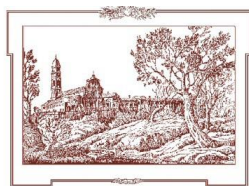


SERVIZIO SANITARIO REGIONALE  
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Istituto Ortopedico Rizzoli di Bologna  
Istituto di Ricovero e Cura a Carattere Scientifico



# TERAPIE PALLIATIVE o ADIUVANTI

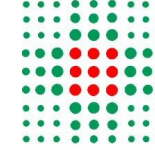
## Il ruolo dell'embolizzazione arteriosa nel trattamento delle metastasi ossee

**Dr G. Facchini - Dr. G. Peta**

S.C Radiologia Diagnostica ed Interventistica (Dr. M. Miceli)

**Roma 20 Ottobre 2022**





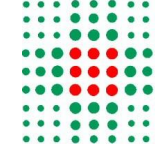
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**NO DISCLOSURE**





Review

# Minimally Invasive Interventional Procedures for Metastatic Bone Disease: A Comprehensive Review

Nicolas Papalexis , Anna Parmeggiani \*, Giuliano Peta, Paolo Spinnato , Marco Miceli and Giancarlo Facchini

## Interventional Radiology Techniques

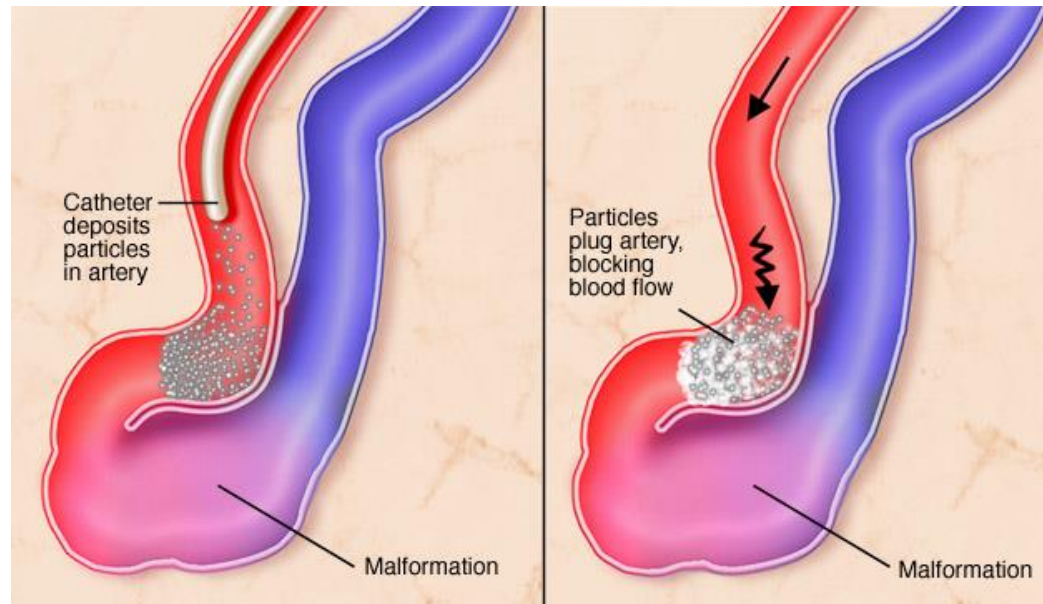
Techniques	Type	Aim of the Technique	Indications	Curative Treatment
Chemical ablation	Ethanol, Doxycycline, Polidocanol (detergent sclerosant, STS (detergent sclerosant)	Chemical-based ablation	<ul style="list-style-type: none"><li>• Malignant tumors</li></ul>	
Embolization	Nano-particles	Minimizing blood loss	<ul style="list-style-type: none"><li>• To reduce blood deficit during surgery</li><li>• To lower pain and natural bleeding of tumors</li><li>• To reduce tumor vascularization before percutaneous ablation</li></ul>	✓
RFA	Energy-based ablations (thermoablation)	Ablation techniques (inducing tumoral necrosis) needle driven	<ul style="list-style-type: none"><li>• Benign tumors</li><li>• Malignant tumors</li><li>• Neurovascular disease related to the musculoskeletal system</li></ul>	✓
MWA	Energy-based ablations (thermoablation)	Ablation techniques (inducing tumoral necrosis) needle driven	<ul style="list-style-type: none"><li>• Benign oo</li><li>• Malignant tumors</li></ul>	✓
CA	Energy-based ablations (thermoablation)	Ablation techniques (inducing tumoral necrosis) needle driven	<ul style="list-style-type: none"><li>• Benign</li><li>• Malignant</li><li>• neurovascular</li></ul>	✓
MRgFUS	Energy-based ablations (thermoablation)	Ablation techniques (inducing tumoral necrosis) needleless technique	<ul style="list-style-type: none"><li>• Benign oo</li><li>• malignant</li></ul>	✓
Cementoplasty	Cementoplasty (PMMA) including free-hand injection, vertebroplasty, kyphoplasty	Mechanical stabilization techniques	<ul style="list-style-type: none"><li>• Severe pain and neurological damage</li><li>• Spinal instability</li><li>• Pz with controindication to open surgery</li></ul>	
Osteosynthesis	Intramedullary nails and screws	Mechanical stabilization techniques	<ul style="list-style-type: none"><li>• Pain palliation and stabilization of pathological bone segment</li></ul>	



# EMBOLIZZAZIONE ARTERIOSA UNA METODICA ANGIOGRAFICA TERAPEUTICA

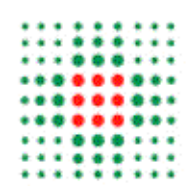


- OCCLUDERE I VASI AFFERENTI AD UNA NEOFORMAZIONE
  - NECROSI ISCHEMICA DATA DALL'OCCLUSIONE DELL'ALBERO VASCOLARE DELLA LESIONE
    - CAMBIARE IL METABOLISMO IN ANAEROBICO
- MODIFICARE IL CICLO CELLULARE, AUMENTANDO L'APOPTOSI E ACCELERANDO LA MORTE CELLULARE
- L'OCCLUSIONE DEVE AVVENIRE IL PIU' DISTALMENTE POSSIBILE : ARTERIOLE TERMINALI PRIVE DI COLLATERALI, UNICA FONTE DI APPORTO EMATICO AL TERRITORIO DA ISCHEMIZZARE



- Mezzi embolizzanti
- Tecniche





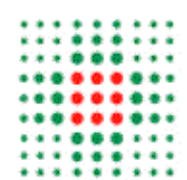
# Indicazioni Embolizzazione in osteoncologia:

