Dr. Niranjan KHANDELWAL

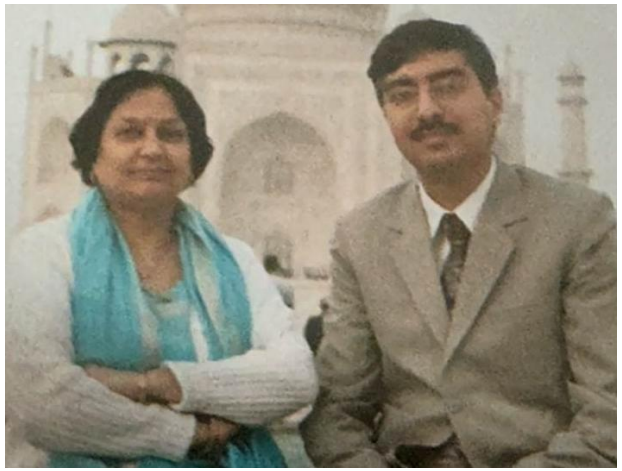
Dr. Niranjan KHANDELWAL
Recognition of Academic Excellence (RAE)

Interventional Radiology

- Former Head, Department of Radiodiagnosis, PGIMER, Chandigarh
- Dr Khandelwal is a world-renowned Neuroradiologist who developed Neurointerventions in India, started the first DM course in Neurointerventional Radiology in India
- He was instrumental in setting up the first Interventional Radiology OPD services in the public sector in India and the first DM course in Interventional Radiology in India
- 345 publications, 6 books, 43 book chapters

Work Institution since 1998

1998 till date, Senior Resident and Faculty Position


My Guide & Mentors

Locoregional Therapy in Hepatocellular Carcinoma:Target,Treat and Triumph

Naveen Kalra

Professor

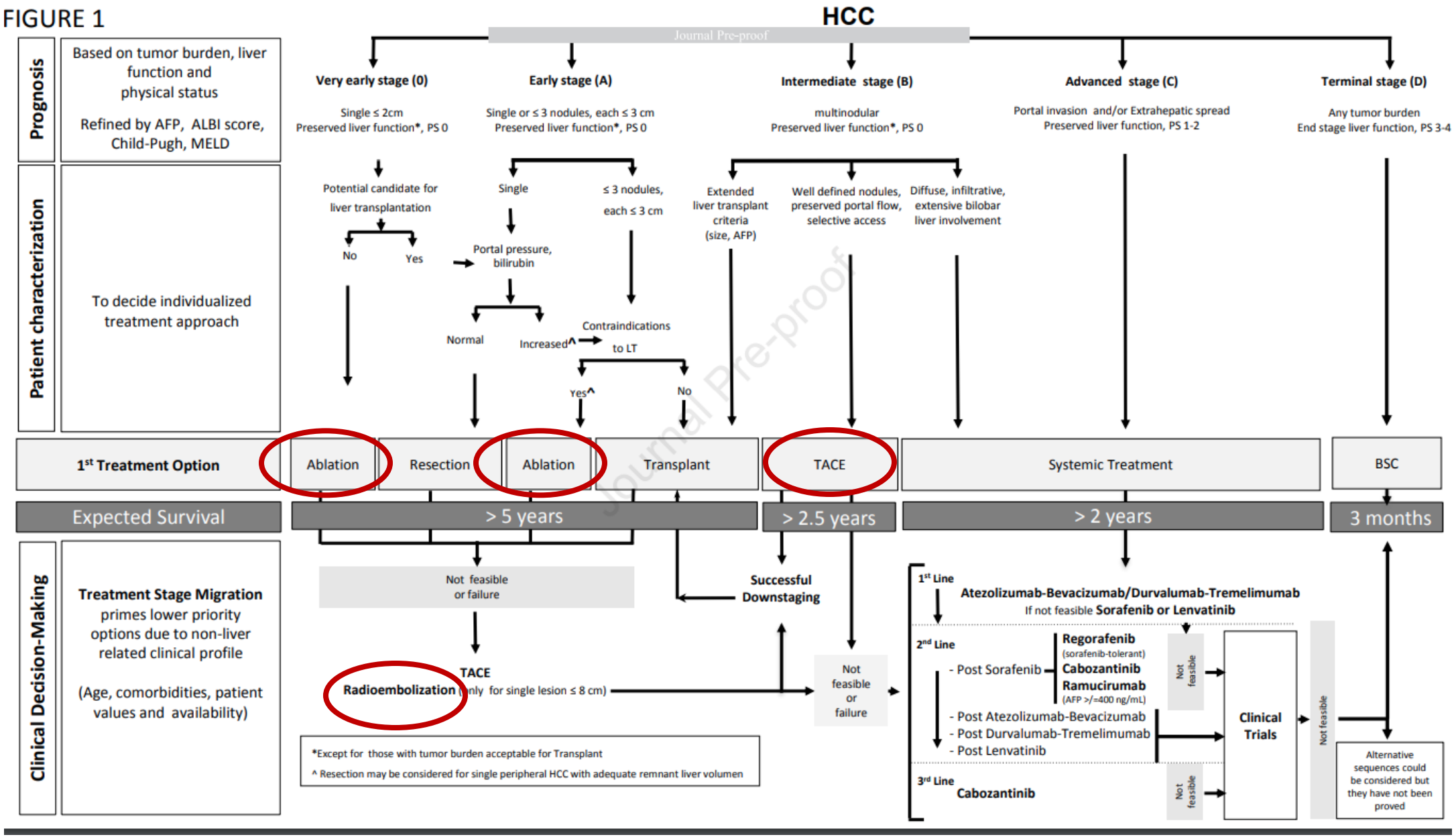
Department of Radiodiagnosis

PGIMER,Chandigarh

Introduction

- Surgery is the treatment of choice for hepatocellular carcinoma (HCC)
- 70%-90% are unsuitable for surgery due to extensive intrahepatic tumor involvement, extrahepatic disease and poor liver reserve
- Ablations, transarterial chemoembolization (TACE) and transarterial radioembolization (TARE) are common locoregional therapies in HCC

FIGURE 1



BCLC Staging System 2022

Indian College of Radiology and Imaging Guidelines on Interventions in Hepatocellular Carcinoma

Pankaj Gupta[1] Naveen Kalra[1] Sreedhara B. Chaluvashetty[1] Shivanand Gamangatti[2]
Amar Mukund[3] Razik Abdul[2] VS Shyam[3] Sanjay Saran Baijal[4] Chander Mohan[5]

[1] Department of Radiodiagnosis and Imaging, Postgraduate Institute of Medical Education and Research, Chandigarh, India
[2] Department of Radiodiagnosis, AIIMS, New Delhi, India
[3] Department of Interventional Radiology, ILBS, New Delhi, India

Address for correspondence Naveen Kalra, MD, MAMS, FICR, Department of Radiodiagnosis and Imaging, Postgraduate Institute of Medical Education and Research, Sector 12, Chandigarh 160012, India (e-mail: navkal2004@yahoo.com).

Indian J Radiol Imaging 2022;32:540–554

Indian Society of Vascular and Interventional Radiology Expert Consensus Statements for Ablation in Hepatocellular Carcinoma: Part I

Pankaj Gupta[1,] Naveen Kalra[1] Shyamkumar N. Keshava[2] Sreedhara B. Chaluvashetty[1]
Amar Mukund[3] Shuvro H. Roy-Choudhury[4] Sanjay Saran Baijal[5] Anubhav Khandelwal[5]
Venkatesh Hosur Ananthashayana[3] Sathya Narayanan R.[2] Suyash Kulkarni[6] Nitin Sudhakar Shetty[6]
Arun Gupta[7] Sanjay Gupta[8]

J Clin Interv Radiol ISVIR:2020;4:98–106

Indian Society of Vascular and Interventional Radiology Expert Consensus Statements for Ablation in Hepatocellular Carcinoma: Part II

Pankaj Gupta[1,] Shyamkumar N. Keshava[2] Naveen Kalra[1] Sreedhara B. Chaluvashetty[1]
Amar Mukund[3] Shuvro H. Roy-Choudhury[4] Sanjay Saran Baijal[5] Anubhav Khandelwal[5]
Venkatesh Hosur Ananthashayana[3] Sathya Narayanan R.[2] Suyash S. Kulkarni[6,7] Nitin Sudhakar Shetty[6,7]
Arun Gupta[8] Sanjay Gupta[9]

[1] Department of Radiodiagnosis and Imaging, Postgraduate Institute of Medical Education and Research, Chandigarh, India
[2] Department of Interventional Radiology, Division of Clinical Radiology, Christian Medical College, Vellore, Tamil Nadu, India

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J Clin Interv Radiol ISVIR:2020;4:175–183

INASL Guidelines

Clinical Practice Guidelines

JOURNAL OF **CLINICAL** AND **EXPERIMENTAL HEPATOLOGY**

2019 Update of Indian National Association for Study of the Liver Consensus on Prevention, Diagnosis, and Management of Hepatocellular Carcinoma in India: The Puri II Recommendations

Ashish Kumar [*], Subrat K. Acharya [†], Shivaram P. Singh [‡], Anil Arora [*], Radha K. Dhiman [§], Rakesh Aggarwal [‖], Anil C. Anand [¶], Prashant Bhangui [#], Yogesh K. Chawla [**], Siddhartha Datta Gupta [††], Vinod K. Dixit [‡‡], Ajay Duseja [§], Naveen Kalra [§§], Premashish Kar [‖‖], Suyash S. Kulkarni [¶¶], Rakesh Kumar [##], Manoj Kumar [***], Ram Madhavan [†††], V. G. Mohan Prasad [‡‡‡], Amar Mukund [§§§], Aabha Nagral [‖‖‖], Dipanjan Panda [¶¶¶], Shashi B. Paul [###], Padaki N. Rao [****], Mohamed Rela [††††], Manoj K. Sahu [‡‡‡‡], Vivek A. Saraswat [‖], Samir R. Shah [‖‖‖], Shalimar [§§§§], Praveen Sharma [*], Sunil Taneja [§], Manav Wadhawan [‖‖‖‖] The INASL Task-Force on Hepatocellular Carcinoma

J Clin Exp Hepatol 2020;10:43-80

Practice Guidelines

JOURNAL OF **CLINICAL** AND **EXPERIMENTAL HEPATOLOGY**

2023 Update of Indian National Association for Study of the Liver Consensus on Management of Intermediate and Advanced Hepatocellular Carcinoma: The Puri III Recommendations

Ashish Kumar [*], Subrat K. Acharya [†], Shivaram P. Singh [‡], Ajay Duseja [§], Kaushal Madan [‖], Akash Shukla [¶], Anil Arora [*], Anil C. Anand [#], Ankur Bahl [**], Arvinder S. Soin [††], Bhawna Sirohi [‡‡], Debnarayan Dutta [§§], Dinesh Jothimani [‖], Dipanjan Panda [¶¶], Gagan Saini [##], Joy Varghese [***], Karan Kumar [†††], Madhumita Premkumar [§], Manas K. Panigrahi [‡‡‡], Manav Wadhawan [§§§], Manoj K. Sahu [‖], Mohamed Rela [¶¶¶], Naveen Kalra [###], Padaki N. Rao [****], Pankaj Puri [††††], Prashant Bhangui [††], Premashis Kar [‡‡‡‡], Samir R. Shah [§§§§], Sanjay S. Baijal [‖‖], Shalimar [¶¶¶¶], Shashi B. Paul [####], Shivanand Gamanagatti [†††††], Subash Gupta [*****], Sunil Taneja [§], Vivek A. Saraswat [‡‡‡‡‡], Yogesh K. Chawla [#]

J Clin Exp Hepatol 2024;14:101269

Indian National Association for Study of the Liver (INASL) Task Force

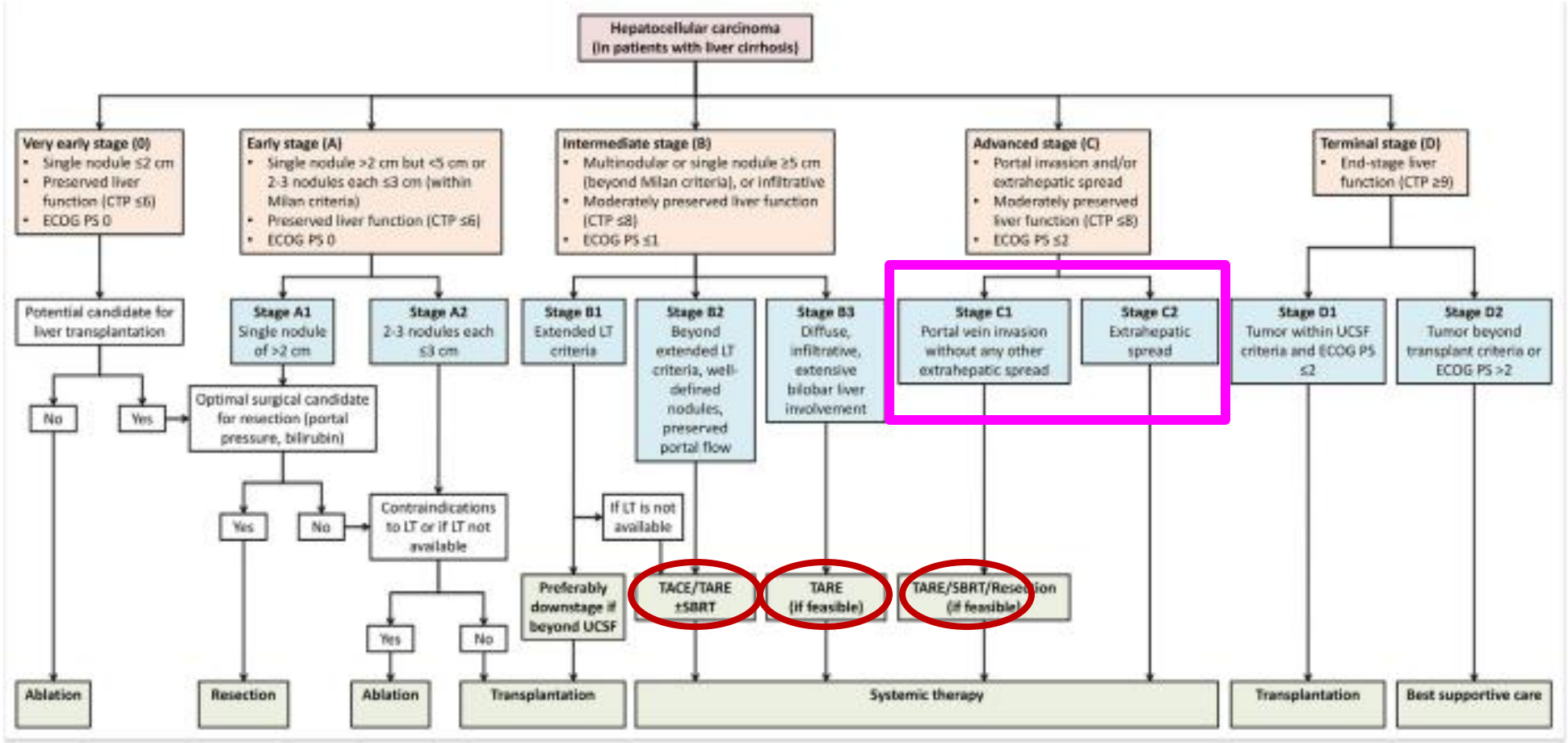
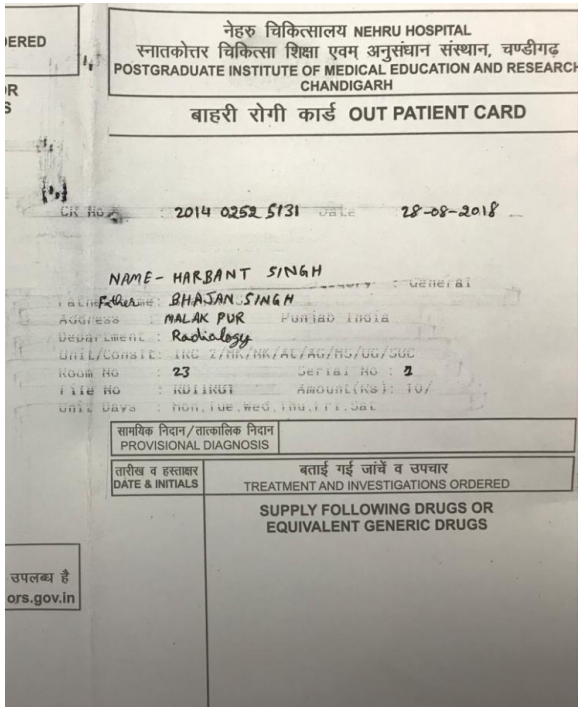


