وبینار "سرطان، فرصتها و چالش ها"

عنوان سخنرانی

دکتر...

سمت...

مرتبه...

oncointervention

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Advanced Diagnostic and Interventional Radiology Research Center (ADIR),
Tehran University of Medical Sciences, Tehran, Iran

SURGERY ,ONCOLOGIST AND RADIOTHERAPY ARE THREE MAIN COLUMN OF CANCER MANAGEMENT

AND

INTERVENTIONAL ONCOLOGY AS THE FOURTH PILLAR OF CANCER CARE

WHAT OUR AIMS IN ONCOLOGY

- **The best tumor control**
- **The Best quality of life**
- **Do the best possible procedure**
- **Consider economy of country and patient**

INSTRUMENTS

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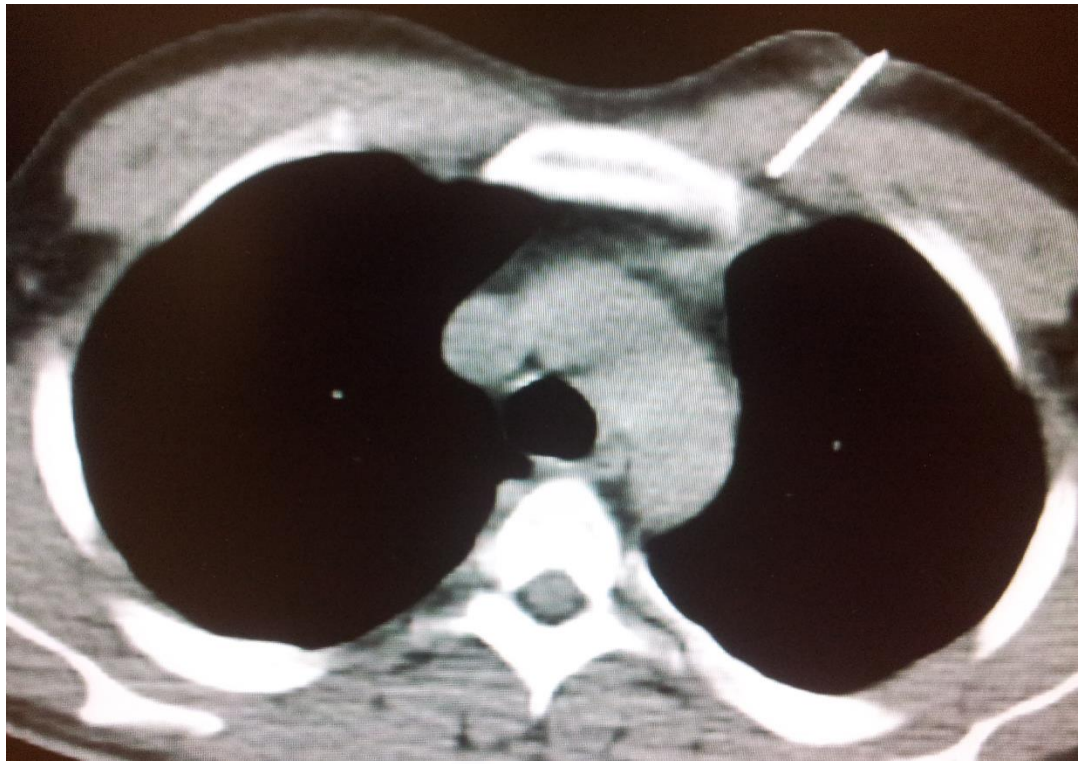
همزمان با روز جهانی سرطان و هفته ملی مبارزه با سرطان۱۴۰۰



- about two-thirds of patients with colorectal liver metastases will die of metastatic liver disease .
- complete surgical resection offers the best chance of long-term survival in patients with colorectal metastatic disease, with 5-year overall survival rates of about 50% ; With only about 25% of patients being amenable to surgery,
- whereas most currently used chemotherapeutic regimens provide a median survival of up to 22 months.

SOME OF INTERVENTIONAL TECHNIQUES

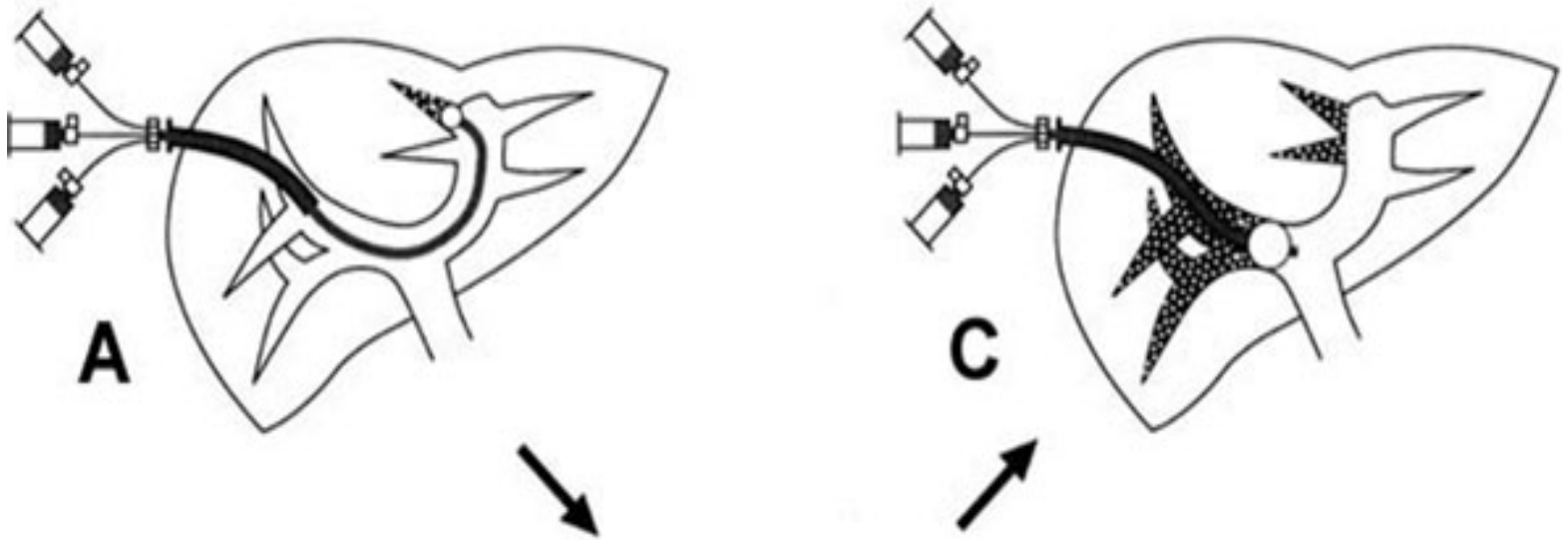
- **Ethanol Ablation: (PEI)**
- **Acetic Acid Ablation**
- **Percutaneous Hot Saline Infusion Therapy**
- **Hepatic Art Infusion Chemotherapy: HAI**
- **Chemoembolization: TACE**
- **Cryoablation**
- **RF: Radio-frequency Ablation**
- **Microwave Ablation**
- **Laser Ablation or laser induced interstitial thermotherapy (LITT)**
- **High intensity focused ultrasound (HIFU)**

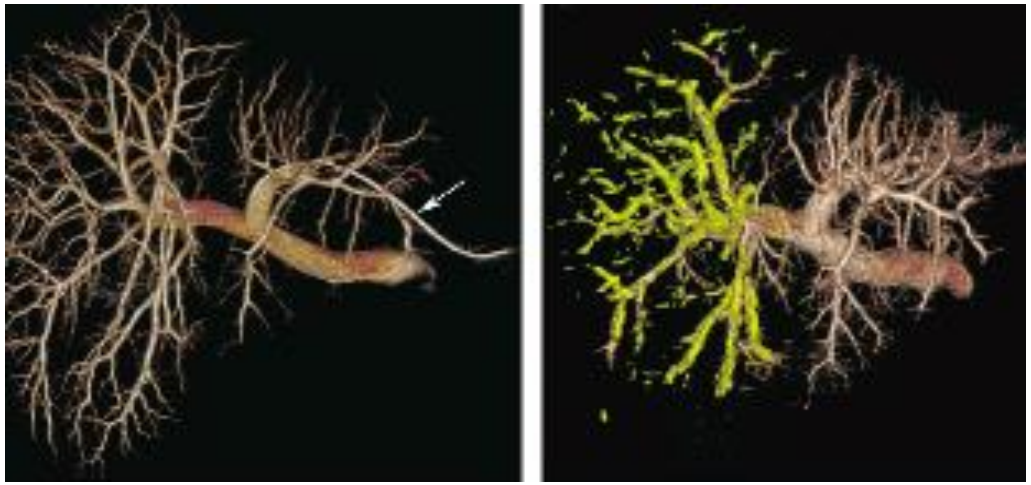
- Portal vein embolization extends the indications of surgery for liver metastases, with a postoperative life expectancy equivalent to surgery performed without portal vein embolization.
- Percutaneous placement of arterial access for hepatic arterial infusion chemotherapy allows the delivery of chemotherapy as effectively as surgically implanted arterial access and results in a response rate higher than that of systemic chemotherapy.
- Transarterial chemoembolization has proven to be particularly valuable for the treatment of melanoma and neuroendocrine liver metastases.
- Transarterial radioembolization has great potential, especially in combination with systemic therapies.
- If performed by expert hands, percutaneous radiofrequency ablation has similar overall survival as surgical resection in selected patients with limited disease.

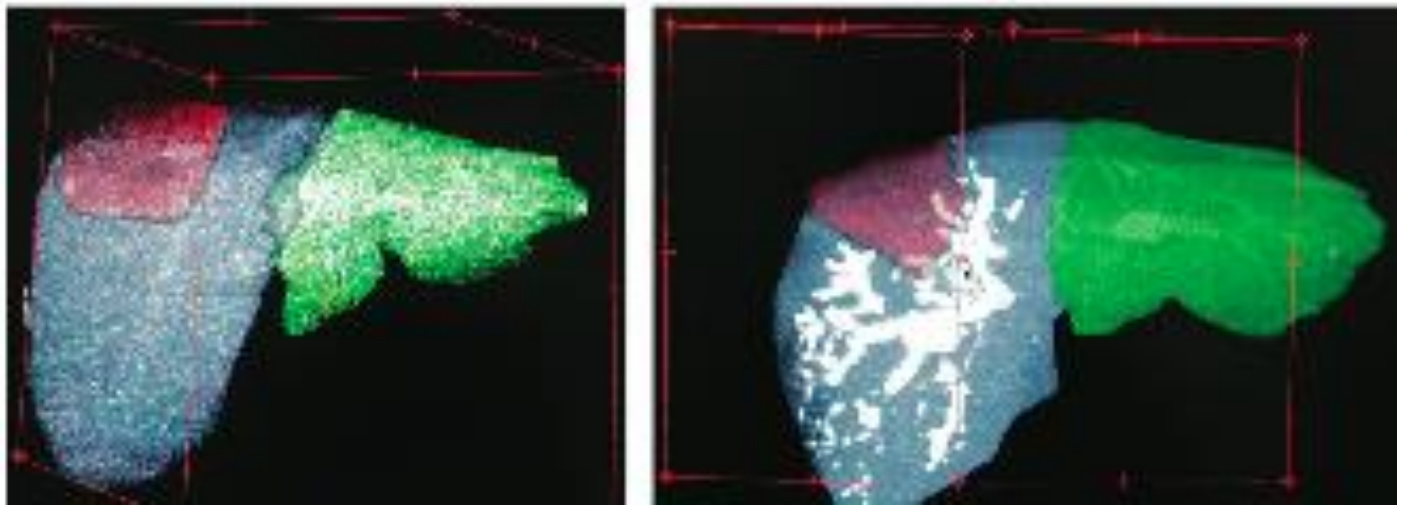
PORTAL VEIN EMBOLIZATION

- **Chemotherapy can increase the possibility of resection by decreasing tumor burden, but chemotherapy will only completely sterilize fewer than 15% of metastatic lesions in colorectal cancer**

X-treme portal vein embolization







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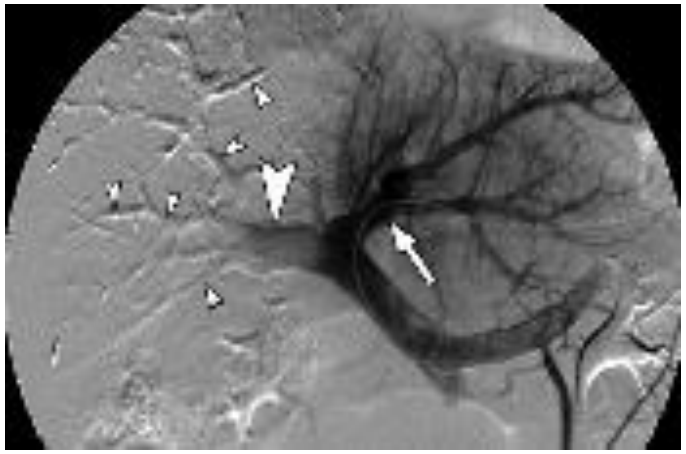
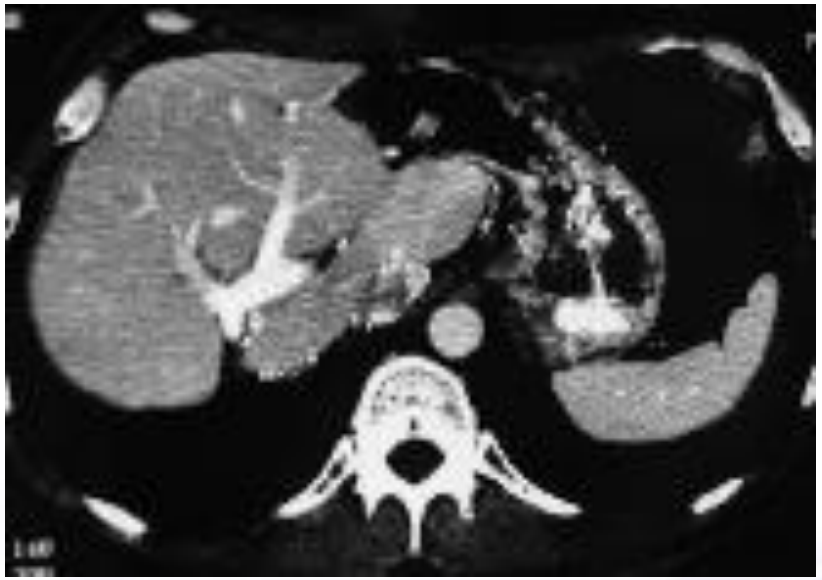




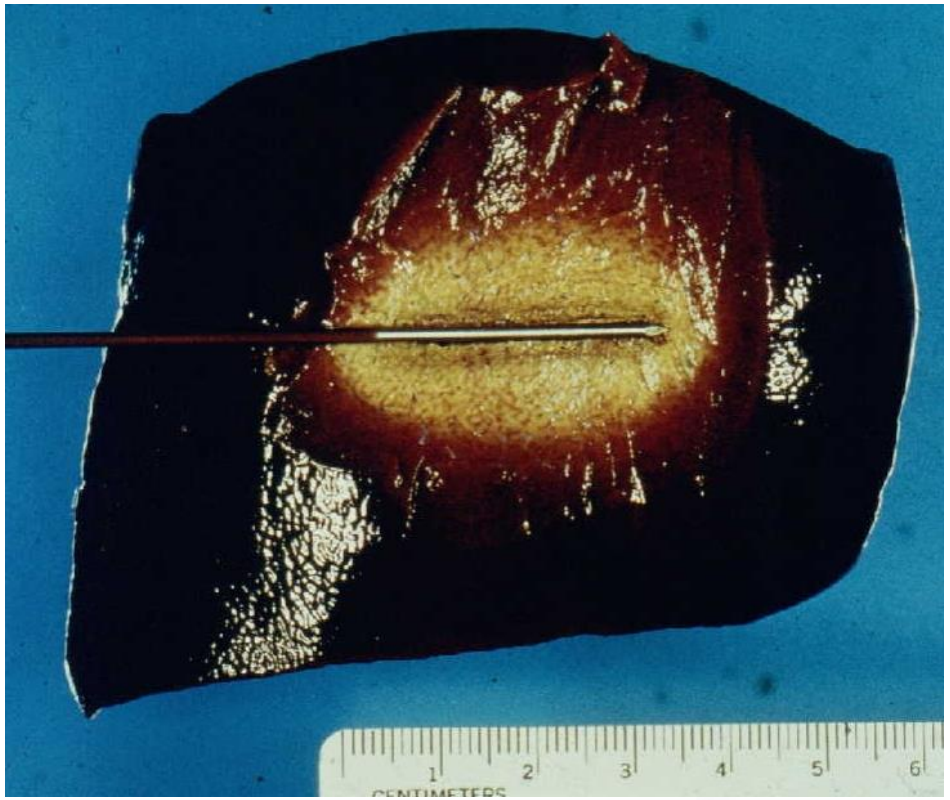
- Previous chemotherapy can alter the degree of future remnant liver hypertrophy.

- Platinum-based chemotherapy, which induces portal sinusoid dilatation also known as “blue liver” , is known to reduce the amount of hypertrophy of the future remnant liver .

- In clinical practice, it is wise to observe a 4–6- week period without any chemotherapy before PVE and to reduce the number of preoperative courses of chemotherapy as much as possible.

