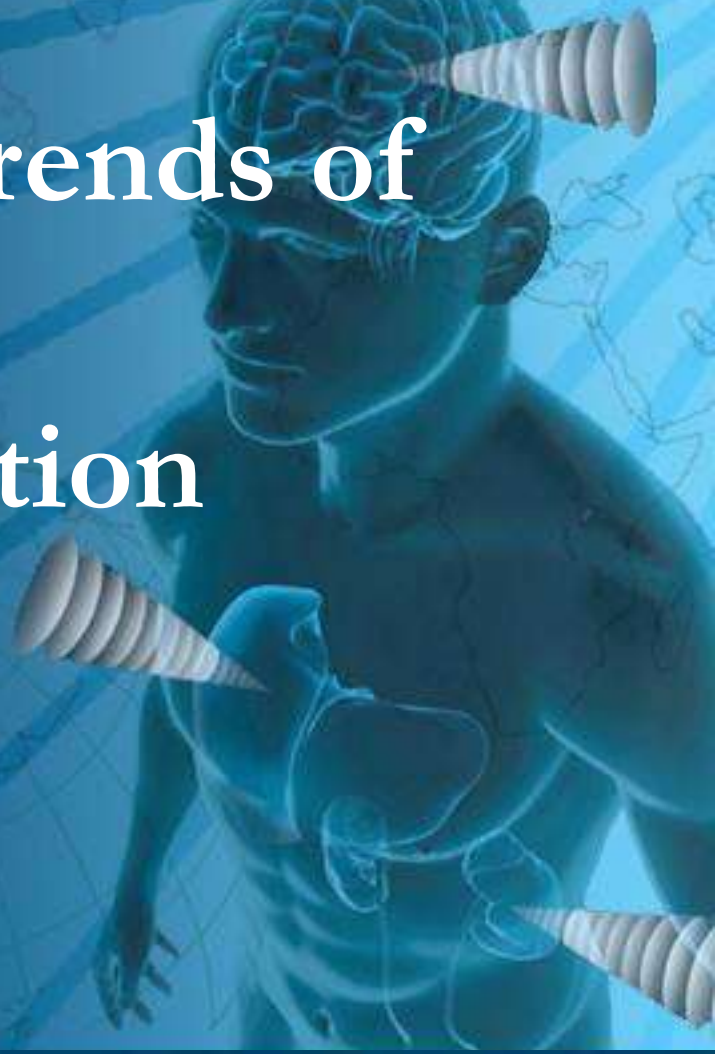
# MRg HIFU: Current and future trends of MR guided Focused Ultrasound in Radiation Oncology

*Arik Hananel*
*MD, MBA, BsCs*



Focused Ultrasound Surgery Foundation

# Disclosure

InSightec
http://www.insightec.com

Focused Ultrasound Foundation
http://www.fusfoundation.org

University of Virginia
http://www.virginia.edu

Journal of Therapeutic Ultrasound
http://www.jtultrasound.com

ISTU
http://www.istu.org

# Topics:

1)MR guided HIFU possible role in oncology

2)MR guided HIFU High level clinical overview

3)Current MR guided HIFU application

4)Future MR guided HIFU application

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# MR guided HIFU role

MR guided HIFU is:

- Image guided, personalized, radio-surgery.