Figure 1 The 'INASL modification of BCLC staging' (INASL-BCLC) for prognosis prediction and treatment of HCC. BCLC, Barcelona Clinic Liver Cancer; HCC, Hepatocellular carcinoma; INASL-BCLC, Indian National Association for the Study of the Liver modification of BCLC

Use of Y90 TARE for stage B2 should be individualized; Use for B3 and C1 stage

J Clin Exp Hepatol 2024;14:101269



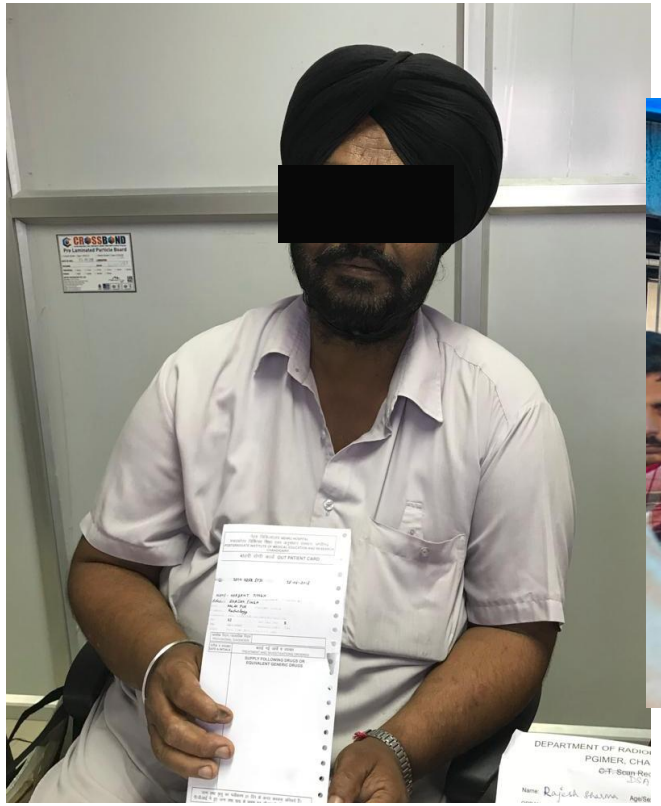
नेहरु चिकित्सालय NEHRU HOSPITAL
स्नातकोत्तर चिकित्सा शिक्षा एवम् अनुसंधान संस्थान, चण्डीगढ़
POSTGRADUATE INSTITUTE OF MEDICAL EDUCATION AND RESEARCH
CHANDIGARH

बाहरी रोगी कार्ड OUT PATIENT CARD

OR NO : 2014 0252 5131 Date : 28-08-2018

NAME- HARBANT SINGH
Father's Name : BHAJAN SINGH
Address : MALAK PUR Punjab India
Department : Radiology
Unit/Consult : IRC 2/HK/HK/AL/AD/RD/GD/SDC
Room No : 23 Serial No : 2
File No : RD11R01 Amount(Rs) : 10/-
Unit Days : Mon,Tue,Wed,Thu,Fri,Sat

सामयिक निदान/तात्कालिक निदान PROVISIONAL DIAGNOSIS	
तारीख व हस्ताक्षर DATE & INITIALS	बताई गई जांचें व उपचार TREATMENT AND INVESTIGATIONS ORDERED
	SUPPLY FOLLOWING DRUGS OR EQUIVALENT GENERIC DRUGS

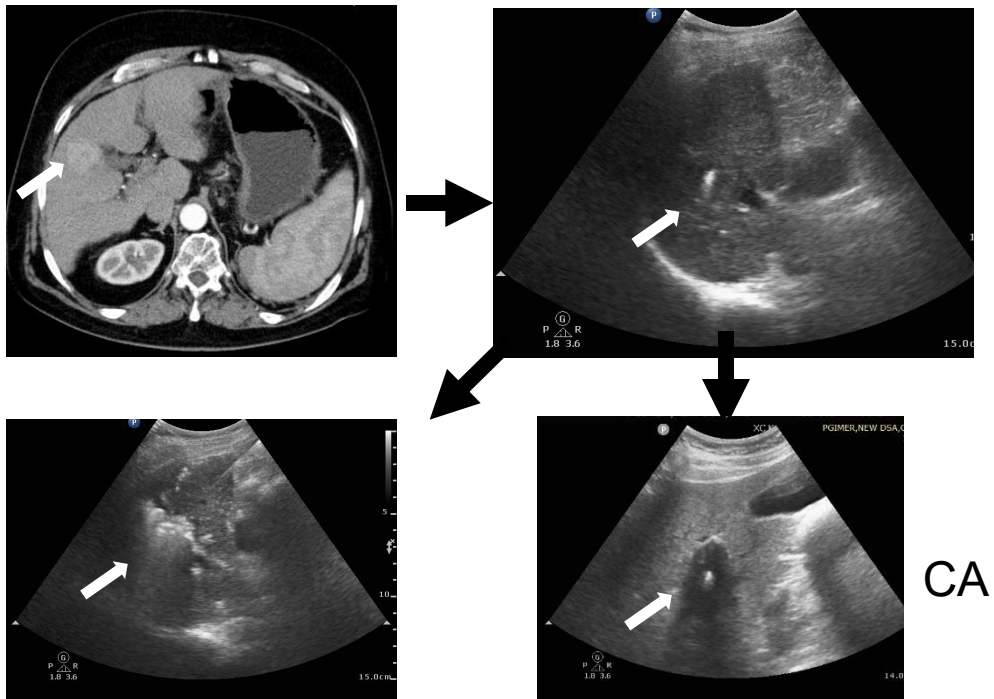


- IR Clinic on two days in a week:
  Monday and Friday
- Longitudinal care to our patients

- 28th September, 2018
- IR Clinic Foundation Day
- First IR Clinic in a public institution

Ablative Therapies

- Ablation involves the use of chemicals, thermal or non-thermal energy delivered via electrodes directly to the tumor to achieve necrosis



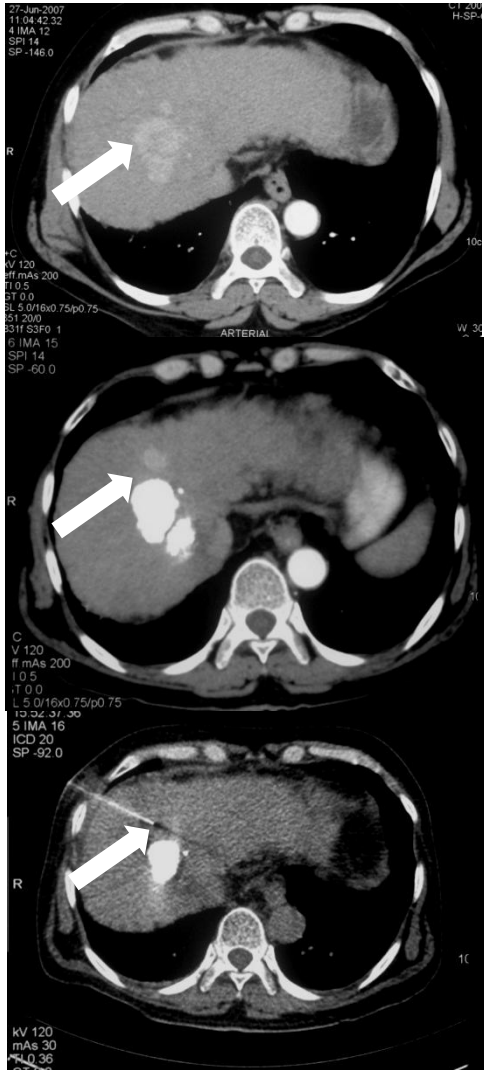
RFA/ MWA

CA

- Chemical Ablation
  -Ethanol
- Thermal Ablation
  -Radiofrequency ablation (RFA)
  -Microwave ablation (MWA)
  -Cryoablation (CA) (first time in India)
- Nonchemical Nonthermal Ablation
  -Irreversible electroporation (IRE) (first time in India)

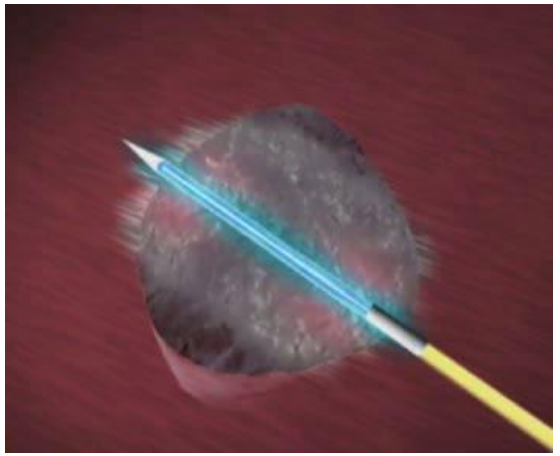
Percutaneous Ethanol Injection (PEI)

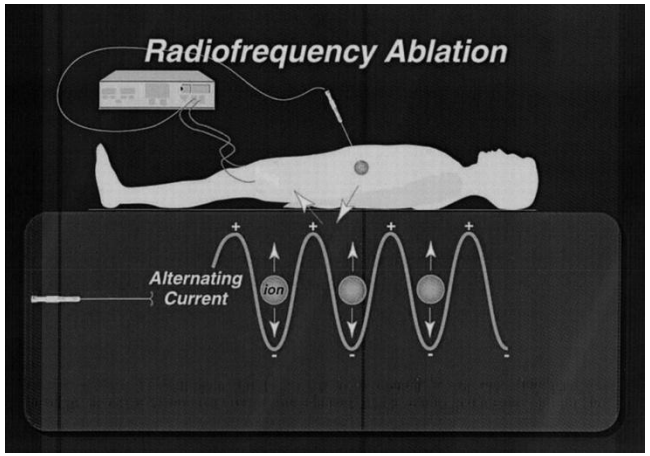
- Seminal technique, 95% ethanol is injected by a non-cutting needle introduced directly into tumor under US/CT guidance
- Nonselective intracellular protein denaturation and cellular dehydration causes coagulative necrosis
- Small vessel thrombosis leads to ischemic tumor necrosis
- Local recurrence rate is high

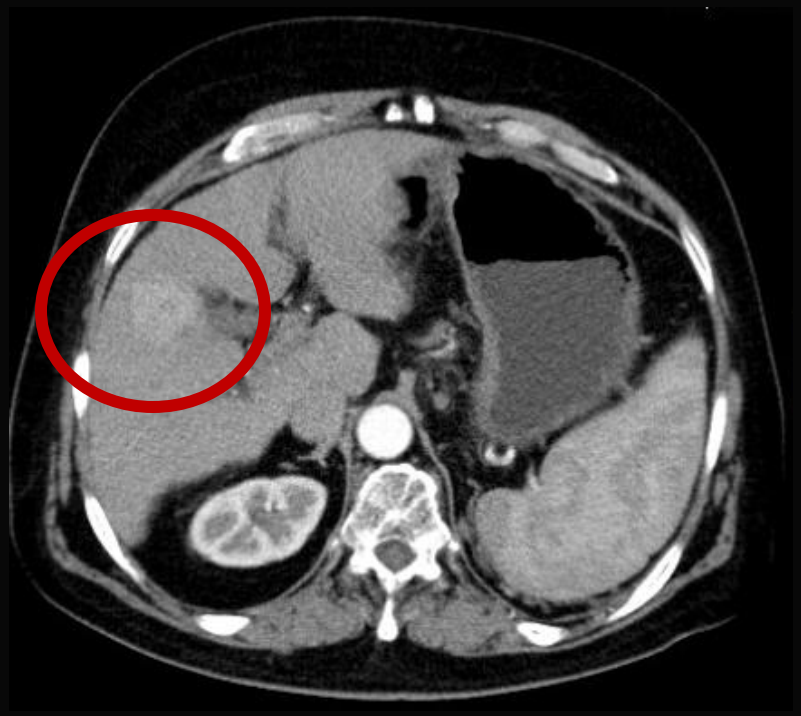


Radiofrequency Ablation (RFA)

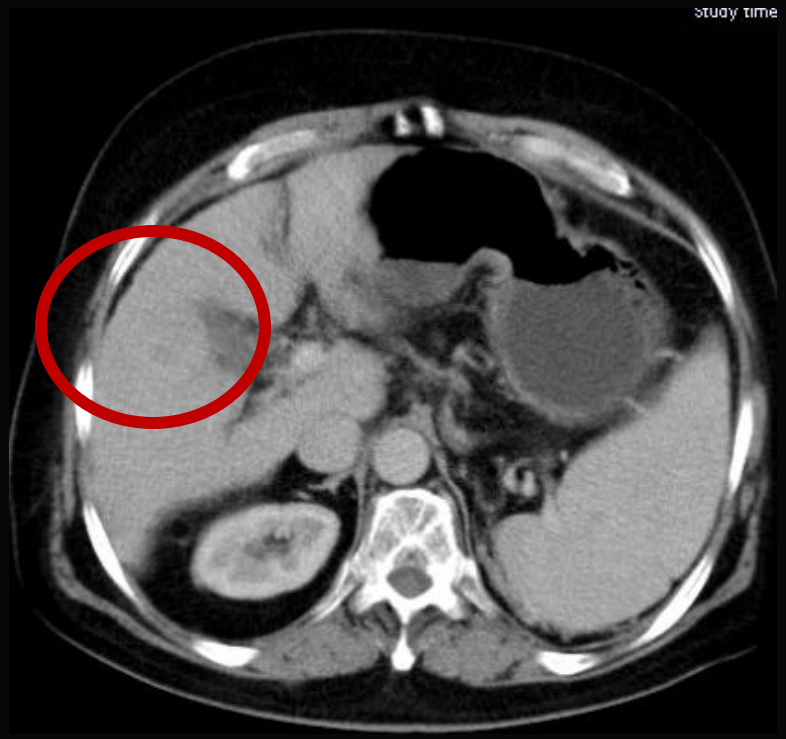
- High frequency alternating current is passed into target tissue from electrode tip
- Cellular heating due to frictional heat after rapid oscillation of ions occurs
- No significant difference for RFA and resection between 1- and 3-year overall survival, recurrence free survival and disease free survival but 5-year survival is lower with RFA
- Suffers from heat sink effect