PERCUTANEOUS ABLATION TECHNIQUES

RFA


1
2
3
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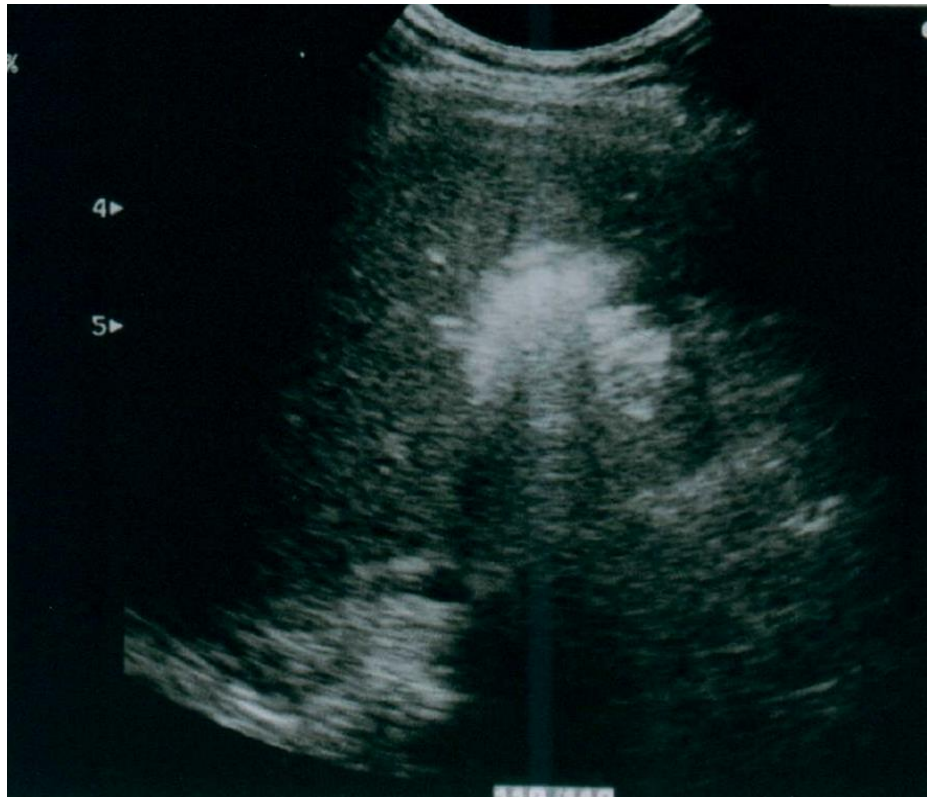
5
6


4
5

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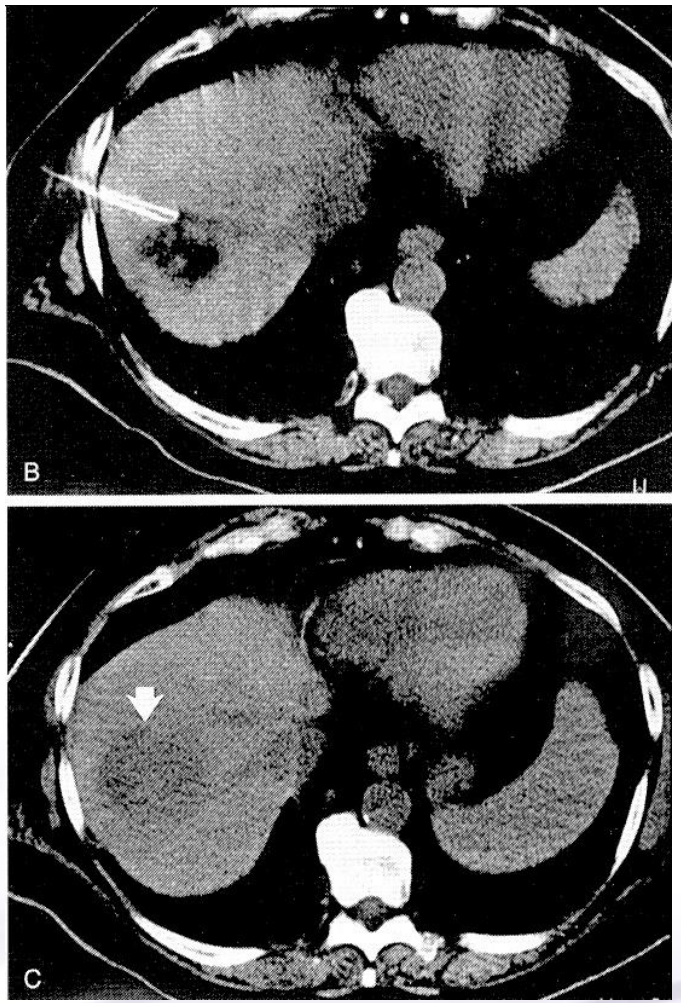
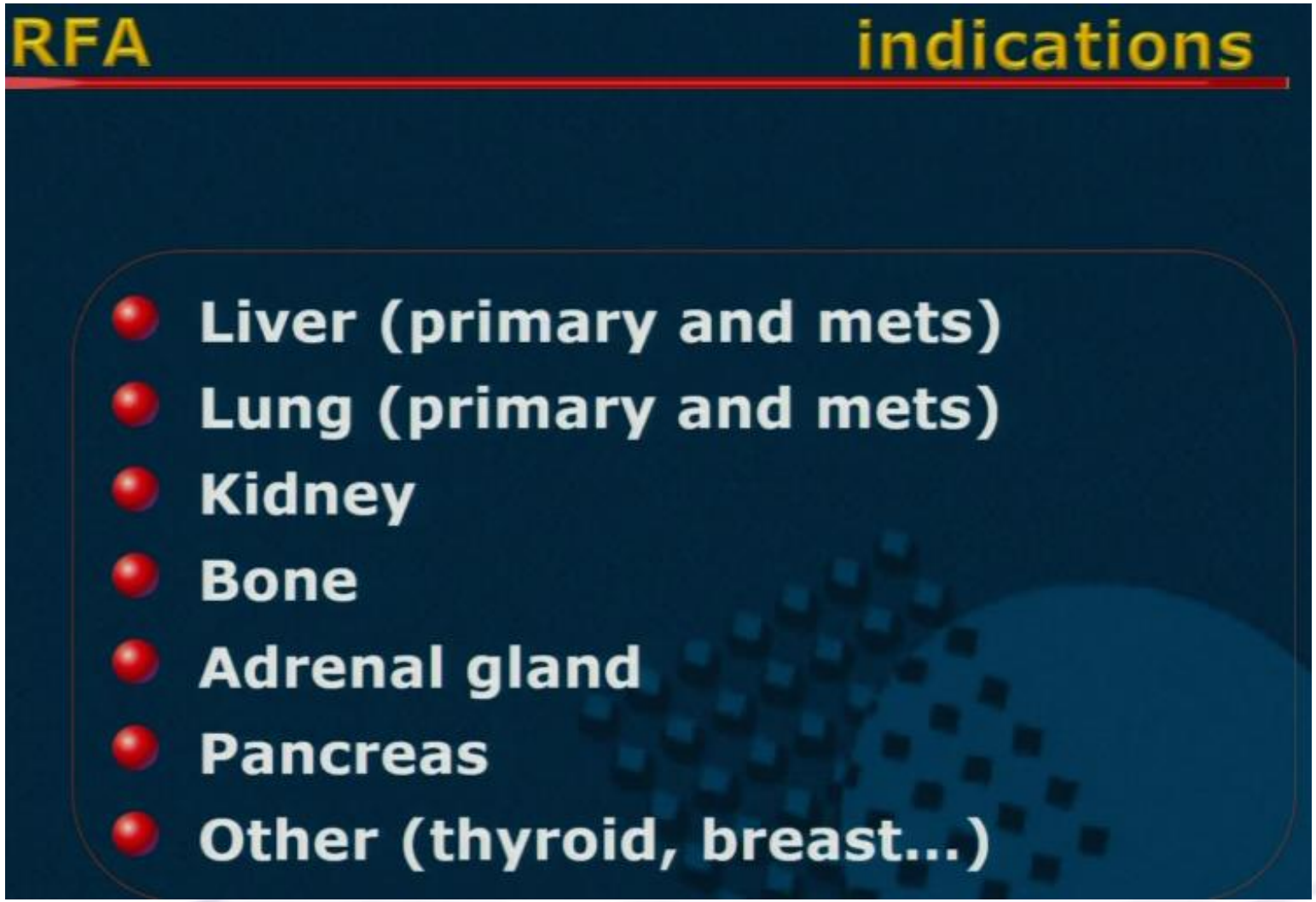
Ethanol Ablation

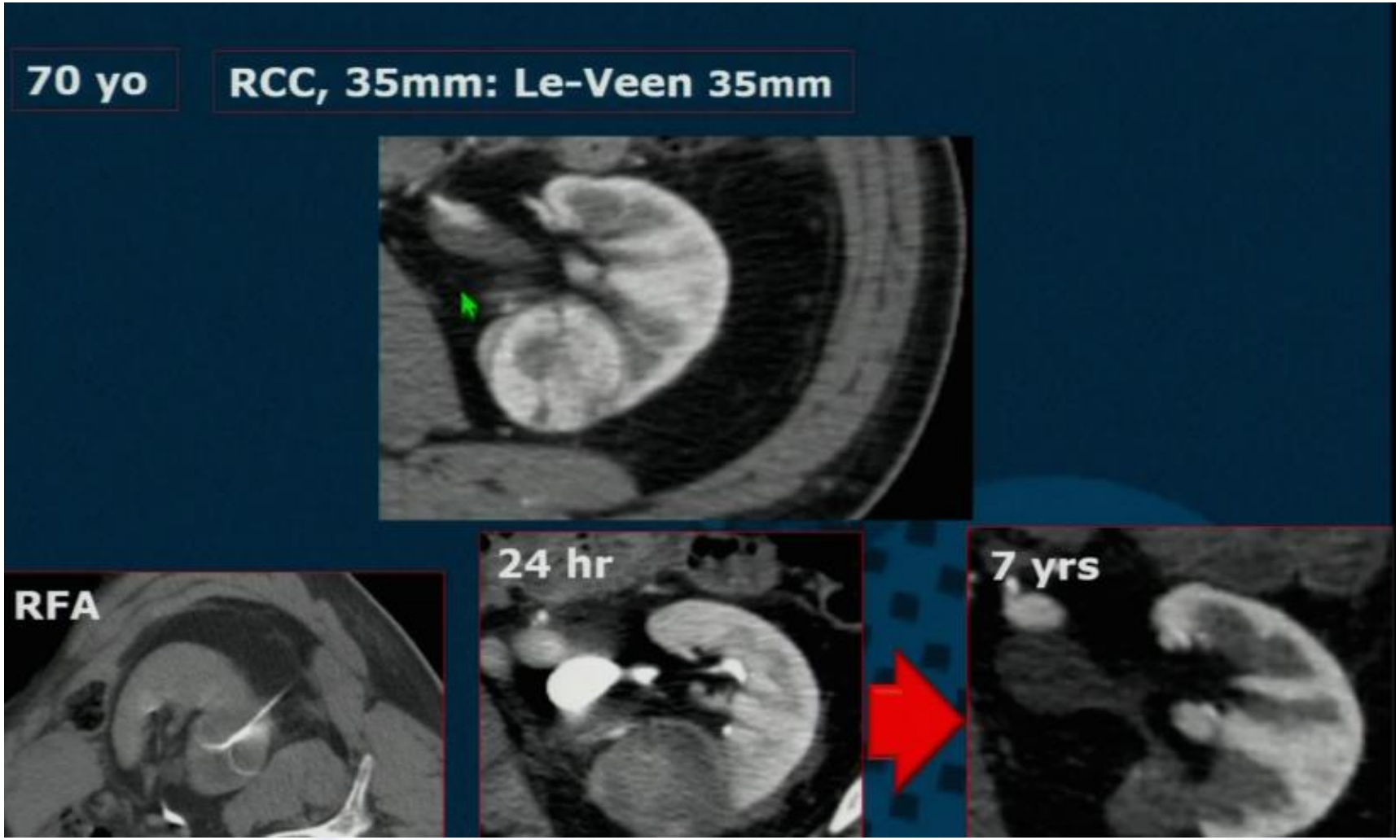
- Easy
- Inexpensive
- Good results

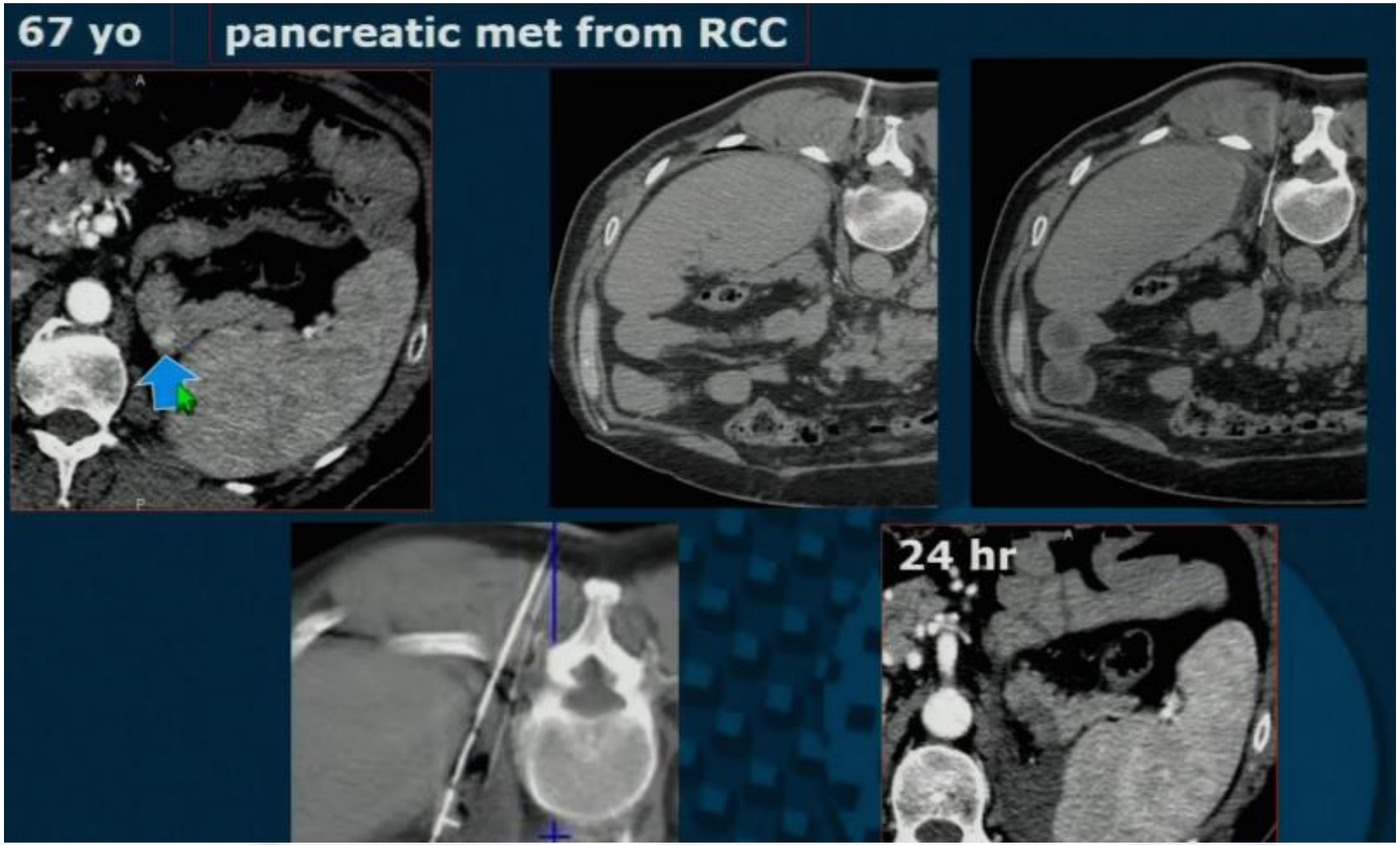


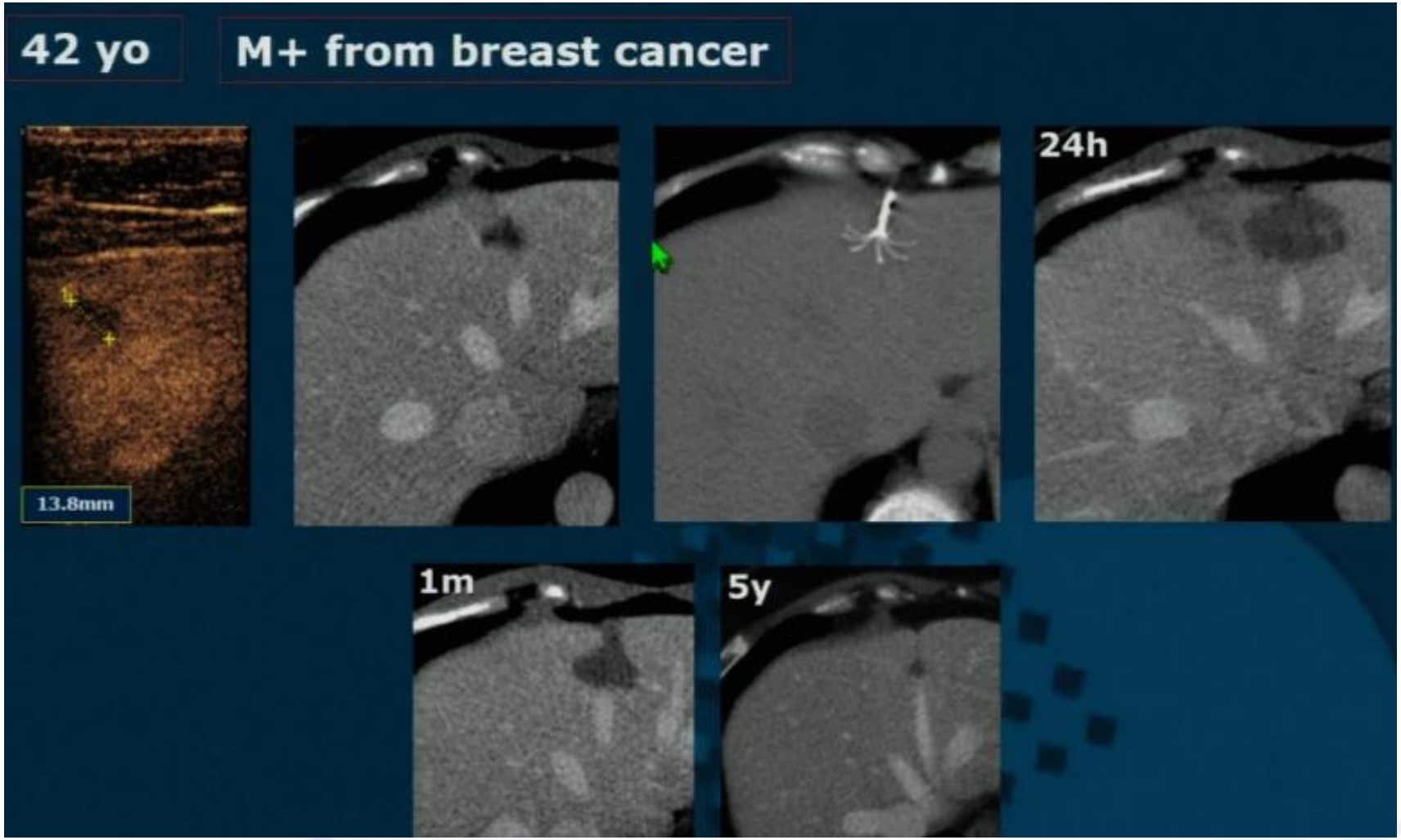
RFA INDICATIONS IN LIVER

- Fewer than 4 lesions
- 5 cm or smaller
- No extrahepatic tumor
- 1 cm from IVC / PV/GB


RFA indications
Liver (primary and mets)
Lung (primary and mets)
Kidney
Bone
Adrenal gland
Pancreas
Other (thyroid, breast...)


