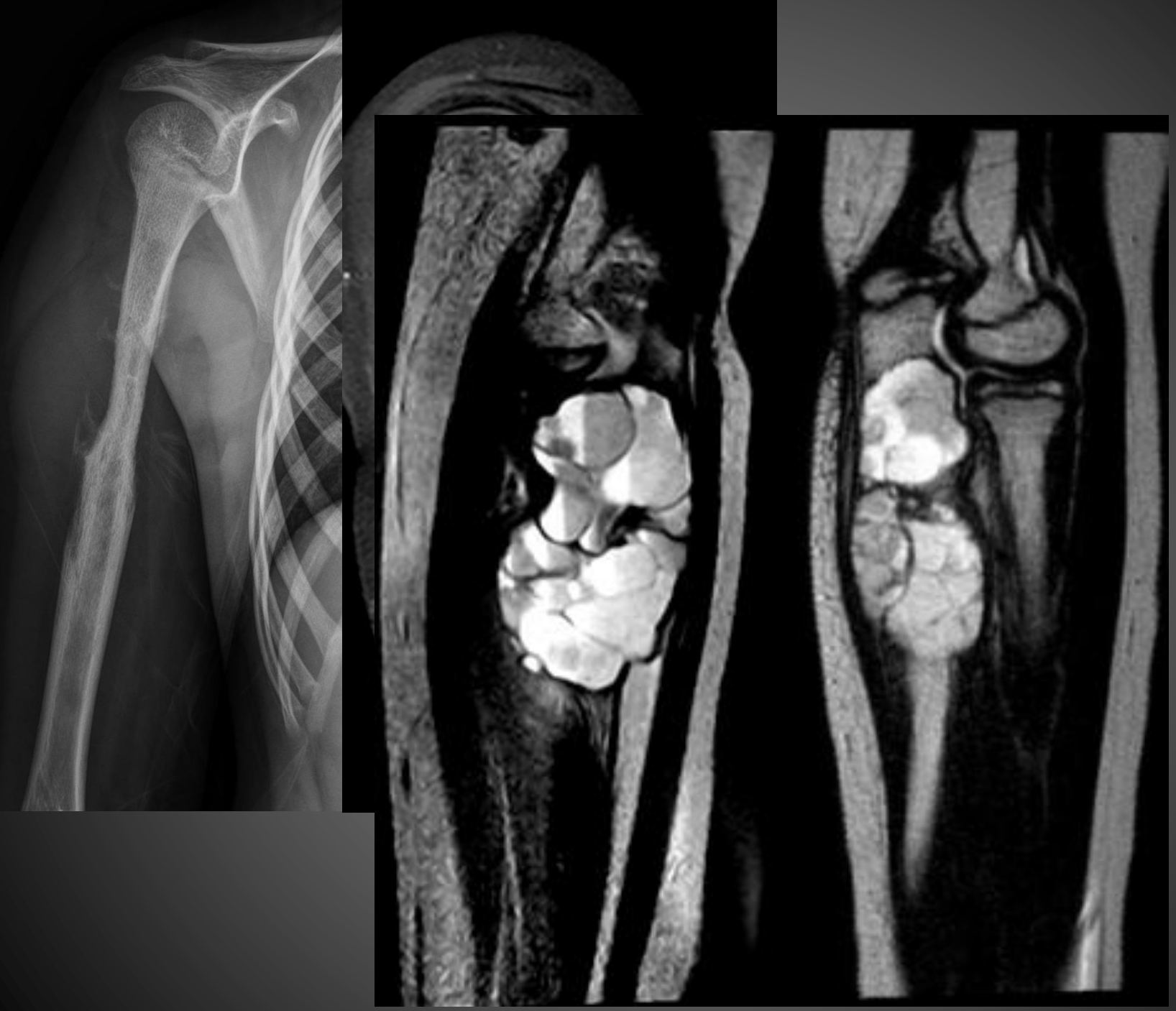












METASTASI OSSEE - CLINICA

Il primo sintomo delle lesioni ossee è di norma il dolore

- Presente nel 28-45% dei Pz con neoplasia e nel 70% di quelli in fase avanzata
- Inizialmente sporadico poi progressivamente invalidante
- Tende a peggiorare di notte

- Il dolore improvviso e di intensità elevata è accompagnato a frattura patologica

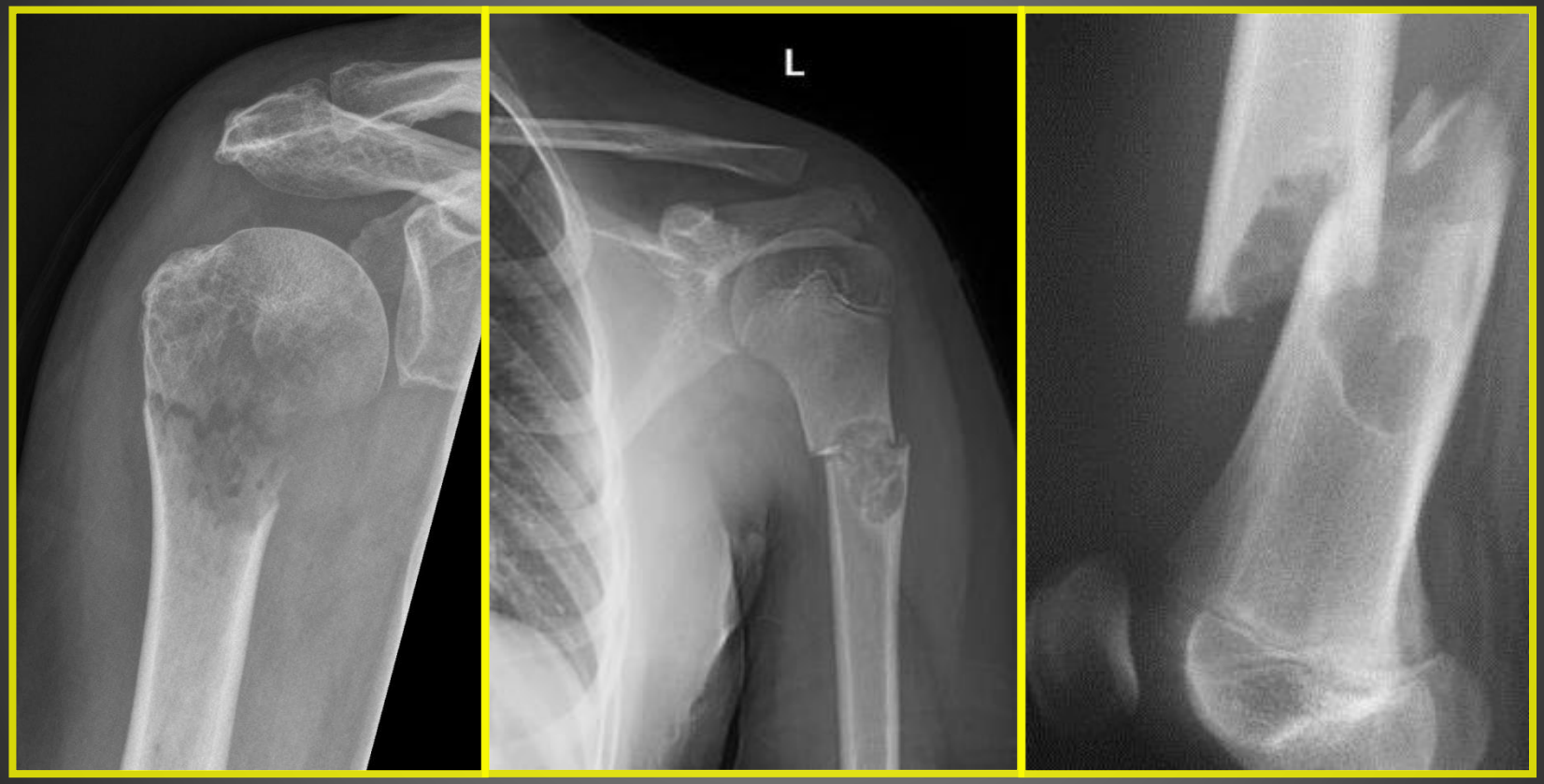
- Coste (anche dopo un colpo di tosse)
- Ossa lunghe
- Corpo vertebrale (generalmente non dolorose)

LE FRATTURE PATOLOGICHE

- Nella maggior parte dei casi secondarie a diffusione ematogena
- Rara l'invasione per contiguità
- Prevalentemente osteolitiche per attivazione osteoclastica
- K mammella → metastasi miste prevalentemente osteolitiche
- K prostata → metastasi osteoaddensanti