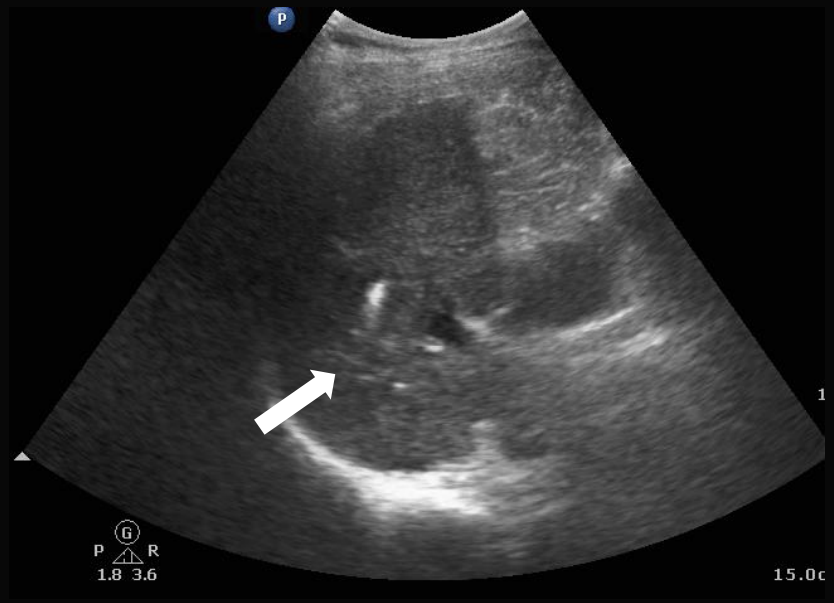
Arterial Phase



Venous Phase

65-year-old male
HCV +

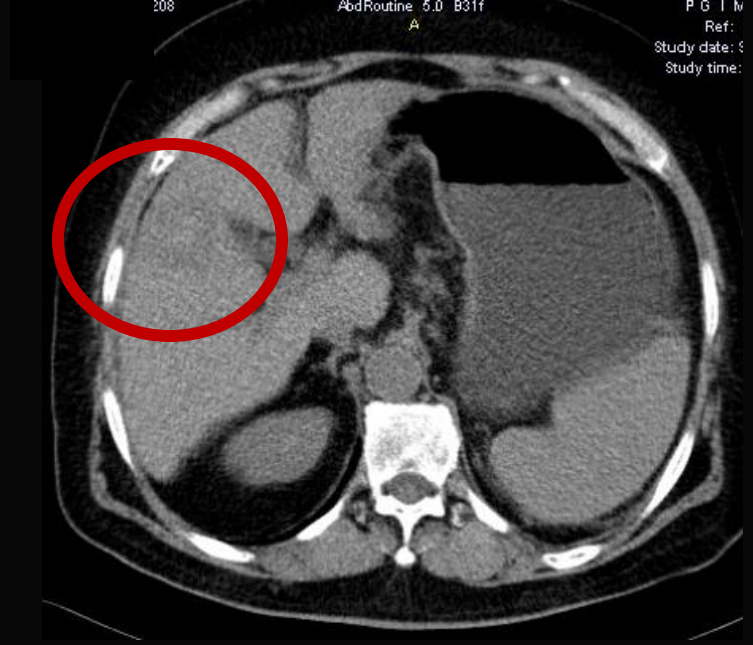

5
10
15.0cm
1.8 3.6


1.8 3.6

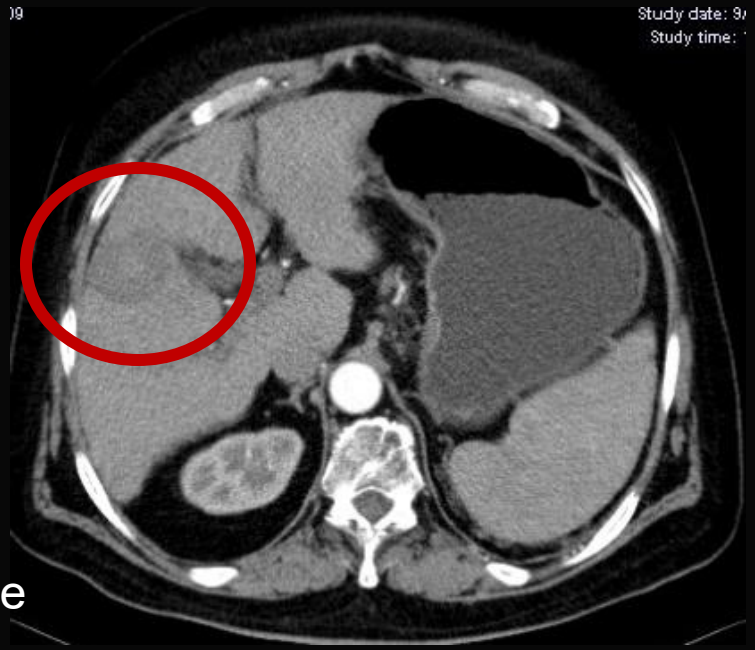

ength 3.00 cm
5
10
15.0cm
1.8 3.6


5
10
15.0cm
1.8 3.6

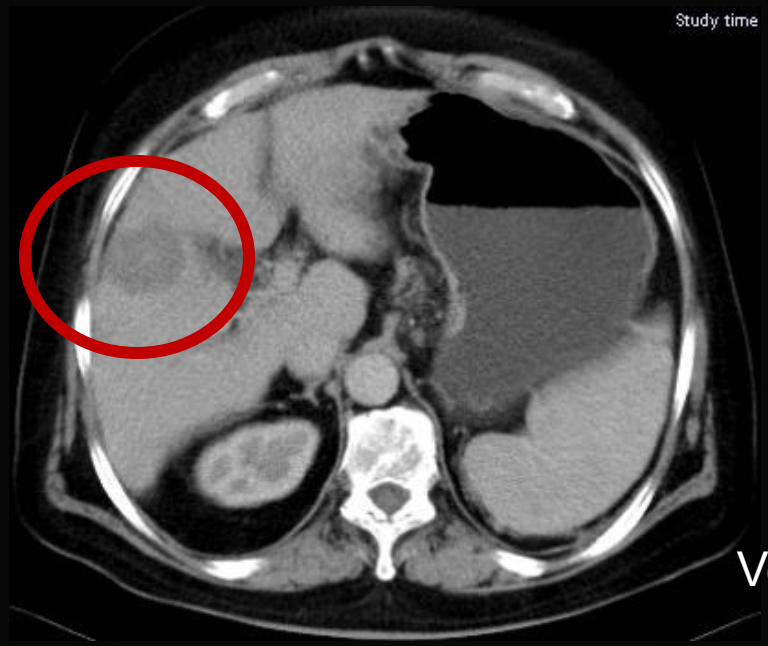
Non-contrast CT



3 months



Arterial Phase

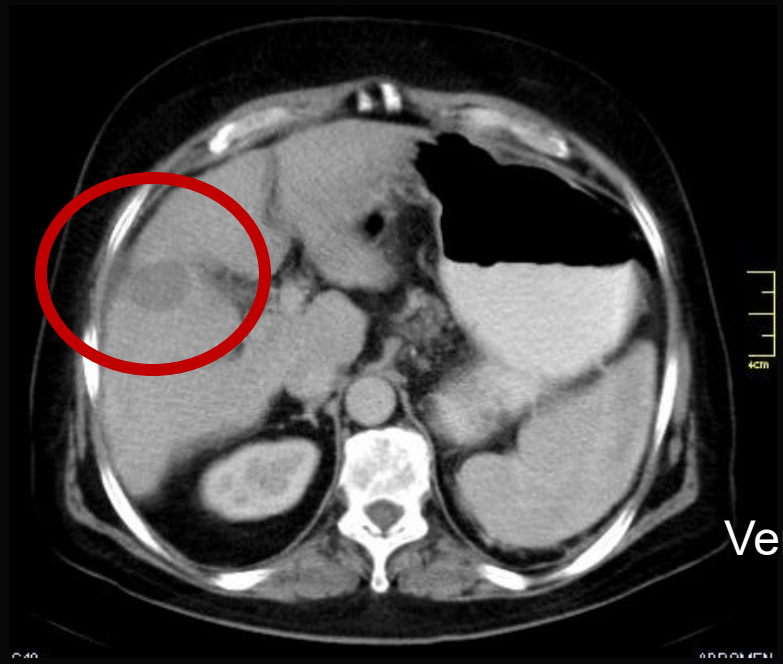


Venous Phase

Non-contrast CT

6 months

Arterial Phase



Venous Phase

VASCULAR AND INTERVENTIONAL RADIOLOGY MINI SYMPOSIA

Role of radiofrequency ablation in unresectable hepatocellular carcinoma: An Indian experience

Naveen Kalra, Mandeep Kang, Anmol Bhatia, Ajay K Duseja[1], Radha K Dhiman[1], Virendra K Arya[2], Arvind Rajwanshi[3], Yogesh K Chawla[1], Niranjan Khandelwal

Departments of Radiodiagnosis and Imaging, [1]Hepatology, [2]Anaesthesia, and [3]Cytology and Gynaecology Pathology, Post Graduate Institute of Medical Education and Research, Sector-12, Chandigarh, India

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Abstract

Aims: To evaluate the role of radiofrequency ablation (RFA) as an ablative technique in patients with unresectable hepatocellular carcinoma (HCC). **Settings and Design:** A tertiary care center, prospective study. **Materials and Methods:** The subjects comprised 31 patients (30 males, one female; age range 32-75 years) with HCC (41 lesions) who were treated with image-guided RFA. The follow-up period ranged from 3 months to 6 years, and included a multiphasic computed tomography (CT) at 1, 3 and 6 months post-RFA, and every 6 months thereafter. Patient outcome was evaluated and the tumor recurrence, survival and complications were assessed. **Statistical Analysis Used:** Discrete categorical data were presented as *n* (%) and continuous data as mean ± SD. Pearson correlation coefficient was used to determine the relationship between the different variables. Kaplan–Meier survival curve and Log-rank test were used to test the significance of difference between the survival time of the different groups. **Results:** The ablation success rate was 80.5% (33/41 HCC lesions). 12.2% (5/41) of the lesions were managed with repeat RFA due to tumor residue. 4.9% (2/41) of the lesions were managed with repeated RFA and transarterial chemoembolization. Eight patients had tumor recurrence (five patients (16.1%) had local recurrence and three patients (9.6%) had distant recurrence). Eleven patients died within 3.5-20 months post-RFA. The survival rate at 1 year in patients who completed at least 1 year of follow-up was 63.3%. There was one major complication (1/31, 3.2%) in a patient with a subcapsular lesion and ascites. This patient developed hemoperitoneum in the immediate postprocedure period and was managed with endovascular treatment. She, however, had hepatic decompensation and died 48 h post-RFA. **Conclusion:** RFA is an effective and safe treatment for small unresectable HCC.

Key words: HCC; RFA; small; unresectable

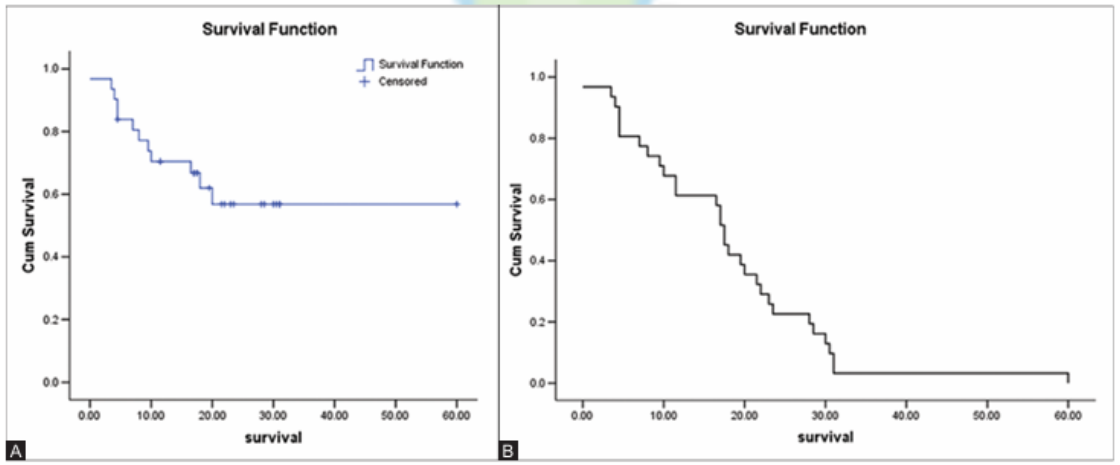


Figure 2 (A, B): Kaplan-Meier survival curves demonstrating the survival (A) and the survival rate (B) during the follow-up period

- 31 patients with 41 HCC observations
- Ablation success rate was 80.5%, rest had tumor residue
- Survival rate was 63.3% at one year
- Complication rate was 3.2%

Indian J Radiol Imaging 2013;23:139-44

Indian J Med Res 146 (Supplement), November 2017, pp 30-37
DOI: 10.4103/ijmr.IJMR_1812_15

Quick Response Code:

Comparison of radiofrequency ablation alone & in combination with percutaneous ethanol injection for management of hepatocellular carcinoma

Naveen Kalra[1], Mandeep Kang[1], Ajay K. Duseja[2], Anmol Bhatia[1], Virendra Singh[2], Radha K. Dhiman[2], Arvind Rajwanshi[3], Yogesh K. Chawla[2] & Niranjan Khandelwal[1]

Departments of [1]Radiodiagnosis & Imaging, [2]Hepatology & [3]Cytology & Gynaecology Pathology, Postgraduate Institute of Medical Education & Research, Chandigarh, India

Received November 19, 2015

Background & objective: **It has been shown that the combined use of alcohol before radiofrequency ablation (RFA) helps to augment the therapeutic advantage of RFA. The present study was conducted to compare the outcome of treatment with RFA alone and RFA with alcohol as ablative technique in patients with small hepatocellular carcinomas (HCCs), who were not candidates for surgery.**

Methods: **Fifty patients with chronic liver disease and concurrent HCC were enrolled in this prospective study. The patients were treated with either RFA alone (n=25) or RFA combined with alcohol (n=25). Patient outcome was evaluated, and the tumour recurrence and survival of the patients were assessed in the two groups.**

Results: **The survival rates at six months in patients who completed at least six months of follow up were 84 and 80 per cent in patients treated with RFA alone and combination therapy, respectively. During the follow up period, 11 and four patients treated with RFA alone showed local and distant intrahepatic tumour recurrence, respectively. All local recurrences were at one to 18 months of the follow up period. The distant recurrences occurred at 6-36 months of the follow up period. During the follow up period, eight and six patients treated with combination therapy showed local and distant intrahepatic tumour recurrence, respectively. All local recurrences were at 1.5-15 months during the follow up period. The distant intrahepatic recurrences occurred at 6-72 months during the follow up period.**

Interpretation & conclusions: **No significant difference was seen between the survival time of the patients treated with RFA alone and RFA with alcohol as well as in the local recurrences and distant intrahepatic recurrences in RFA compared to RFA and alcohol group patients. Combined use of RFA and alcohol did not improve the local tumour control and survival in patients with HCC compared to RFA alone.**

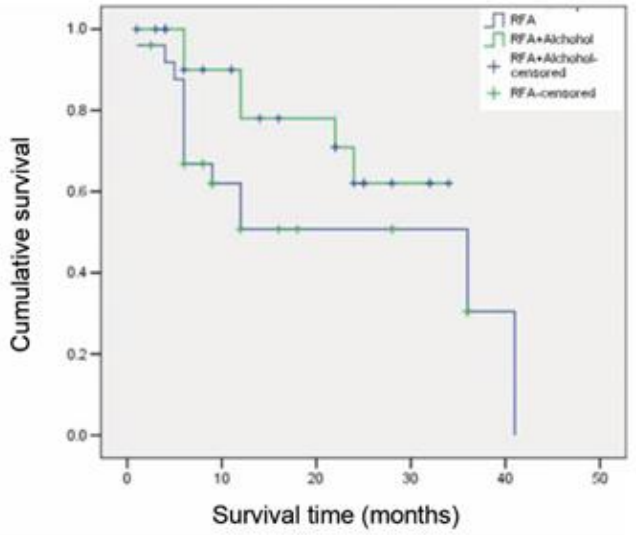
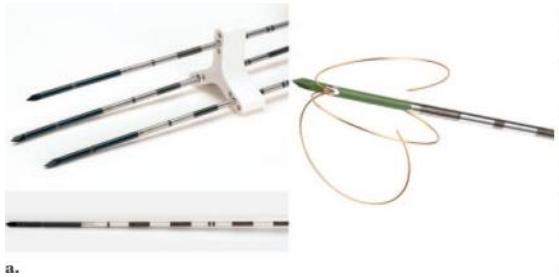


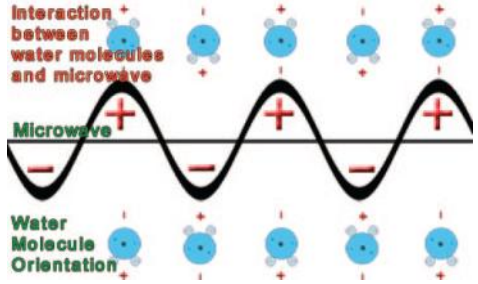
Fig. 4. Kaplan-Meier curve showing no significant difference in the survival in the patients in the two groups (P=0.131).