70 yo
RCC, 35mm: Le-Veen 35mm
RFA
24 hr
7 yrs


67 yo
pancreatic met from RCC
24 hr


42 yo
M+ from breast cancer
13.8mm
24h
1m
5y

- US is usually preferred for targeting and needle insertion: *Real-Time imaging*
- Once needle is placed, CT confirms the right position and relationships with sensitive adjacent structures

CT IS BETTER FOR EVALUATION OF RFA RESULT AND EVALUATION OF CHANGES DURING RFA

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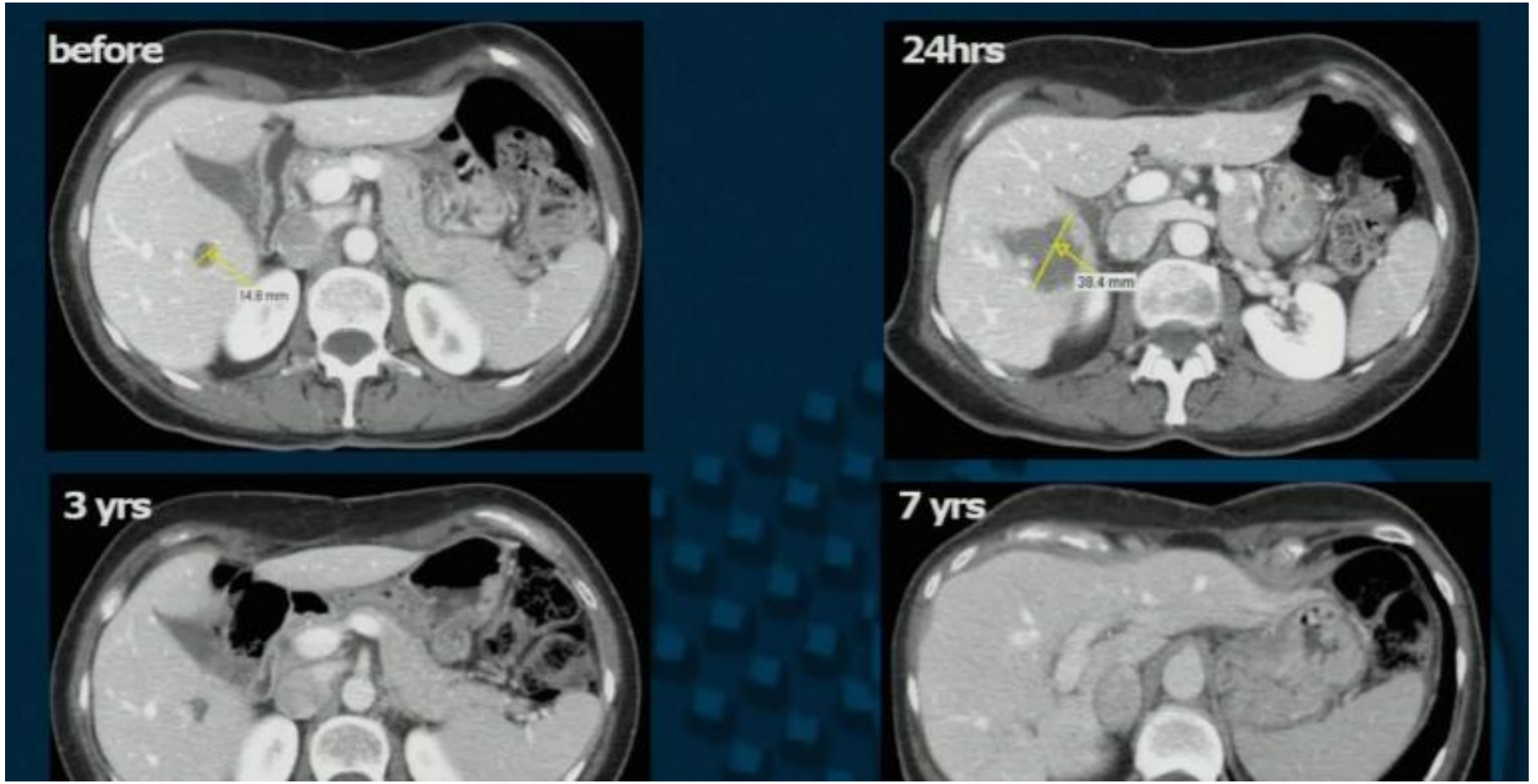
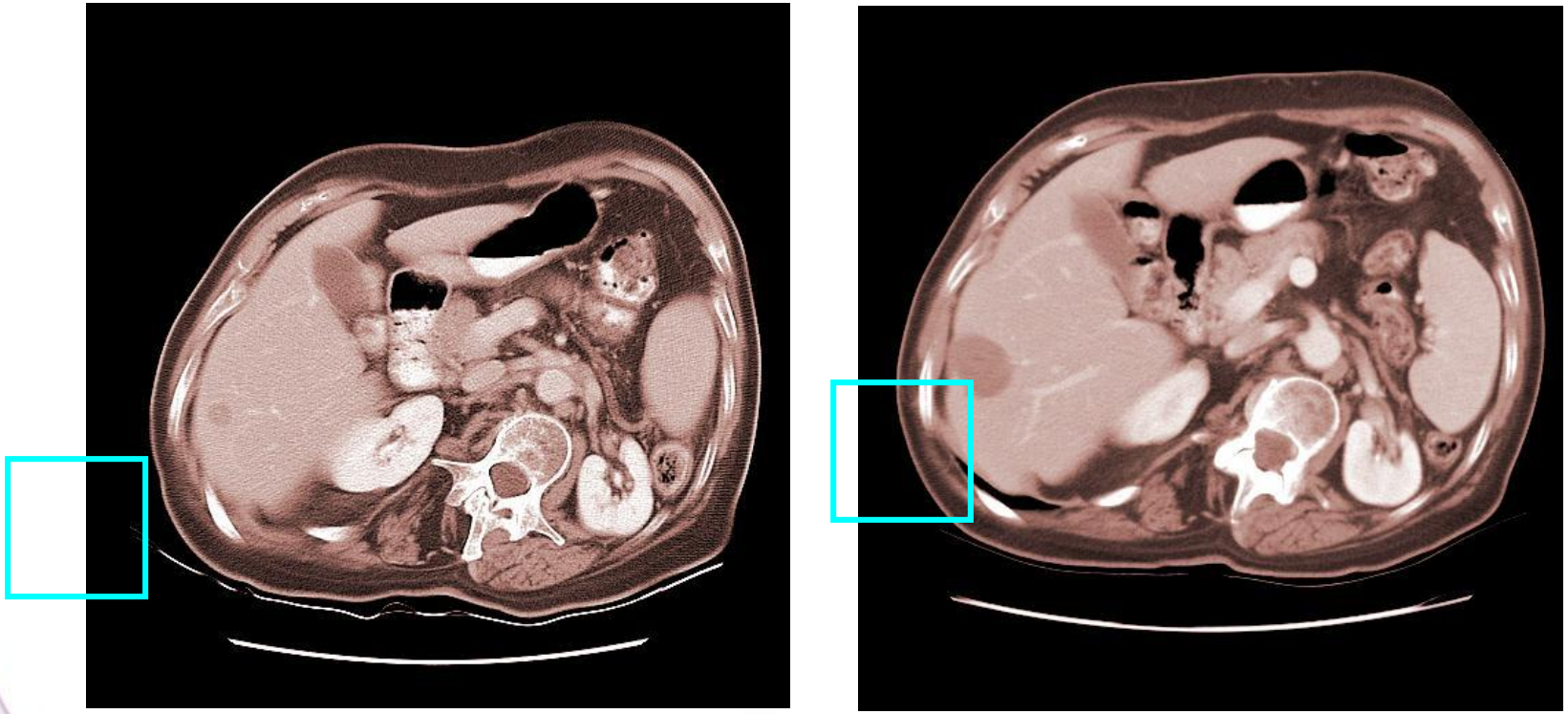


OUTCOME

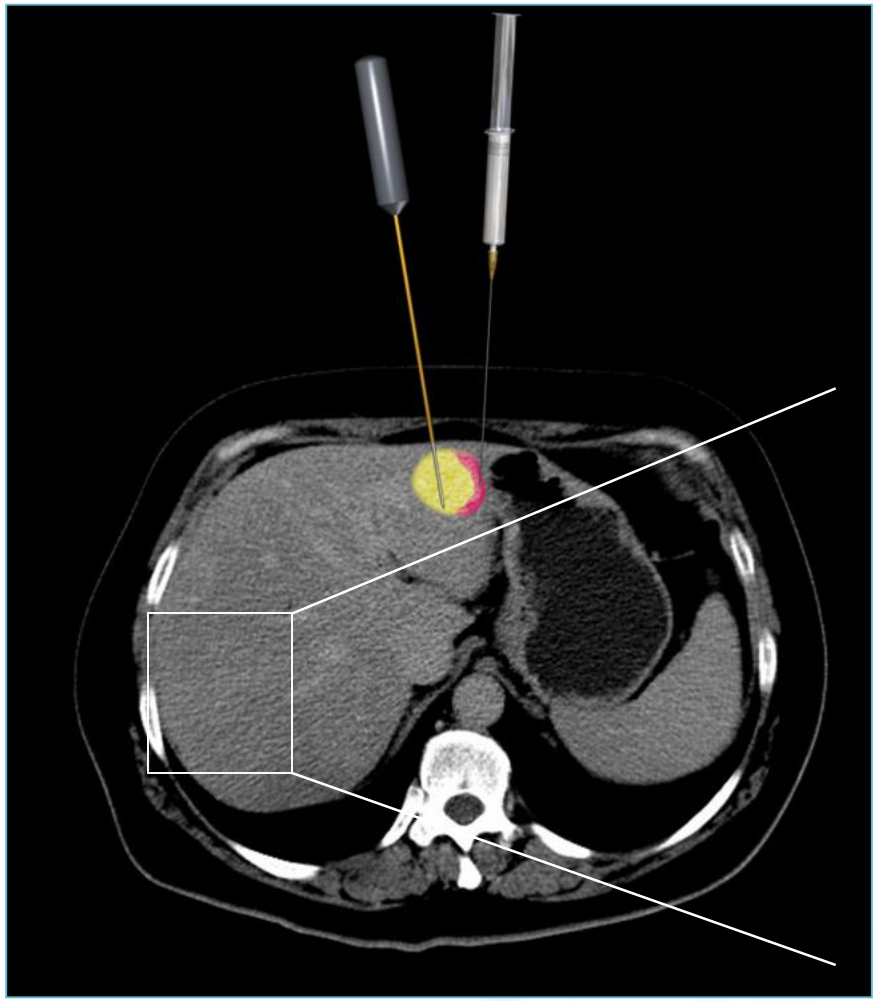
- RFA for unresectable CRLM is a safe, effective and potentially curative treatment option; the long-term results are comparable with those of previous investigations employing surgical resection. Factors determining success are lesion size, the number of lesions and location.

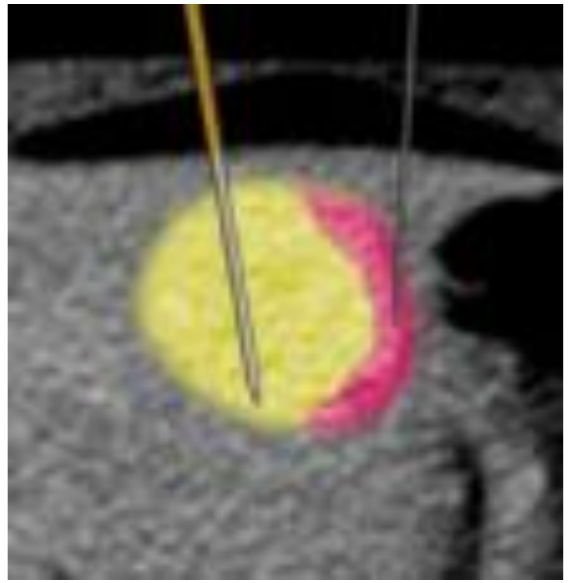
RFA Before and After



Consecutive CT images - the input to the 3-D optimization

COMBINATION THERAPY



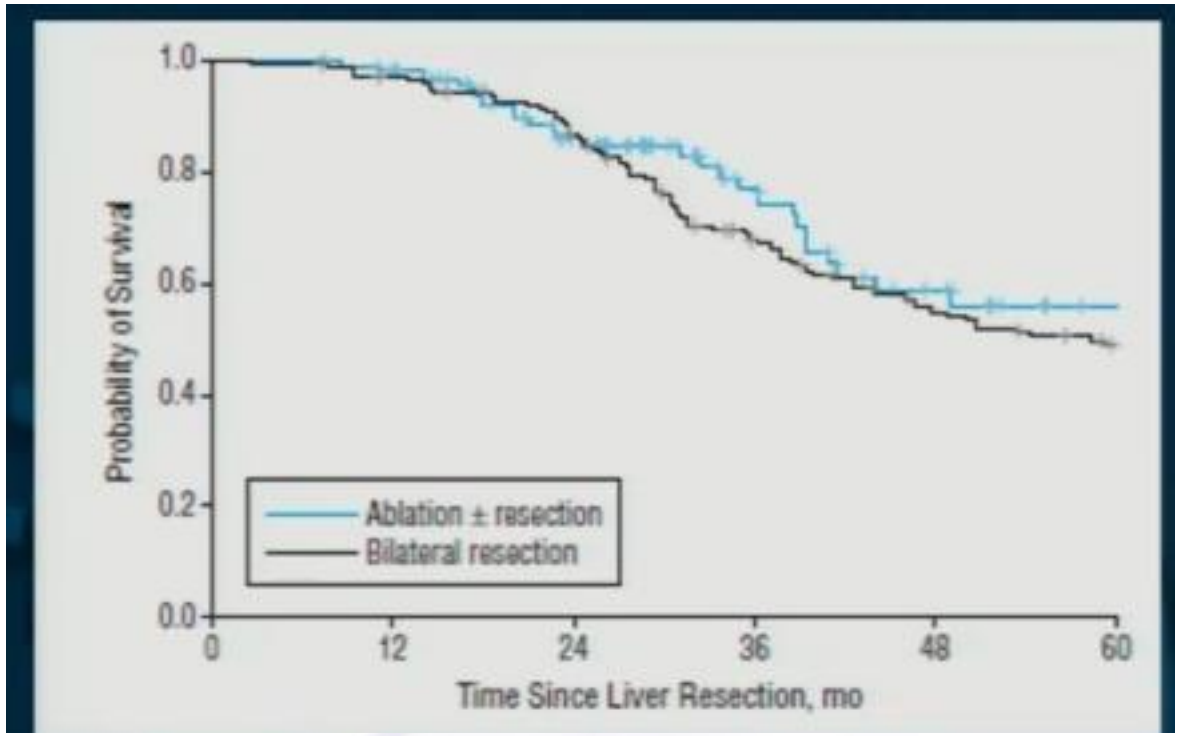


COMPLICATIONS

- t is a procedure with a relatively low complication rate (<10%, mostly minor complications that are often unnecessary to treat) and a very small risk of death (<1%), notably when compared with resection.