Another view could be

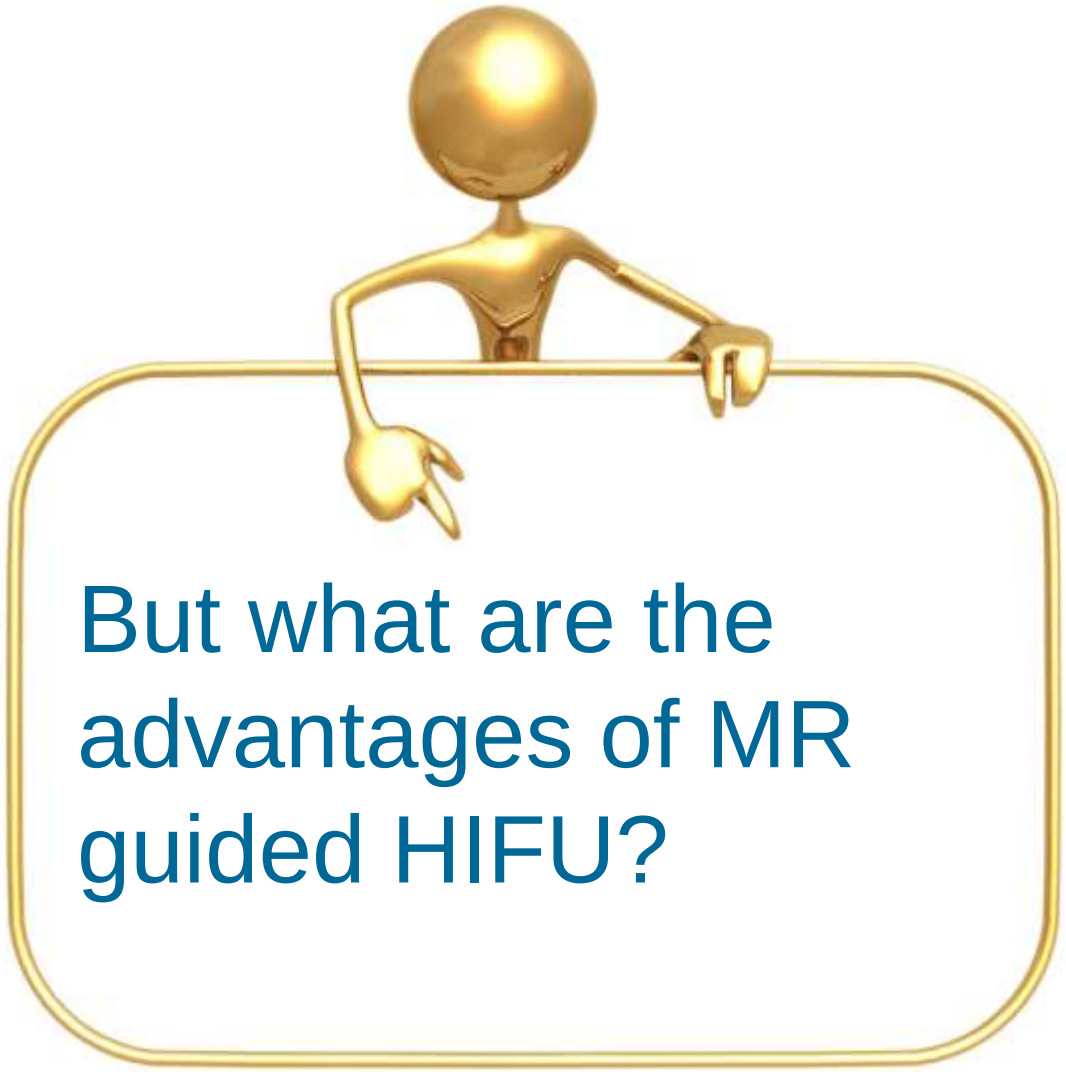
- RF ablation without a needle

# MR guided HIFU role

Why?

- MR guided HIFU kills everything
- MR guided HIFU is image guided
- MR guided HIFU enable treatment personalization

# MR guided HIFU role



# MR guided HIFU role

MR guided HIFU differences:

1) No-ionizing therapy

2) Repeatable treatment

3) Closed loop thermal feedback

4) Very sharp lesion margins

5) None-invasive therapy.