- RFA alone group (n=25) and RFA combined with ethanol (n=25)
- Survival rate at 6 months, 84% in RFA alone group and 80% in combination group

Indian J Med Res 2017;146(Suppl):S30-S37

Microwave Ablation (MWA)



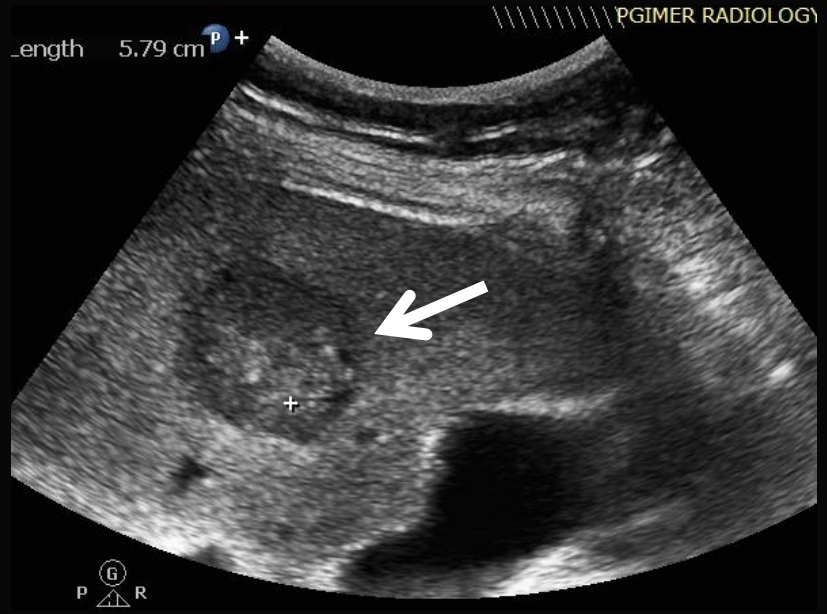


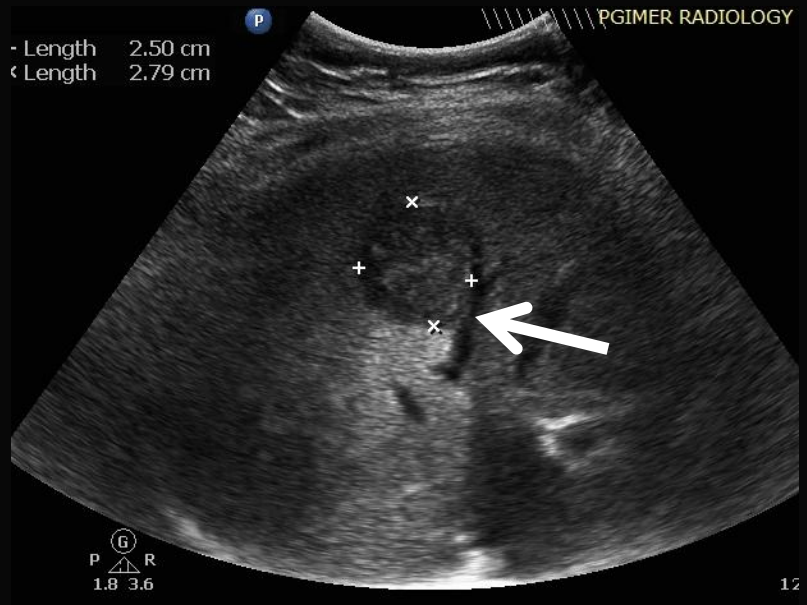
- Microwaves are electromagnetic waves with a frequency >900kHz, usually 2450 MHz
- Water molecules act as an electric dipole and align to the changing field lines
- Neighboring macromolecules are heated by convection
- Shorter duration of therapy
- Less pronounced heat-sink effect
- Higher temperature at target tissue