Curley SA, Izzo F, Delrio P, Ellis LM, Granchi J, Vallone P, et al. Radiofrequency ablation of unresectable primary and metastatic hepatic malignancies. Results in 123 patients. Ann Surg 1999;230:1–8

LIFE EXPECTANCY OF RFA IN COMPARE TO SURGERY

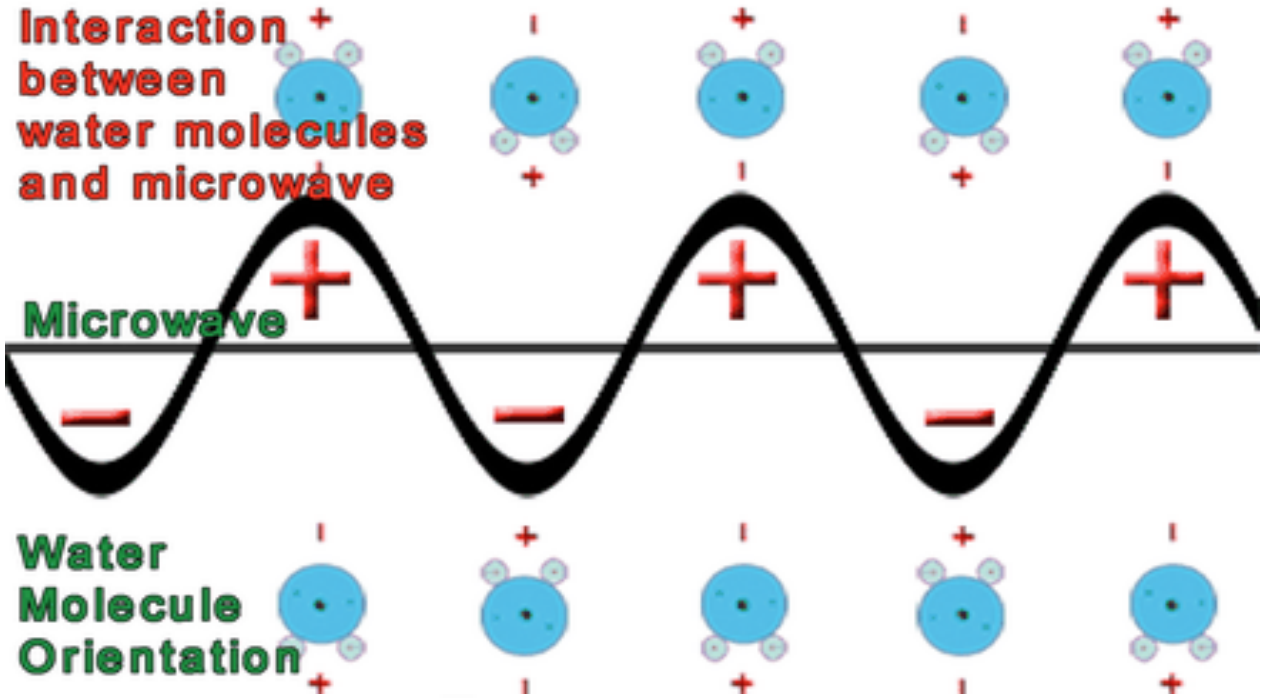


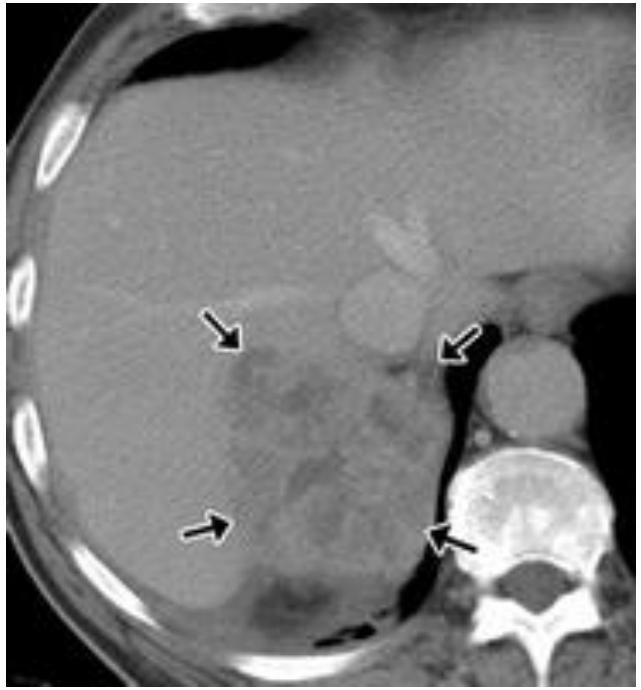
Long-term Outcomes Following Tumor Ablation for Treatment of Bilateral Colorectal Liver Metastases

Paul J. Karanicolas, MD, PhD; William R. Jarnagin, MD; Mithat Gonen, PhD; Scott Tuorto, BA; Peter J. Allen, MD; Ronald P. DeMatteo, MD; Michael I. D'Angelica, MD; Yuman Fong, MD

Microwave Ablation

Microwave ablation refers to the use of all electromagnetic methods for inducing tumor destruction by using devices with frequencies of at least 900 MHz

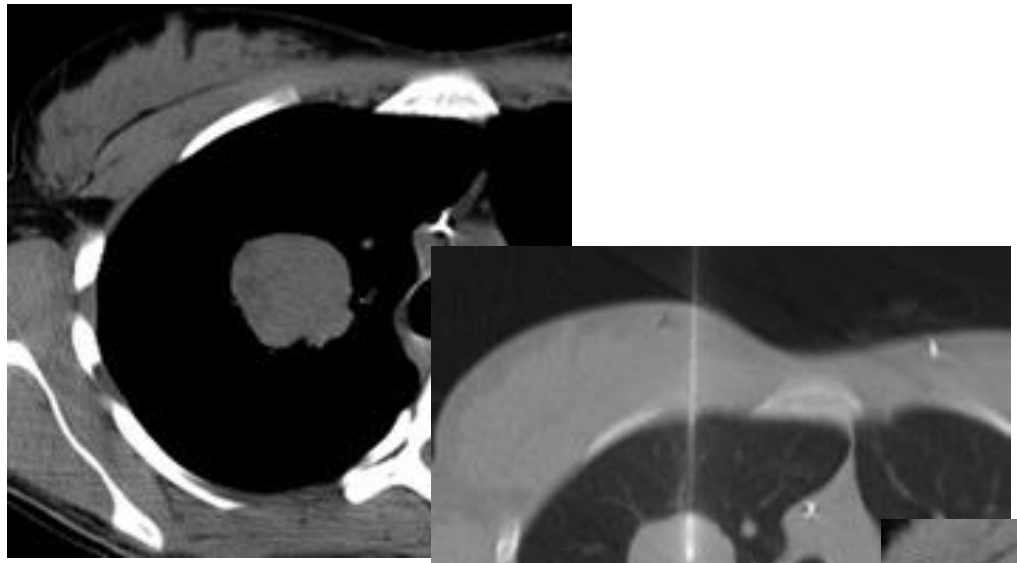

Interaction between water molecules and microwave
Microwave
Water Molecule Orientation

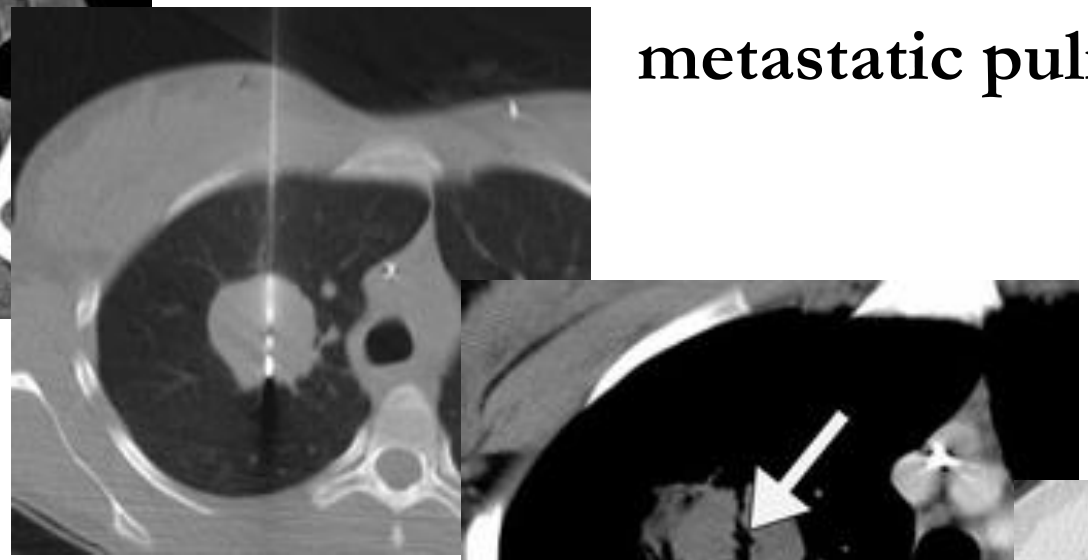


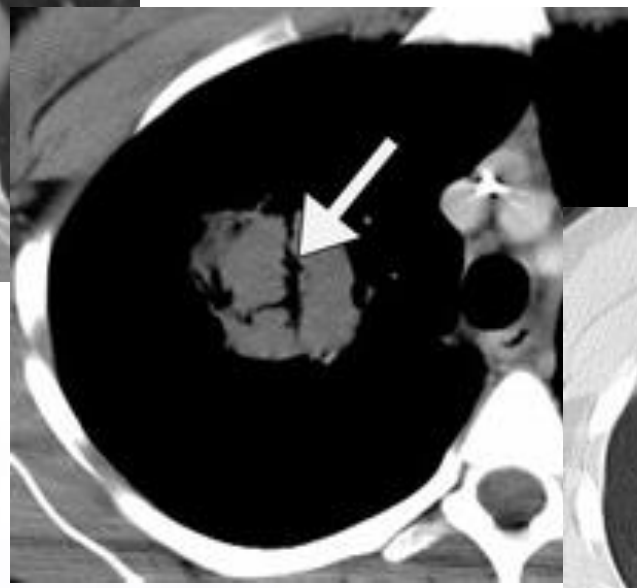
Microwave ablation of an undifferentiated adrenal cortical carcinoma

On follow-up CT, the nonenhancing tumor mass (arrows) appears smaller and exerts less mass effect on the inferior vena cava.

Microwave ablation of metastatic pulmonary lesions

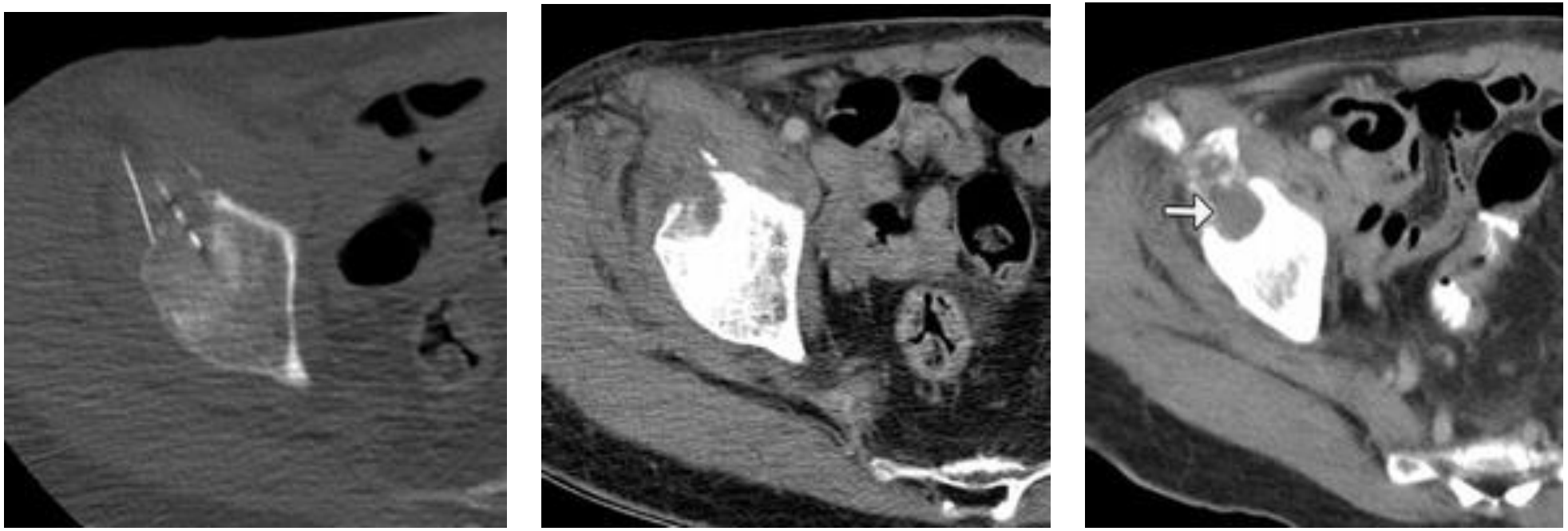






follow-up show cavitation and no enhancement in the lesion and persistent tracks from the microwave antennae

Microwave ablation of metastatic bladder cancer in the acetabulum

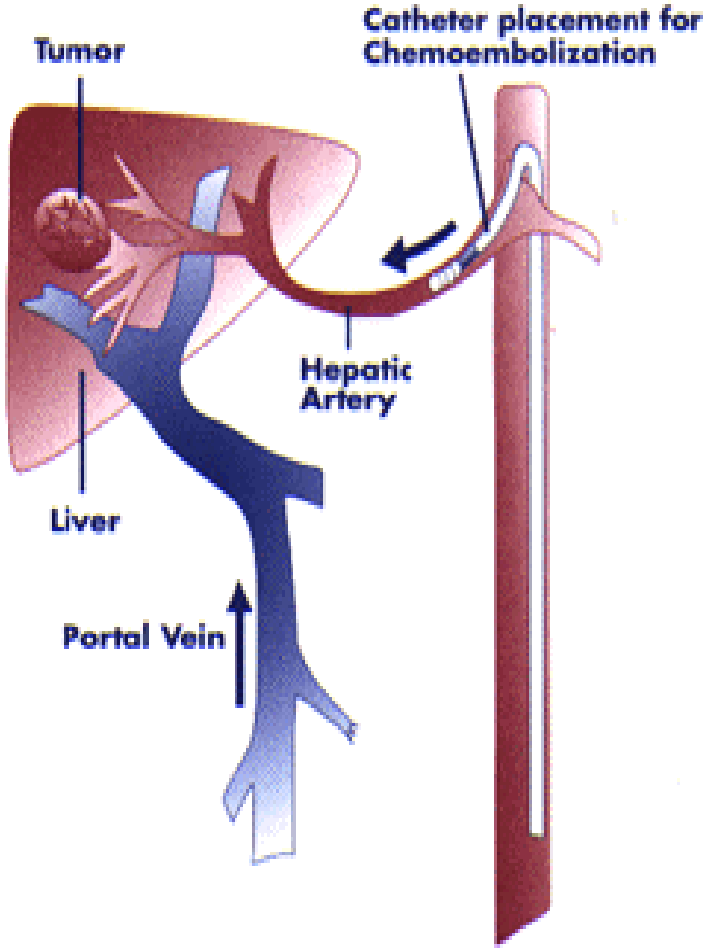


Contrast-enhanced CT scan obtained at 6-month follow-up shows an interval decrease in the size of the bone metastasis, with no pronounced enhancement (arrow)

Chemoembolization

. An initial diagnostic mesenteric and hepatic arteriography is performed with the digital subtraction technique.

. With the catheter lodged in the appropriate vessel supplying the tumor, the chemotherapy mixture is then injected.