# MR guided HIFU role

## Possible uses of MR guided HIFU:

# MR guided HIFU role

Combining HIFU with EBRT

1)Big lesions targeted and treated by localized therapy

- Prostate cancer focal therapy
- Breast lumpectomy replacement

# MR guided HIFU role

Combining HIFU with EBRT

2) Synergistic effects on same target

- Pain palliation of bone metastasis
- Using HIFU for hyperthermia

# MR guided HIFU role

Replacing radiosurgery RF ablation with HIFU

1) Brain treatments, (Tumors, neuro-functional)

2) Treatment for young children, (tumors, epilepsy)

# MR guided HIFU role

When radiation dose is maxed out

1)Prostate cancer salvage therapy

2)Selected cases of bone metastasis

# MR guided HIFU role

## When HIFU will not be a good choice?

# MR guided HIFU role

MR guided HIFU can not do well:

1)Metastasis at vertebra body

2)Vascular Aneurism

3)Lung cancer

4)Treat intervertebral disk

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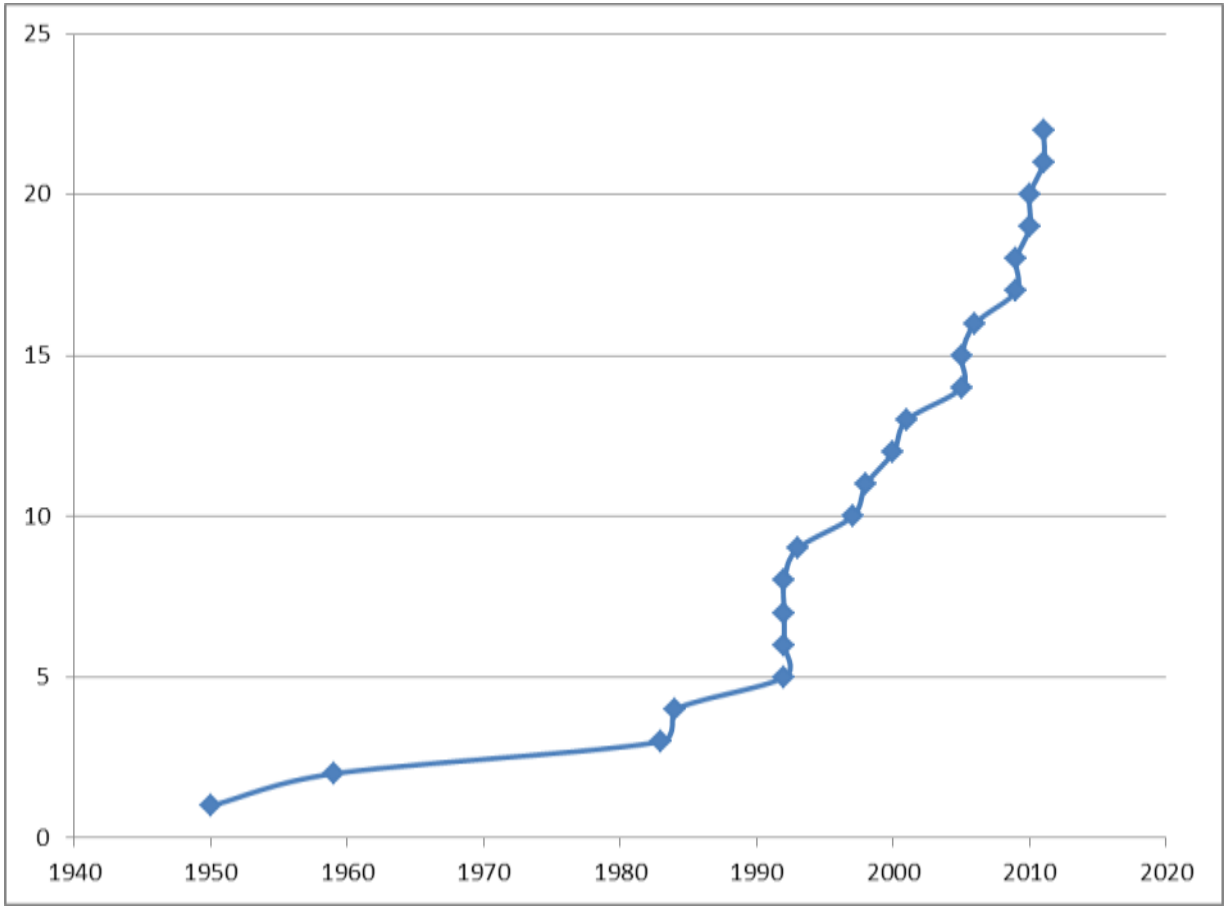
# Clinical status