Preoperatoria

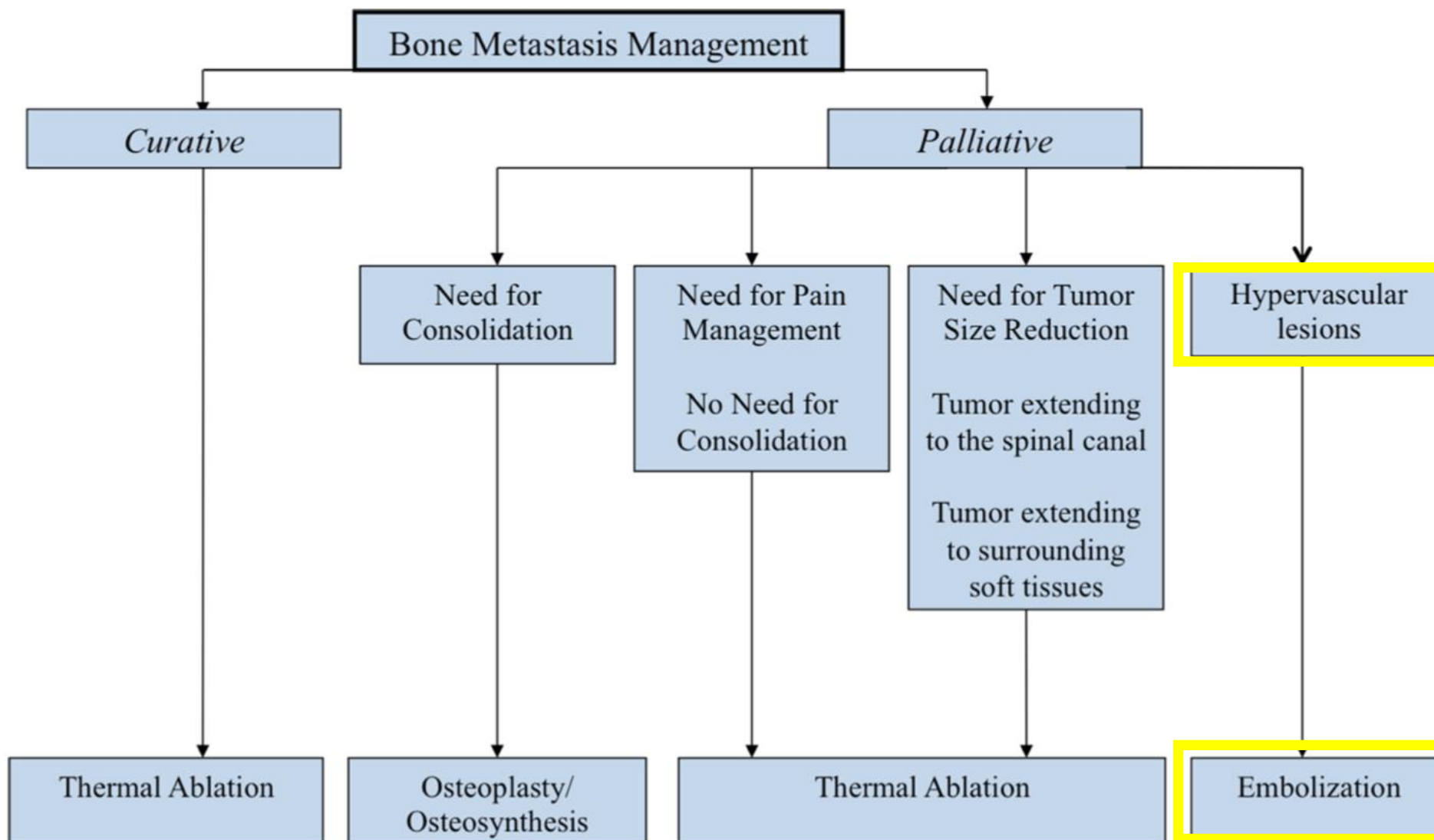
Palliazione

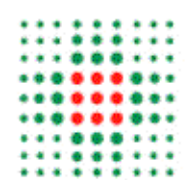
Curativa / Trattamento locale

Sinergia con altre terapie

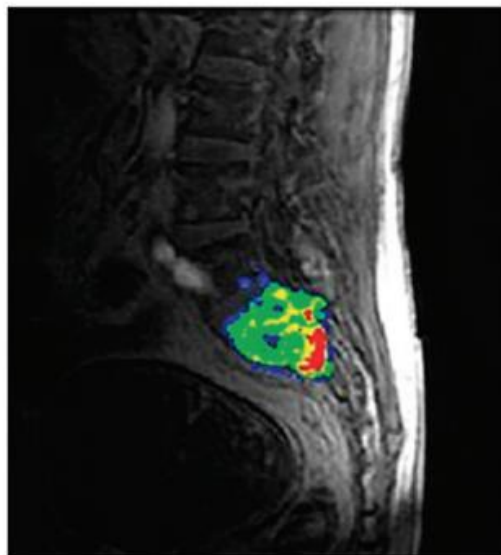


***Percutaneous management of bone metastases: state of the art, interventional strategies and joint position statement of the Italian College of MSK Radiology (ICoMSKR) and the Italian College of Interventional Radiology (ICIR). Radiol Med. 2018 Sep 6.***





# MA COSA è IPERVASCOLARE??



Istologie:

## IPERVASCOLARE

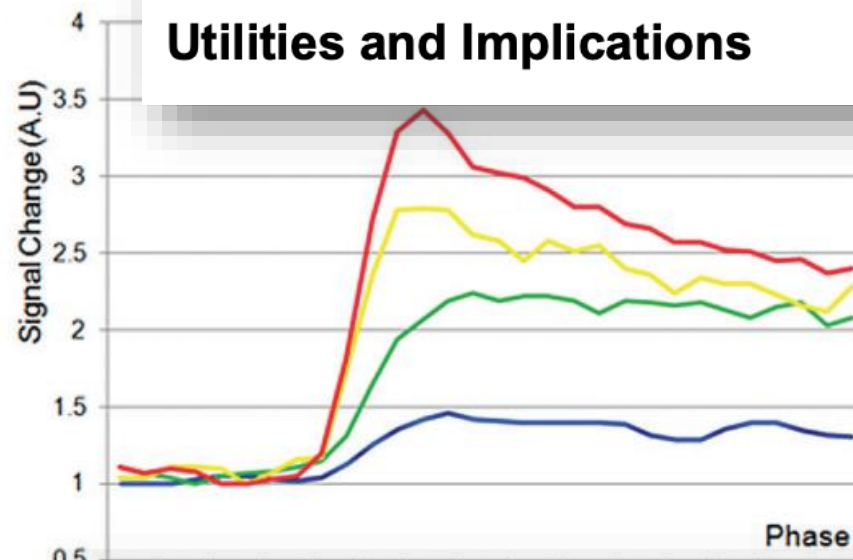
RCC

TIROIDE

HCC

NEUROENDOCRINI

## Magnetic Resonance Perfusion Characteristics of Hypervascular Renal and Hypovascular Prostate Spinal Metastases: Clinical Utilities and Implications



MR-DCE perfusion curve

**Dynamic contrast-enhanced magnetic resonance perfusion compared with digital subtraction angiography for the evaluation of extradural spinal metastases: a pilot study.**

Mazura JC<sup>1</sup>, Karimi S, Pauliah M, Banihashemi MA, Gobin YP, Bilsky MH, Patsalides A.

## IPOVASCOLARE

MELANOMA

MIELOMA MULTIPLO



Infiltranti

MAMMELLA

POLMONE

COLON

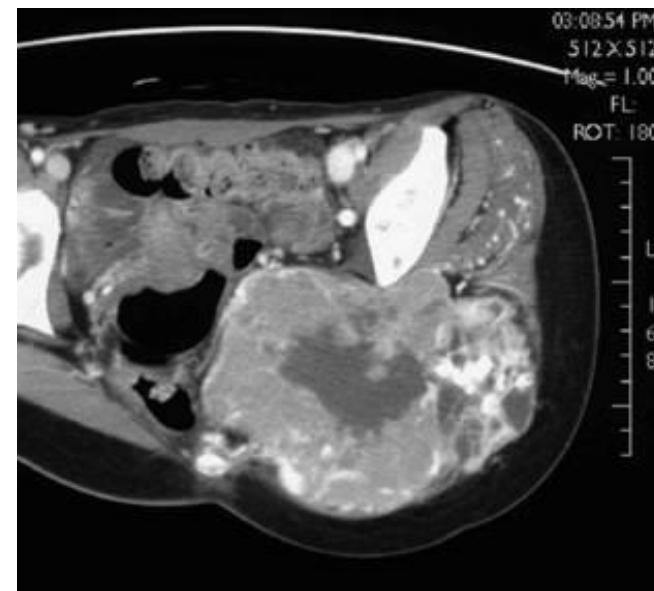
PROSTATA

??