RADIOGRAFIA CONVENZIONALE

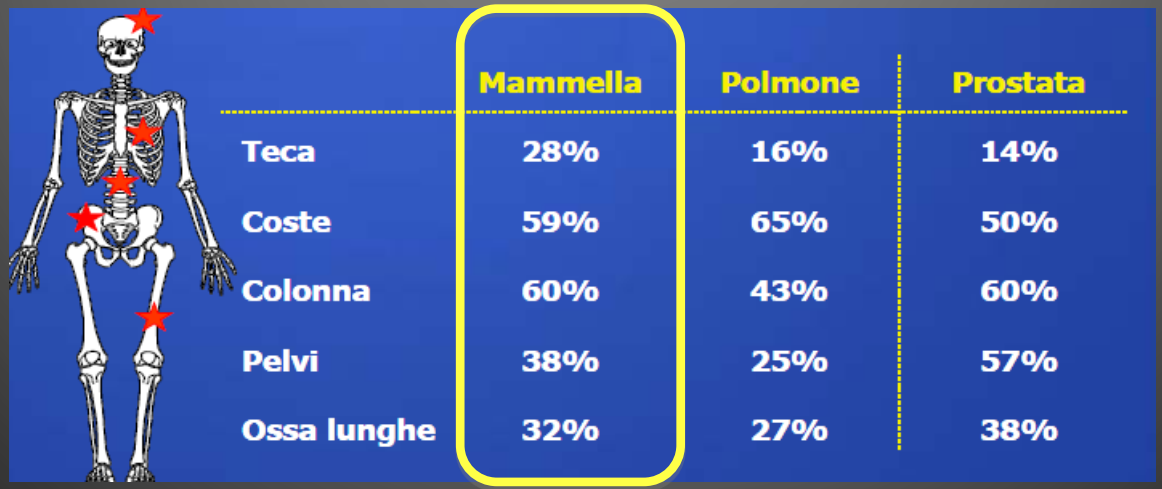
Le fratture patologiche



- Spontanee, avvengono anche in assenza di trauma
- Compaiono nel 8-30% dei pazienti

METASTASI OSSEE

Mammella	**65-75%**
Prostata	**65-75%**
Tiroide	**60%**
Vescica	**40%**
Polmone	**30-40%**
Rene	**20-25%**
Melanoma	**14-45%**



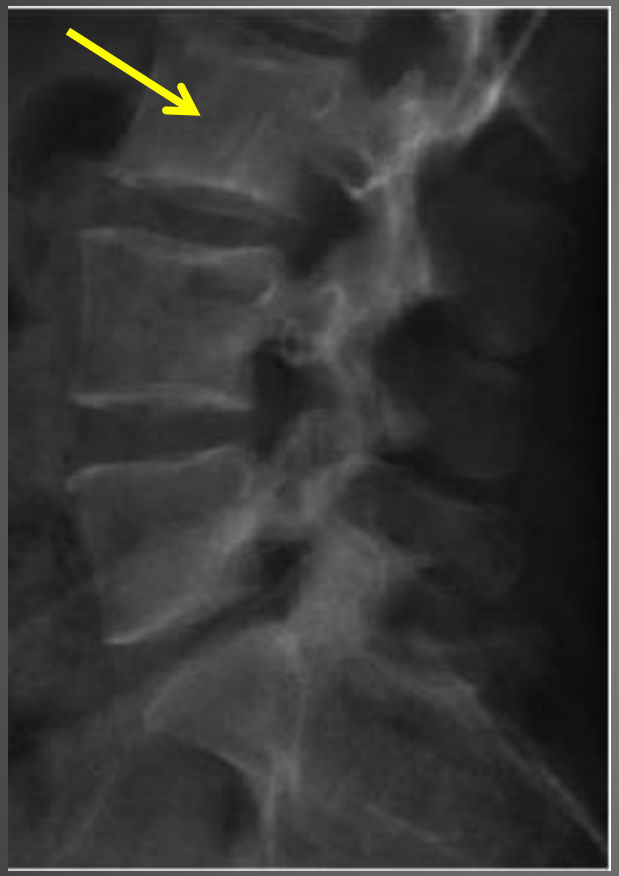
	Mammella	Polmone	Prostata
Teca	28%	16%	14%
Coste	59%	65%	50%
Colonna	60%	43%	60%
Pelvi	38%	25%	57%
Ossa lunghe	32%	27%	38%

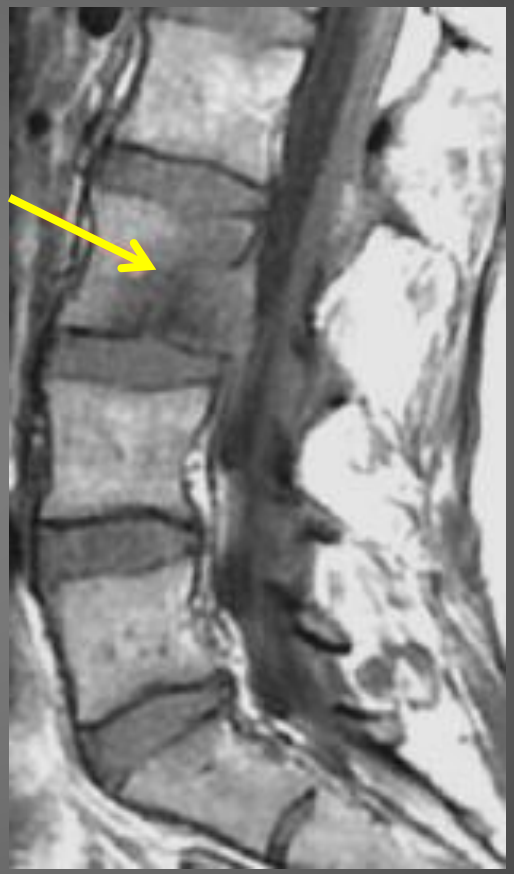
Coleman RE, Cancer, 1997

METODICHE DI IMAGING

	Corticale ossea	Trabecole ossee	Midollo osseo	tumore	Metabolismo osseo	Metabolismo tumorale (glucosio)
RX	X	X				
CT	X	X	X	X		
MRI			X	X		
Scinti SPECT					X	
PET					X	x
PET-TC	x	x	x	x	x	X
	Aspetto osseo		Aspetto tumorale		Aspetto metabolico	

RADIOGRAFIA CONVENZIONALE



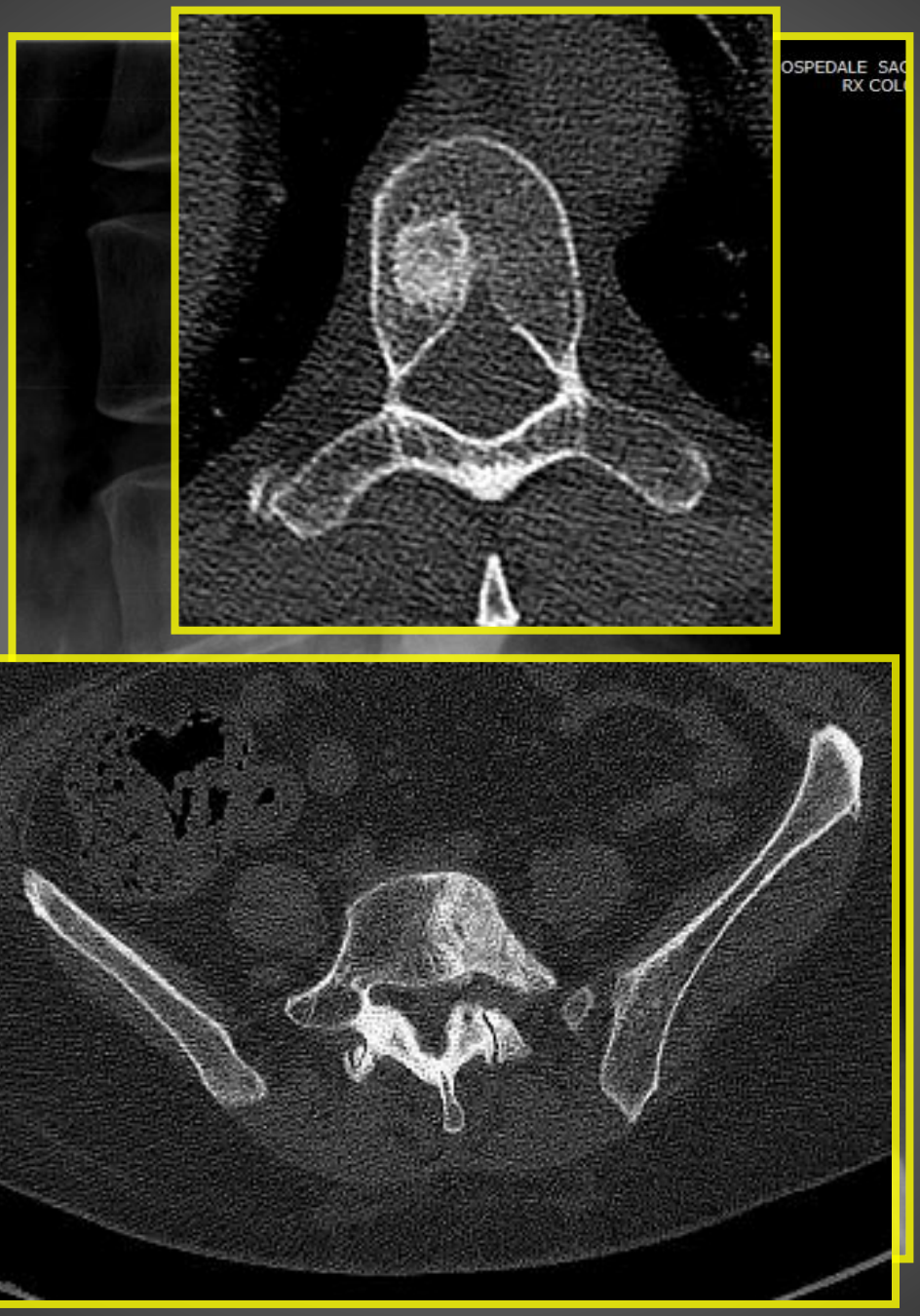


……circa il 40% delle lesioni sono misconosciute con incremento del falsi neg

Imaging of spinal metastic disease Lubdha M.