Accumulated number of indications entering first in human stage

# Global Development Landscape

Conceptual | Preclinical | Anecdotal | Pilot | Pivotal | CE Mark | FDA | Reimbursement

## Neurological

- Essential Tremor
- Parkinson's Disease
- Neuropathic Pain
- Brain Tumors
- Epilepsy
- Stroke
- Hydrocephalus
- Trigeminal Neuralgia
- Alzheimer's Disease
- OCD
- Cancer Pain

## Oncological

- Bone
- Prostate Tumors
- Thyroid/Parathyroid
- Breast Cancer
- Pancreas
- Soft Tissue
- Liver
- Kidney
- Bladder
- Colon
- Esophagus

## Musculoskeletal

- Back Pain
- Osteoarthritis
- Osteoid Osteoma
- Sacroilitis

## Cardiovascular

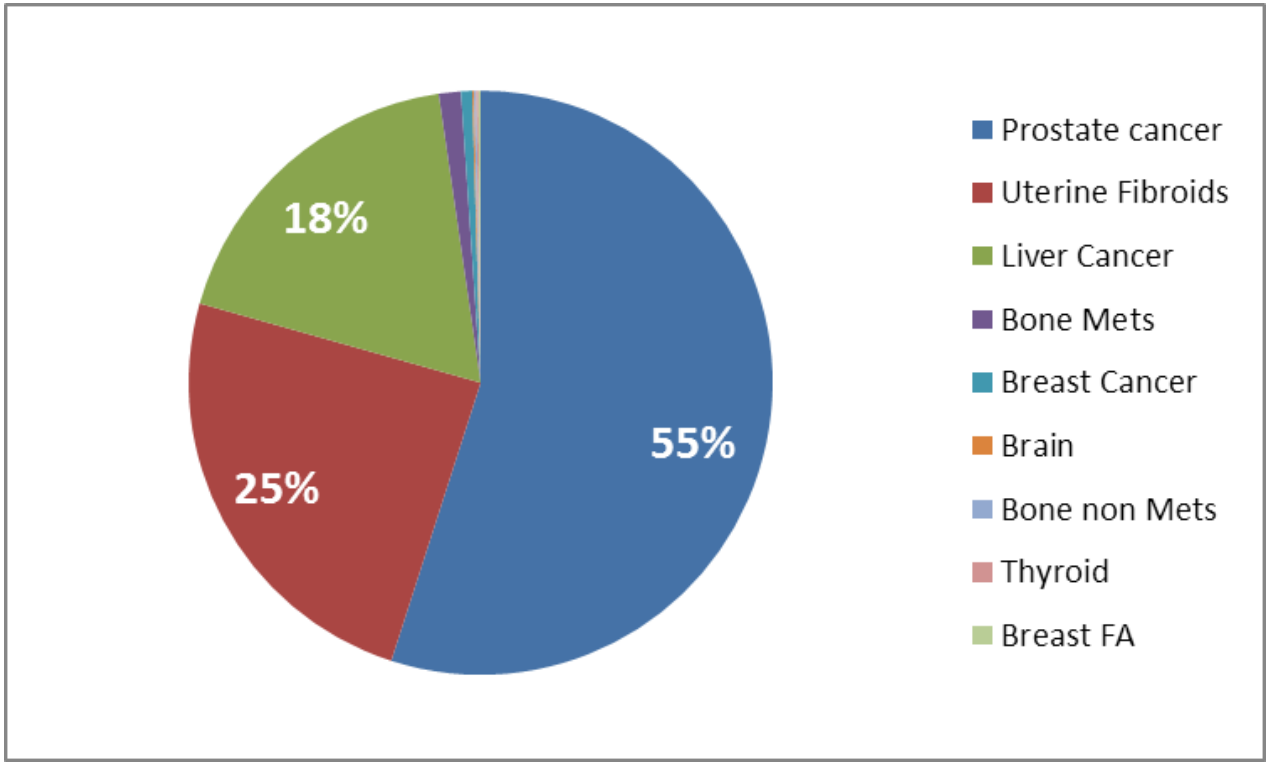
- Hypertension
- Atherosclerosis
- Atrial Fibrillation
- Septal Perforation