# Selezione delle lesioni:

## Predittori di successo

- Lesioni tipicamente litiche
- Rapida crescita – distruzione progressiva
- Frattura patologica
- Intenso enhancement dopo mdc





# Cosa ci aspettiamo di vedere al FU:

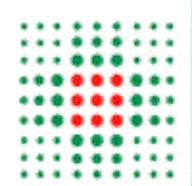
Necrosi prevalentemente centrale

Riduzione di dimensioni

- Variabile che dipende da vari fattori (istotipo – indicazione ecc.)
- Scarsa correlazione con la palliazione del dolore

Remineralizzazione

- Impiega alcuni mesi (dalla periferia al centro)



# Indicazione: embolizzazione pre-operatoria

- Embolizzazione delle arterie che portano sangue al tumore, descritta per la prima volta da Benati nel 1974
  - Limita le perdite ematiche operatorie e complicanze emorragiche post-chirurgiche
  - Facilita la resezione perché assicura una migliore visuale del campo
  - Riduce il tempo operatorio e la mortalità
- ✓ **Benefici aggiuntivi:**
- Controllo locale della malattia
  - Prolunga potenzialmente la sopravvivenza??

### ORIGINAL RESEARCH

# Systematic review and meta-analysis of effectiveness of preoperative embolization in surgery for metastatic spine disease

Panya Luksanaprukha,<sup>1</sup> Jacob M Buchowski,<sup>2</sup> Sasima Tongsai,<sup>3</sup>  
Weerasak Singhatanadgige,<sup>4</sup> Jack W Jennings<sup>5</sup>

> [Spine J.](#) 2022 Aug;22(8):1334-1344. doi: 10.1016/j.spinee.2022.03.001. Epub 2022 Mar 6.

### INDIPE

## Preoperative embolization in surgical treatment of spinal metastases originating from non-hypervascular primary tumors: a propensity score matched study using 495 patients

- Luksanaprukha P, Buchowski JM, Tongsai S, et al (2018) *Systemat* doi: 10.1136/neurintsurg-2017-013350
- Pazonis TJC, Papanastassiou ID, Maybody M, Healey JH (2014) *Ei* 014-3734-3.
- Kato S, Hozumi T, Takaki Y, et al (2013) *Optimal schedule of preo*

Olivier Q Groot<sup>1</sup>, Nicole J van Steijn<sup>2</sup>, Paul T Ogink<sup>3</sup>, Robert-Jan Pierik<sup>2</sup>,  
Michiel E R Bongers<sup>2</sup>, Hester Zijlstra<sup>4</sup>, Tom M de Groot<sup>2</sup>, Thomas J An<sup>5</sup>, James D Rabinov<sup>5</sup>,  
Jorrit-Jan Verlaan<sup>3</sup>, Joseph H Schwab<sup>2</sup>

-601 .

!999-

# EMBOLIZZAZIONE ADIUVANTE

FACILITARE IL TRATTAMENTO CHIRURGICO DI LESIONI RIPETITIVE

## FASE PRE-OPERATORIA:

- RIDURRE LE DIMENSIONI DELLA LESIONE FACILITANDONE L'ASPORTAZIONE CHIRURGICA

## FASE POST-OPERATORIA:

- COMPLETARE I RISULTATI DELLA CHIRURGIA (RECIDIVA)
- TRATTARE UN EVENTUALE SANGUINAMENTO POST- CHIRURGICO





CASO 1

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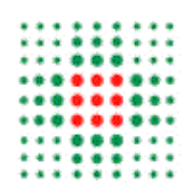












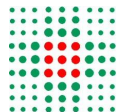
# EMBOLIZZAZIONE PALLIATIVA

- DIMINUIZIONE DI DIMENSIONI DEL TUMORE CON CONSEGUENTE MINOR COMPRESSIONE SUL PERIOSTIO LE CUI FIBRE SONO RESPONSABILI DEL DOLORE
- RALLENTAMENTO DEI PROCESSI DI OSTEOLISI NEOPLASTICA E MINOR RISCHIO DI FRATTURA PATOLOGICA



## METASTASI

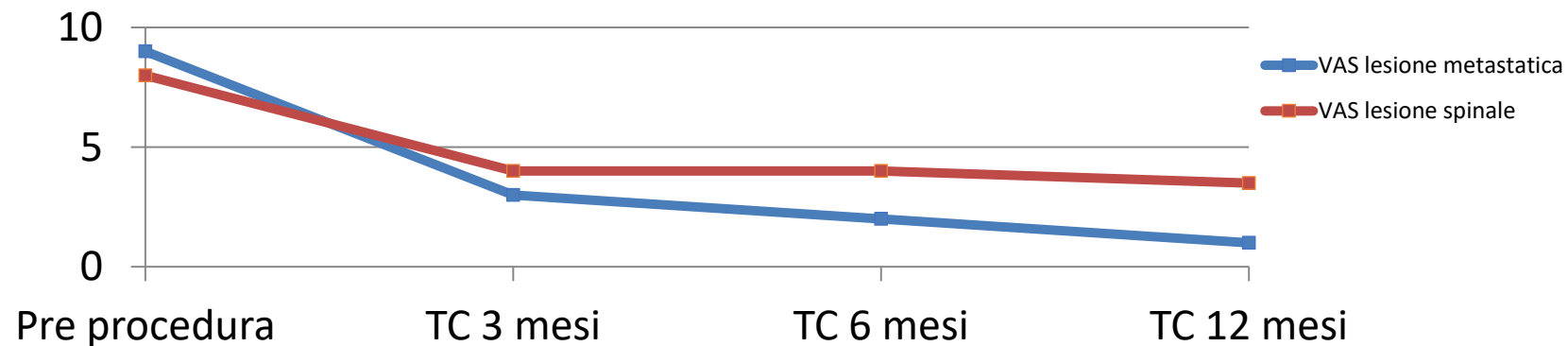
- Lesioni inaccessibili da altre procedure
- Nessun limite di dimensione ---> lesioni anche molto grandi
- Fratture patologiche già trattate chirurgicamente
- Recidive di dolore (può essere ripetuta più volte anche a distanza di tempo)