TOMOGRAFIA COMPUTERIZZATA

- Elevata risoluzione spaziale
- Indagine di secondo livello
- Imaging multiplanare
- Software di ricostruzione dedicato
- Utile nel bilancio di estensione
- Guida bioptica


OSPEDALE SA
RX COL

TOMOGRAFIA COMPUTERIZZATA

Radiol med (2014) 119:852–860
DOI 10.1007/s11547-014-0401-4

DIAGNOSTIC IMAGING IN ONCOLOGY

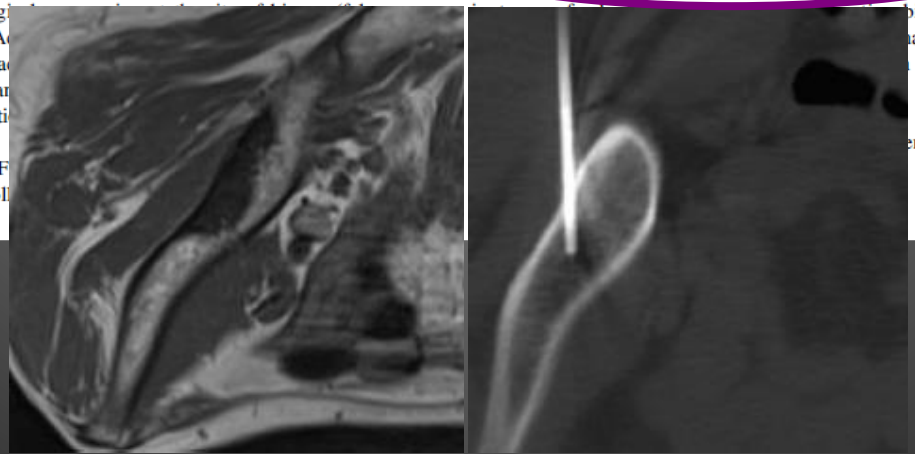
Ct-guided bone biopsy in cancer patients with suspected bone metastases: retrospective review of 308 procedures

Lorenzo Monfardini · Lorenzo Preda · Gaetano Aurilio · Stefania Rizzo · Vincenzo Bagnardi · Giuseppe Renne · Sara Maccagnoni · Paolo Della Vigna · Disalvatore Davide · Massimo Bellomi

Received: 15 October 2013 / Accepted: 27 January 2014 / Published online: 4 April 2014
© Italian Society of Medical Radiology 2014

Abstract
Purpose The authors assessed the adequacy and sensitivity of CT-guided bone biopsy in 308 procedures performed in 286 cancer patients with suspected bone metastases.
Materials and methods An electronic search of our CT-guided bone biopsy database was retrospectively performed to evaluate the adequacy of samples and, in the event of negative samples, whether the patients had radiologi
tive). A
with ra
length ar
associati
Results
quate. F
were fol

of biopsy in 10 cases (false-negative cases); overall sensitivity was 96.7 %. Specimen length was significantly correlated to the probability of an adequate biopsy ($p = 0.035$) and inversely correlated to the probability to obtain a false-negative result ($p = 0.02$). We encountered 11/308 (3.5 %) minor
Conclusion CT-guided biopsy of bone lesions in cancer patients allows for a final diagnosis in 94 % of cases. A
longer than 1 cm may lead to a significant
biopsies
agnetic
should
ents ·



RISONANZA MAGNETICA

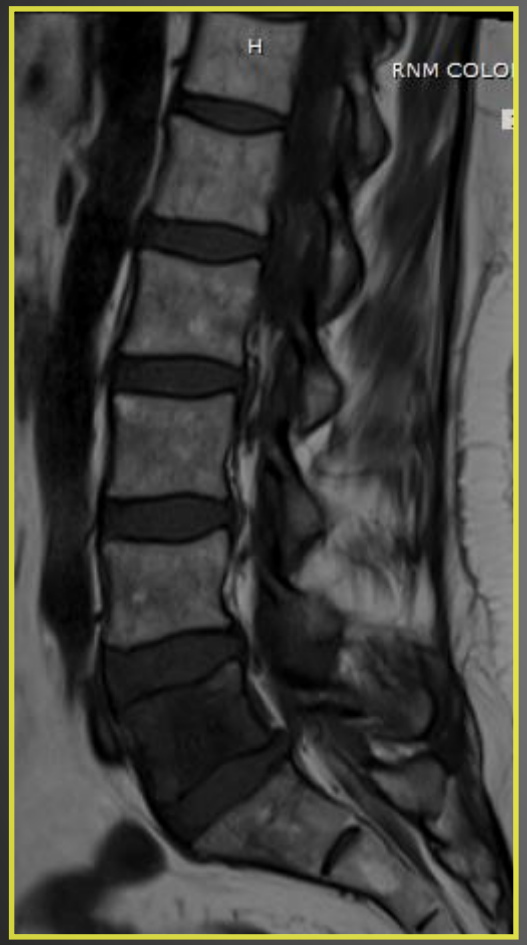
- ELEVATA SENSIBILITA’
- RISOLUZIONE DI CONTRASTO
- IMAGING MULTIPLANARE
- VALUTAZIONE MULTIPARAMETRICA
- PANORAMICITA’

RISONANZA MAGNETICA

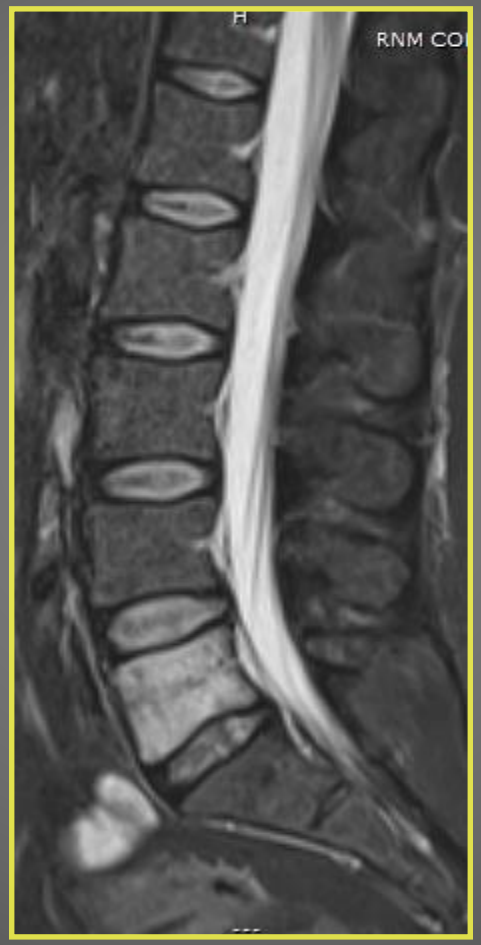
	MR	Pet-TC	TC	Scintigr.
SENSIBILITA' (%)	90	91	73	86
SPECIFICITA' (%)	95	97	95	81

Dtsch Arztebl Int oct. 2014 Heindel W.

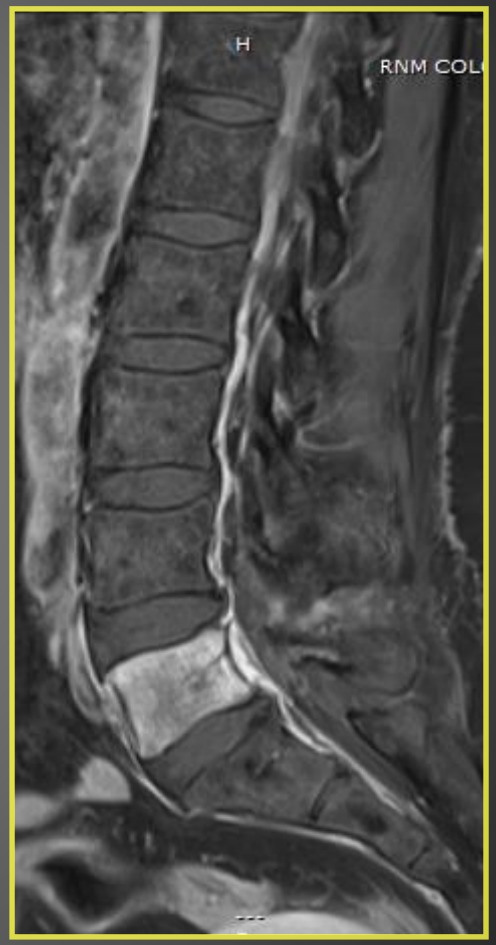
RM - MULTIPARAMETRICITA’