## Miscellaneous

- Uterine Fibroids
- Uterine Adenomyosis
- Breast Fibroadenomas
- Acute Tubular Necrosis
- Obesity
- Diabetes
- Glaucoma
- Benign Prostatic Hypertrophy

# How about some numbers?

# Numbers…




Overall, more then 80,000 patients have been treated using HIFU



* All guidance methods

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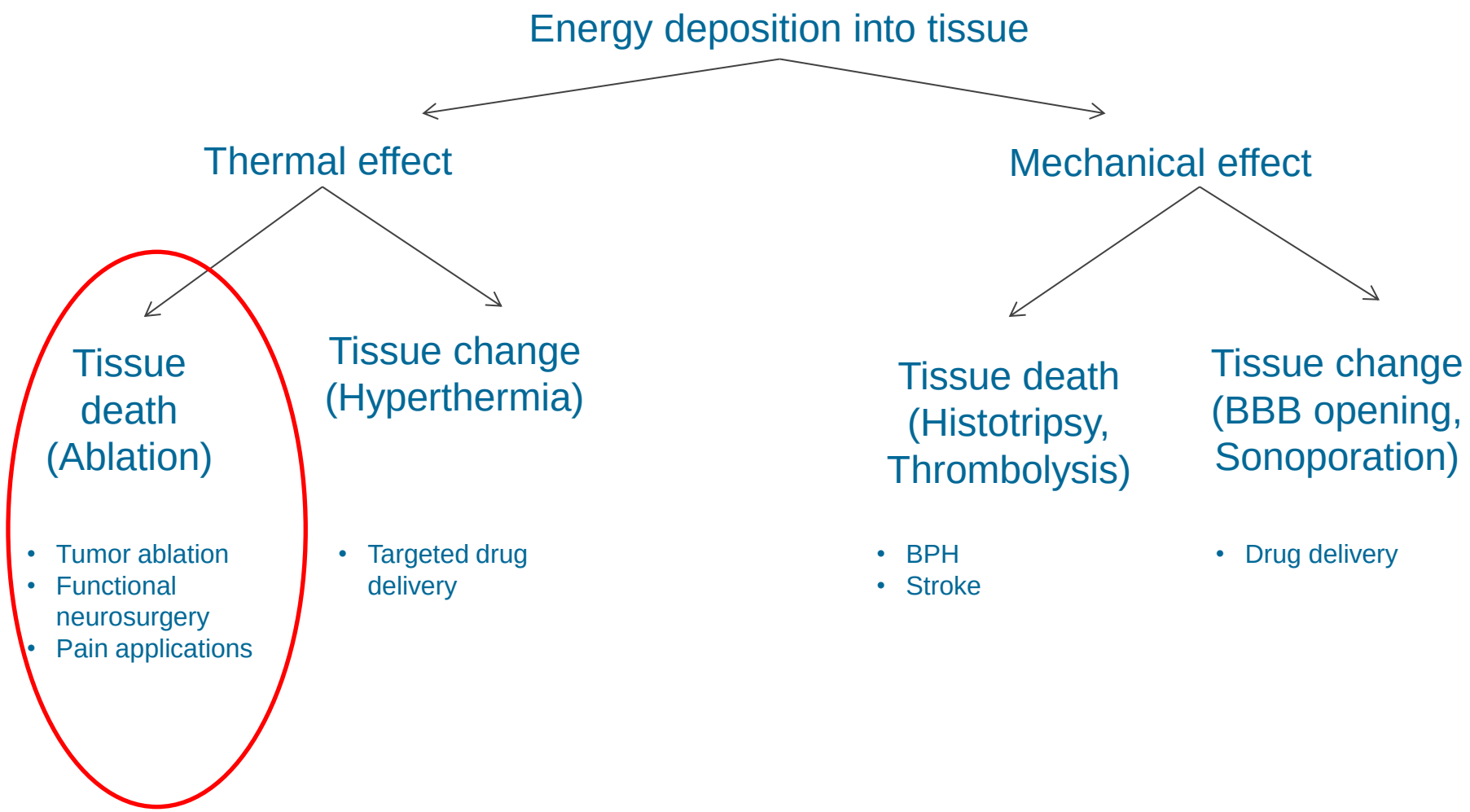
# HIFU in practice