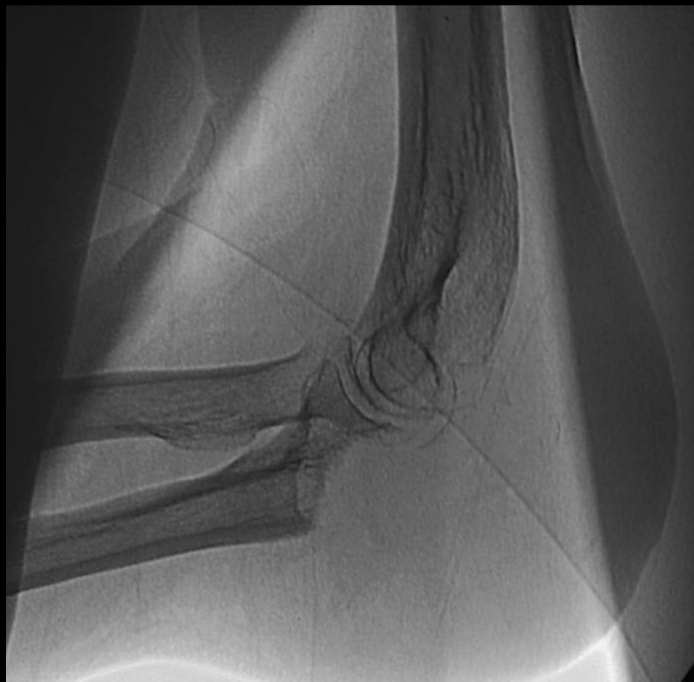


## RISULTATI:

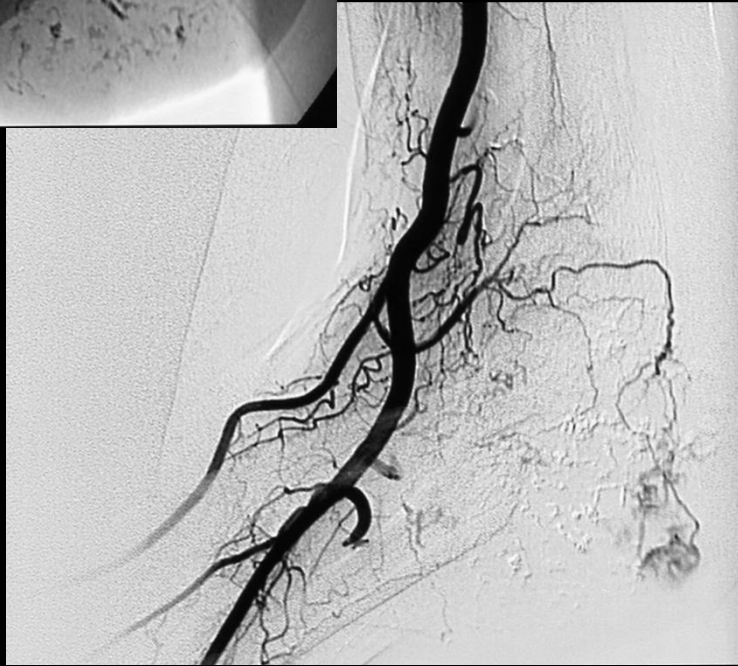
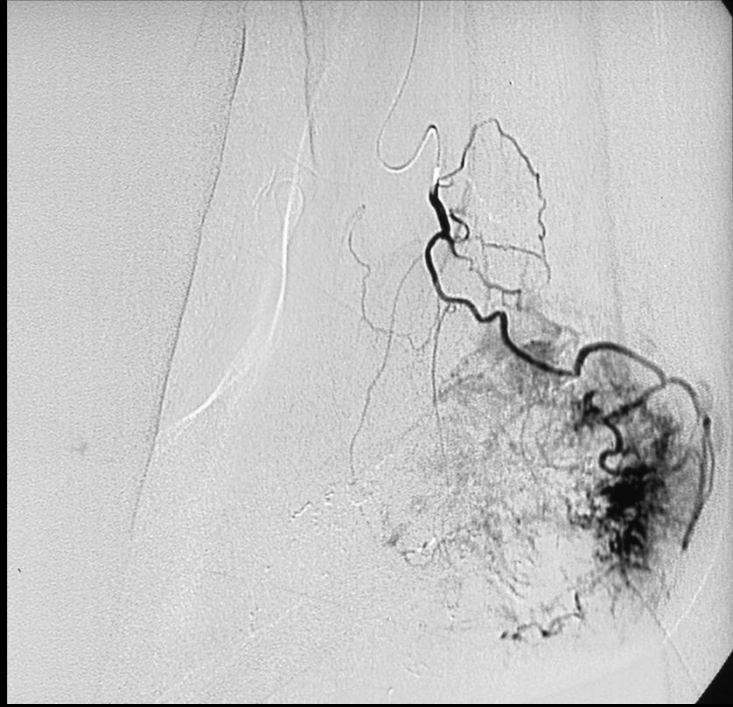
### Terapia Palliativa

- La miglior risposta PZ **con lesioni metastatiche molto dolorose** prima della procedura (7-10 punti nella scala VAS).
  - quasi totale sollievo dal dolore (0-3 nella scala VAS) e una riduzione significativa della dose di analgesici necessaria quotidianamente.
- Un modesto sollievo dal dolore (4-6 punti nella scala VAS) si è osservato nei pazienti con lesioni spinali (5-8 scala VAS pre- procedura) e una riduzione di circa il 50% della dose di analgesici necessaria.





CASO 2

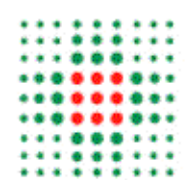








LA LESIONE è GUARITA, GLI ABBIAMO SALVATO UN ARTO



## Neurointerventional procedures

Neurointerventional radiology has emerged as a key discipline in the multidisciplinary management of spinal metastases. There are several procedures performed by interventional radiologists, neurosurgeons, or orthopaedic spine surgeons that are helpful for the management of patients with spinal metastases. These procedures are provided at different times in a patient's care and include: CT-guided biopsy, spinal myelography, local ablative techniques, cement or device augmentation of the spinal column, and intra-arterial tumour embolisation.

The oncological risk assessment is based primarily on tumour histology, radiosensitivity, and radioresponsiveness, and is paramount in guiding appropriate management decisions. In many cases, when a patient presents with spinal metastases (ie, de-novo metastatic disease), the underlying tumour histological subtype is unknown. In these cases, it is crucial to achieve tissue diagnosis quickly and safely. Interventional radiologists

provide a palliative treatment option for painful spinal metastases. Multiple types of locally ablative techniques can be performed by interventionalists, including radiofrequency ablation, microwave ablation, cryoablation, laser interstitial thermal therapy, and thermal ablation.<sup>66,84,85</sup> Local ablative techniques can be done as primary treatment, but are most commonly used as a salvage treatment option in cases where previous radiotherapy has been delivered and re-irradiation is unlikely to be safe or effective. One study showed that salvage radiofrequency ablation after previous radiotherapy decreased pain scores from 7·7 to 3·3 in 1 month, with approximately 50% of patients having a reduction in opioid usage.<sup>86</sup>

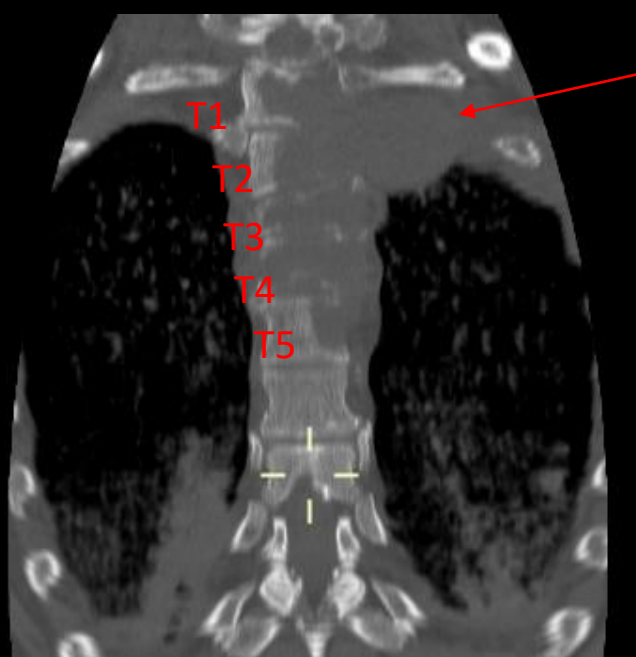
Preoperative transarterial embolisation of a hypervascular vertebral tumour with particles, glue, or ethylene vinyl alcohol can reduce intraoperative blood loss.<sup>85</sup> Furthermore, embolisation has an effective palliative role in controlling pain and neurological symptoms in patients with vertebral metastases.<sup>87,88</sup>