INCLUSION CRITERIA:

- **Unresectable tumor**
- **Tumor responsive to chemoembolization**
- **Patent portal vein**
- **Satisfactory liver function (normal alkaline phosphatase and aspartate transaminase levels)**
- **Serum bilirubin level < 2 mg/dL (34 µmol/L)**
- **No major contraindications to angiography (eg, normal coagulation and renal function)**

EXCLUSION CRITERIA:

- **Clinically apparent jaundice**
- **Hepatic encephalopathy**
- **Occluded portal vein**
- **Hepatofugal portal vein flow**

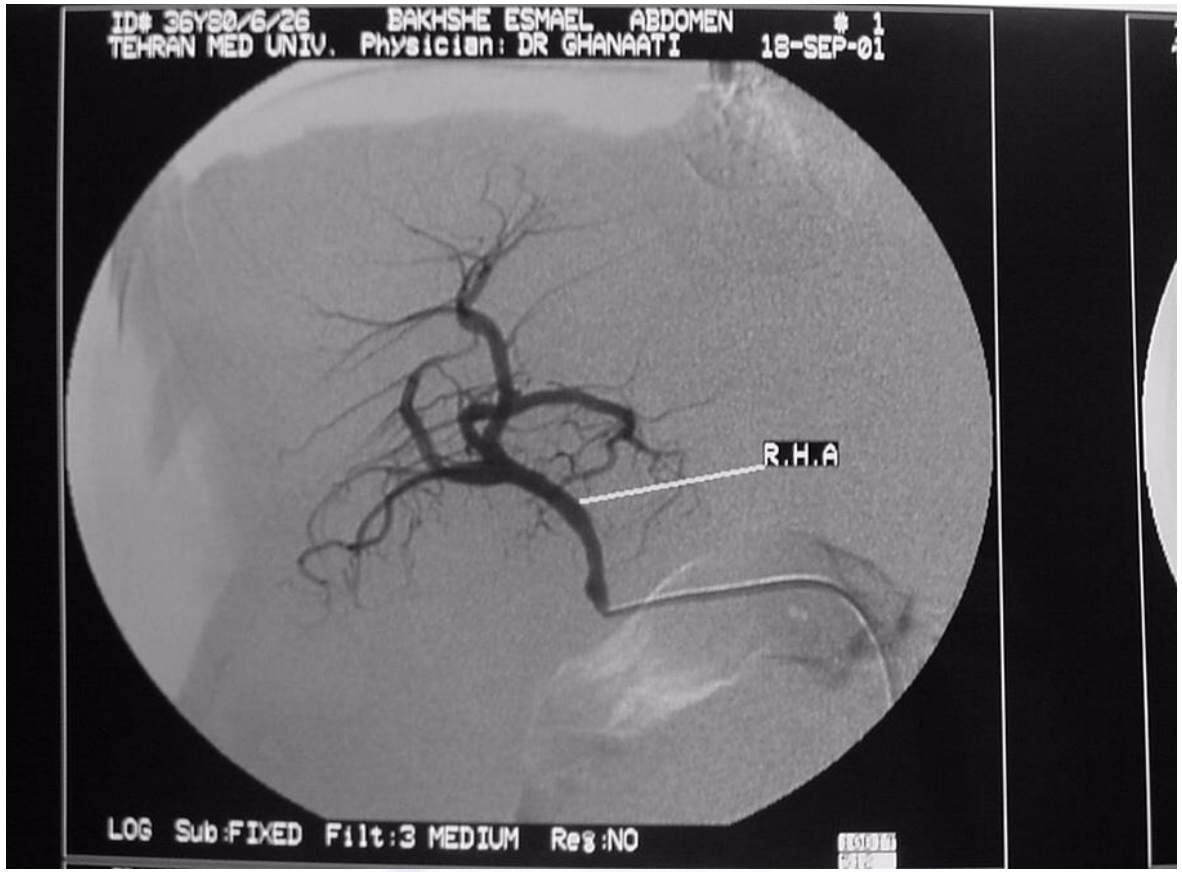
EXCLUSION CRITERIA:

- **Extrahepatic tumors**
- **Other medical condition likely to be life threatening within 3 months.**
- **Liver rupture or tumor penetration of liver capsule.**
- **Poor liver function (coagulopathy not correctable with vitamin K, lactate dehydrogenase level > three times institutional upper limit of normal).**

EXCLUSION CRITERIA:

- **Serum creatinine level > 2 mg/dL**
- **White blood cell count < 2.5 x 1000/µL**
- **Platelet count < 60 x 1000/µL**
- **Pregnancy**

CHEMOEMBOLIZATION

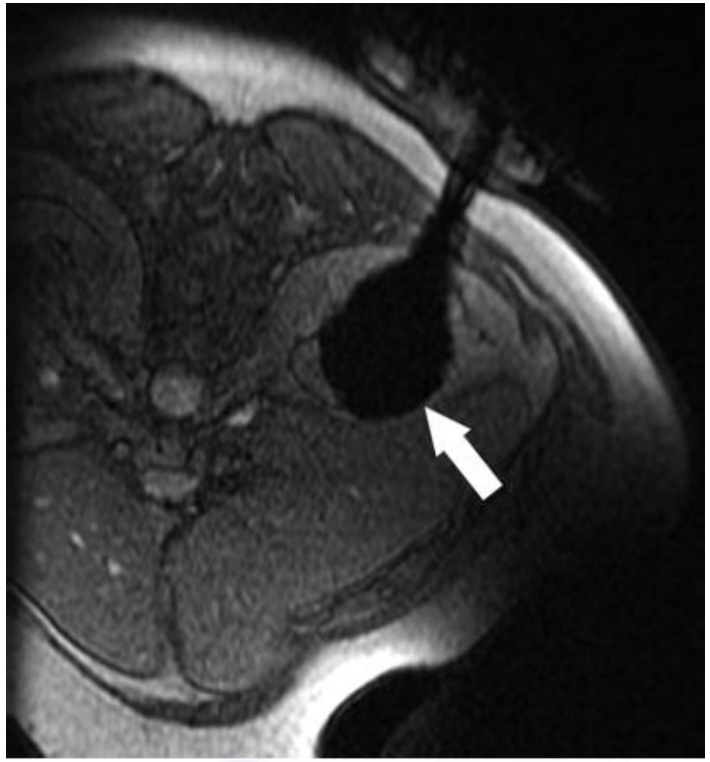


CHEMOEMBOLIZATION


LOG Sub:FIXED Filt:3 MEDIUM Reg:NO
10Bit
512
ID# 36Y80/6/26 BAKHSHE ESMAEL ABDOMEN # 1
TEHRAN MED UNIV. Physician: DR GHANAATI 18-SEP-01
R.H.A
LOG Sub:FIXED Filt:3 MEDIUM Reg:NO
10Bit
512
LOG Sub:
POST.
LOG Sub:

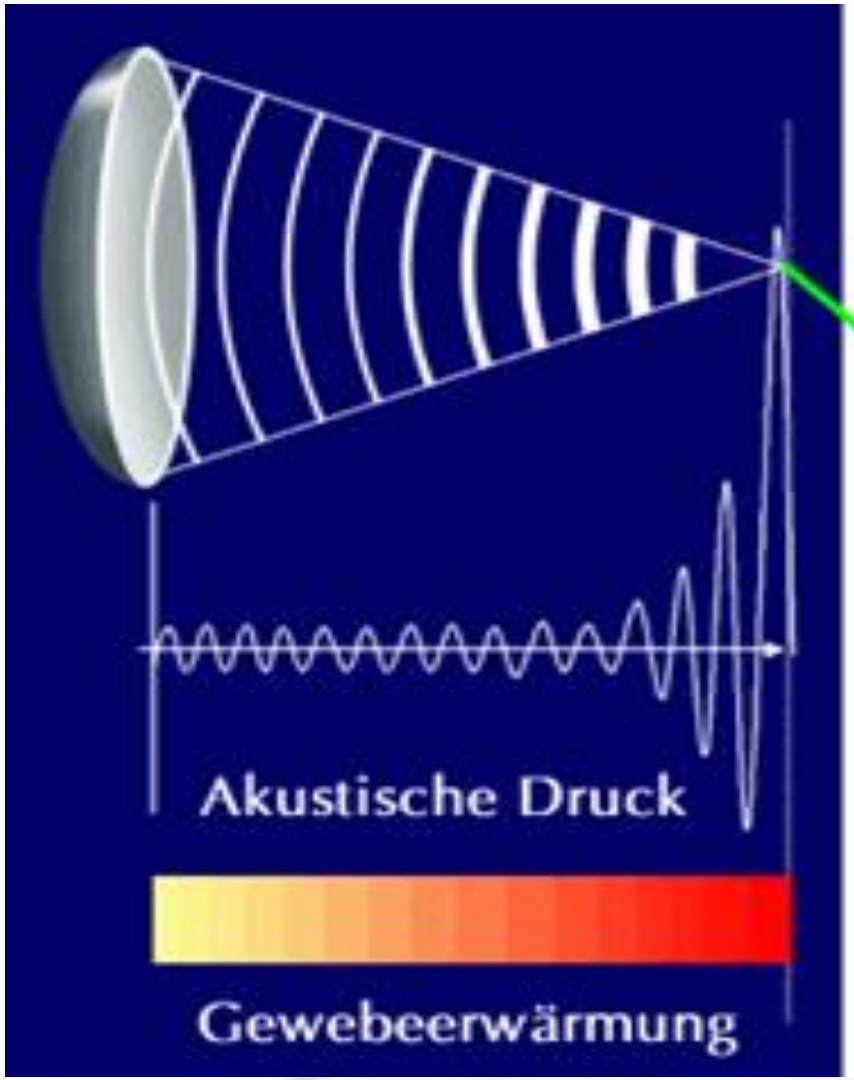

ID# 36Y80/6/26 BAKHSHE ESMAEL ABDOMEN # 2
TEHRAN MED UNIV. Physician: DR GHANAATI 18-SEP-01
POST.CHEMOTERAPY
LOG Sub:FIXED Filt:3 MEDIUM Reg:NO

CRYOABLATION

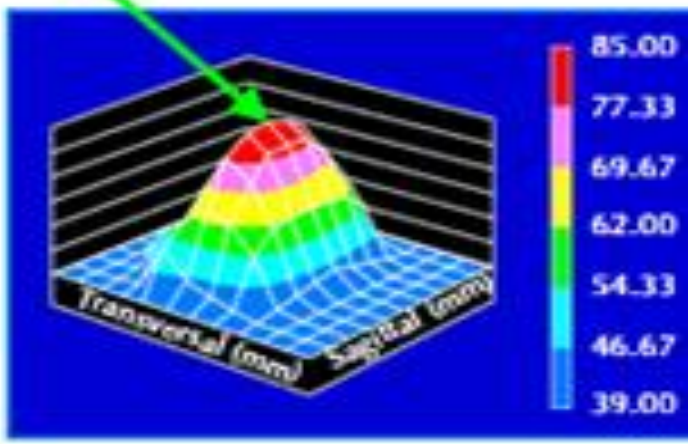


HIFU

High Intensity Focused Ultrasound
(Ultrasound Ablation, Focused Ultrasound Ablation)



Fokussierter
Schallwandler
der Ultraschallwellen aussende



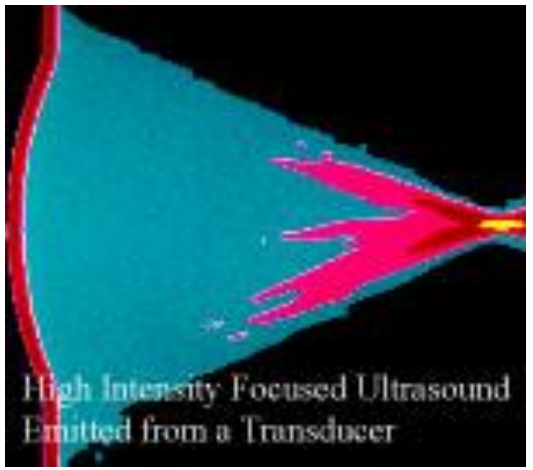
HIFU is intended to allow the radiologist to necrosis prostatic tissue without damaging intervening & surrounding tissue,

thus eliminating the need for incision & their resulting complications

Since US in non-iniozing (as apposed to iniozing in radiation), tissue in the entry & exit path of the *HIFU* beam is not injured.

The area dimension is related to the firing duration: the area starts a the transducer focus progresses toward the transducer during the firing sequence.

Low Intensity at Transducer Face (20-40 Watts) …..



Translates to Very High Site Intensity at the Focus Point (1600 - 2000 Watts/Cm2) …..

INDICATIONS

1- Localized Prostate Cancer (T1,T2)

2- Control of Bleeding

3- Primary Breast Cancer

4- Bone Cancer

(Primary & metastatic tumor of bone except for cranium & spine)

5- Pancreas Cancer

6- Uterine Fibroids

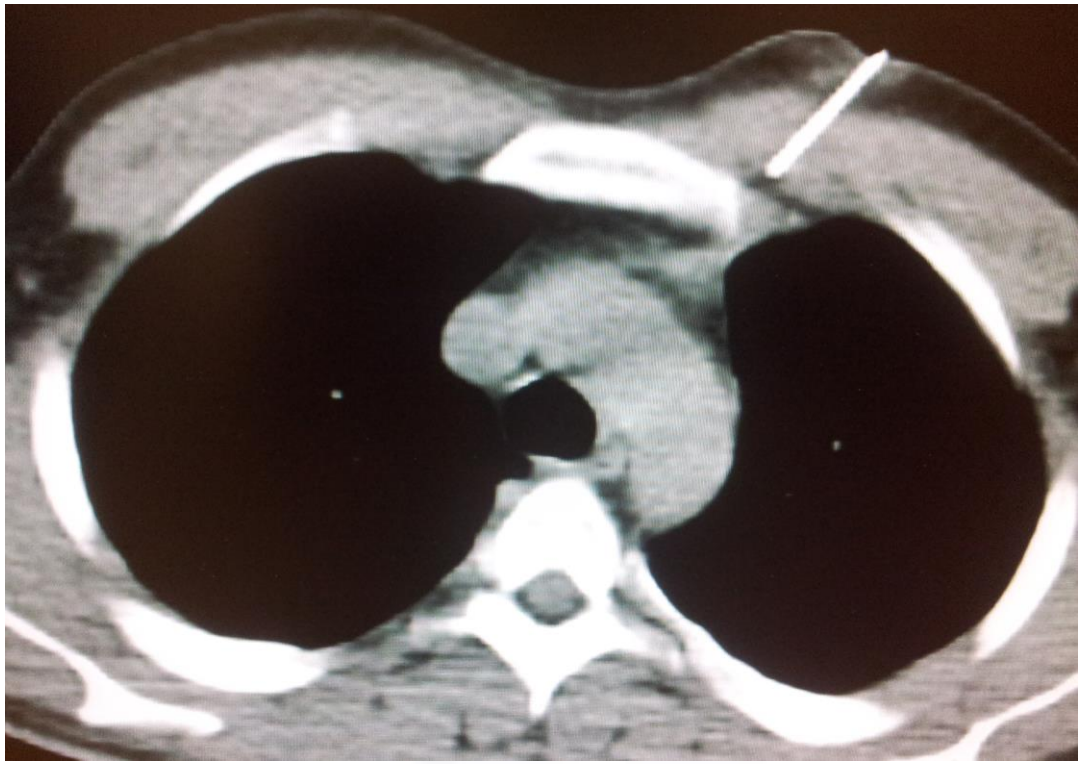
7- Primary & metastatic carcinoma of liver, hepatic hemangioma & other benign tumors

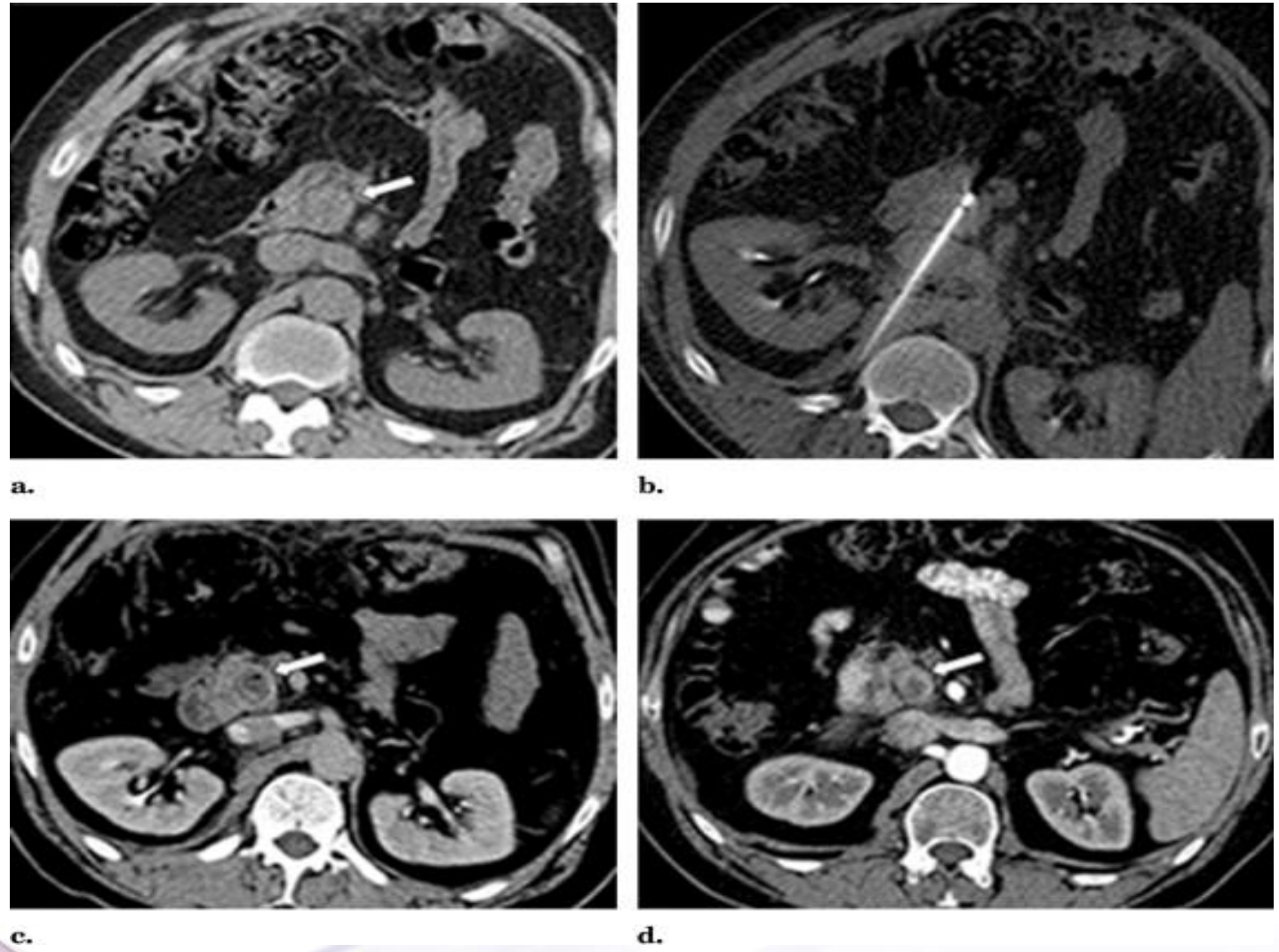
8- primary , metastatic, recurrent, malignant tumors & tumors remaining after surgery on soft tissue

9- lipoma & other tumors

FUTURE OF INTERVENTION IN MANAGEMENT OF COLORECTAL METASTASIS

ROLE OF INSTRUMENTS AND TECHNOLOGIC INNOVATIONS





a. b.

c. d.