# Mechanism of action and applications



# Clinically tested

## Brain Indications

- Neuropathic pain
- Essential Tremor
- Tremor Dominant Parkinson
- Parkinson Dyskinesia
- OCD

# Clinically tested

## Gynecological and urological indications

- Prostate cancer
- Kidney tumors

- Symptomatic uterine fibroids
- Adenomysis

# Clinically tested

## Abdominal indications

- Liver tumors
- Pancreatic cancer

# Clinically tested

## MSK indications

- Bone metastasis
- Osteoid Osteoma
- Facet Rhizotomy

# Clinically tested

Other indications

- Benign Thyroid nodules
- Hyperparathyroidisim
- Renal nerve denervation

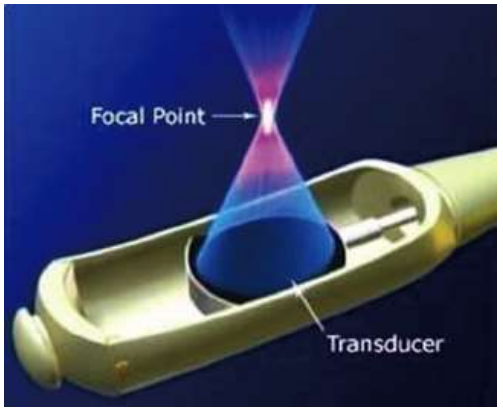
- Glaucoma

- Breast cancer
- Breast Fibroadenoma

# Regulatory status

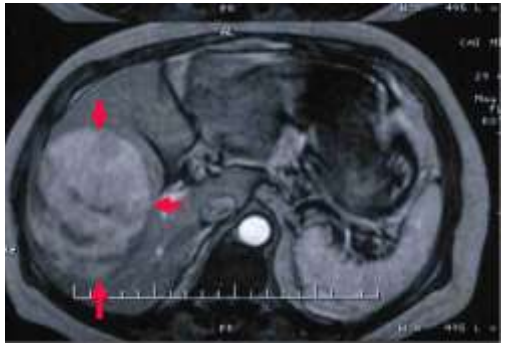
- USA – UF and Bone Mets
- Europe – UF, Bone Mets, Thalamotomy, Prostate cancer, Thyroid nodules, Breast Fibroadenoma, Liver and pancreatic cancer, Breast cancer, Kidney tumors, Facet arthritis and Osteoid Osteoma
- Asia – UF, Bone Mets, Prostate cancer