# CASO 3

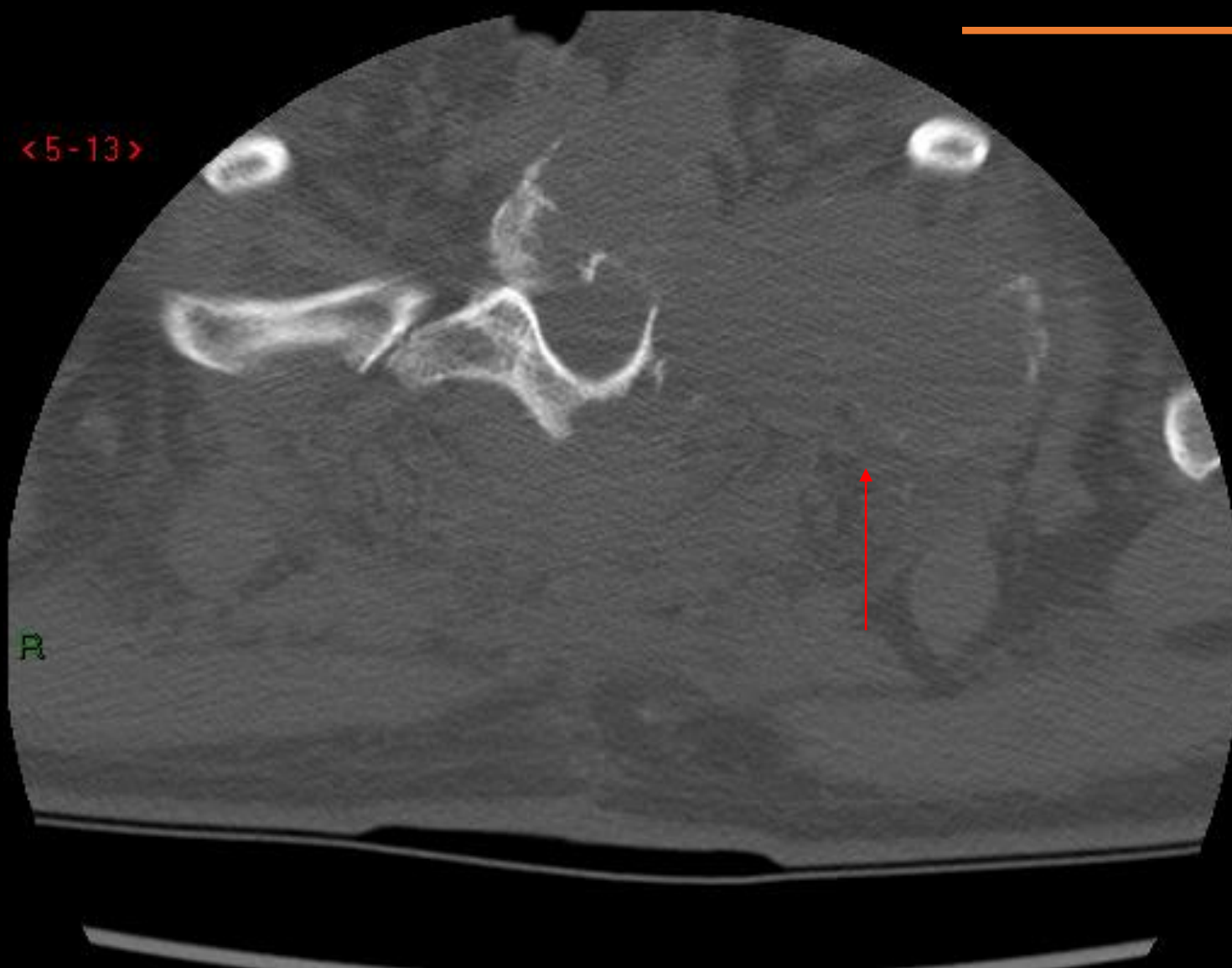
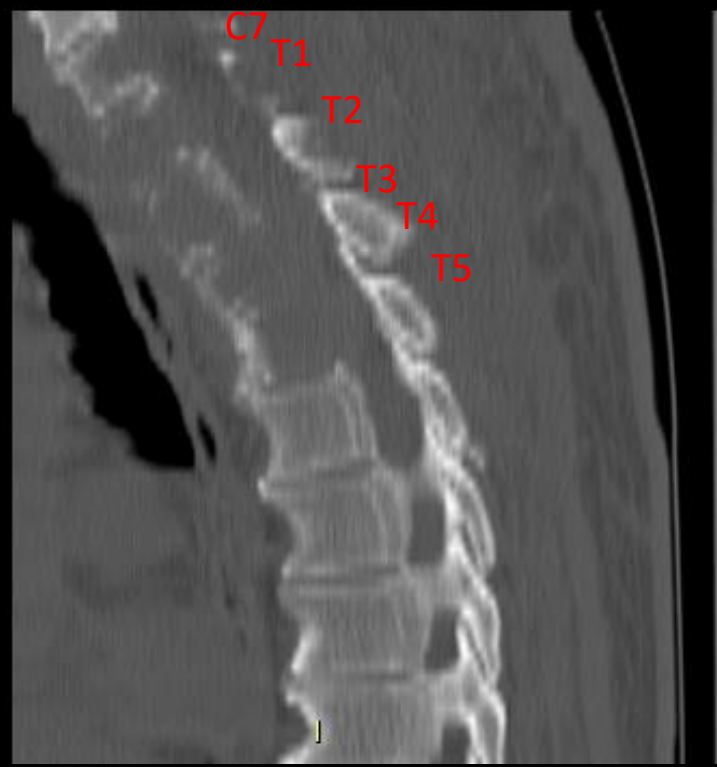
CASO 3