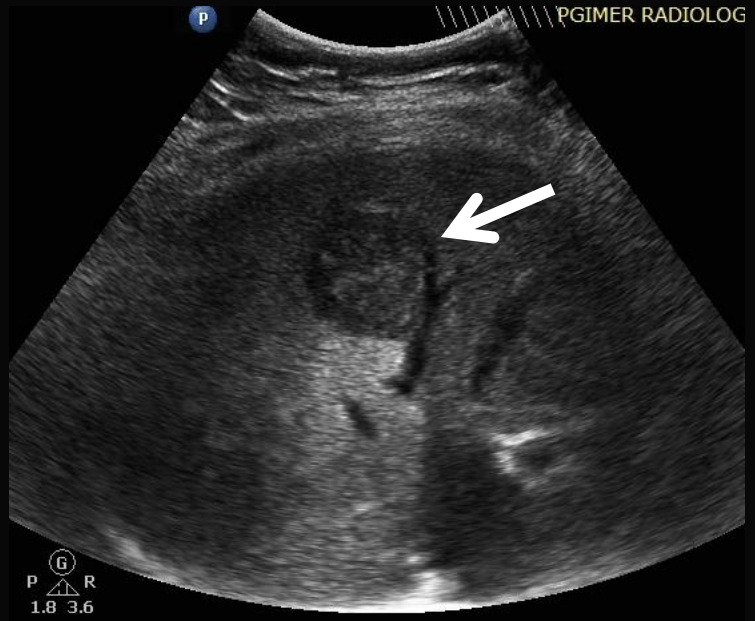
Arterial Phase

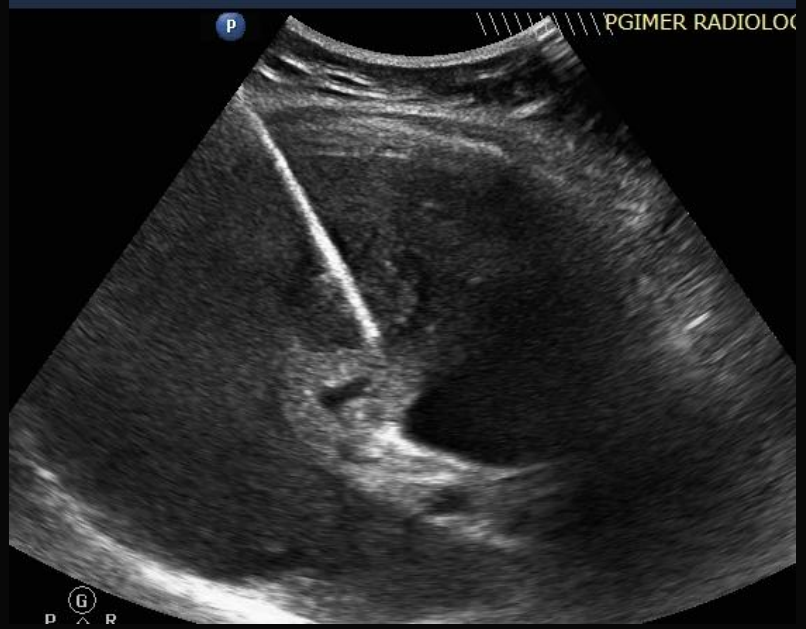
52-year-old female
HCV+

Venous Phase


Length 5.79 cm
PGIMER RADIOLOGY


Length 2.50 cm
Length 2.79 cm
PGIMER RADIOLOGY
1.8 3.6

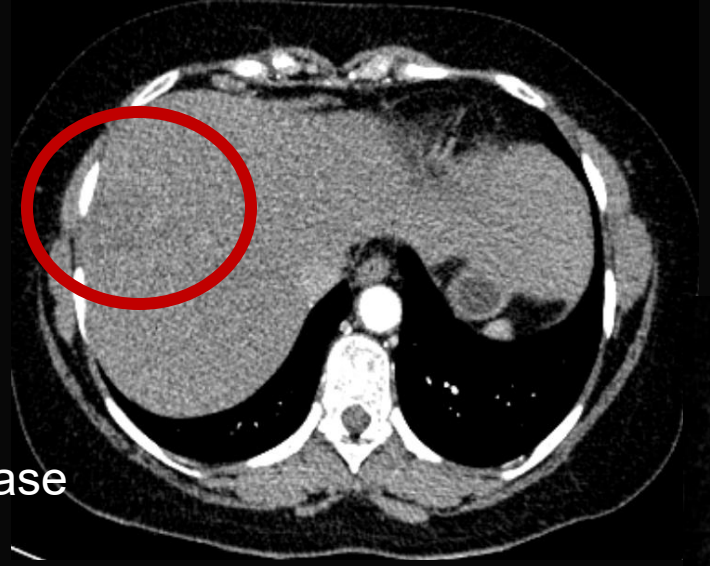

PGIMER RADIOLOG
1.8 3.6


PGIMER RADIOLOG


PGIMER RADIOLOGY


PGIMER RADIOLOGY DSA
1.8 3.6

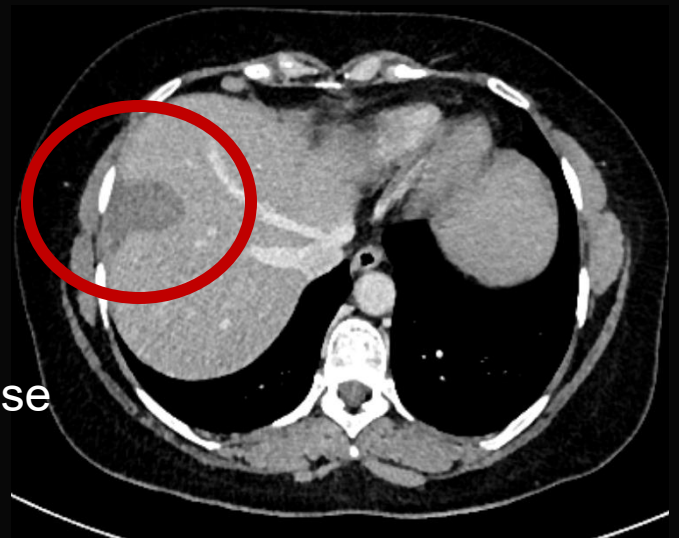

PGIMER RADIOLOGY DSA 2
1.8 3.6
12.0cm



Arterial Phase

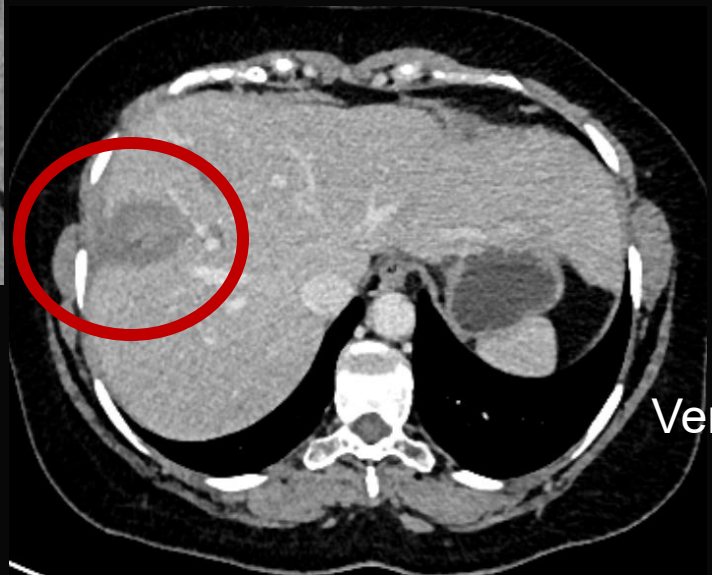
Arterial Phase

Venous Phase



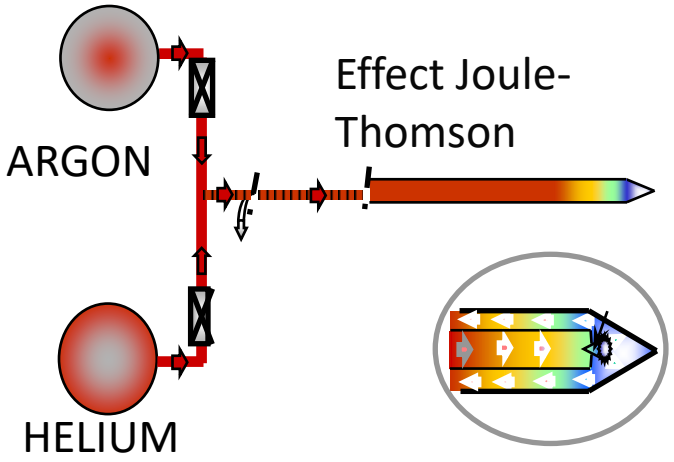
Venous Phase

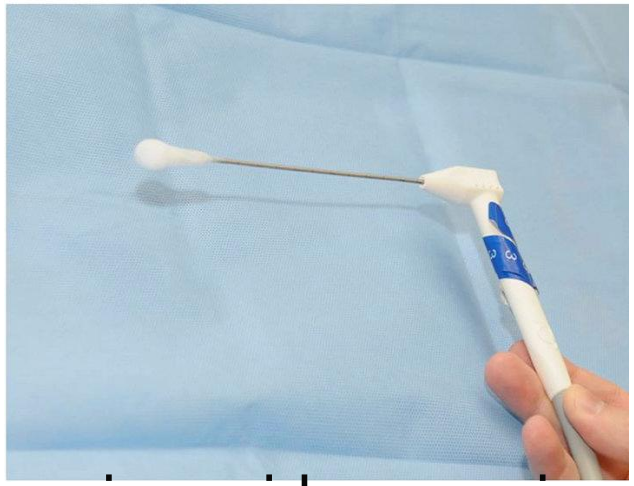
3 months

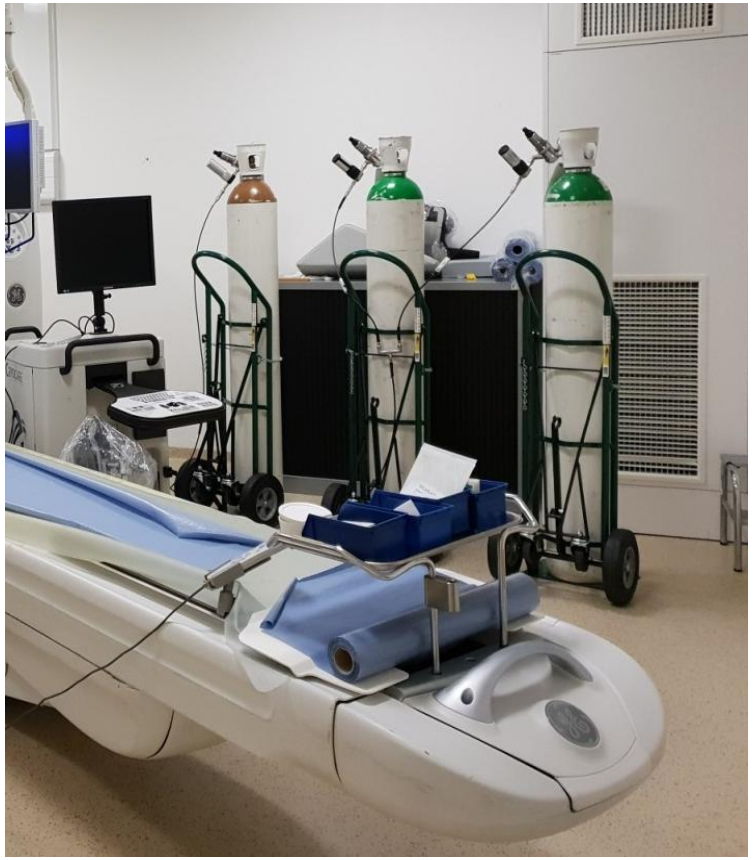


Venous Phase

Cryoablation

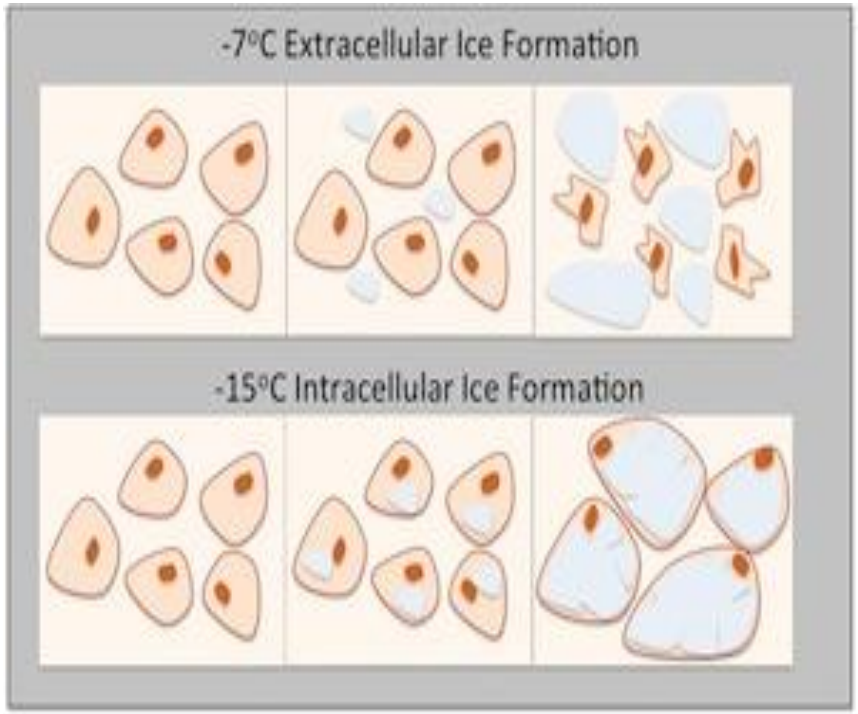


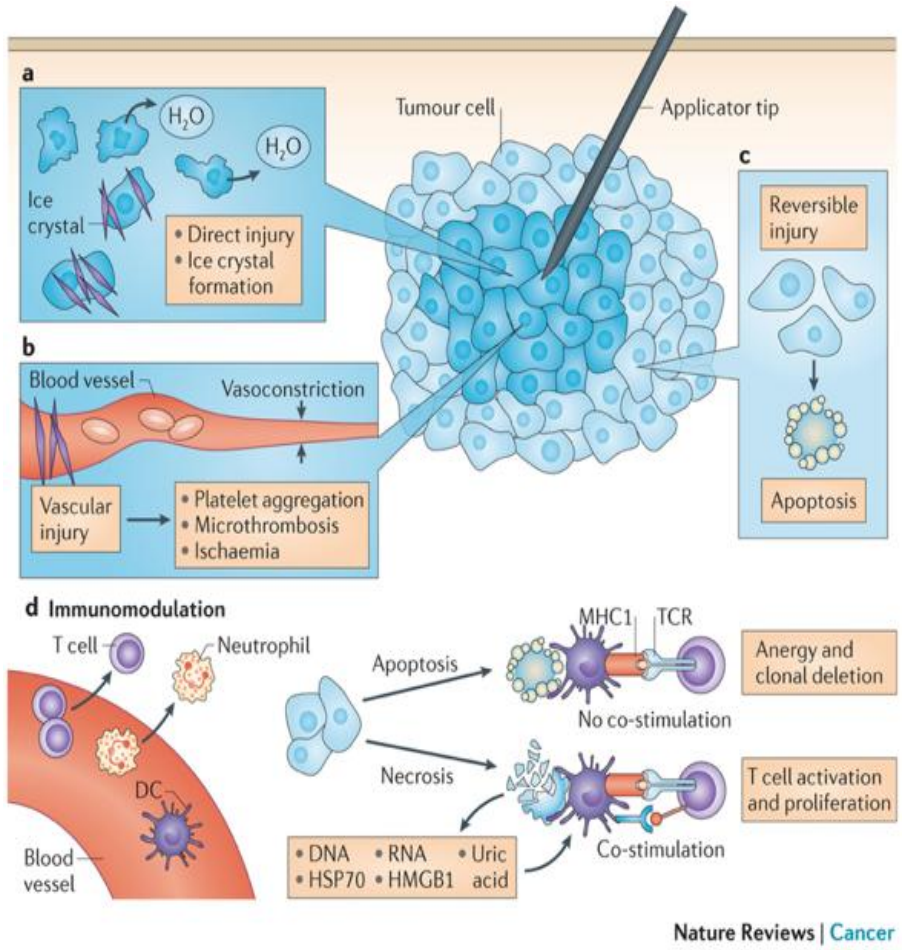




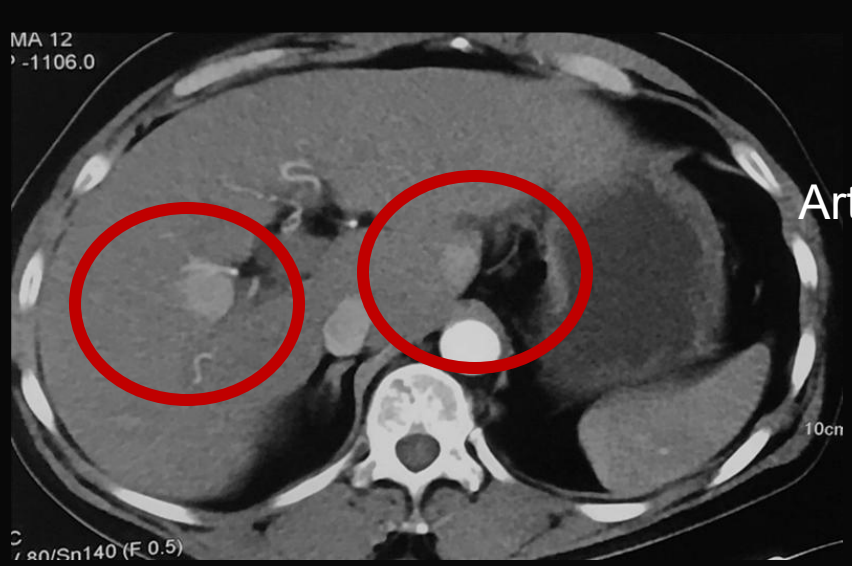
Cooling via rapid expansion, oblong ice ball is formed in the tumor, no collateral damage

Mechanism

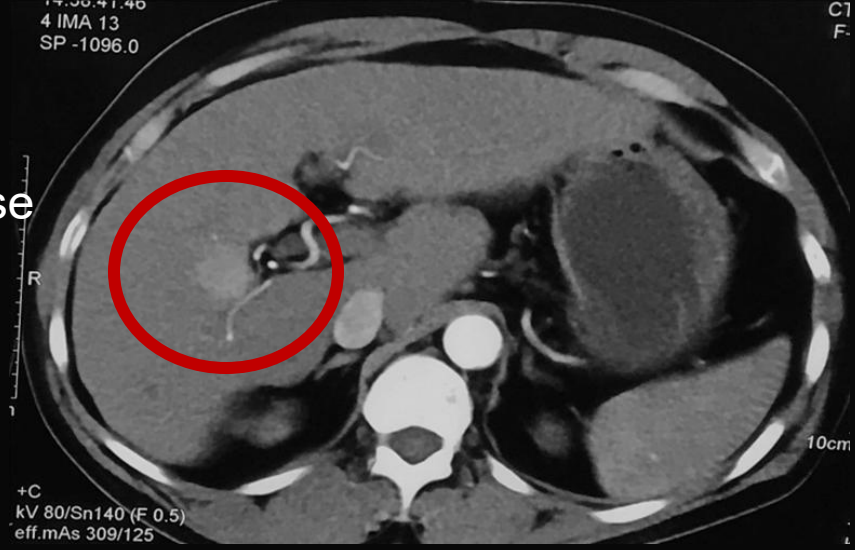




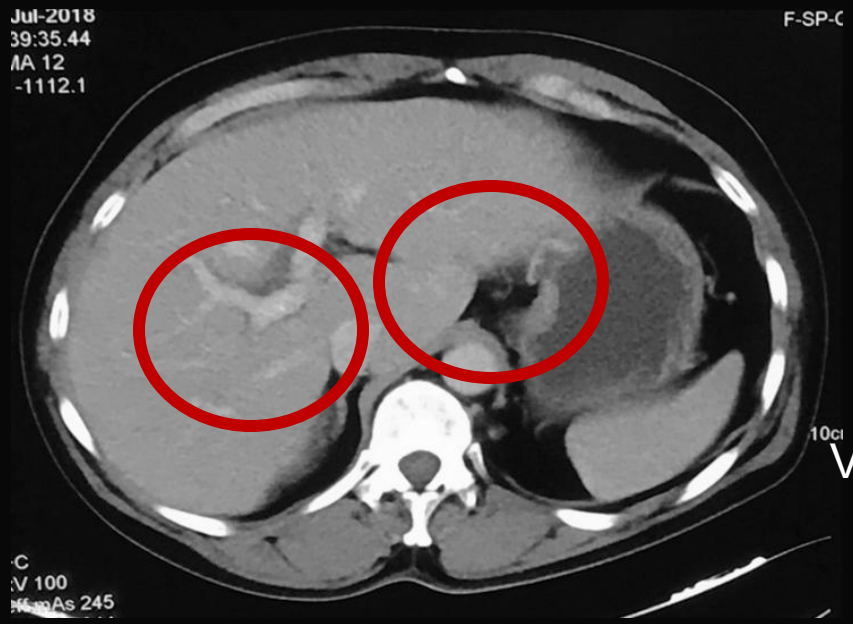
- Coagulation necrosis of tissue by rapid freeze and slow thaw
- Direct cell injury due to crystallization of water molecules
- Interruption of the local microcirculation
- Induction of apoptosis in the periphery of the lesion



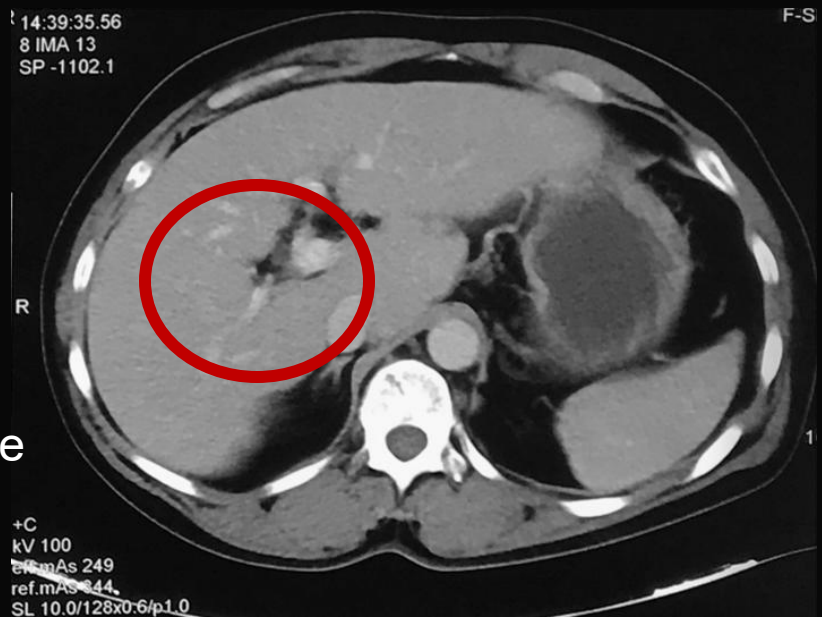
Arterial Phase



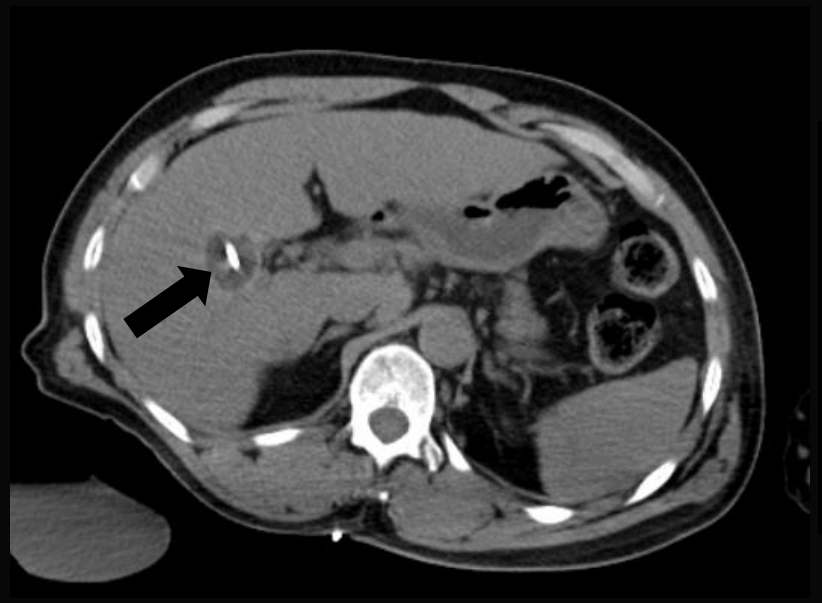
58-year-old male, ethanol related cirrhosis

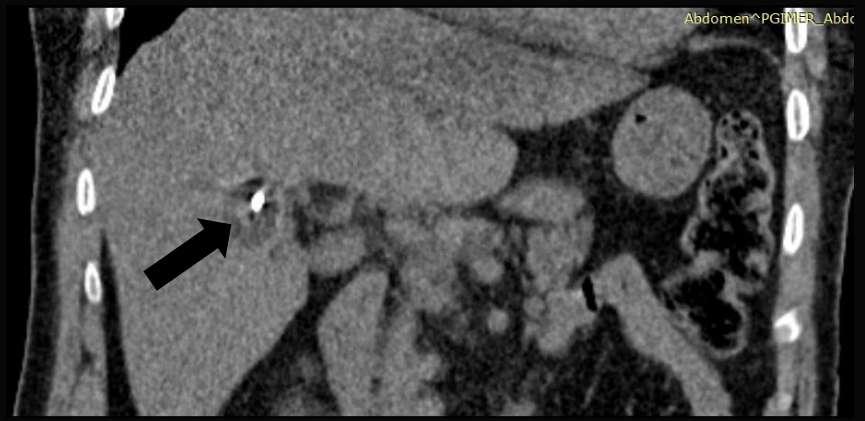


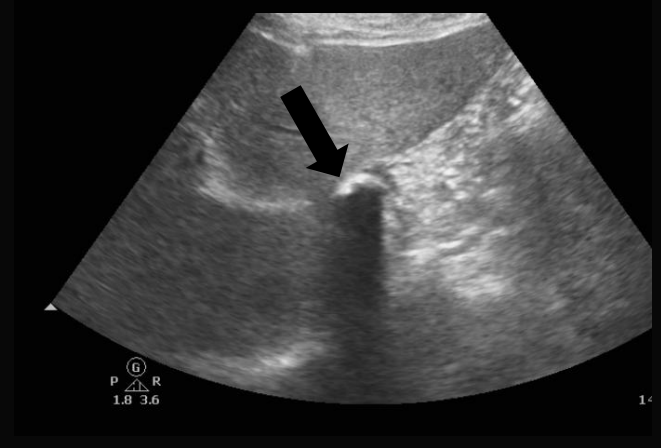
Venous Phase

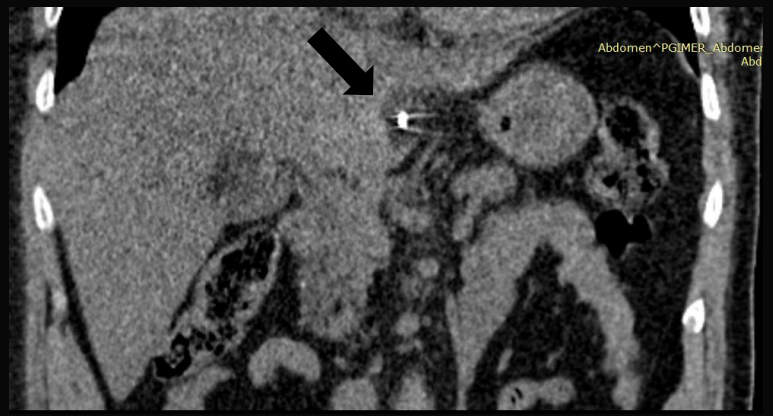


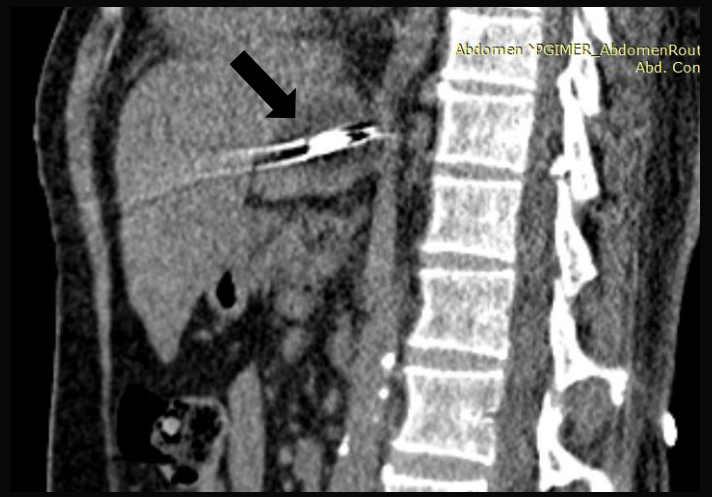
Non-contrast CT











Non-contrast CT

Original Article JOURNAL OF CLINICAL AND EXPERIMENTAL HEPATOLOGY

Percutaneous Cryoablation of Liver Tumors: Initial Experience from a Tertiary Care Center in India