T1

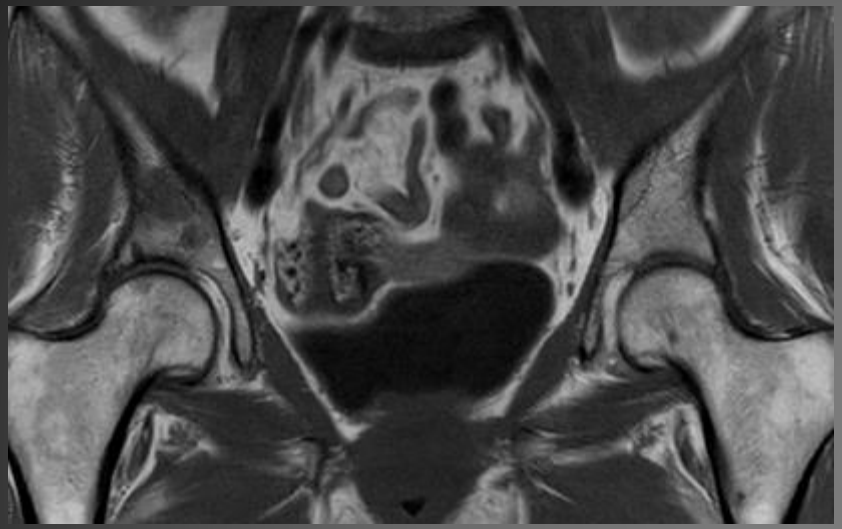


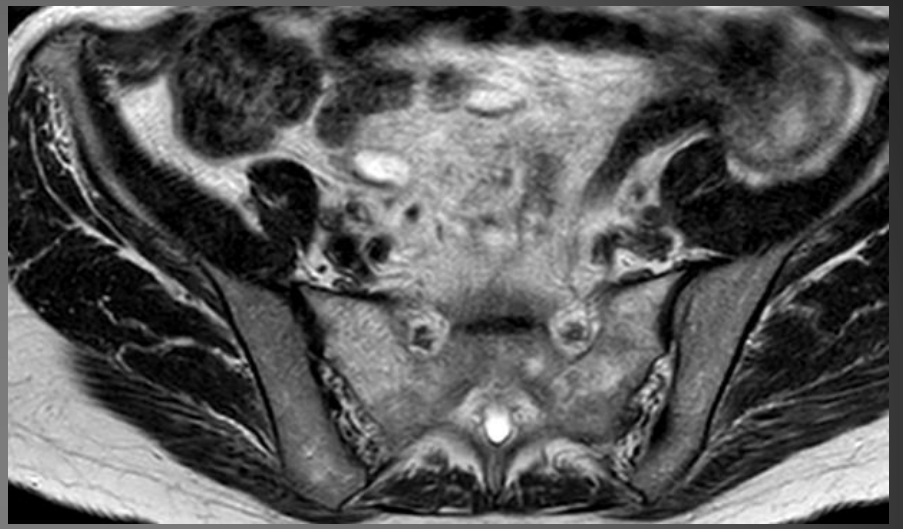
STIR

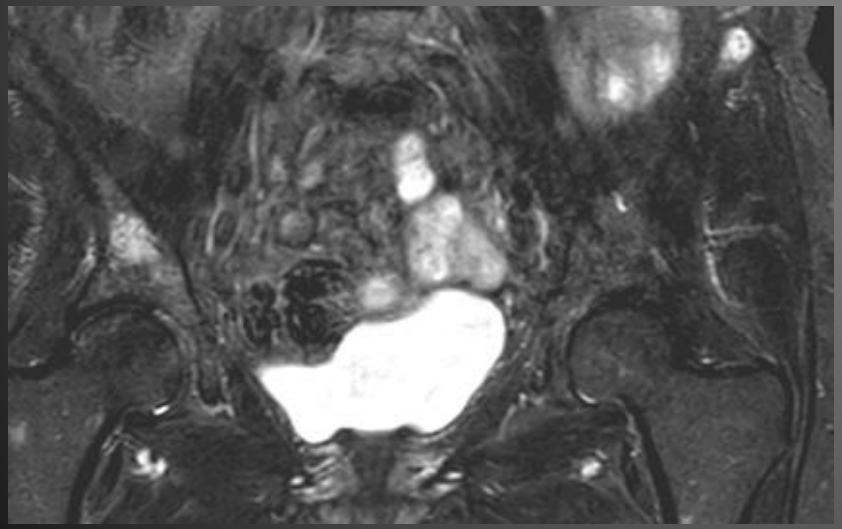


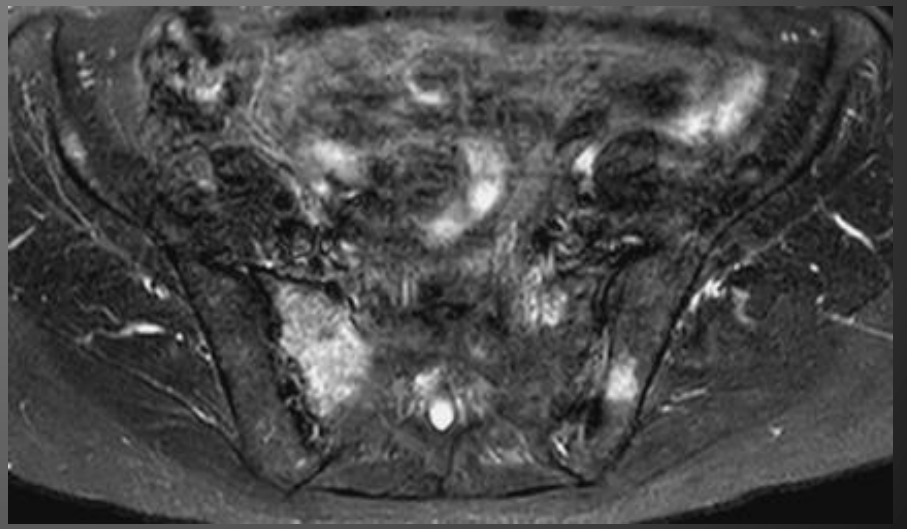
MDC

RM - MULTIPLANARIETA’