<5-13>

R



A





<1-146 (TUTTO) >

<1-147 (TUTTO) >

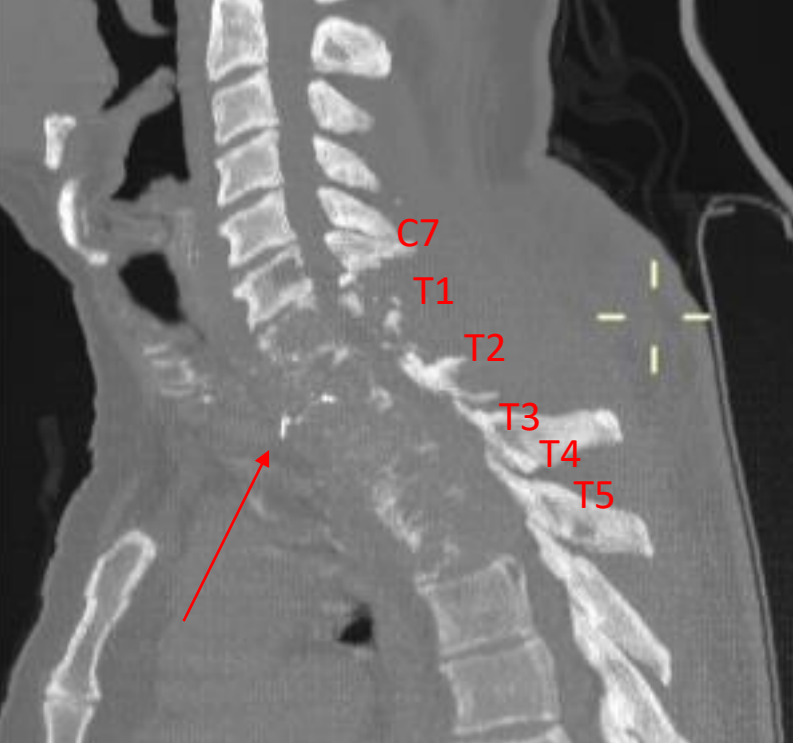
<1000-19 >

<1000-22 >

*a. Intercostale suprema*

*a. tiro-cervicale di sinistra*

Embolizzazione con *colla (NBCA) - Glubran2*

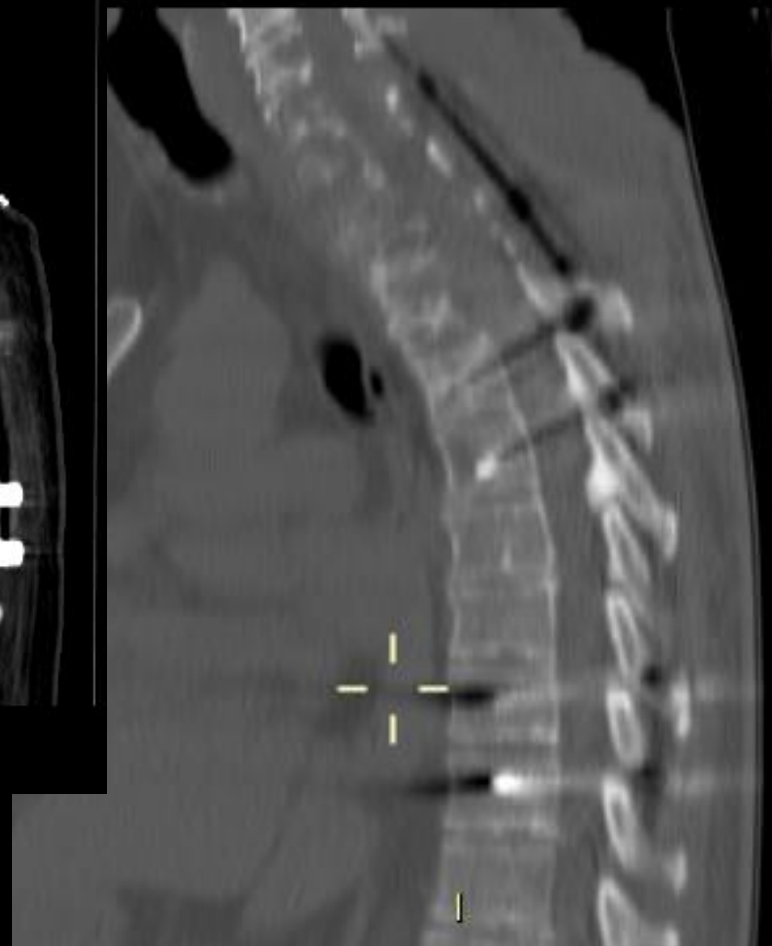


24 giorni

<3>



3 mesi



5 mesi



9 mesi

*Laminectomia decompressiva  
e stabilizzazione C3-T10*

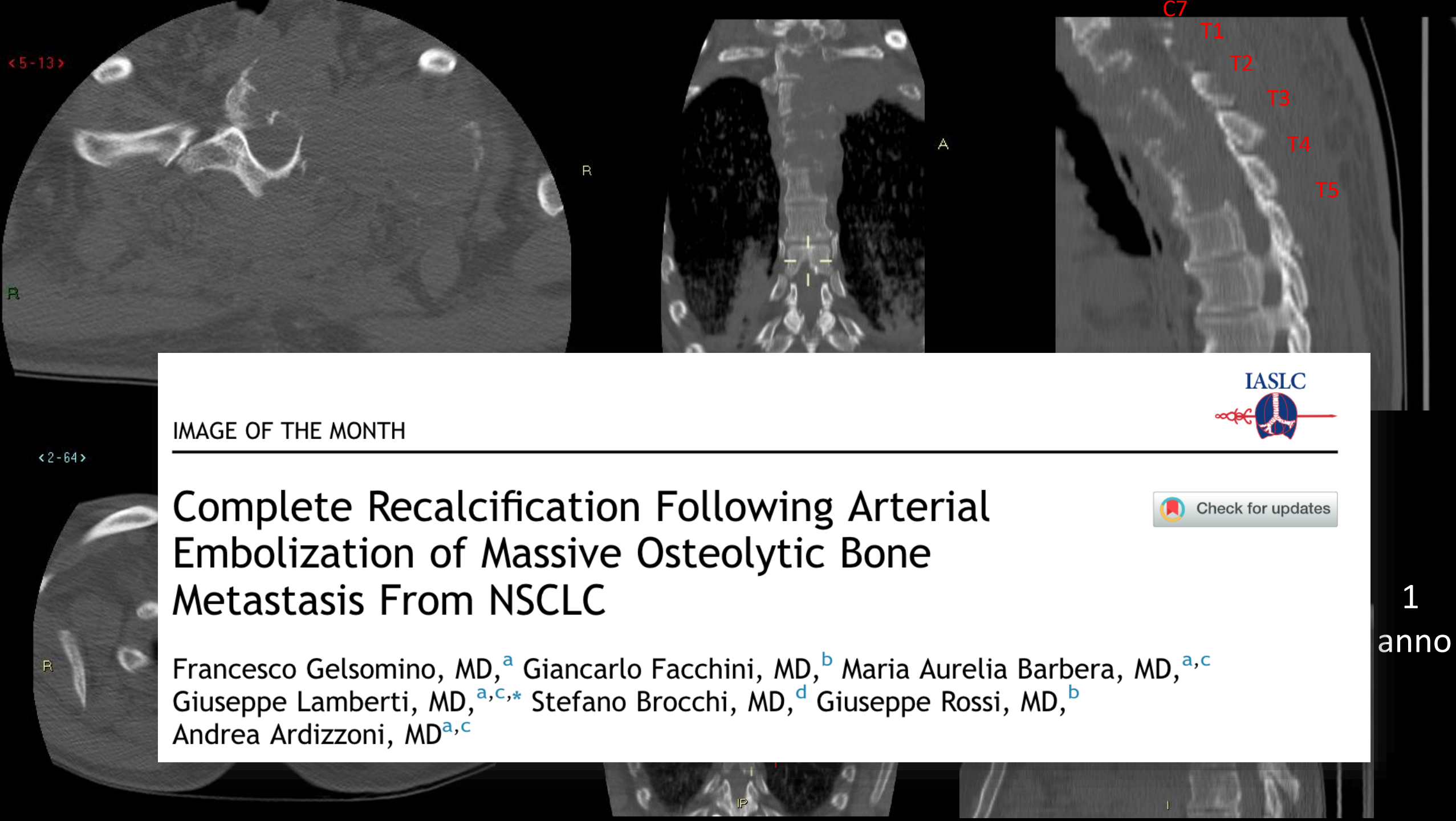


IMAGE OF THE MONTH

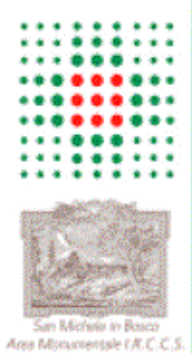


## Complete Recalcification Following Arterial Embolization of Massive Osteolytic Bone Metastasis From NSCLC

Francesco Gelsomino, MD,<sup>a</sup> Giancarlo Facchini, MD,<sup>b</sup> Maria Aurelia Barbera, MD,<sup>a,c</sup> Giuseppe Lamberti, MD,<sup>a,c,\*</sup> Stefano Brocchi, MD,<sup>d</sup> Giuseppe Rossi, MD,<sup>b</sup> Andrea Ardizzoni, MD<sup>a,c</sup>

1  
anno





# Chemo-embolizzazione in MSK tumor (TACE):

- La chemo-embolizzazione *poco indagata* nell'oncologia muscoloscheletrica
- I limiti sono legati alla caratteristica di malattia sistemica dei tumori

> Eur Radiol. 2020 Mar;30(3):1525-1533. doi: 10.1007/s00330-019-06454-8. Epub 2019 Nov 14.

## Concomitant radiotherapy and transarterial chemoembolization reduce skeletal-related events related to bone metastases from renal cell carcinoma

Joichi Heianna<sup>1</sup>, Wataru Makino<sup>2</sup>, Takuro Ariga<sup>2</sup>, Kazuki Ishikawa<sup>2</sup>, Takeaki Kusada<sup>2</sup>,

**Methods:** We included in this retrospective study 25 RCC patients (28 bone metastases), who were treated with RT at our institution. Patients were divided into two groups: patients treated with RT alone (monotherapy group; n = 17) and those treated with RT combined with TACE (combined therapy group; n = 11). The administered median RT dose was 30 Gy in 10 fractions. Anti-cancer agents used in TACE were cisplatin (median dose, 50 mg) and carboplatin (median dose, 240 mg) for patients with reduced renal function. We evaluated the objective response, post-RT-skeletal-related event (PR-SRE)-free rate, and adverse events associated with treatment for each group.

**Results:** The objective response rates for bone metastases in the monotherapy and combined therapy groups were 33% and 82%, respectively ( $p = 0.009$ ). The 2-year PR-SRE-free rate in the monotherapy and combined therapy groups was 41.8% and 100%, respectively ( $p = 0.009$ ). The objective response and PR-SRE-free rates were significantly superior in the combined therapy than in the monotherapy group. There were no significant differences in adverse events or survival between the two groups.

**Conclusion:** RT combined with TACE is a promising treatment for bone metastases from RCC, as it results in higher objective response, and PR-SRE-free rates compared with RT alone.