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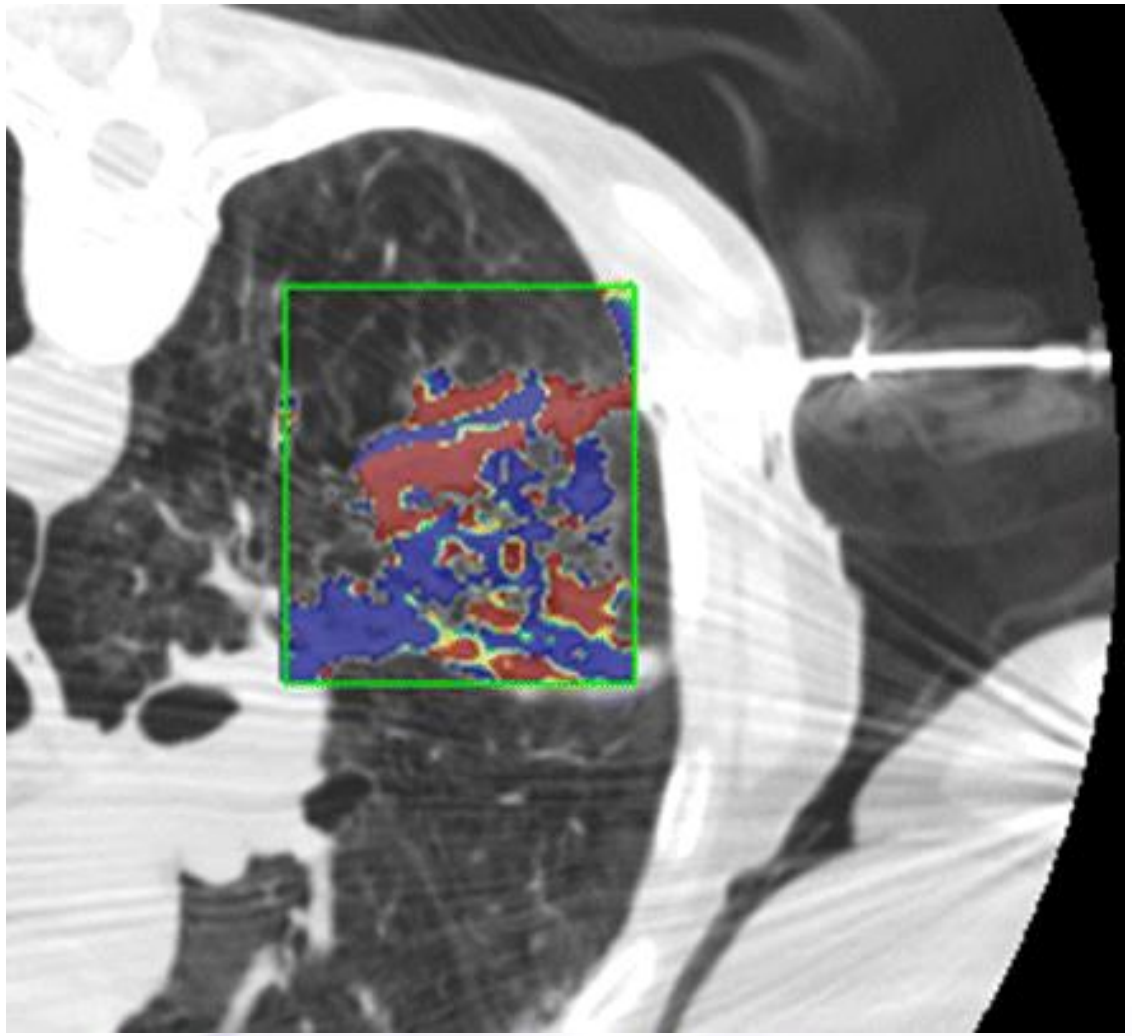

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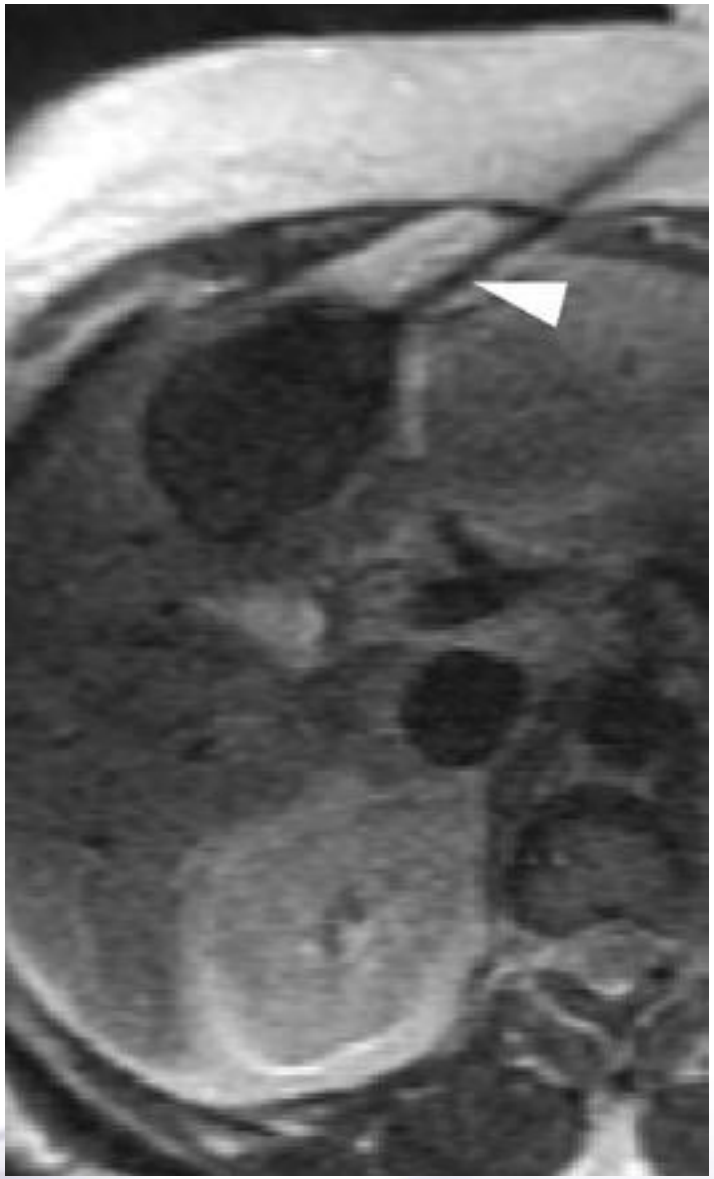

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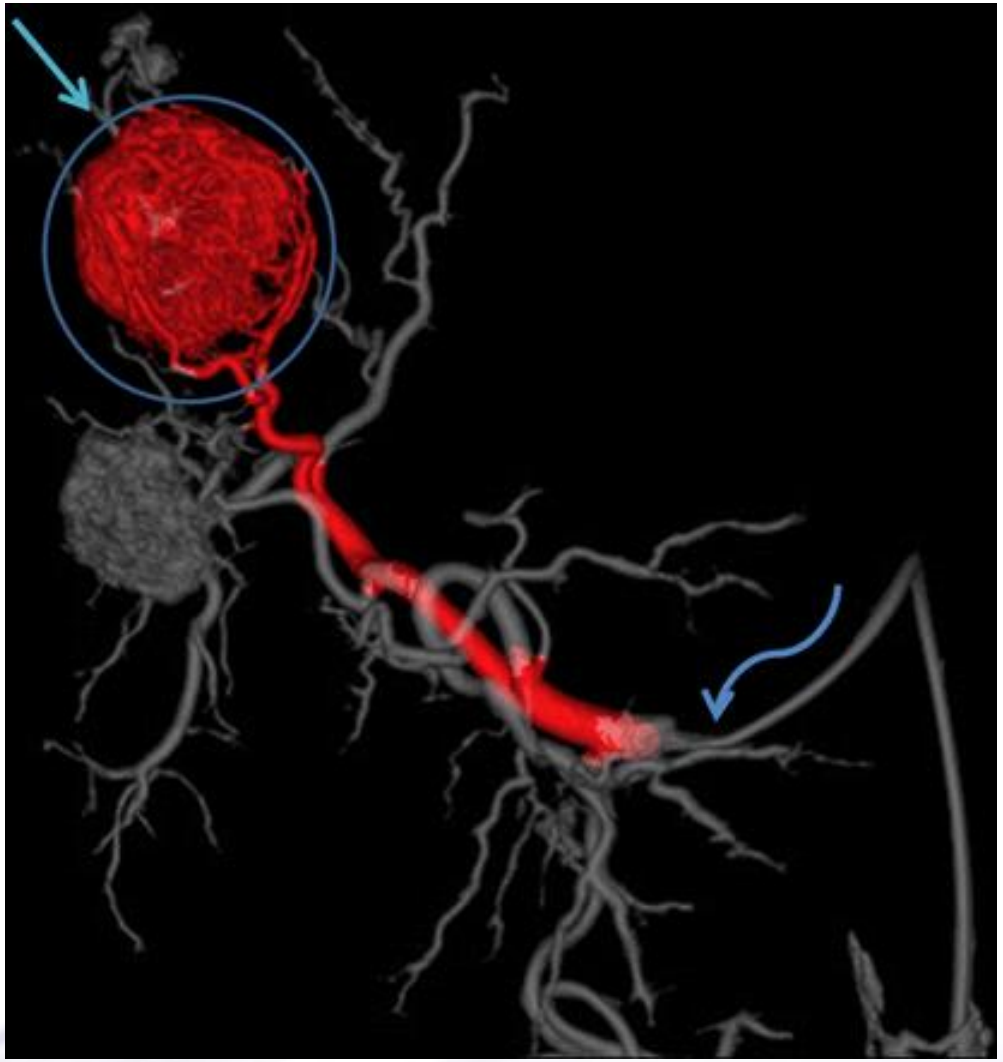

- The antitumor effect mostly comes from radiation rather than embolization.
- The most commonly used radioisotope is Yttrium-90. The commercially available devices are TheraSphere® (glass-based) and SIR-Sphere® (resin-based).
- The procedure is performed on outpatient basis.
- The incidence of complications is generally less than other locoregional therapies and may include nausea, fatigue, abdominal pain, hepatic dysfunction, biliary injury, fibrosis, radiation pneumonitis, gastrointestinal ulcers and vascular injury.
- However, these can be avoided by meticulous pretreatment assessment, careful patient selection and adequate dosimetry. This article focuses on both the technical and clinical aspects of radioembolization with emphasis on patient selection, uses and complications.

Comparison between tace and tare

- Recently, a comparative effectiveness study of radioembolization versus chemoembolization in a cohort of 123 patients (without portal venous thrombosis and/or extrahepatic metastases at baseline) treated with radioembolization and 122 with chemoembolization was published [8].
- The investigators concluded that radioembolization leads to longer time-to-progression and reduced toxicity with similar survival outcomes when compared with chemoembolization.

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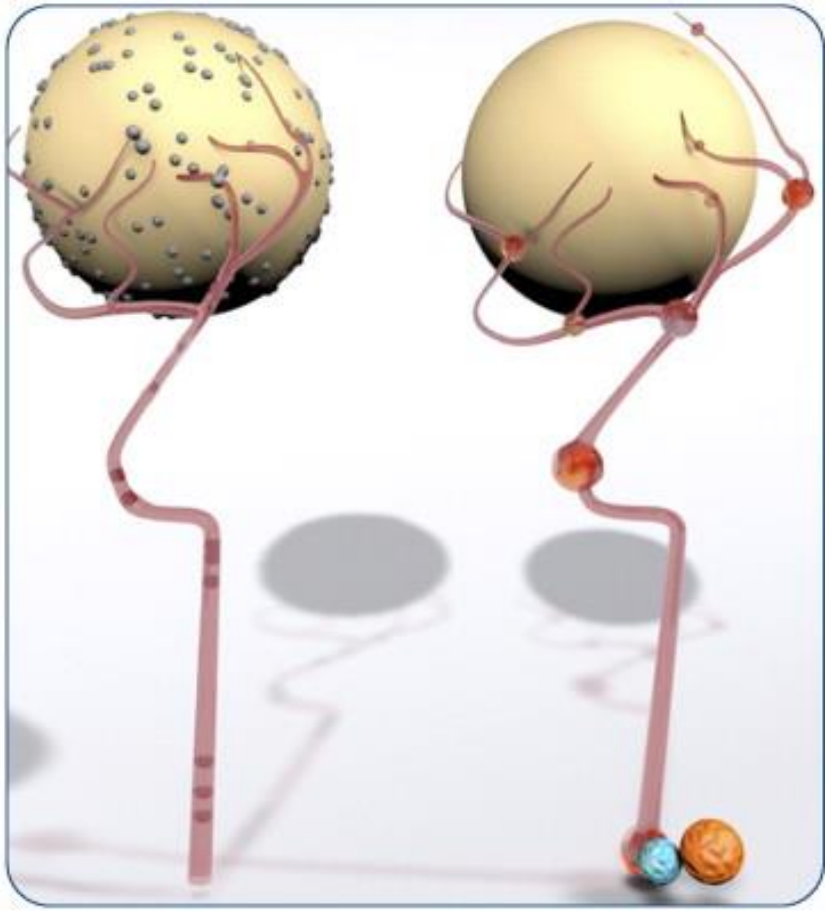

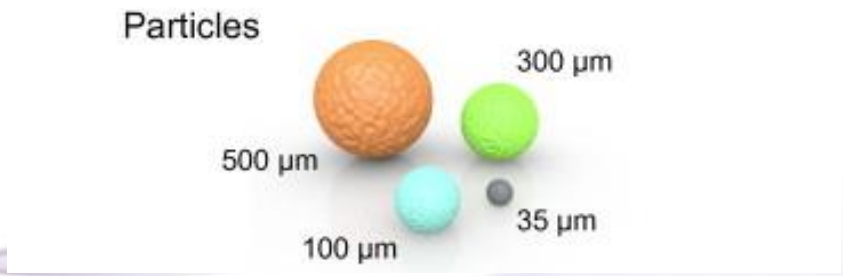

Radioembolization: Technical Aspects

Vascular anatomy of the Liver

- The liver has a dual blood supply (portal vein and hepatic artery).
- The hepatic artery proper is a branch of the common hepatic artery which itself arises from the celiac trunk. This branch divides into the right and left which supply their corresponding hepatic lobes.
- The right hepatic artery also gives off the cystic artery supplying the gall bladder. Interestingly, normal hepatocytes are primarily supplied by portal blood whereas cancer cells are supplied primarily by the hepatic artery .
- This variable blood supply is exploited by intra-arterial therapies and forms the basis for prioritizing the delivery of cytotoxic therapy to the capillary bed of tumor cells via the hepatic arterial route while limiting the exposure to normal hepatocytes.
- Given this fact, very high doses of radiation can be selectively administered to hepatic tumors, with little dose to the surrounding liver.

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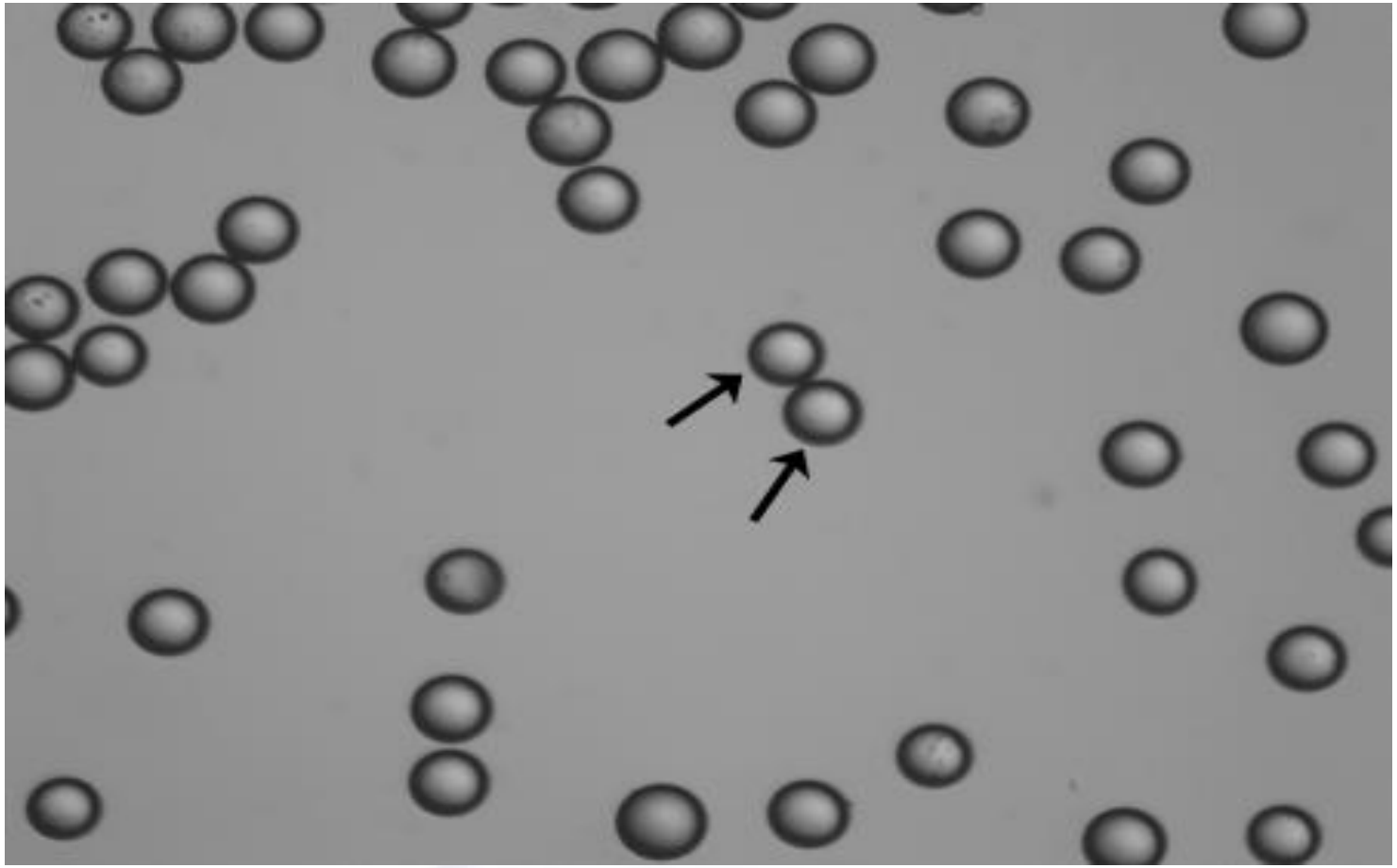


- Incorporation of a high energy β-emitter, such as yttrium-90 (Y90), would create a zone of radiation exposure confined to the vicinity of the tumor while maintaining nontumorous hepatic parenchymal exposure to tolerable levels.