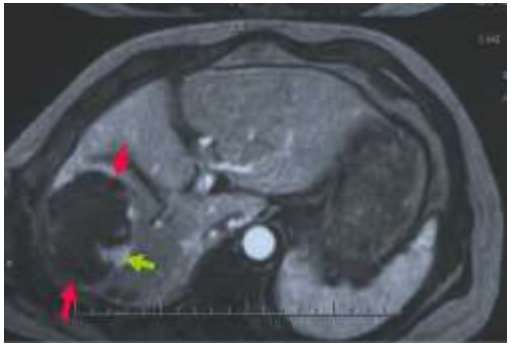
# Prostate Cancer - Transrectal

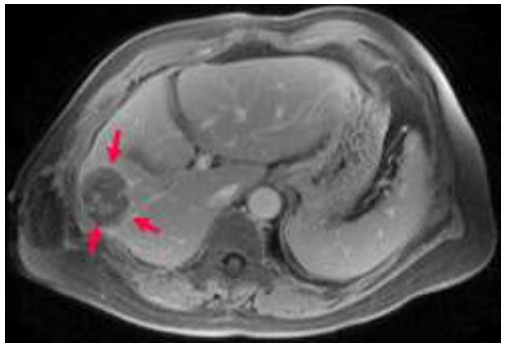


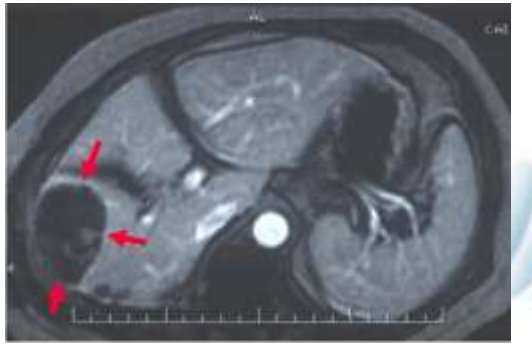


# Liver Tumors









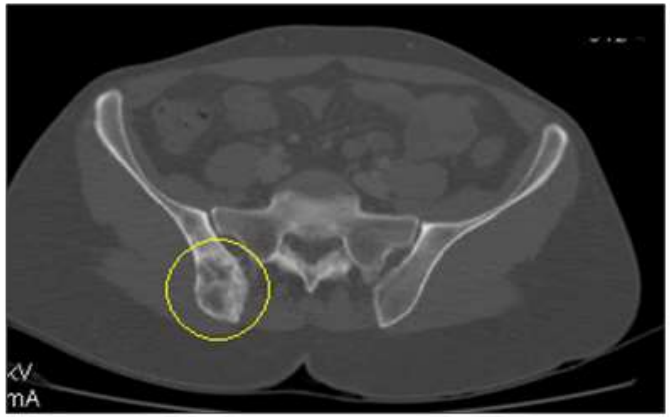
* Eur J Radiol. 2009 Oct;72(1): High intensity focused ultrasound (HIFU) therapy for local treatment of hepatocellular carcinoma: role of partial rib resection. Zhu H, Zhou K, Zhang L, Jin C, Peng S, Yang W, Li K, Su H, Chen W, Bai J, Wu F, Wang Z.

# Pain Palliation of Bone Metastases

**Patient with osteolytic breast cancer metastasis at right iliac bone**
**Pain score of 5.5 before treatment  reduced to 0 at 3M follow up**

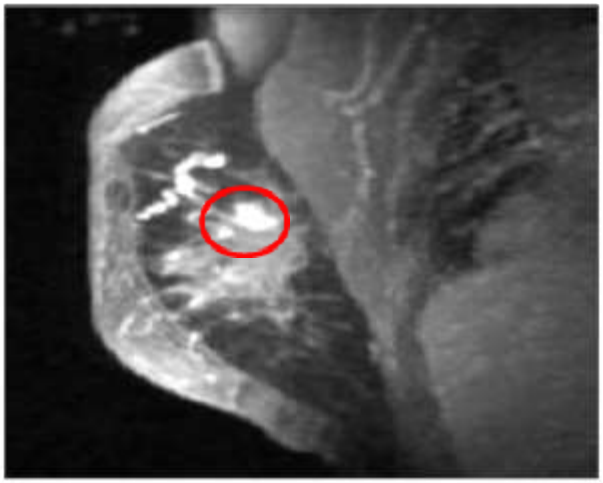
CT Before Treatment

Note: At 3M new bone formation and thickening of cortical layer in treatment area