## Journal of Vascular and Interventional Radiology

Available online 13 December 2020

In Press, Corrected Proof



Clinical Study

## Transarterial Chemoembolization for the Palliation of Painful Bone Metastases Refractory to First-Line Radiotherapy

### ABSTRACT

**Purpose:** To compare the efficacy and safety of transarterial chemoembolization for the palliation of radiotherapy (RT)-failure bone metastases (BMs) with those of re-radiotherapy (Re-RT) in achieving pain relief.

**Materials and Methods:** Fifty consecutive patients with RT-failure BMs who had undergone Re-RT (23 patients) and transarterial chemoembolization (27 patients) were retrospectively analyzed. The primary endpoint was clinical response, and the secondary endpoints were objective response and adverse events. Pain assessment was performed using the numerical rating scale, and tumor response was evaluated using the modified Response Evaluation Criteria in Solid Tumors. Pain relief was defined as lack of pain with no analgesic usage (complete pain response) or a decrease in pain score by  $\geq 3$  points with analgesic usage (partial pain response).


**Results:** The pain relief rates in the Re-RT and transarterial chemoembolization groups were 57% and 92%, respectively ( $P = .006$ ). The median pain relief duration was 2 and 3 months in the Re-RT and transarterial chemoembolization groups, respectively ( $P = .002$ ). The 6-month pain-free survival rates were 30% and 51% in the Re-RT and transarterial chemoembolization groups, respectively ( $P = .08$ ). The median tumor reduction rates were -4% and 9% in the Re-RT and transarterial chemoembolization groups, respectively ( $P < .001$ ). The objective response rates were 0% and 11% in the Re-RT and transarterial chemoembolization groups, respectively ( $P = .29$ ). No serious adverse events or complications were observed.

**Conclusions:** Transarterial chemoembolization achieved a superior response rate and longer duration of palliation in symptomatic RT-failure BMs.





# TIMING: **Combinazioni** con altri trattamenti:

- 
- ✓ Se la **radioterapia** è pianificata fatela prima dell'embolizzazione in quanto l'ipossia rende le cellule più radioresistenti

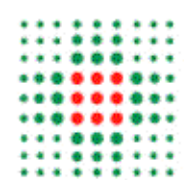
> [Eur Radiol.](#) 2020 Mar;30(3):1525-1533. doi: 10.1007/s00330-019-06454-8. Epub 2019 Nov 14.

## **Concomitant radiotherapy and transarterial chemoembolization reduce skeletal-related events related to bone metastases from renal cell carcinoma**

Joichi Heianna <sup>1</sup>, Wataru Makino <sup>2</sup>, Takuro Ariga <sup>2</sup>, Kazuki Ishikawa <sup>2</sup>, Takeaki Kusada <sup>2</sup>, Hitoshi Maemoto <sup>2</sup>, Masafumi Toguchi <sup>2</sup>, Junji Ito <sup>2</sup>, Masato Goya <sup>3</sup>, Minoru Miyazato <sup>3</sup>, Yuko Iraha <sup>2</sup>, Sadayuki Murayama <sup>2</sup>

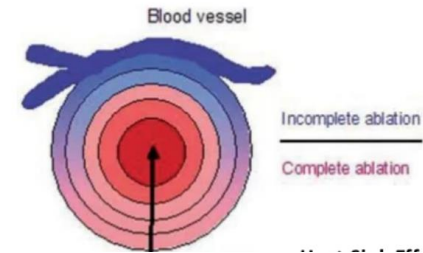
**Results:** The objective response rates for bone metastases in the monotherapy and combined therapy groups were 33% and 82%, respectively ( $p = 0.009$ ). The 2-year PR-SRE-free rate in the monotherapy and combined therapy groups was 41.8% and 100%, respectively ( $p = 0.009$ ). The objective response and PR-SRE-free rates were significantly superior in the combined therapy than in the monotherapy group. There were no significant differences in adverse events or survival between the two groups.

**Conclusion:** RT combined with TACE is a promising treatment for bone metastases from RCC, as it results in higher objective response, and PR-SRE-free rates compared with RT alone.



# TIMING: **Combinazioni** con altri trattamenti:

- ✓ Se la **termoablazione** è pianificata fatela il prima possibile DOPO l'embolizzazione in modo che l'effetto «heat-sink» sia minimizzato



Skeletal Radiology (2019) 48:1161–1169

<https://doi.org/10.1007/s00256-018-3140-0>

## REVIEW ARTICLE



## Thermal ablation to relieve pain from metastatic bone disease: a systematic review

Nicolò Gennaro<sup>1</sup>  • Luca Maria Sconfienza<sup>2,3</sup> • Federico Ambrogi<sup>3</sup> • Sara Boveri<sup>4</sup> • Ezio Lanza<sup>5</sup>

**Conclusion** All techniques achieved pain relief after 1 and 3 months, in up to 91% and 95% of patients respectively. MWA showed a negligible complication rate, whereas MRgFUS is associated with a noteworthy rate of adverse events. Future studies should adopt a standardized pain reporting scale to allow for meta-analysis.



Anti-Tumour Treatment

Interventional therapy combined with immune checkpoint inhibitors:  
Emerging opportunities for cancer treatment in the era of immunotherapy



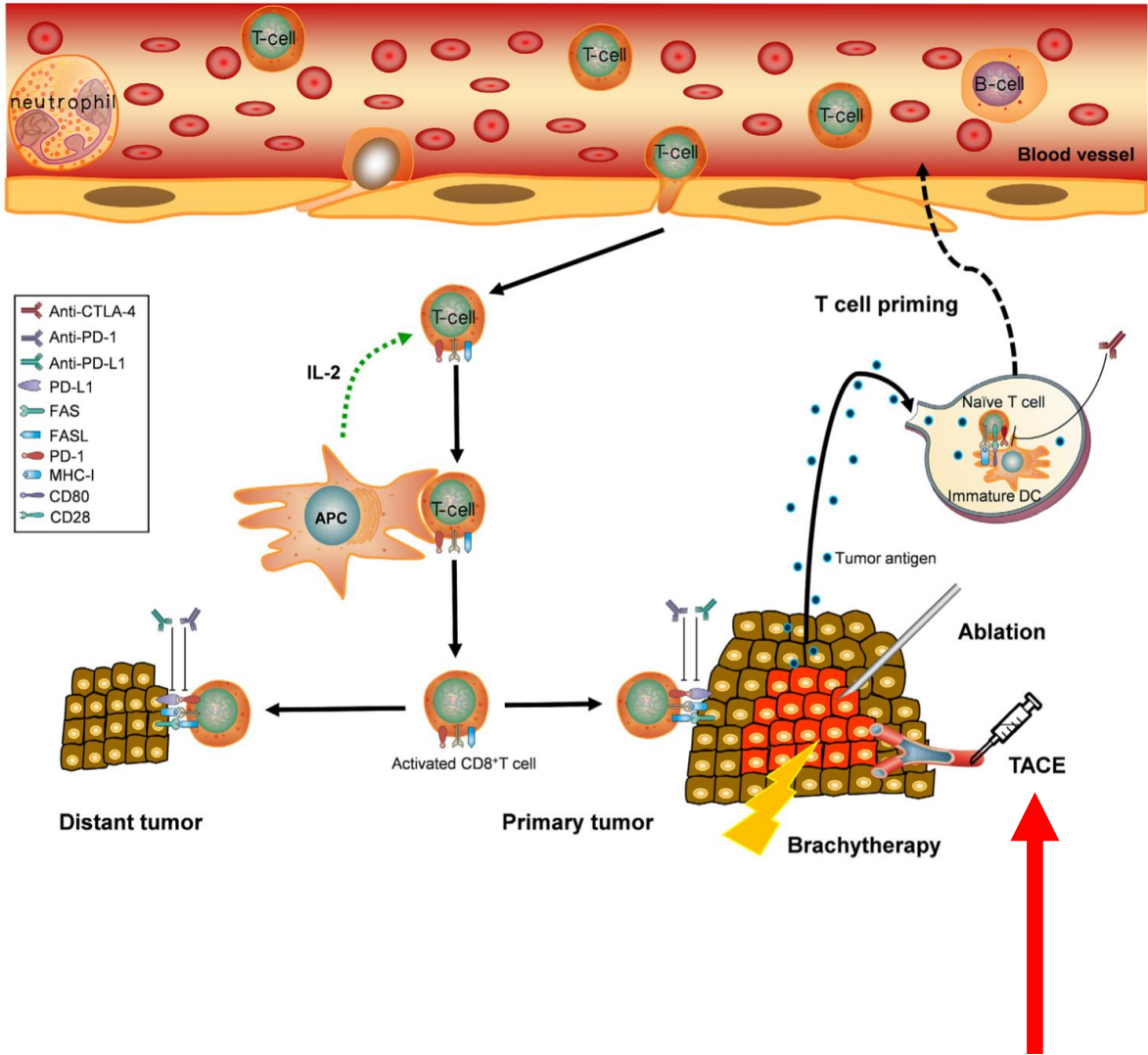
Potential mechanism(s)