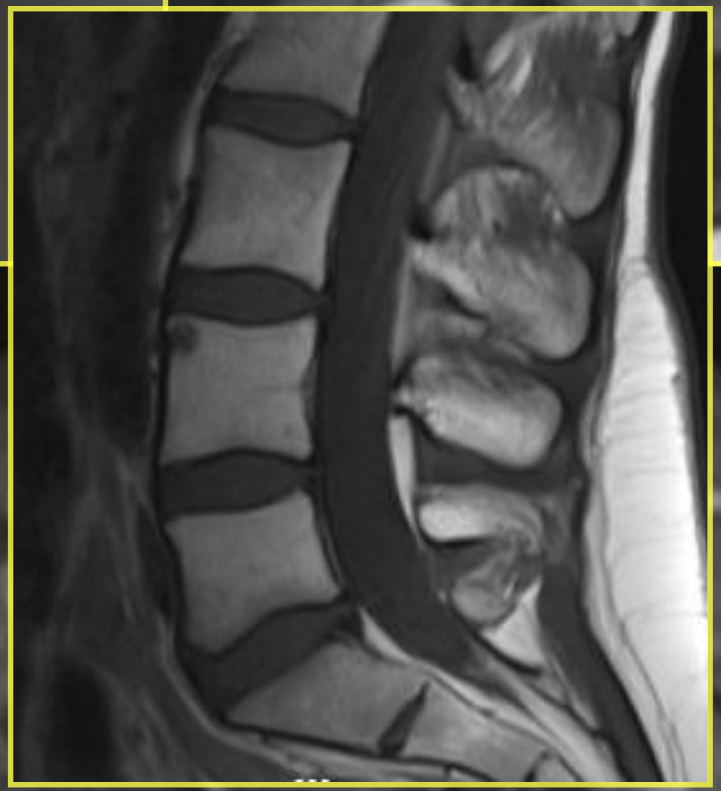


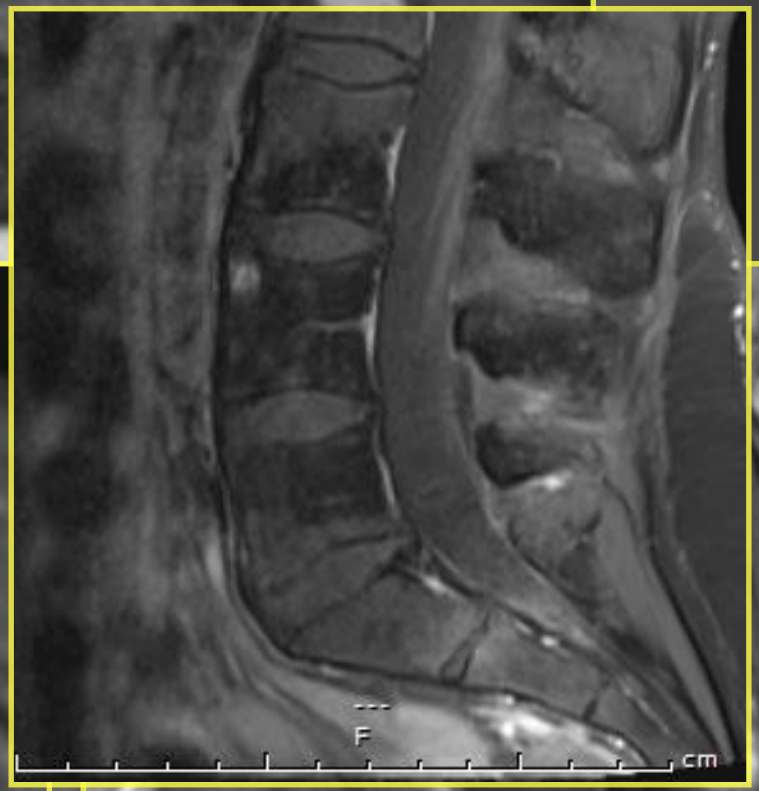






LESIONE SINGOLA

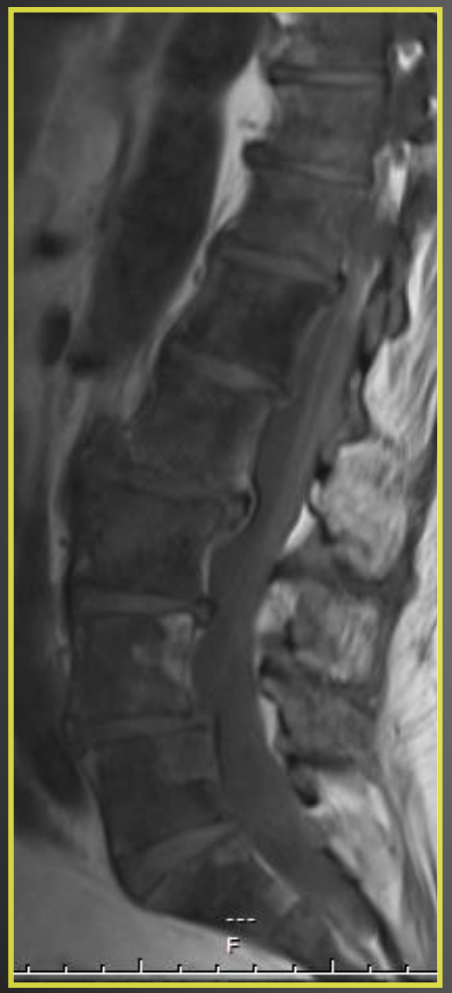




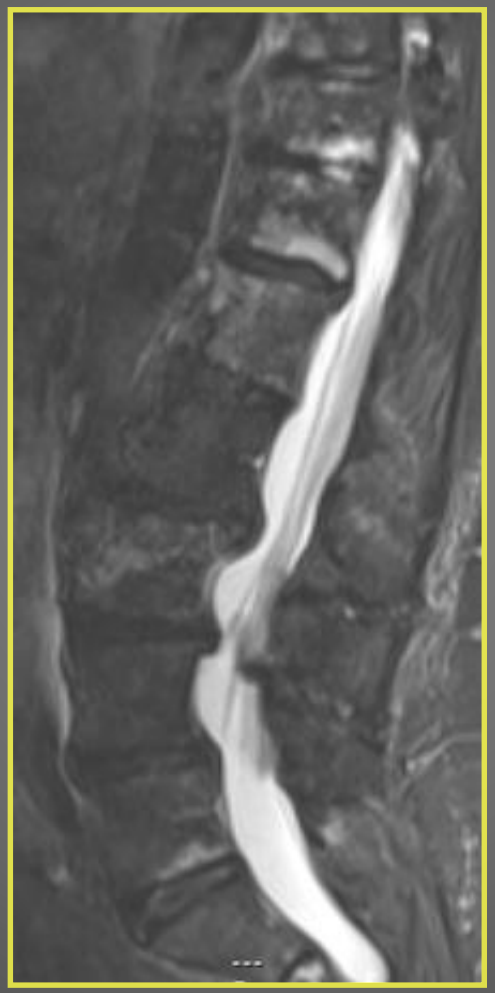
T1

MDC

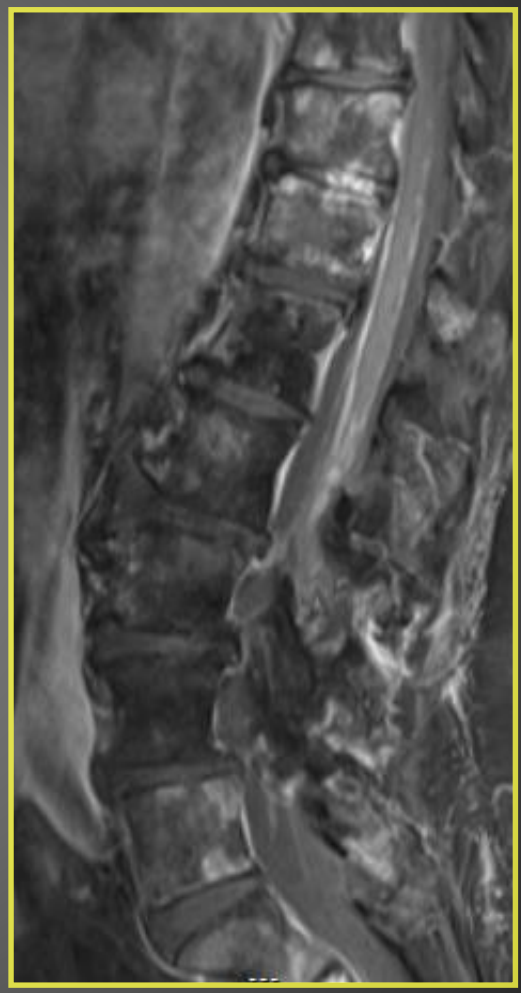
LESIONI MULTIPLE



T1



STIR



MDC

RISONANZA MAGNETICA

Accuratezza diagnostica elevata

- Elevata frequenza di metastasi extra-assiali → **valutazione panoramica**
- Tempi di acquisizione e costi elevati per la RM Convenzionale

- **SVILUPPO TECNOLOGICO → RM WHOLE BODY IMAGING**

- *Sequenze T1,STIR e DWI sul piano coronale e sagittale per il rachide*
- *Sincronizzazione respiro ,elevato FOV. No mdc e.v.*
- *Utilizzo di software dedicati per la rivisitazione alla work station.*

Current Concepts in Whole-Body Imaging Using Turbo Short Tau Inversion Recovery MR Imaging

G. Hargaden[1], M. O'Connell[1], E. Kavanagh[1], T. Powell[1], R. Ward[1], S. Eustace[1,2]

Developments in pulse sequence design, localizing gradients, and synchronized tabletop movement allow rapid whole-body MR imaging. In this pictorial essay, we outline the current technique and both the accepted and the evolving applications of whole-body turbo short tau inversion recovery (STIR) MR imaging.

Basic Technique

Without a Moving Tabletop

Total body coverage is yielded by four contiguous coronal acquisitions, each performed using turbo STIR tissue excitation and the following parameters: TR range/TE effective, 2000–4000/40; inversion time at 1.5 T, 160 msec; echo-train length, 6; and field of view, 45 cm. The TR that was selected depended on the amount of coverage required. These parameters allow the acquisition of 24 slices that allow coverage from anterior to posterior with contiguous 8-mm-thick slices in most adults in 4-min increments for each coronal station. Using respiratory triggering during the acquisition of images of the thorax and abdomen increases the acquisition time at these sites.

Coronal scans of the head, neck, and thorax are acquired with the patient in the head-first position, whereas coronal scans of the abdomen, pelvis, and lower extremities are acquired with the patient in the feet-first position. The need to reposition the patient from the

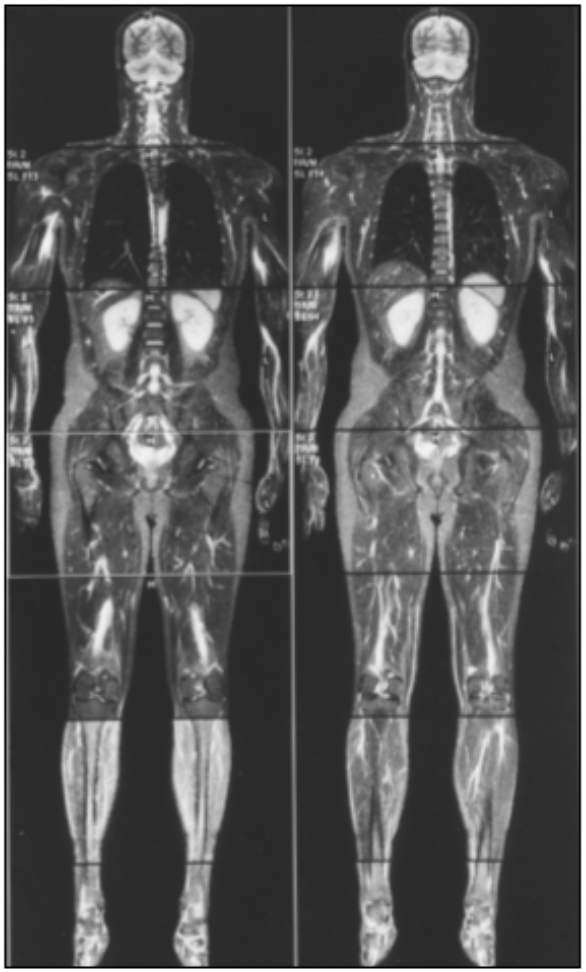


Fig. 1.—Healthy 32-year-old male volunteer. Contiguous coronal MR images were obtained using moving tabletop and tabletop extender to show normal skeleton and viscera.

Received February 8, 2002; accepted after revision June 21, 2002.