- In clinical practice, millions of microspheres, measuring ~30 μ in diameter incorporating yttrium-90, are injected via an arterial catheter to the hepatic arterial supply of the tumor.
- This technique allows large doses of radiation (200 to 300 Gy) to be given to liver tumors with minimal serious effect on the nontumorous liver.

- The indications for radioembolization are evolving.
- At the time of consider patients with unresectable hepatic primary or metastatic cancer who harbor liver-dominant tumor burden with a life expectancy > 3 months.

Contraindication

Absolute

Exaggerated hepatopulmonary shunting

Propensity for uncorrectable gastrointestinal reflux

Pregnanc

Capecitabine therapy breastfeeding (SIR-Spheres)

Relative

Prior hepatic radiotherapy

Portal vein compromis

Liver failure

Renal failure

Right to left cardiopulmonary shunting

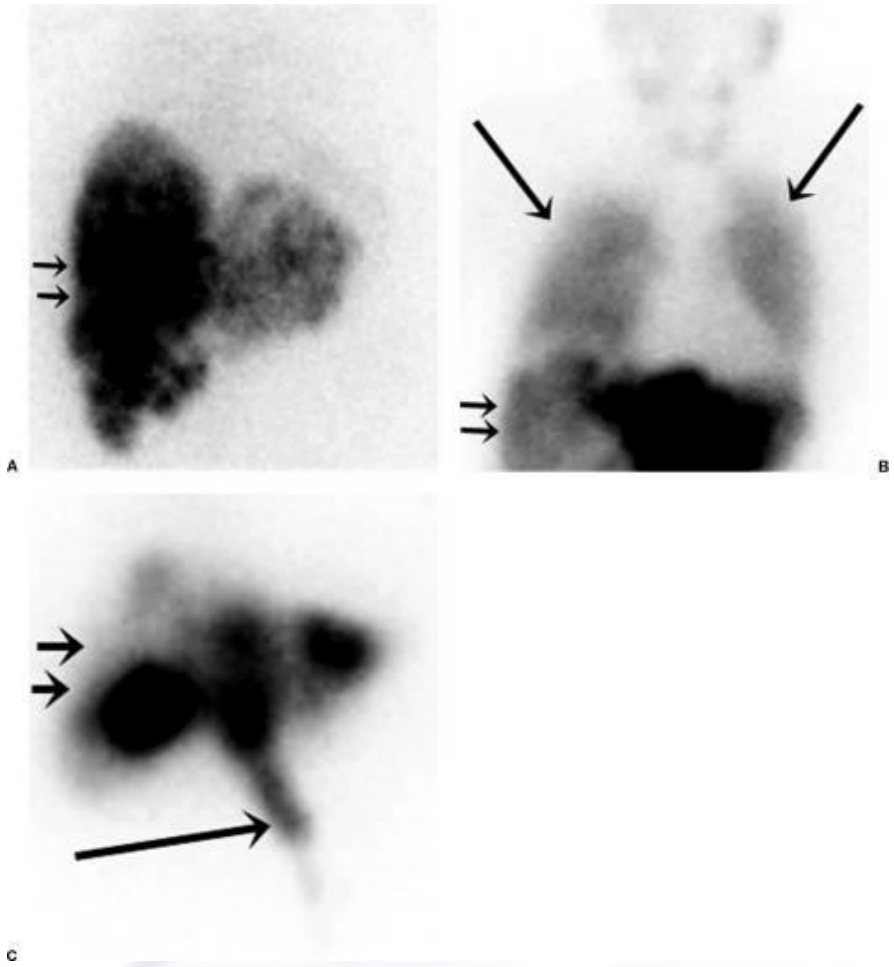
Biliary obstruction

Microspheres injected into the hepatic artery pass through tumor-related arteriovenous shunts and eventually embolize within pulmonary arteriolar branches.

Radioactive microspheres can reach the lungs causing clinically significant radiation pneumonitis if the magnitude of shunting is large.

Maintenance of lung exposure below a mean dose of 30 Gy has been demonstrated in clinical practice to avoid this complication.

The likelihood of developing this complication fortunately can be detected before definitive treatment by utilizing technetium 99m (Tc99m) macroaggregate albumin (MAA) as a surrogate that mimics the distribution of the Y90 microspheres


A
B
C

THERAPY PLANNING

- Serum chemical analyses are also performed to evaluate hepatic and renal function
- Treatment with Y90 microspheres must be based on cross-sectional images and arteriograms in the individual patient.
- The workup should include computed tomography (CT) or magnetic resonance (MR) imaging of the liver for assessment of tumoral and nontumoral volume, portal vein patency, and extent of extrahepatic disease.

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- Solitary or multiple lesions distributed in a lobe or both lobes can be treated with single and multiple microsphere treatments successfully. Nomenclature for the current convention for whole liver treatment by first treating one lobe and then the other in 4 to 6 weeks is termed "sequential" or "lobar" delivery, as opposed to both lobes treated at one setting, termed "whole liver delivery" in the absence of a lobectomy

- The current practice is to allow a 4- to 6-week interval between infusions if treatment was intended to be delivered sequentially to allow for resolution of any treatment-related toxicities.

Procedure

- Conventional catheter systems utilized for hepatic arteriography (including large inner diameter microcatheters) are utilized for Y90 radioembolization

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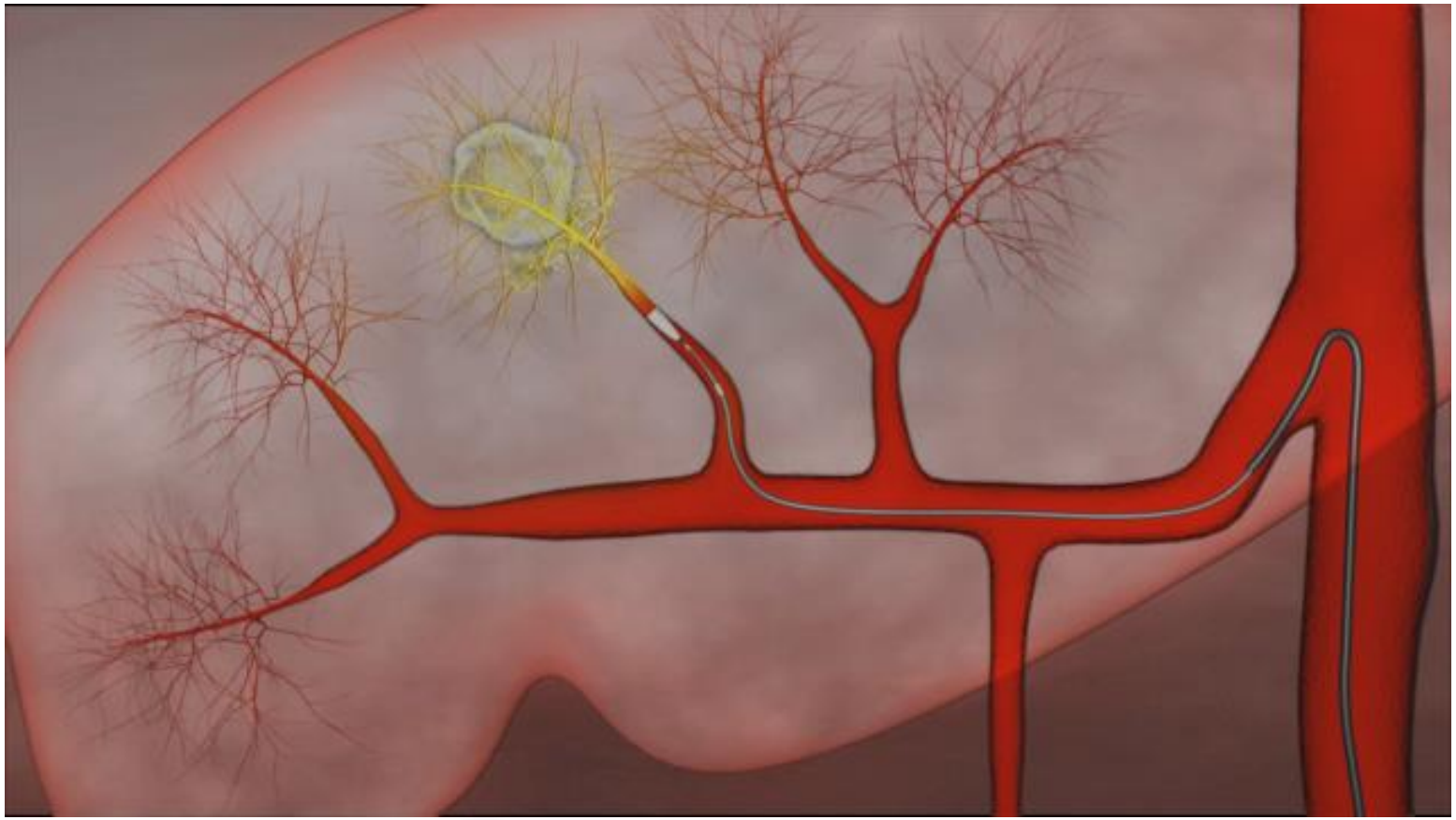
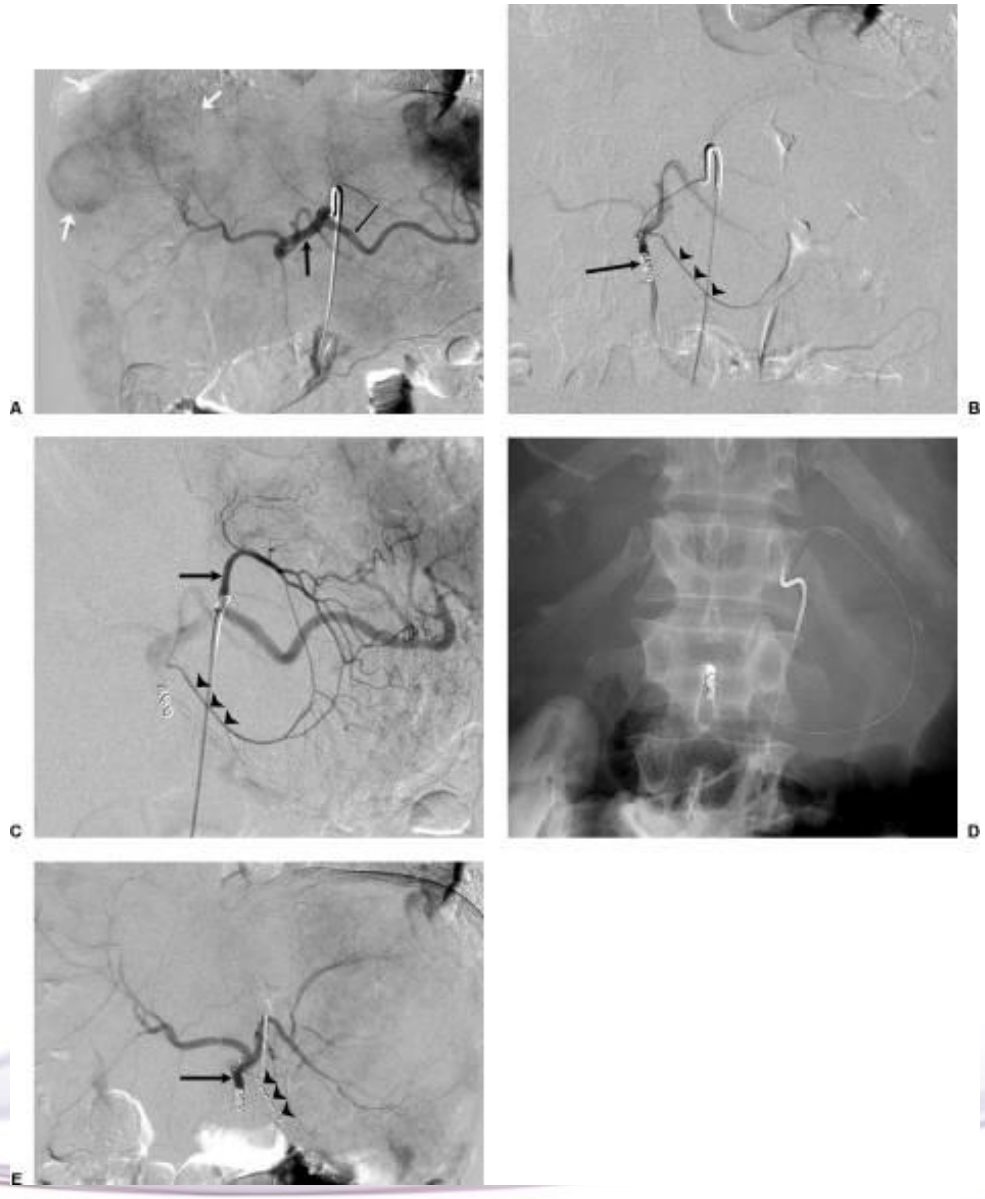


Pretreatment Angiography

- TARE requires pretreatment aortic, superior mesenteric, and celiac trunk angiography to accurately assess the hepatic vasculature, surrounding structures, portal vein patency, and the presence of arterioportal shunting

- . In addition, angiography determines the presence of extrahepatic blood flow to other organs; microspheres injected through these nontarget vessels may result in adverse events.
- Coil embolization of nontarget vessels may be performed but is no longer routinely recommended

- Arteriography is essential to map the hepatic arterial supply from the celiac and the superior mesenteric artery, and it is the single most important test to mitigate gastrointestinal complications
- Once identified, these gastrointestinal tract arteries are coil embolized to ensure prevention of reflux of microspheres into the gut.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- The delivery of the radioactive microspheres is based on the principle of fluid displacement and suspension of the particles in the infusate that created the displacement per se.


PHILIPS
86
62
183/88 (113)
NUCLEAIRE GENEESKUNDE
a. ^{90}Y-injection

- The device-specific proprietary infusion kits protect the operator by separating him or her from the radiotherapy source and are directly connected to the hepatic arterial catheter. The difference in specific gravity influences the relative pressure required to suspend and eject the microspheres from the vial (i.e., more for glass microspheres).

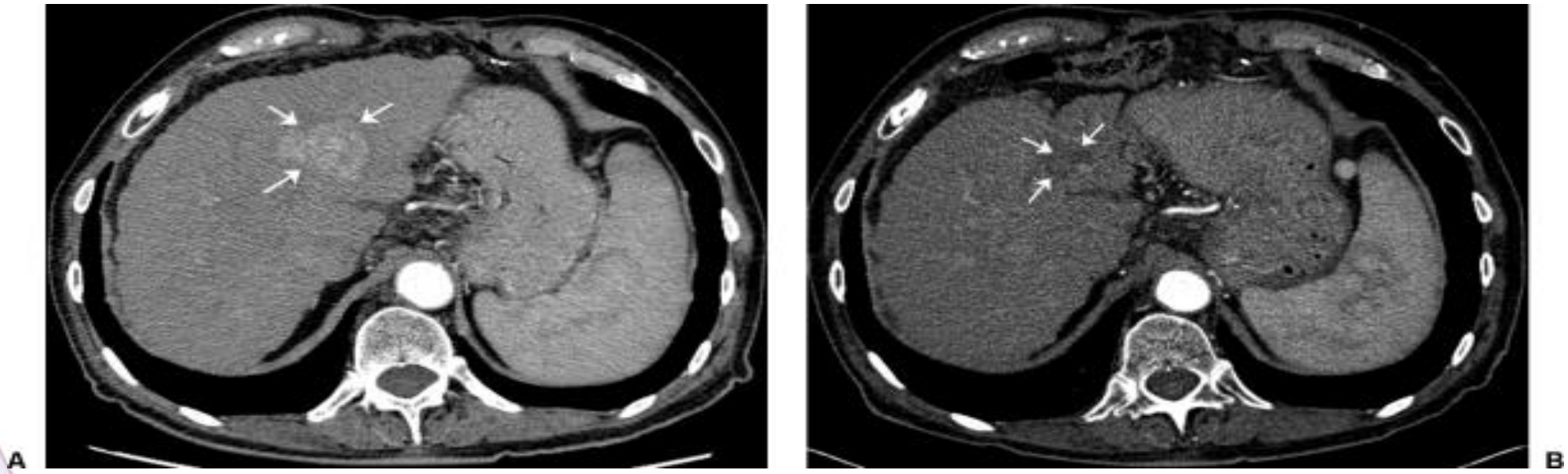
- The delivery kit of the resin microsphere allows for the injection of contrast alternating with the microspheres to determine the appropriate endpoint for microsphere delivery.