Immune stimulation

- ① Result in necrosis of the tumor tissue;
- ② Reduce the release of immunosuppressive factors;
- ③ Alter peripheral immune cell phenotypes

Immune suppression

- ① Reduce the number of peripheral T helper cells;
- ② Induce a hypoxic microenvironment;
- ③ Upregulate HIF-1 $\alpha$  and PD-L1 expression;
- ④ Damage the normal liver tissue



Management of bone metastases

Oligometastatic

Curative

Radiotherapy  
+  
Arterial embolization  
+

Small lesion, not too close to  
vascular or neural structures

RFA

Big lesion, not too  
close to vascular or  
neural structures

MWA or  
cryoablation

Lesion very close to  
neural or vascular  
structures

ECT or  
Cryoablation

Plurimetastatic

Palliative

Need for consolidation

Osteoplasty/Osteosynthesis

Need for pain management and  
NO need for consolidation

Thermal ablation or ECT

Need to tumor size reduction  
Tumor extending to the spinal canal  
Tumor extending to surrounding soft  
tissues

Hypervascular lesions

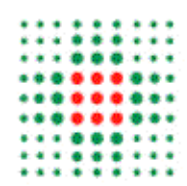
Embolization



Combination therapies according to the characteristics of the lesion and the therapeutic goal

+ IMMUNOTHERAPY





# Conclusioni:

Quando vedete una lesione ossea:

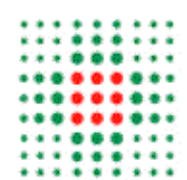
*Chiedetevi l'embolizzazione è appropriata????*

- Se la risposta è **SI**.....

Discutetela ai meeting multidisciplinari

e

Includetela nel piano di trattamento



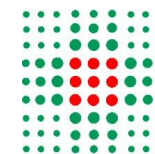
# Conclusioni:

- *L'embolizzazione nell'osso e generalmente sotto utilizzata*
- **SEMPLIFICA** LA CHIRURGIA E RIDUCE LE COMPLICANZE INTRAOPERATORIE
- **GRANDE ARMA** CONTRO IL DOLORE, RIDUCENDO LE DIMENSIONI DELLA MASSA
- **COMPLEMENTARE** AD ALTRI TRATTAMENTI E PUO' ADDIRITTURA POTENZIARNE ALTRI

## Approccio multidisciplinare:

- Non si devono interrompere terapie (chemio)
- Rapido recupero del paziente
- Riduzione morbidità
- Riduzione dei costi di ospedalizzazione

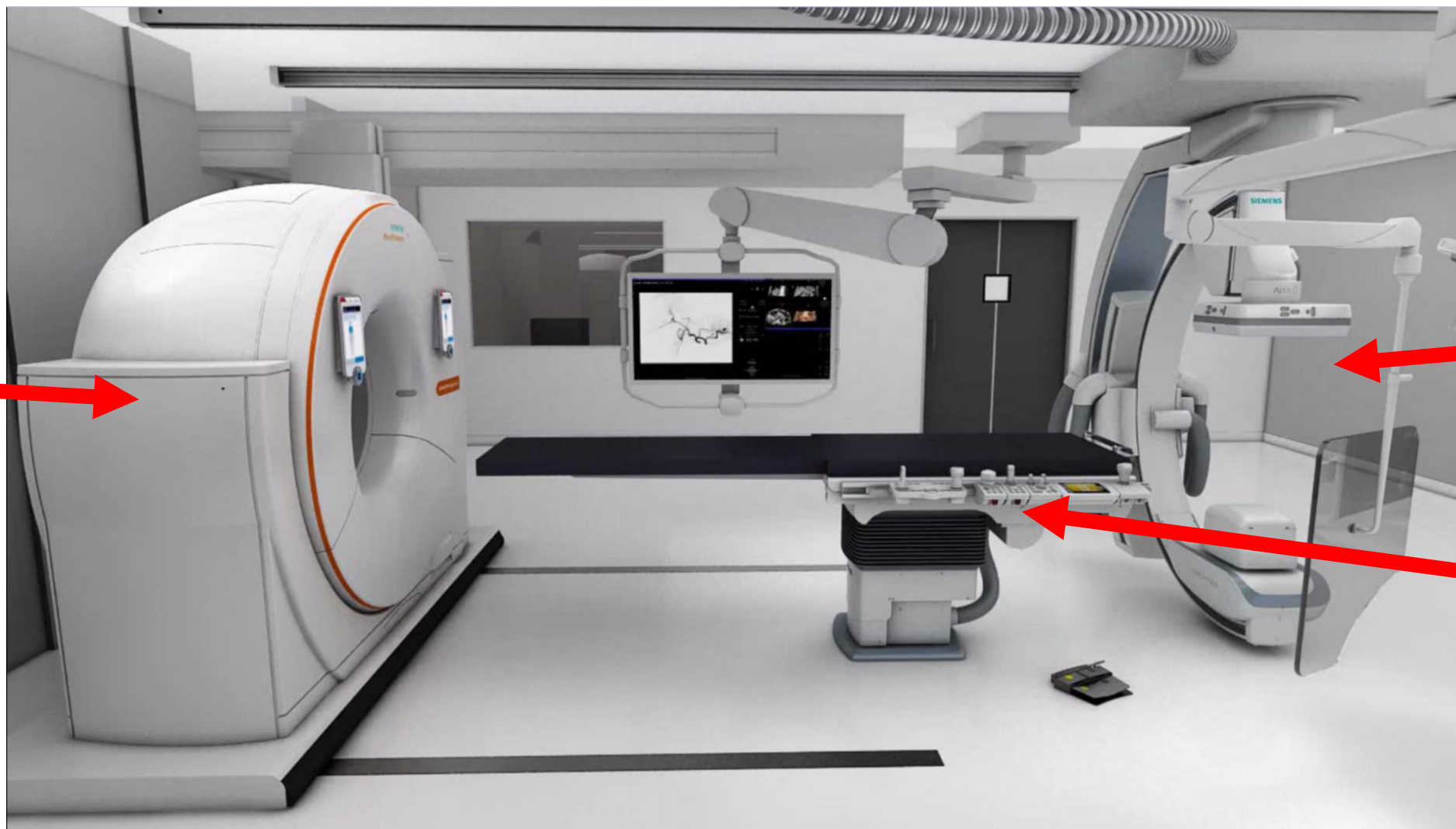
# TECNOLOGIA



SERVIZIO SANITARIO REGIONALE  
EMILIA - ROMAGNA  
Istituto Ortopedico Rizzoli di Bologna  
Istituto di Ricovero e Cura a Carattere Scientifico



TC



ANGIOGRAFO



ECOGRAFO



CONTEMPORANEITA'..... Soon at IOR