The evolving role of MRI in oncohaematological disorders

Il ruolo della RM nelle malattie oncoematologiche

O. Tamburrini[1] • M.A. Cova[2] • D. Console[1] • P. Martingano[2]

[1]UO di Radiologia, Università "Magna Graecia" di Catanzaro, Campus di Germaneto, Viale Europa, I-88100 Catanzaro, Italy
[2]UCO di Radiologia, Università di Trieste, Ospedale di Cattinara, Strada di Fiume 447, I-34149 Trieste, Italy
Correspondence to: O. Tamburrini, Tel.: +39-961-3647284, Fax: +39-961-3647395, e-mail: tamburrini@unicz.it

Received: 15 September 2006 / Accepted: 15 November 2006 / Published online: 23 July 2007

Abstract
Magnetic resonance imaging (MRI) has opened new possibilities to current diagnostic radiology in the evaluation of bone marrow. Compared with other imaging modalities, MRI is the only technique able to directly visualise bone marrow with its different components of red and yellow marrow. Other advantages of MRI are high-contrast resolution and multiplanar view, as well as extensive coverage of the skeleton with whole-body MRI (WBMRI). However, specificity of signal alterations of bone marrow is low. Therefore, MRI findings need to be integrated with clinical and laboratory findings as well as with haematological and oncological evaluation. MRI provides information that effectively aids diagnosis, staging and follow-up of various bone marrow disorders. There is increasing interest in the capabilities of MRI in the evaluation of bone marrow, in particular of haematological malignancies. According to some authors much work remains to be done to improve sensitivity and specificity of MRI in order to define the real clinical value of this imaging modality in the multidisciplinary management of patients with a haematological malignancy. This article presents recent developments and perspectives in the use of MRI in oncohaematological diseases.

Key words Haematology • Bone marrow • Magnetic resonance

Riassunto
La risonanza magnetica (RM) ha aperto nuove possibilità alla radiologia diagnostica per la valutazione del midollo osseo. A differenza delle altre modalità di imaging, la RM è la sola tecnica capace di visualizzare direttamente il midollo osseo, nelle sue componenti di midollo rosso e giallo. Altri vantaggi della RM sono rappresentati dall'elevata risoluzione di contrasto e dalla visione multiplanare, assieme ad un'ampia copertura dello scheletro, fino alla RM "whole body" (WBMRI). Tuttavia la specificità delle alterazioni di segnale è bassa, perciò i reperti di RM devono essere integrati con la clinica e i risultati di laboratorio assieme alla valutazione ematologica ed oncologica. La RM fornisce informazioni che aiutano la diagnosi, lo staging ed il follow-up di diverse malattie del midollo osseo. Vi è un crescente interesse per la capacità della RM di valutare il midollo osseo, particolarmente nelle neoplasie ematologiche. Secondo alcuni autori "molto lavoro deve ancora essere fatto" per migliorare la sensibilità e la specificità della RM e per definire il reale valore clinico di questa modalità di imaging nella gestione multidisciplinare del paziente con una neoplasia ematologica. Questo articolo presenta i recenti sviluppi e le prospettive nell'uso della RM nelle patologie oncoematologiche.

Contents lists available at ScienceDirect

Surgical Oncology

journal homepage: www.elsevier.com/locate/suronc

Review

Comparison of whole-body MRI and skeletal scintigraphy for detection of bone metastatic tumors: A meta-analysis

Qingwu Wu, Ruimin Yang*, Fengmei Zhou, Ying Hu

Department of Medical Imaging, The First Affiliated Hospital of Xinxiang Medical University, Weihui 453100, PR China

ARTICLE INFO

Article history:
Accepted 7 October 2013

Keywords:
Whole-body MRI
Skeletal scintigraphy
Malignant tumors
Bone metastases

ABSTRACT

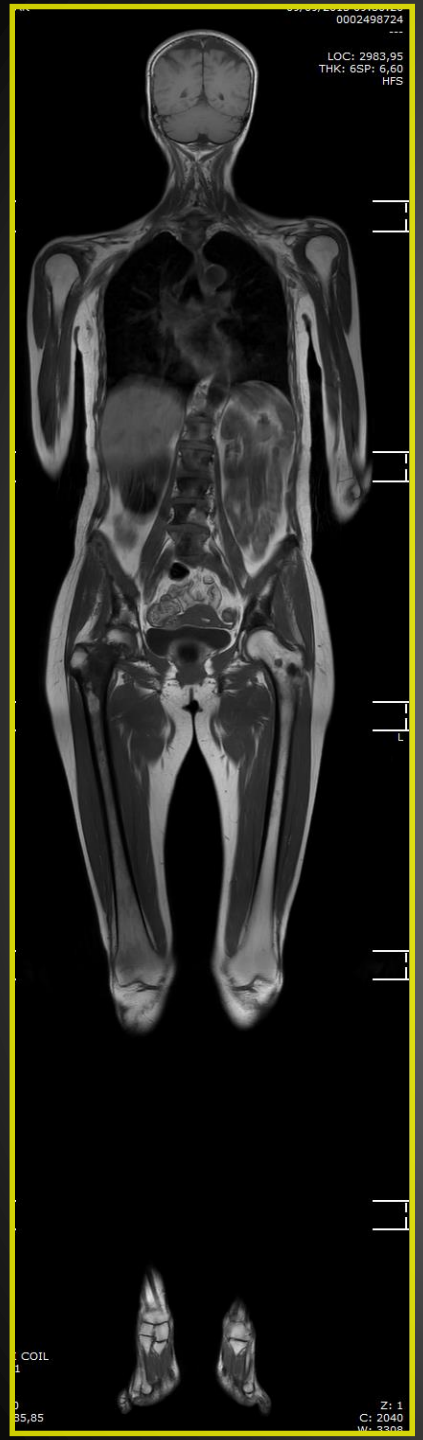
Purpose: We performed a meta-analysis to investigate and compare diagnostic performance of whole-body MRI and skeletal scintigraphy for detection of bone metastatic tumors.

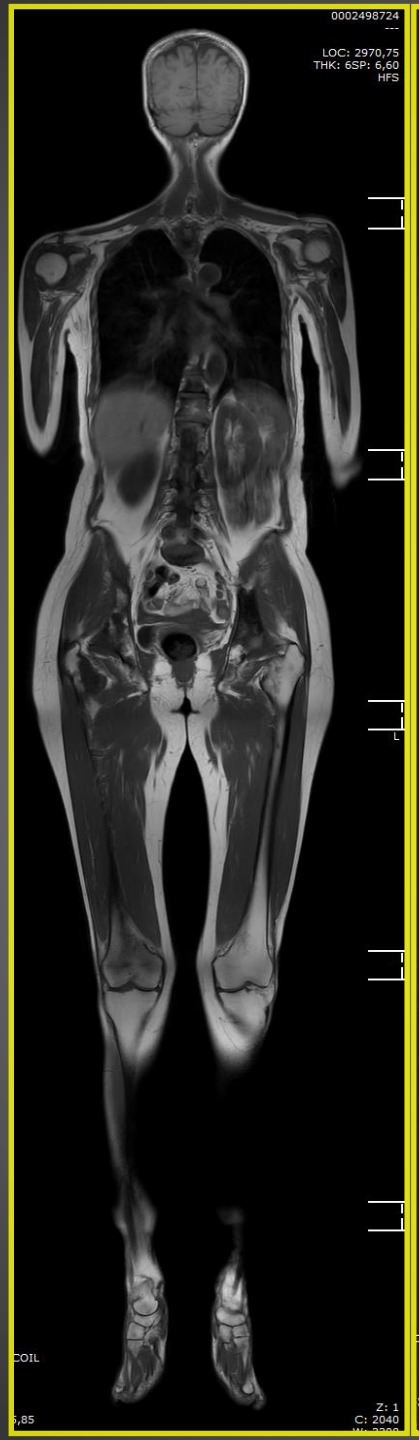
Materials and methods: PubMed and Embase were searched for relevant articles. We calculated sensitivities, specificities, diagnostic odds ratios (DOR), positive likelihood ratios (PLR), negative likelihood ratios (NLR), and constructed summary receiver operating characteristic curves using bivariate models for whole-body MRI and skeletal scintigraphy, respectively.