POST PROCEDURE EVALUATION

- Patients are usually seen in the clinic weekly or every 2 weeks for a month and then once every month. At the time of clinic visits complete blood count, serum tumor markers, and liver function tests are assayed. Cross-sectional imaging with CT/MRI is performed between 60 and 90 days following treatment to avoid attenuation changes of the hepatic parenchyma to be interpreted erroneously as progression.

hepatic metastatic colorectal cancer refractory to oxaliplatin and irinotecan chemotherapy

after a 2-year follow-up period



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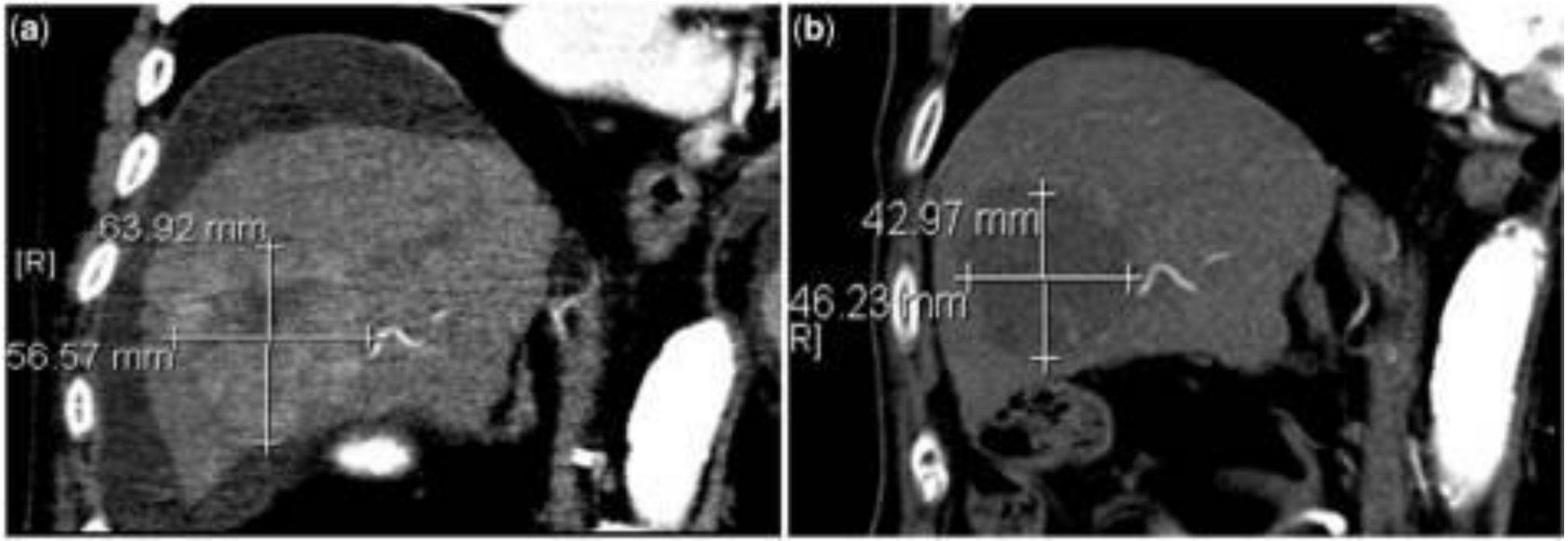
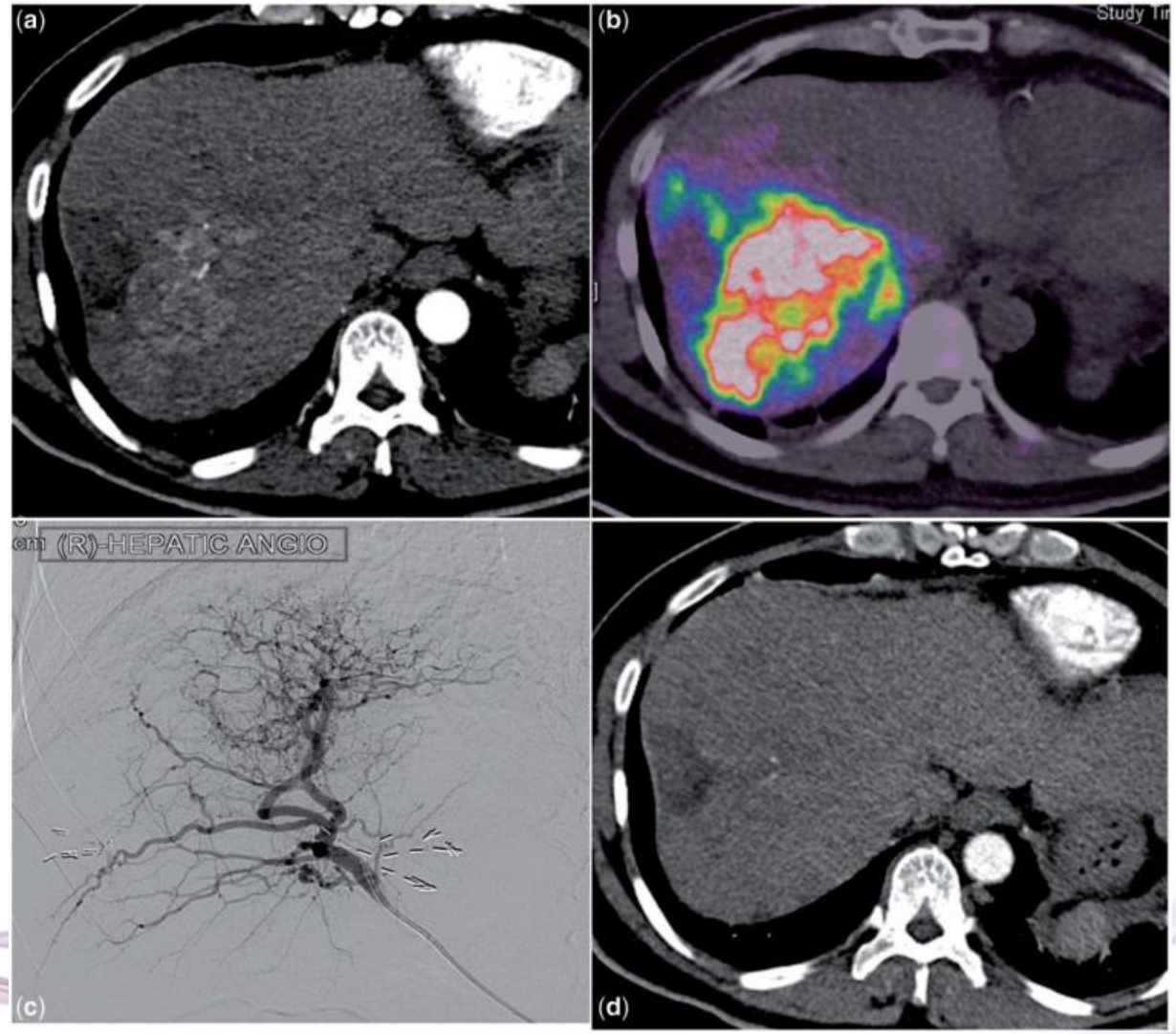
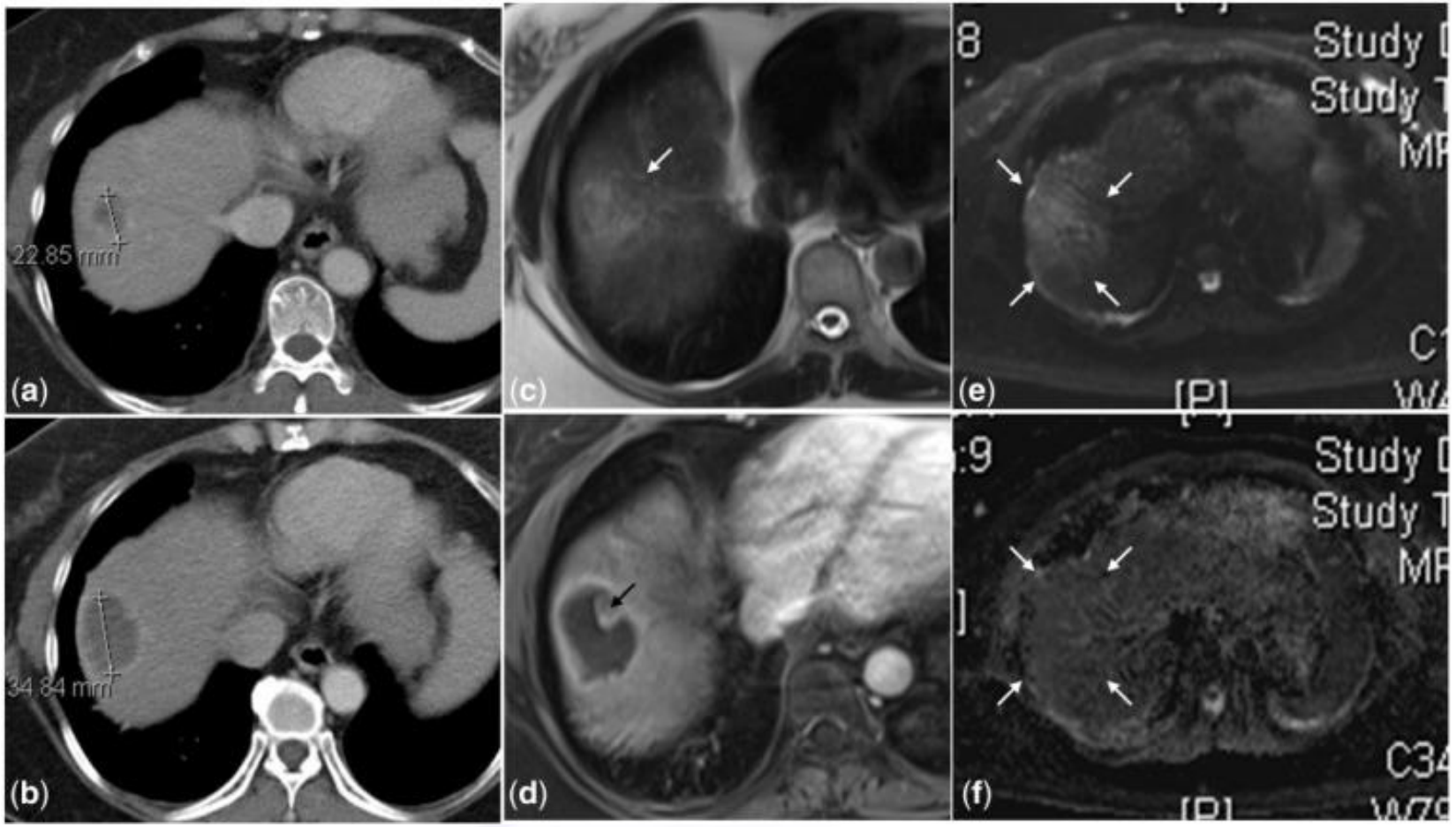

(a)
63.92 mm
[R]
56.57 mm
(b)
42.97 mm
46.23 mm
R]

Local recurrence of a previously resected, poorly differentiated hepatoma



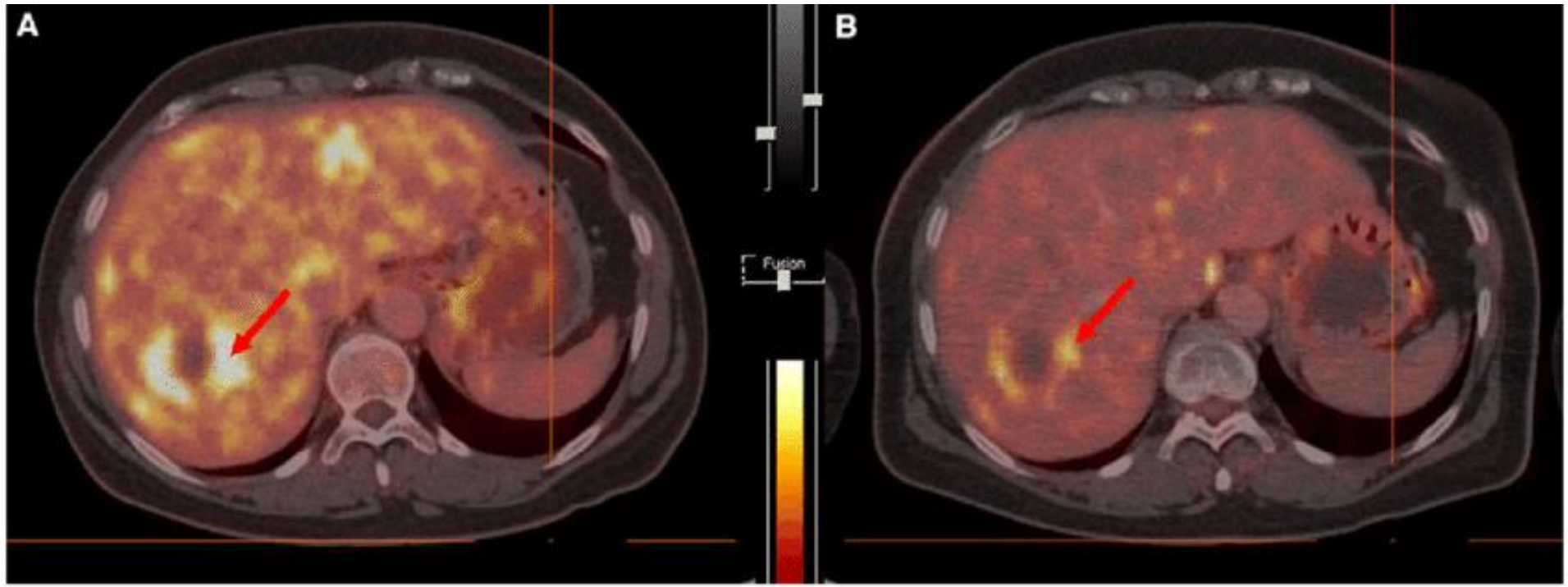


hypodense at 1 month after TARE

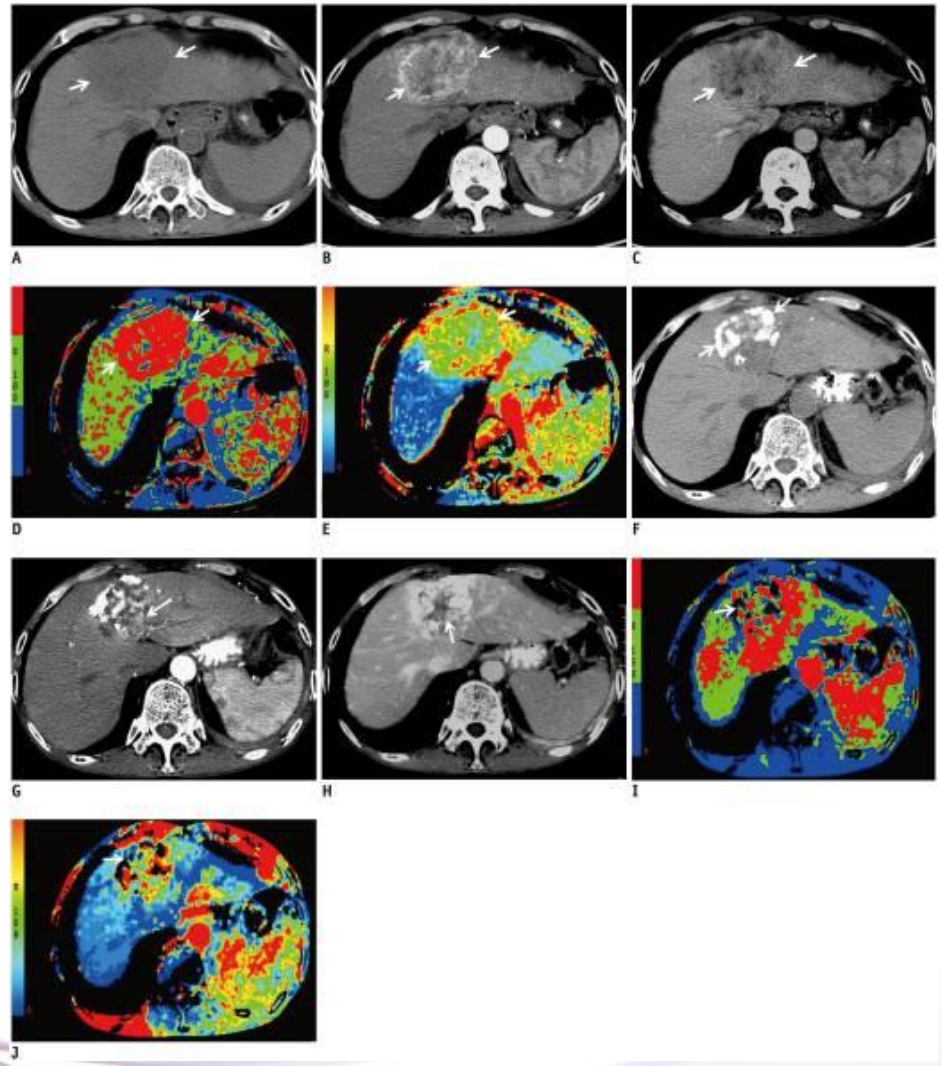
MRI depicts an eccentric solid nodule

absence of any residual disease

PET



PERFUSION IMAGING



complications

- transient mild to moderate fatigue and abdominal pain
- Nausea and vomiting
- harbinger for gastrointestinal ulceration
- Radiation pneumonitis
- Gallbladder wall edema
- Radiation-induced liver disease

Post-Radioembolization Syndrome

- fatigue,
- nausea
- /vomiting,
- abdominal pain
- /discomfort, and/
- or cachexia.
- PRS is less severe than that observed after embolic therapies.

CONCLUSION

- Radioembolization is being employed for treatment of various hepatic malignancies. As with any other common therapy, knowledge of potential complications of this therapy is essential.
- It’s success rate is very highwith around 60% cure .
- Selecting appropriate patients using a multidisciplinary approach can improve outcomes and decrease complications.
- Meticulous pre-treatment planning (angiography and ^{99m}Tc-MAA scintigraphic imaging) is necessary to minimize side effects of radioembolization.
- The incidence of complications that may require intervention is low.

با تشکر از توجه شما

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