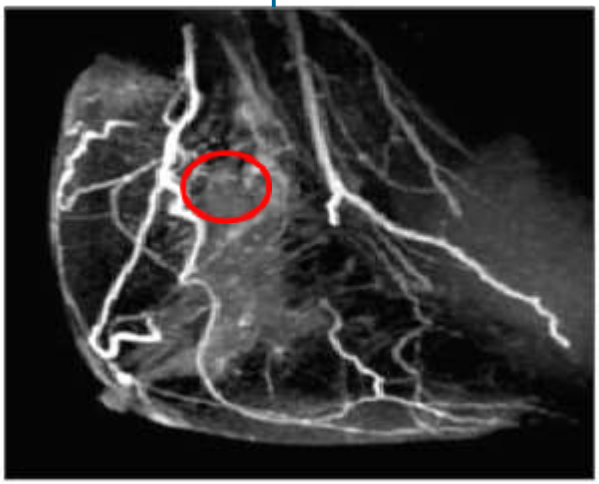


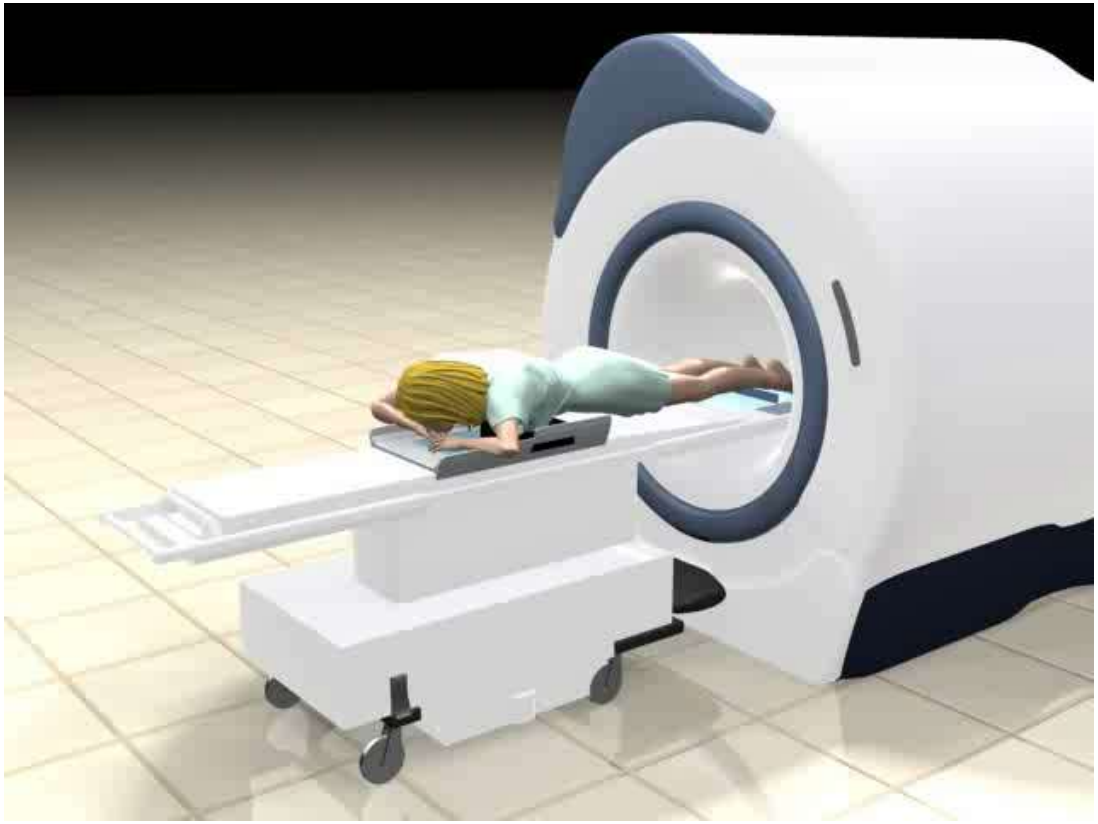

# Breast Cancer

Pre-treatment



Two weeks post treatment





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# Future brain indication

1)Brain Oncology
   1)Tumors
   2)BBB opening
   3)Sonodynamic therapy

2)Epilepsy

3)Brain aneurism(*)

# Future Body indications

- 1)Lung cancer (*)
- 2)Sacroiliitis
- 3)Infected implant sterilization

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# Questions?