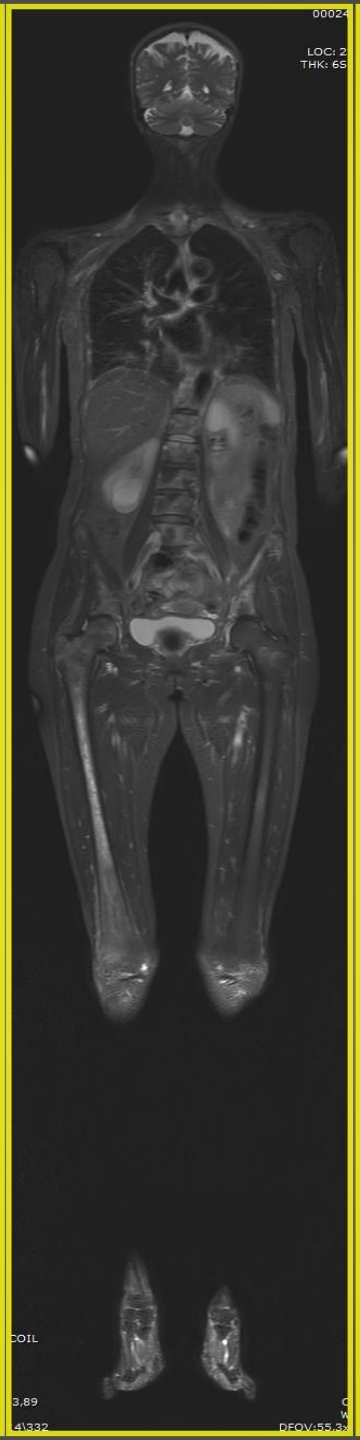
Results: Across 7 studies (332 patients), whole-body MRI have similar patient-based sensitivity (0.84 *vs* 0.83), specificity (0.96 *vs* 0.94), DOR (137.0 *vs* 70.2), PLR (23.3 *vs* 13.0) and NLR (0.17 *vs* 0.19) with skeletal scintigraphy. Area under curves for whole-body MRI and skeletal scintigraphy was 0.94 and 0.89, respectively.

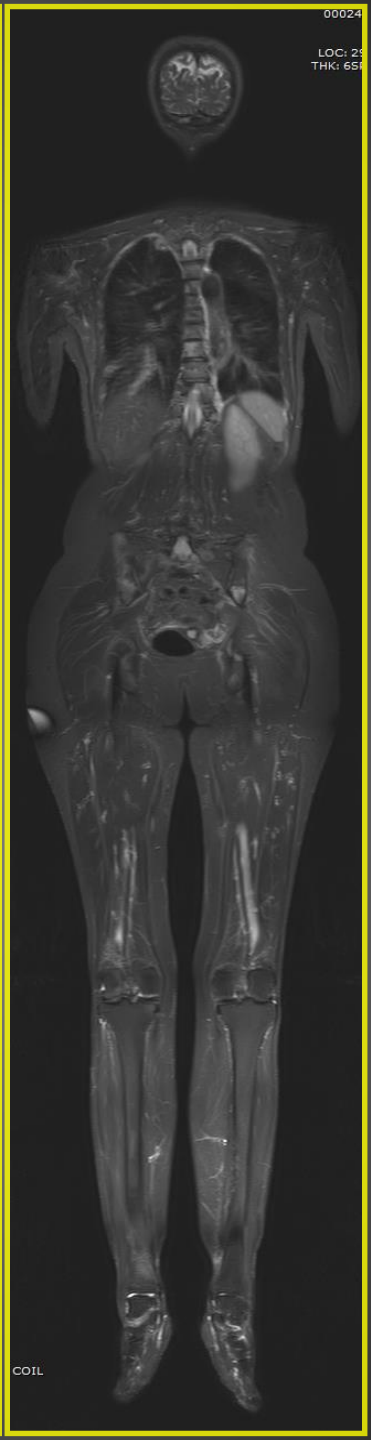
Conclusion: Both whole-body MRI and skeletal scintigraphy have good diagnostic performance for detecting bone metastatic tumors. It remains inconclusive whether whole-body MRI or bone scintigraphy is superior in detecting bone metastatic tumors.

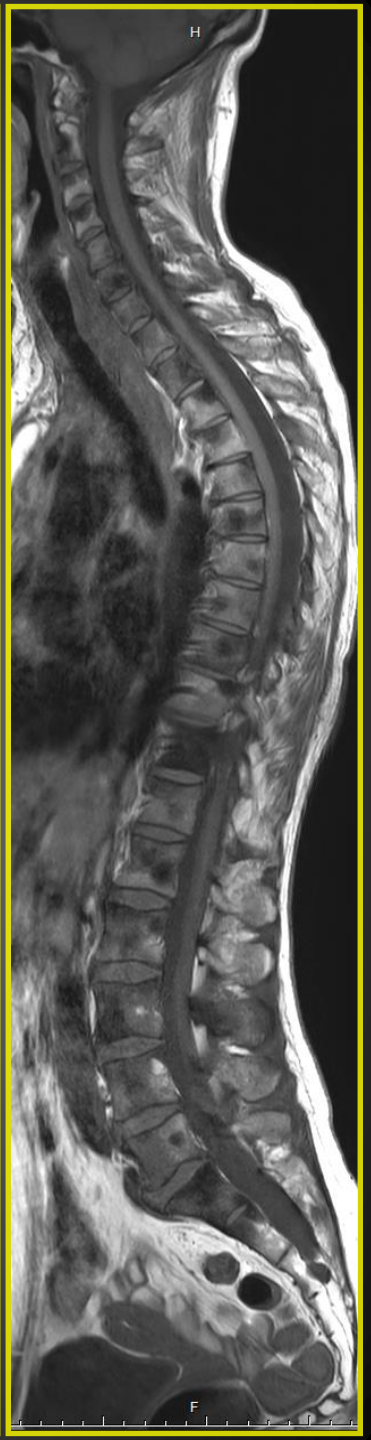
© 2013 Elsevier Ltd. All rights reserved.


0002498724
LOC: 2983,95
THK: 6SP: 6,60
HFS
COIL
Z: 1
C: 2040


0002498724
LOC: 2970,75
THK: 6SP: 6,60
HFS
COIL
Z: 1
C: 2040


LOC: 2
THK: 6S
COIL


LOC: 29
THK: 6S
COIL


H
F

Magn Reson Med Sci, Vol. 6, No. 3, pp. 147–155, 2007

MAJOR PAPER

Whole-body MRI for Detecting Metastatic Bone Tumor: Diagnostic Value of Diffusion-weighted Images

Katsuyuki NAKANISHI[1]*, Midori KOBAYASHI[1], Kazunori NAKAGUCHI[2], Miyaji KYAKUNO[3], Nobuyuki HASHIMOTO[4], Hiromitsu ONISHI[5], Noboru MAEDA[5], Saki NAKATA[6], Masatomo KUWABARA[7], Takamichi MURAKAMI[7], and Hironobu NAKAMURA[5]

Departments of [1]Radiology, [2]Surgery, and [3]Urology, Osaka Seamen's Insurance Hospital
1–8–30, Chikko, Minato-ku, Osaka 552–0021, Japan
[4]Department of Orthopedic Surgery, Osaka Medical Center for Cancer and Cardiovascular Disease
[5]Department of Radiology, Osaka University Graduate School of Medicine
[6]Department of Radiology, Toyonaka Municipal Hospital
[7]Department of Radiology, Kinki University School of Medicine
(Received April 11, 2007; Accepted September 5, 2007)

Purpose: We assessed the diagnostic value of whole body magnetic resonance (MR) imaging (WB-MRI) using diffusion-weighted images (DWI) for detecting bone metastasis and compared it with that of skeletal scintigraphy (SS).

Materials and Methods: Thirty patients with malignancies (breast cancer, 17 patients; prostate cancer, 9; and one patient each, thyroid cancer, liposarcoma, leiomyosarcoma, and extraskeletal Ewing sarcoma) underwent both WB-MRI and SS to detect bone metastasis. All patients were followed more than 6 months by MR imaging, SS, or computed tomographic (CT) examination. For WB-MRI, patients were placed in feet-first supine position with table-top extender and quadrature body coil.

We acquired DWI (axial plane from lower neck to proximal femur) (single shot short TI inversion-recovery [STIR]: repetition time [TR] 6243/echo time [TE] 59/inversion time [TI] 180 ms; b value: 600 s/mm^2; 5-mm slice thickness; 112 × 112 matrix), T_1-weighted fast spin echo (T_1WI), and STIR (sagittal plane of total spine images and coronal plane of whole body images) images.

Four blinded readers independently and separately interpreted images of combined MR sequences of T_1WI + STIR (session 1) and T_1WI + STIR + DWI (session 2).

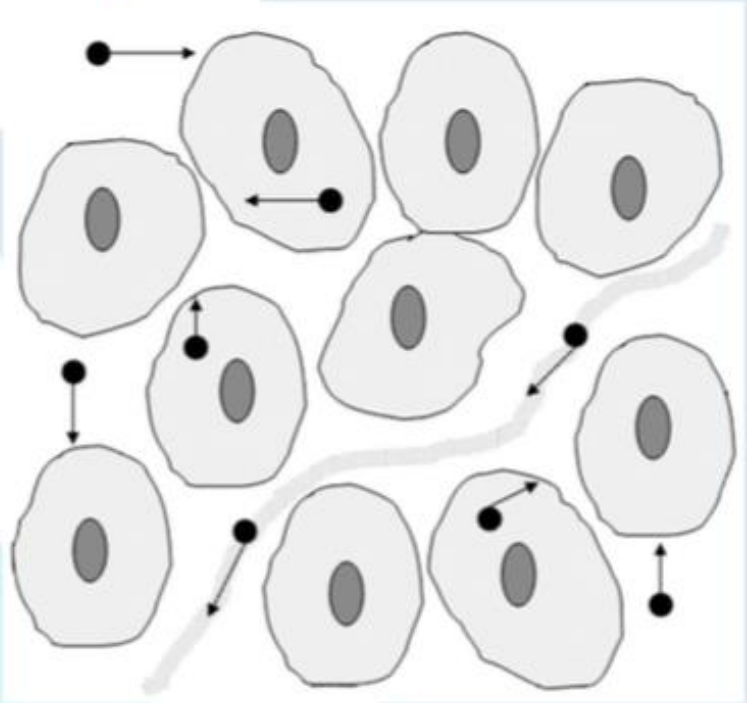
Results: In 10 of 30 patients, we detected a total of 52 metastatic bone lesions; in the other 20, follow-up examinations confirmed no metastatic bone lesions.