Naveen Kalra *, Pankaj Gupta *, Tejeshwar Jugpal *, Shailendra S. Naik *, Ujjwal Gorsi *, Sreedhara B. Chaluvashetty *, Harish Bhujade *, Ajay Duseja †, Virendra Singh †, Radha K. Dhiman †, Manavjit S. Sandhu *

*Department of Radiodiagnosis and Imaging, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India and †Department of Hepatology, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Background: Percutaneous ablation is an important part of management strategy for liver tumors. While radiofrequency ablation and microwave ablation are the most widely used ablative techniques, cryoablation (CA) has several technical advantages but has been underused till recently. In this study, we report the initial experience with percutaneous CA of liver tumors. *Methods:* This was a retrospective evaluation of consecutive patients with liver tumors who underwent percutaneous CA between October 2018 and August 2019. The ablation procedures were performed under combined ultrasound and computed tomography guidance using argon-helium–based CA systems. The baseline tumor characteristics (including size and location), Barcelona Clinic Liver Cancer stage, and Child-Pugh score were recorded. Each patient underwent a follow-up after 1 month and at 3 months subsequently. Technical success, complete response, local tumor progression, and overall survival were evaluated. *Results:* Nine patients (mean age, 62.4 years, median age, 66 years, five men and four women) with 10 liver tumors (mean size, 2.22 cm) underwent CA. Seven (77.8%) patients had hepatocellular carcinoma (HCC), and 2 patients had solitary liver metastasis. One patient with HCC had two lesions, while the rest had only one lesion. Of the two metastatic lesions, one was from carcinoma of the cervix and the other was from jejunal neuroendocrine tumor. Five tumors were located adjacent to the gallbladder, two lesions were adjacent to the right portal vein, two lesions were subcapsular, and one lesion was adjacent to the stomach. Technical success was achieved in all the patients. Complete response was achieved in 7 (77.8%) patients. The median follow-up period was 7 months (range, 3–12 months). There was no local tumor progression and no death during the follow-up period. No procedure-related complication was seen. *Conclusion:* Percutaneous CA of hepatic tumors is technically feasible and is a safe and effective ablative technique. (J Clin Exp Hepatol xxxx;xxx:xxx)

Table 2 Outcomes in Patients Treated With Cryoablation.

Characteristic	Number (n = 9)
Median follow-up	7 months (range, 3–12 months).
Complete response[a]	7 (77.8%)
Partial response[a]	2[b] (22.2%)
Characteristics of tumors with PR	
Location	Subcapsular [segment III (n = 1) and V (n = 1)]
Size	2.3 cm and 2.1 cm
Adjuvant therapies for residual disease	
• TACE	1 (11.1%)
• PEI	1 (11.1%)

PR, partial response; TACE, transarterial chemoembolization; PEI, percutaneous ethanol injection; modified RECIST, modified response evaluation criteria in solid tumors.
[a]Based on modified RECIST at 1 month.[12]
[b]Both were hepatocellular carcinoma.

- 9 patients with 10 tumors
- Technical success in all patients
- Complete response in 7 (77.8%) patients
- No complications
- No local tumor progression or death in the follow-up period of 3-12 months

J Clin Exp Hepatol 2021;11:305-311

European Radiology
https://doi.org/10.1007/s00330-020-07610-1

INTERVENTIONAL

Overall survival and local recurrence following RFA, MWA, and cryoablation of very early and early HCC: a systematic review and Bayesian network meta-analysis

Pankaj Gupta[1] · Muniraju Maralakunte[1] · Praveen Kumar-M[2] · Karamvir Chandel[1] · Sreedhara B. Chaluvashetty[1] · Harish Bhujade[1] · Naveen Kalra[1] · Manavjit Singh Sandhu[1]

Received: 18 June 2020 / Revised: 17 November 2020 / Accepted: 4 December 2020

Abstract

Objective To compare overall survival (OS) and local recurrence (LR) following radiofrequency ablation (RFA), microwave ablation (MWA), and cryoablation (CA) for very early and early hepatocellular carcinoma (HCC).

Methods This systematic review was performed according to the PRISMA guidelines. MEDLINE, Embase, and Cochrane databases were searched. Randomized controlled trials (RCTs) and observational studies were included. OS and LR at 1 year and 3 years were assessed. OS was reported as hazard ratio (HR) with 95% credible intervals (CrI) and LR as relative risk (RR) with 95% CrI, to summarize effect of each comparison.

Results Nineteen studies (3043 patients), including six RCTs and 13 observational studies, met inclusion criteria. For OS at 1 year, as compared to RFA, CA had HR of 0.81 (95% CrI: 0.43–1.51), and MWA had HR of 1.01 (95% CrI: 0.71–1.43). For OS at 3 years, as compared to RFA, CA had HR of 0.90 (95% CrI: 0.48–1.64) and MWA had HR of 1.07 (95% CrI: 0.73–1.50). For LR at 1 year, CA and MWA had RR of 0.75 (95% CrI: 0.45–1.24) and 0.93 (95% CrI: 0.78–1.14), respectively, as compared to RFA. For LR at 3 years, CA and MWA had RR of 0.96 (0.74–1.23) and 0.98 (0.87–1.09), respectively, as compared to RFA. Overall, none of the comparisons was statistically significant. Age of patients and tumor size did not influence treatment effect.

Conclusions RFA, MWA, and CA are equally effective for locoregional treatment of very early and early HCC.

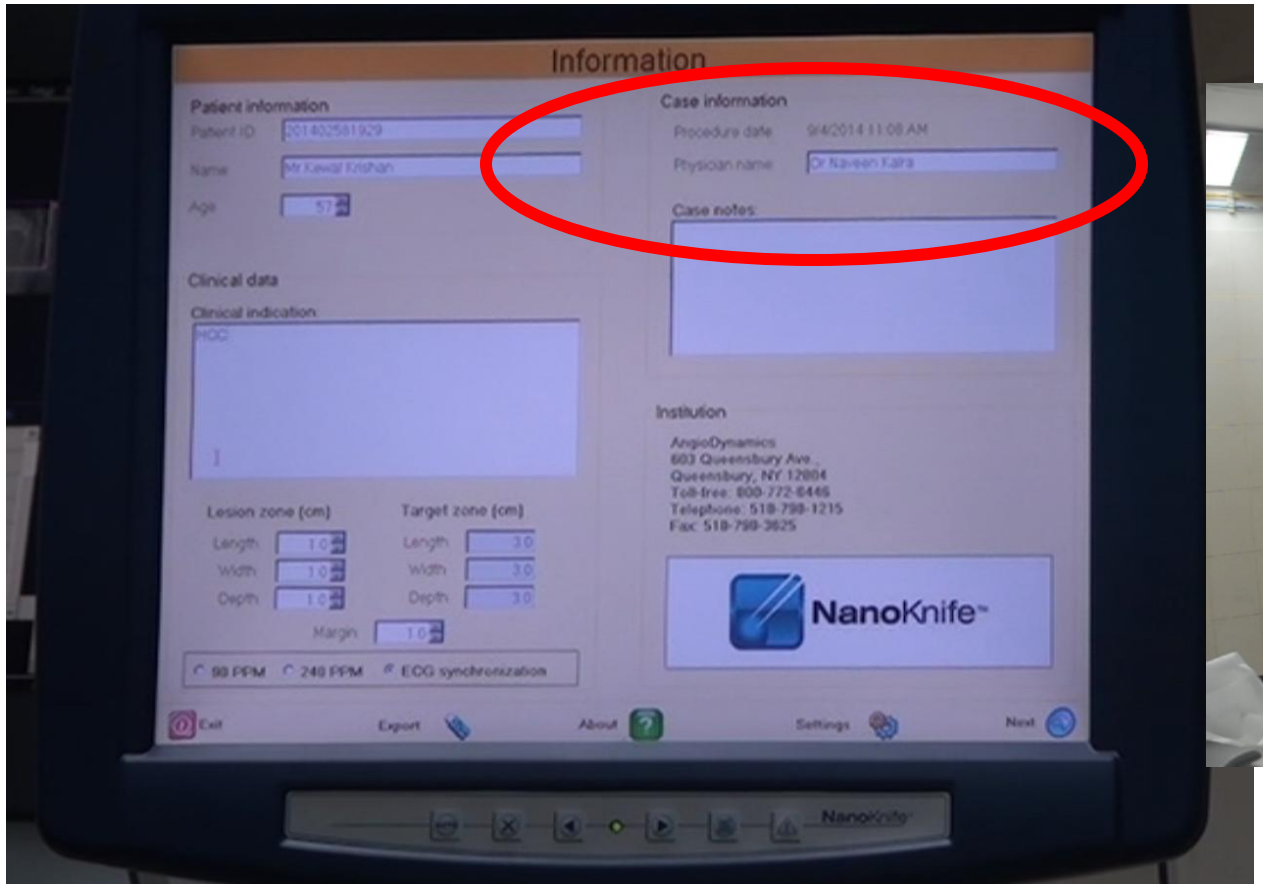
Key Points

- *There is no significant difference in the OS and LR (at 1 year and 3 years) following ablation of very early and early HCC with RFA, MWA, and CA.*
- *There was no effect of tumor size on the treatment efficacy.*
- *More RCTs comparing CA with RFA and MWA should be performed.*

There is no significant difference in the OS and LR (at 1 year and 3 years) following ablation of very early and early HCC with RFA, MWA, and CA.

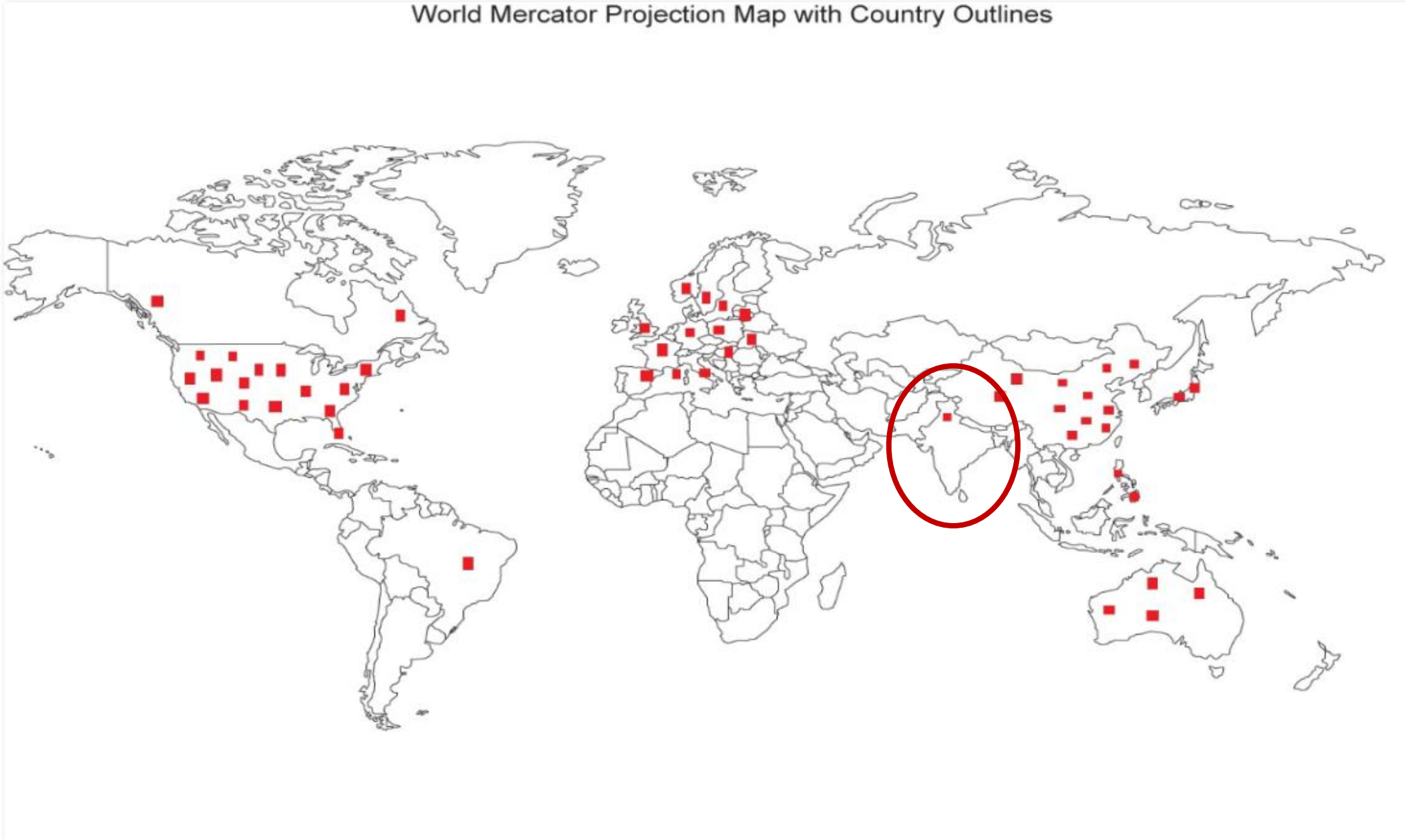
Eur Radiol 2021;31:5400-5408

First Irreversible Electroporation (IRE)



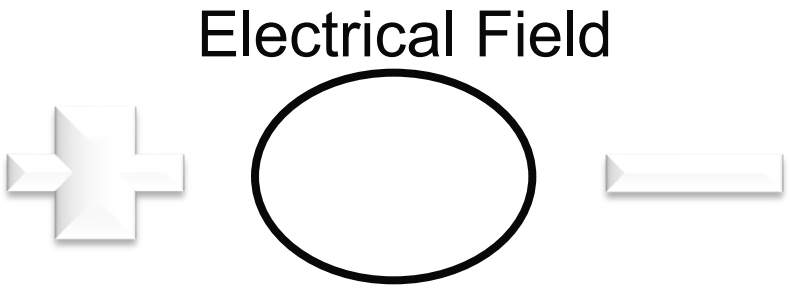
4th September,

2014 at 11am

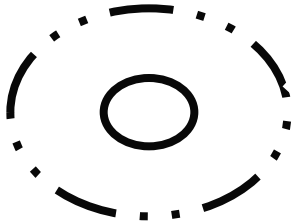

World Mercator Projection Map with Country Outlines

Irreversible Electroporation (IRE)

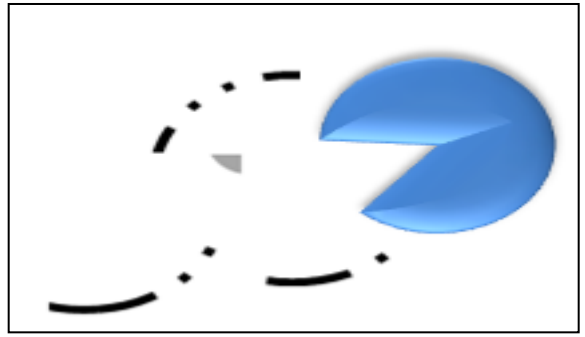
- Irreversible electroporation (IRE) is a non-thermal technique
- Delivery of 70 microsecond ultrashort pulses of high voltage (1500-3000V) using parallel probes
- Creates irreversible pores in cell membrane
- Apoptotic induced cell death occurs
- Connective tissue framework and vital structures are not damaged
- No heat sink effect