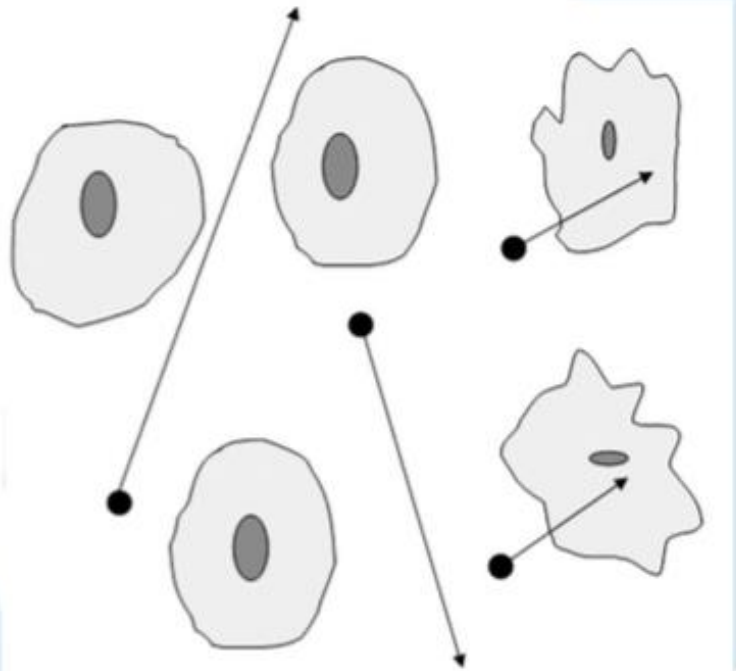
For these 52 lesions, for session 2, the mean sensitivity was 96% and the positive predictive value (PPV) was 98%. Those values were superior to those of session 1 (sensitivity: 88%; PPV: 95%) and those of SS (sensitivity: 96%; PPV: 94%).

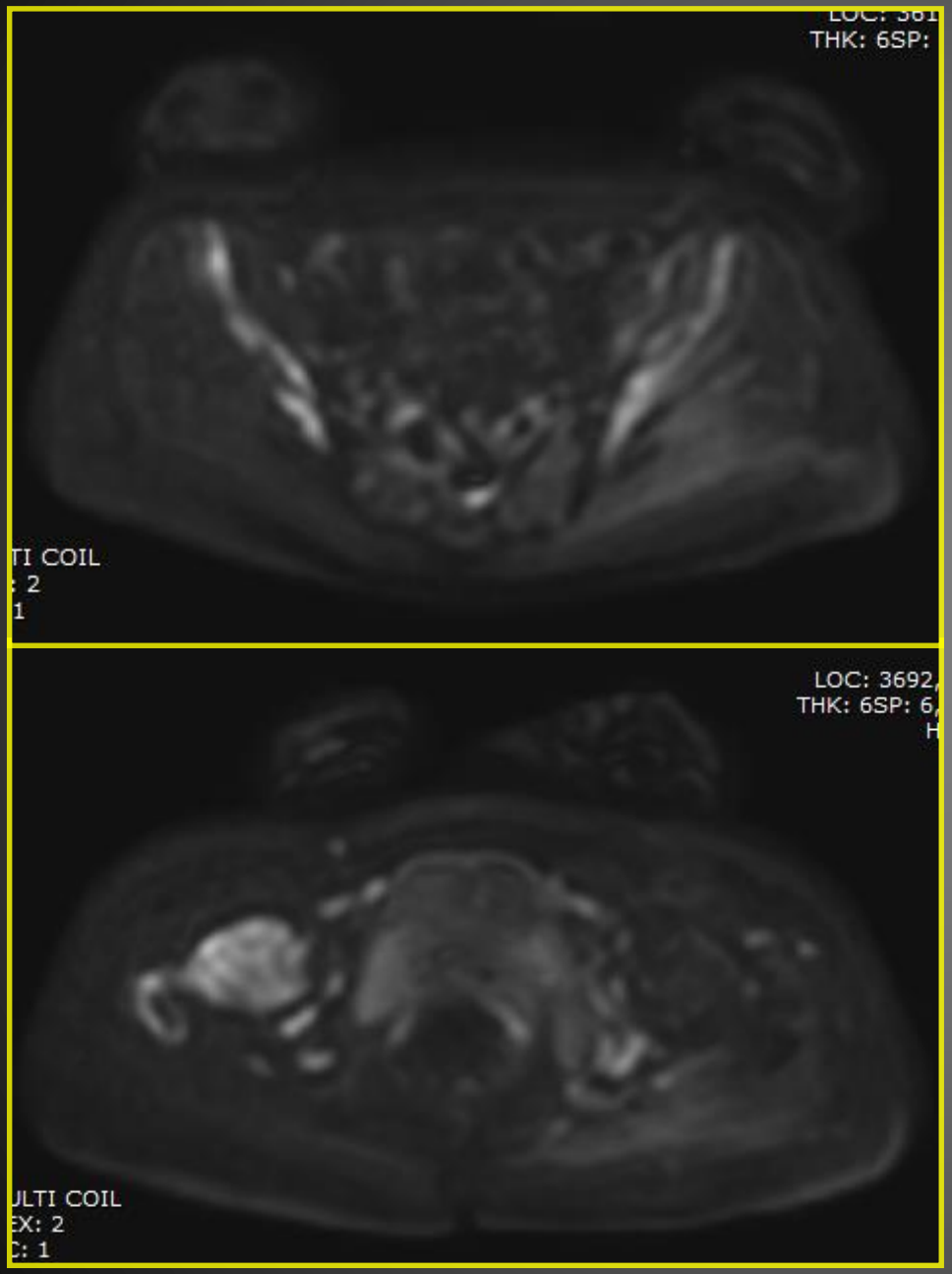
Conclusion: WB-MRI that included DWI was useful for detecting bone metastasis.

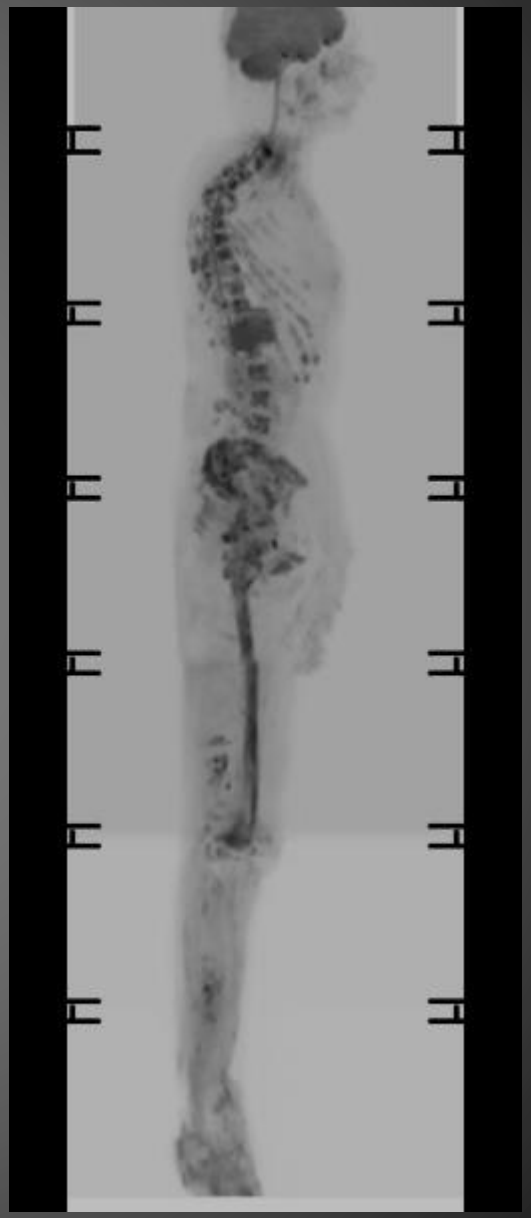
Keywords: ***bone metastasis, diffusion-weighted images, whole-body MRI***

- **Diffusion Weighted Imaging (DWI)**
  - **Tumore maligno – elevata cellularità – restrizione della diffusione protonica – misurazione quantitativa della diffusione (ADC)**






THK: 6SP:
TI COIL
: 2
1
LOC: 3692,
THK: 6SP: 6,
H
ULTI COIL
EX: 2
C: 1



CONCLUSIONI

La scintigrafia ossea rappresenta l'esame di prima scelta nella ricerca delle lesioni ossee.
La radiografia tradizionale ha ancora un suo ruolo nella valutazione dei rischi di frattura delle ossa lunghe.
La TC è un esame semplice e veloce da effettuare e permette uno studio più accurato delle coste e delle ossa compatte.
La MRI ha mostrato di avere altissima sensibilità e specificità e rappresenta il "gold standard" per lo studio di colonna vertebrale, ossa lunghe e bacino. In fase di sperimentazione la MRI whole-body