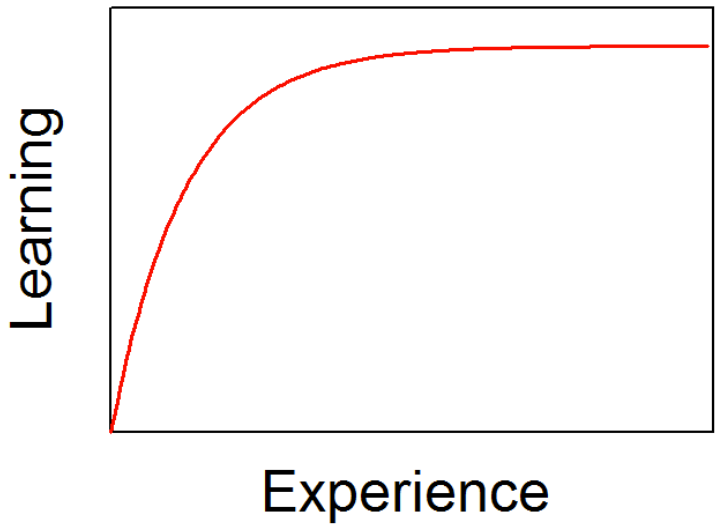


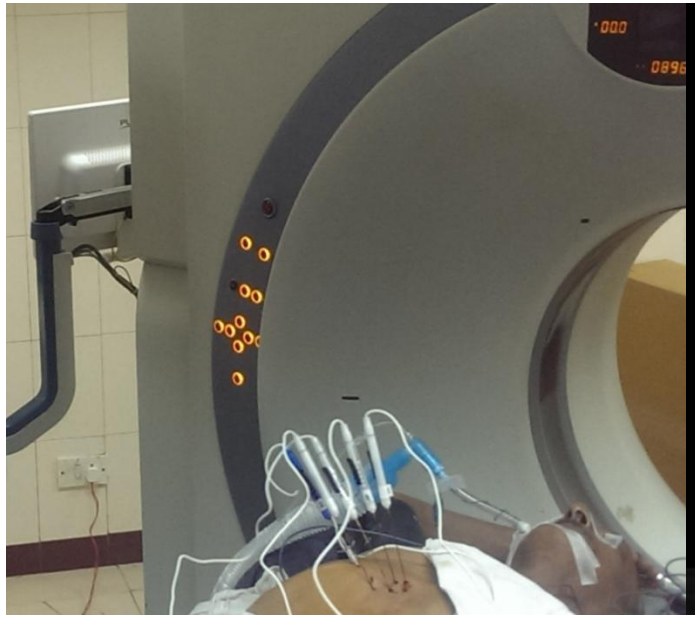
Cell

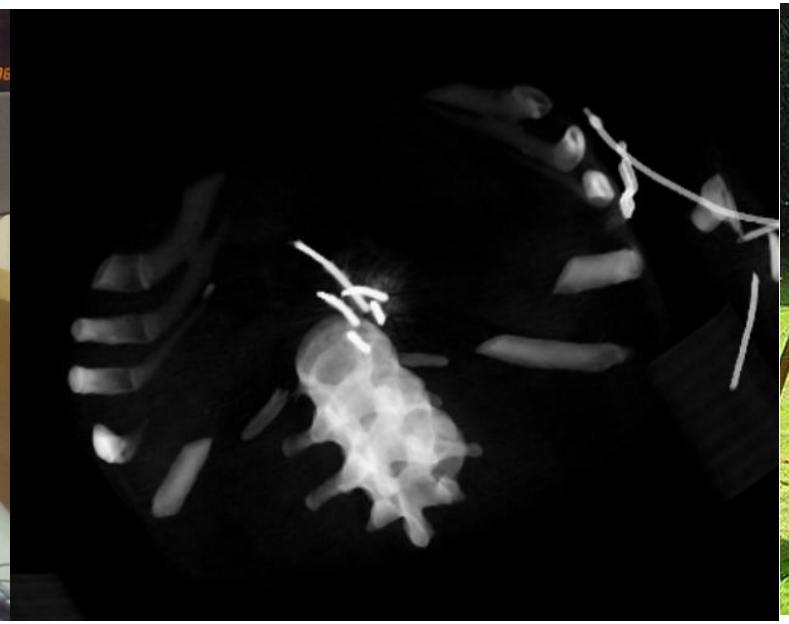


Permeabilized / Porated Cell Membrane









Accuracy and Precision

Hepatic Lesions

- Perivascular (within 0.5cm) and peribiliary (within 1cm) lesions

  -perihilar central location/ segment 1 lesion

- Subcapsular lesions close to diaphragm or digestive tract

  Prevent collateral damage/ Incomplete thermal ablation

Cardiovasc Intervent Radiol
https://doi.org/10.1007/s00270-019-02164-2

CIRSE CrossMark

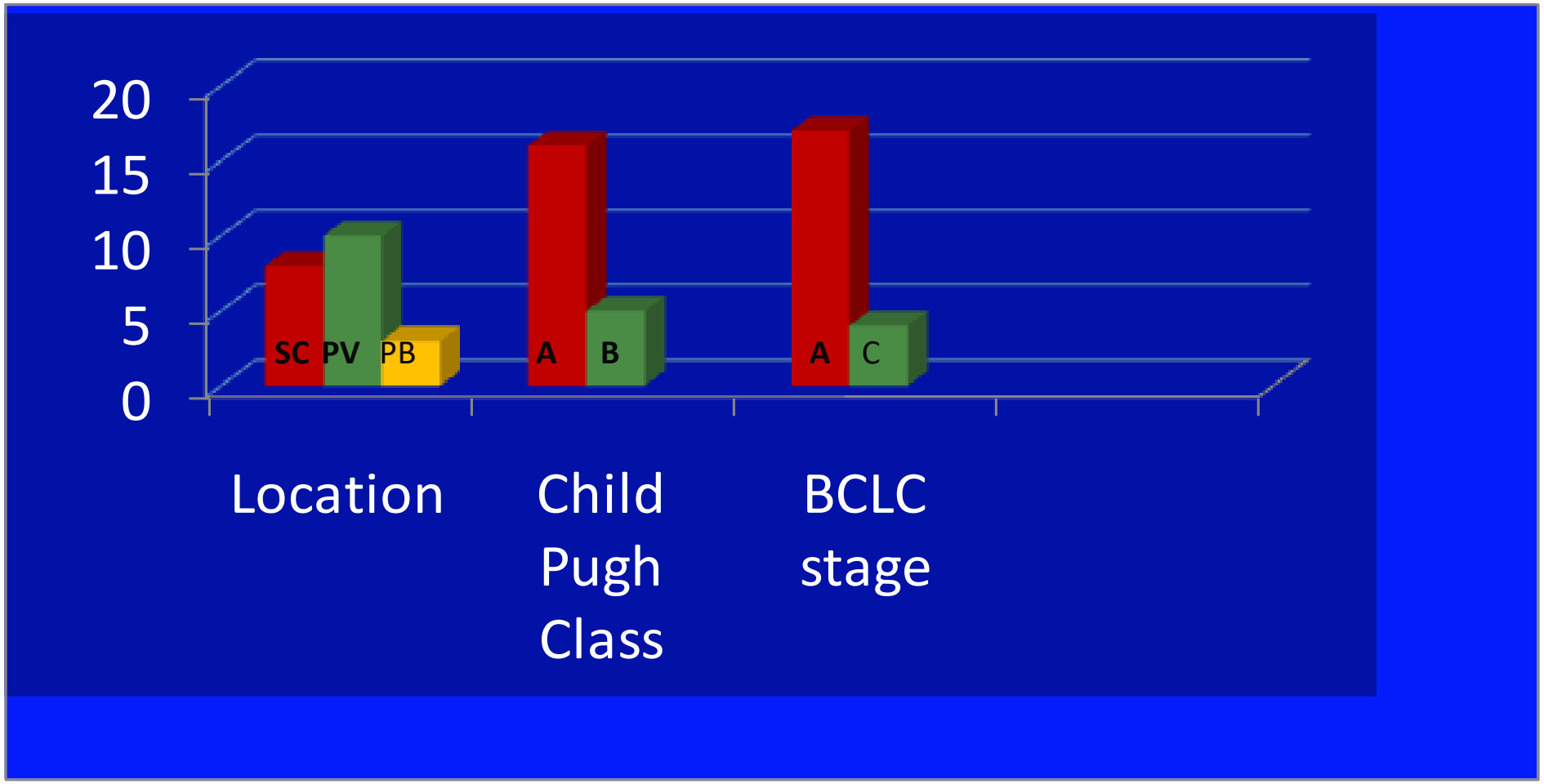
CLINICAL INVESTIGATION INTERVENTIONAL ONCOLOGY

Irreversible Electroporation for Unresectable Hepatocellular Carcinoma: Initial Experience

Naveen Kalra[1] · Pankaj Gupta[2] · Ujjwal Gorsi[1] · Harish Bhujade[1] · Shreedhara B. Chaluvashetty[1] · Ajay Duseja[3] · Virendra Singh[3] · Radha K. Dhiman[3] · Yogesh K. Chawla[3] · Niranjan Khandelwal[1]

- Retrospective study over three years (2014-2017)
- 21 HCCs in 21 patients with cirrhosis were treated with IRE
- Diagnosis of HCC was based on American Association of Study of Liver Diseases (AASLD) guidelines
- Choice of IRE was based on tumor location

Cardiovasc Intervent Radiol 2019; 42: 584-90



- Subcapsular or exophytic : 8, Perivascular : 10, Peribiliary : 3
- Child-Pugh Class A : 16 patients, Child-Pugh Class B : 5 patients
- BCLC stage A: 17 (81%), stage C: 4 (19%)

- Local tumor progression: 5 patients (24%)
- Median time for LTP: 4 months (range 3-4 months)
- Median local tumor progression free survival (PFS): 7 months (range 3-30 months)
- 6-month PFS: 71.4%

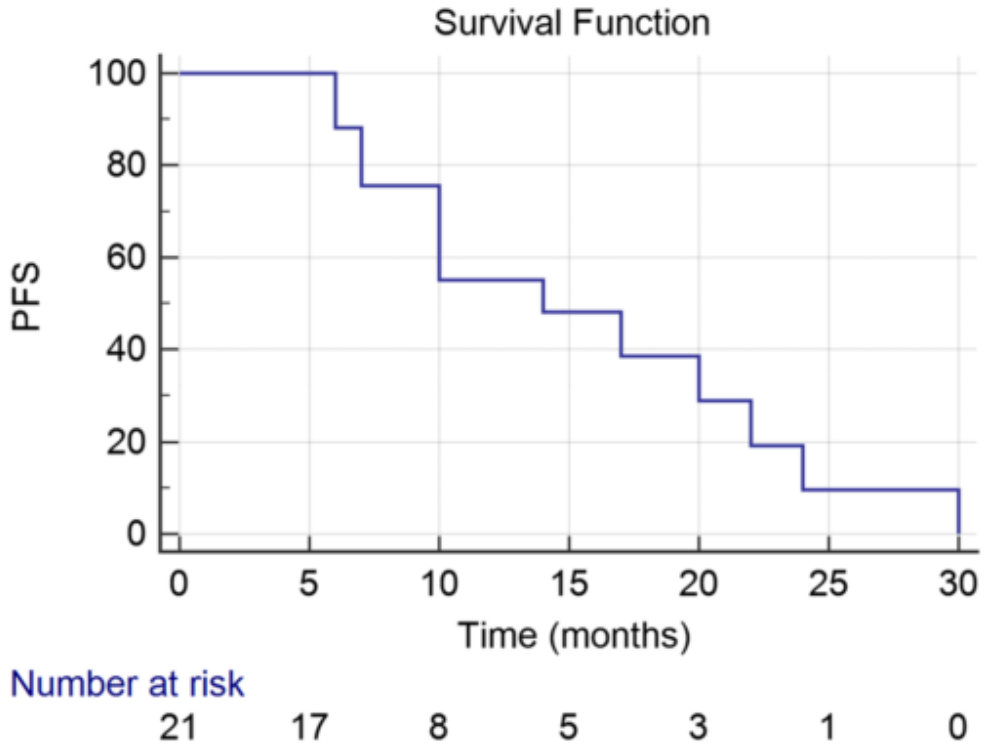
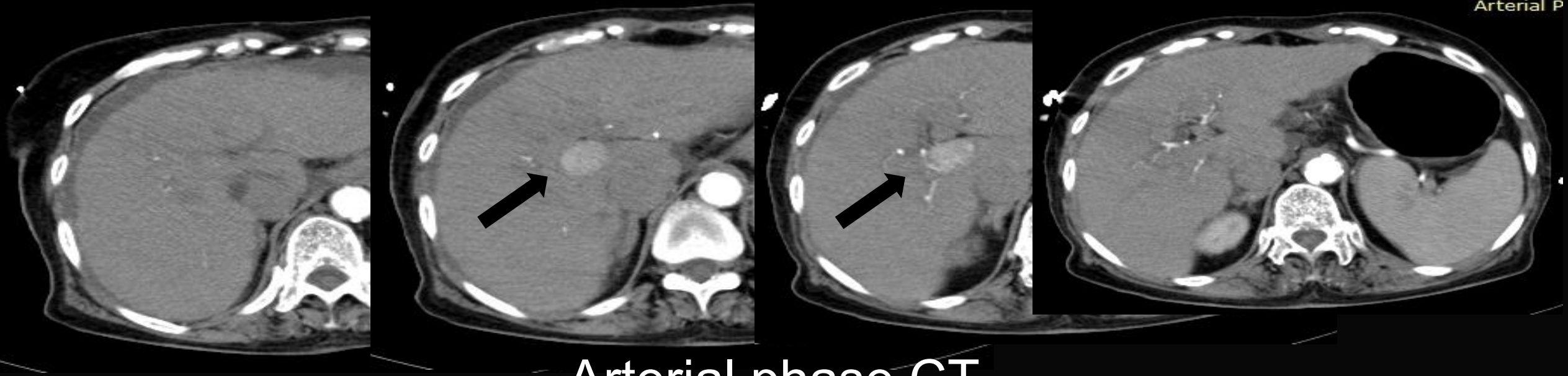


Fig. 3 Kaplan–Meier curve showing local tumor progression-free survival following IRE in 21 patients

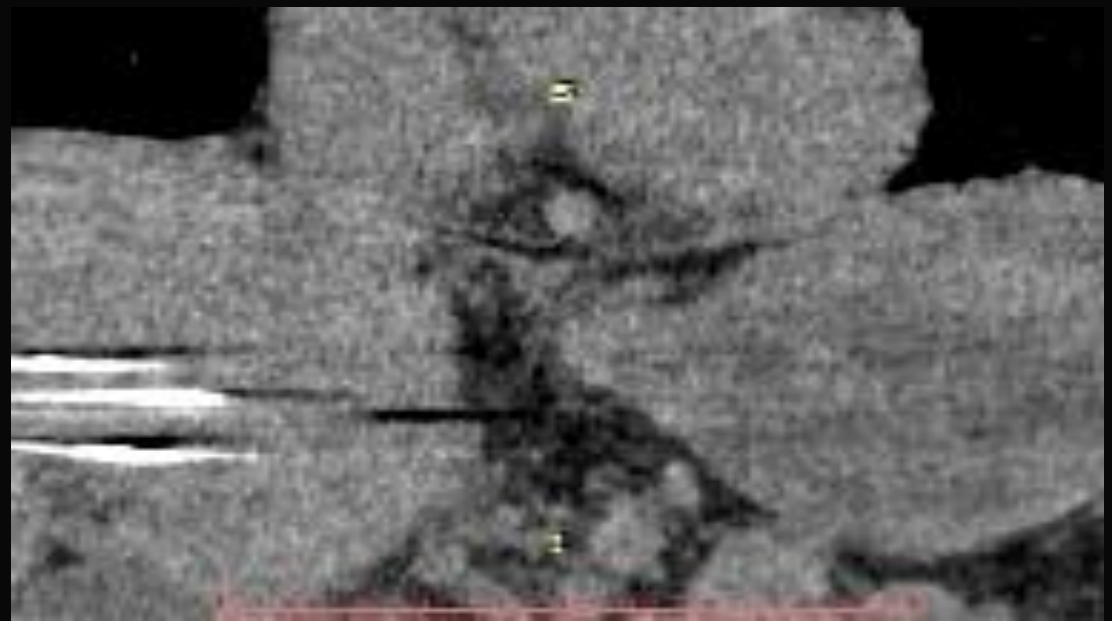


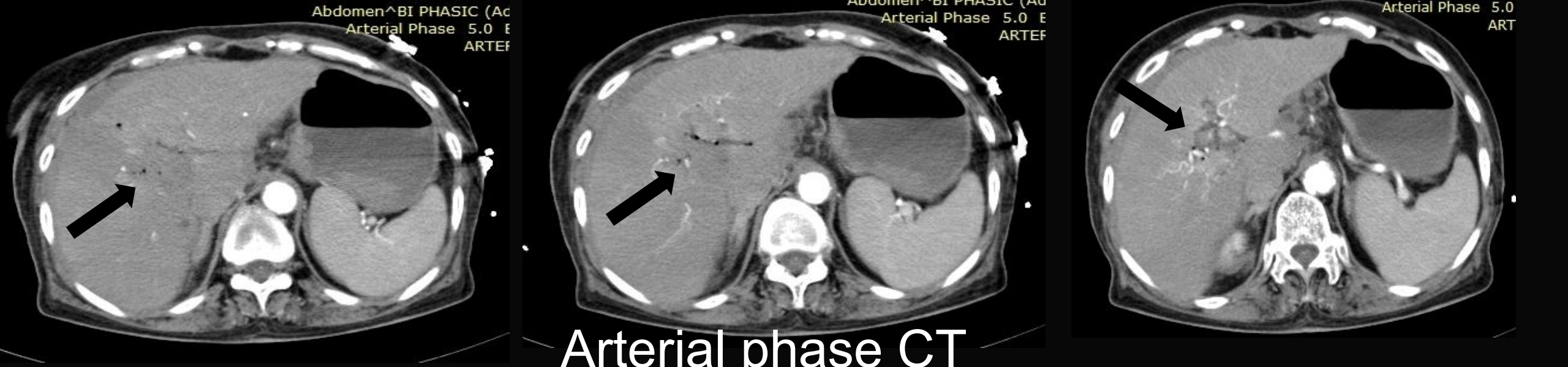
Arterial phase CT

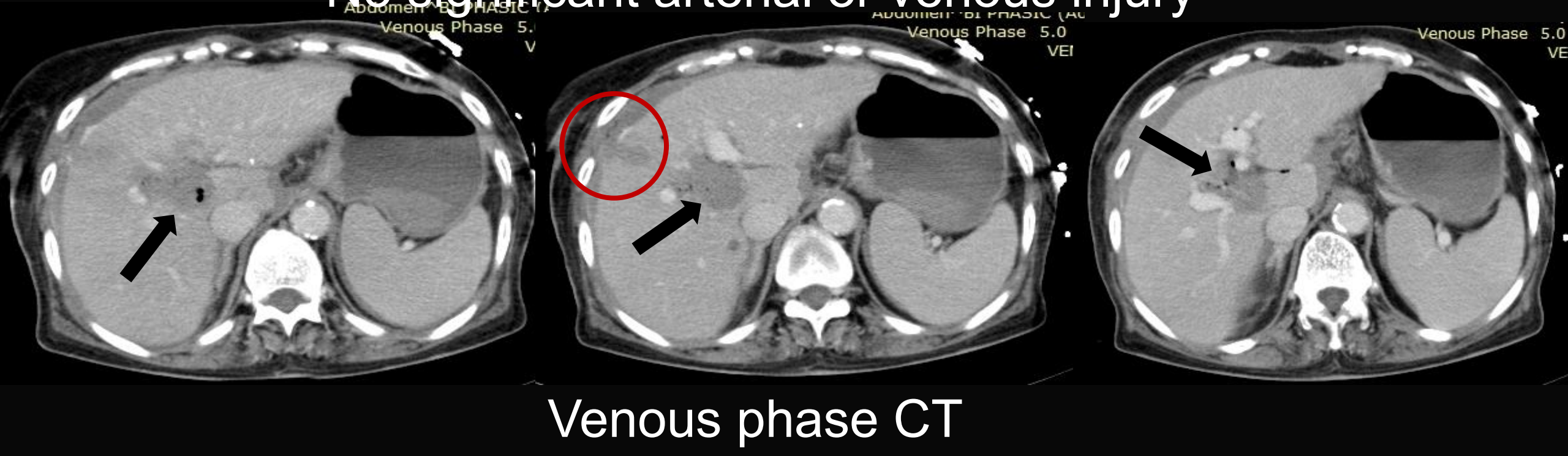
Case : 72-year-old female, HCV cirrhosis, 1X2cm

Venous phase CT

Antero-lateral Approach: Multiple parallel oriented probes were inserted for IRE




Arterial phase CT
No significant arterial or venous injury


Venous phase CT

Meta-Analysis > Eur Radiol. 2021 Sep;31(9):6511-6521. doi: 10.1007/s00330-021-07742-y. Epub 2021 Feb 27.

Efficacy and safety of irreversible electroporation for malignant liver tumors: a systematic review and meta-analysis

Pankaj Gupta [1], Muniraju Maralakunte [2], Sathya Sagar [2], Praveen Kumar-M [3], Harish Bhujade [2], Sreedhara B Chaluvashetty [2], Naveen Kalra [2]

Affiliations + expand

PMID: 33638687 DOI: 10.1007/s00330-021-07742-y

Abstract

Objective: The data regarding overall survival (OS) and progression-free survival (PFS) following irreversible electroporation (IRE) is scarce. We performed a systematic review of the safety and efficacy of IRE for liver malignancies.

Methods: Searches of MEDLINE, EMBASE, and SCOPUS databases were performed through September 1, 2019. Studies reporting the survival data (OS and PFS) and complications (graded according to the Society of interventional Radiology classification) were included. A generalized linear mixed method with a random-effects model was used for assessing pooled incidence rates and corresponding 95% confidence intervals (CIs).

Results: A total of 25 studies (n = 776, 15 prospective, 10 retrospective) were included. Metastasis, hepatocellular carcinoma, and cholangiocarcinoma were present in 354, 285, and 100 patients, respectively. The pooled OS at 6, 12, 24, and 36 months was 93.28% (95% CI: 63.23-99.12, I^2= 67%), 81.29% (95% CI: 69.80-89.22, I^2 = 73%), 61.47% (95% CI: 52.81-69.46, I^2 = 0%), and 40.88% (95% CI: 28.43-54.61, I^2 = 64%), respectively. The pooled PFS at 6, 12, and 24 months was 79.72% (95% CI: 67.88-87.97, I^2 = 70%), 64.19% (95% CI: 56.68-71.06, I^2 = 57%), 49.05% (95% CI: 11.47-87.73, I^2 = 96%), respectively. Overall complication rate was 23.7%. Major complications (grade C-F) occurred in 6.9% patients.

Conclusion: IRE is associated with favorable OS and PFS. Although the overall complication rate is high, most complications are graded as minor.

Key points: • The pooled OS and PFS at 6, 12, and 24 months for all the tumor types was 93.28% and 79.72%, 81.29% and 64.19%, and 61.47% and 49.05%, respectively. • HCC was associated with a better OS at 12 and 36 months. • The overall complication rate was 23.7%, with major complications (SIR grade C-F) comprising 6.9%.

Keywords: Ablation technique; Electroporation; Hepatocellular carcinoma.

The pooled OS and PFS at 6, 12, and 24 months for all the tumor types was 93.28% and 79.72%, 81.29% and 64.19%, and 61.47% and 49.05%, respectively

- HCC was associated with a better OS at 12 and 36 months
- The overall complication rate was 23.7%, with major complications (SIR grade C-F) comprising 6.9%

Eur Radiol 2021;31:6511-6521

Endovascular Therapies

Catheter based endovascular approach

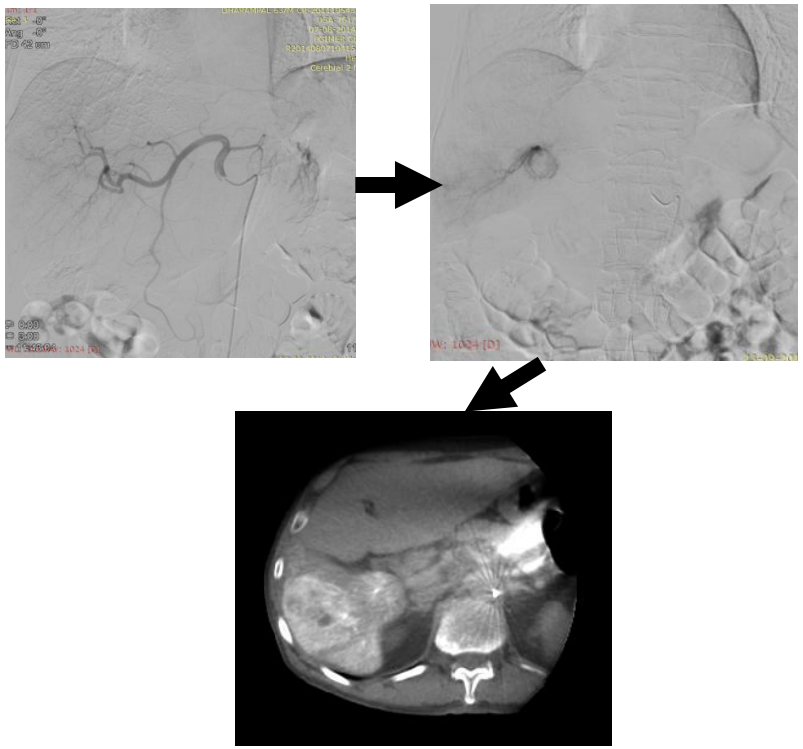
_ TAE (Transarterial embolization)

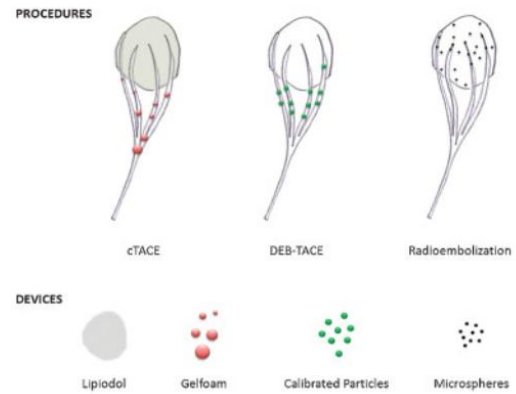
– cTACE (Transarterial chemoembolization)

– DEB (Drug-eluting beads) TACE

– TARE (Transarterial radioembolization/

Yttrium-90 radiotherapy)





Transarterial Chemoembolization (TACE)

TACE is defined as the infusion of a mixture of chemotherapeutic agents with or without iodized oil, followed by embolization with particles

Rationale of therapy

- Tumors fed primarily from hepatic arteries
- Normal parenchyma has dual blood supply
- Intra-arterial injection of Doxorubicin 50-100 mg
- Higher intratumoral concentration, minimizes systemic side effects

Contraindications

Absolute

- Portal vein malignant thrombosis
- Hepatofugal blood flow
- Impaired hepatic function (Child Pugh B8 or greater)
- Poor performance status (ECOG P2 or greater)

Relative

- Segmental or subsegmental portal vein thrombosis

Correlation between Treatment Outcome of HCC with Tumor Histology and Biochemical Parameters

Correlation between Treatment Outcome of HCC with Tumor Histology and Biochemical Parameters

M. Kasana (1) ; N. Kalra (2) ; H. Bhujade (1) ; A. Kumar (3) ; S. Mitra (4) ; S. Taneja (5) ; A. Duseja (5)
(1) Department of Radiodiagnosis and Imaging, PGIMER Chandigarh, Chandigarh, India; (2) Radiodiagnosis and Imaging, PGIMER, Chandigarh, India; (3) Radiodiagnosis and Imaging, PGIMER Chandigarh, Chandigarh India; (4) Histopathology, PGIMER Chandigarh, Chandigarh India; (5) Hepatology, PGIMER Chandigarh, Chandigarh, India

Background
Tumor differentiation is a well-established prognostic factor in hepatocellular carcinoma (HCC), with well-differentiated tumors generally associated with slower progression and improved outcomes compared to moderately or poorly differentiated tumors. Histological grading remains the gold standard for assessing tumor differentiation. Biochemical markers such as alpha-fetoprotein (AFP), Protein Induced by Vitamin K Absence or Antagonist-II (PIVKA-II), and tumor histology are frequently used in clinical practice, although their correlation with treatment response remains unclear.

Aim
To correlate the treatment outcome of HCC after conventional transarterial chemoembolization (cTACE) with tumor histology and biochemical parameters along with doxorubicin–lipiodol dosing ratios.

Methods
Thirty-three patients (28 males, 5 females; age range 52–81 years) with intermediate-stage HCC cancer with histologically confirmed cancer were included. Underlying etiologies were viral hepatitis (n = 19), metabolic dysfunction–associated steatotic liver disease (n = 6), MASLD with viral hepatitis (n = 5), and ethanol-related liver disease (n = 3). Tumors were categorized as well-differentiated (n = 15) or moderately/poorly differentiated (n = 18). All patients had Child–Turcotte–Pugh Class A (score 5 or 6) and Barcelona Clinic Liver Cancer (BCLC) stage A or B disease. All patients underwent conventional transarterial chemoembolization (cTACE) with the infusion of doxorubicin lipidol emulsion. Univariate analysis was performed to assess the correlation between 3-month post-treatment tumor viability (viable vs. non-viable) with histological grade, biochemical parameters (AFP and PIVKA-II), and doxorubicin–lipiodol ratios (1:2 and 1:1), and immune-rich and immune-poor tumors. Correlations between categorical variables were evaluated using chi-square tests, with $p < 0.05$ considered statistically significant.

Results
Statistical significant correlation was observed between 3-month treatment outcome after cTACE and histological grade ($p = 0.04$), while no statistically significant correlations were observed between AFP levels ($p = 0.75$), PIVKA-II levels ($p = 0.256$), doxorubicin–lipiodol ratio ($p = 0.86$), and immune-rich and immune-poor tumors ($p = 0.255$). Although numerical differences were noted across groups, none demonstrated predictive significance for short-term treatment response.

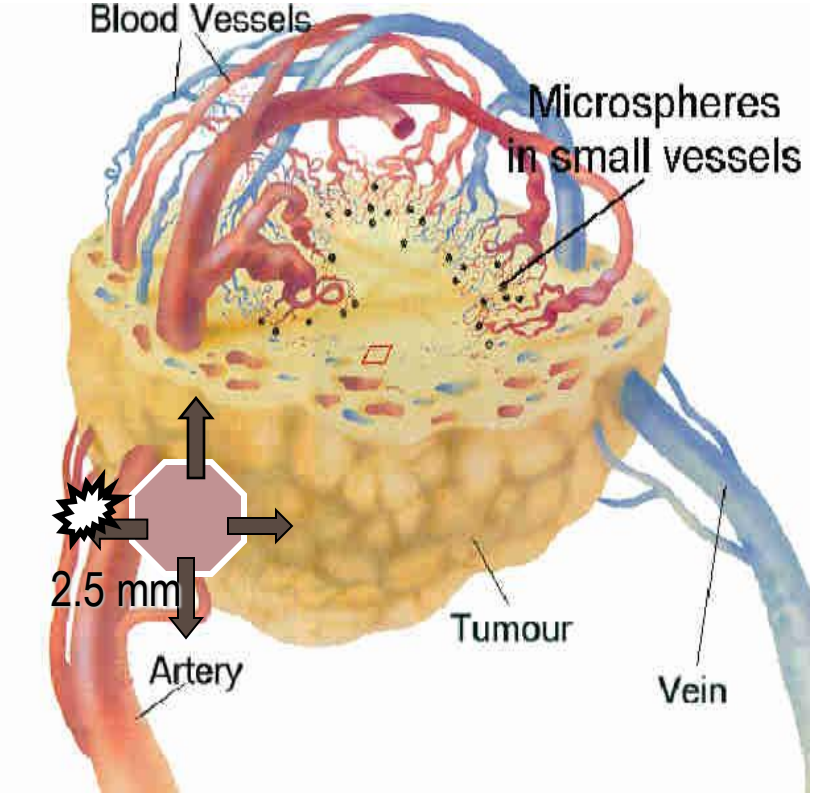
Conclusion
In this cohort, tumor histology demonstrated a significant correlation with short-term treatment outcomes in HCC patients after cTACE, whereas biochemical parameters and variations in drug-to-lipiodol ratios were not significantly correlated.

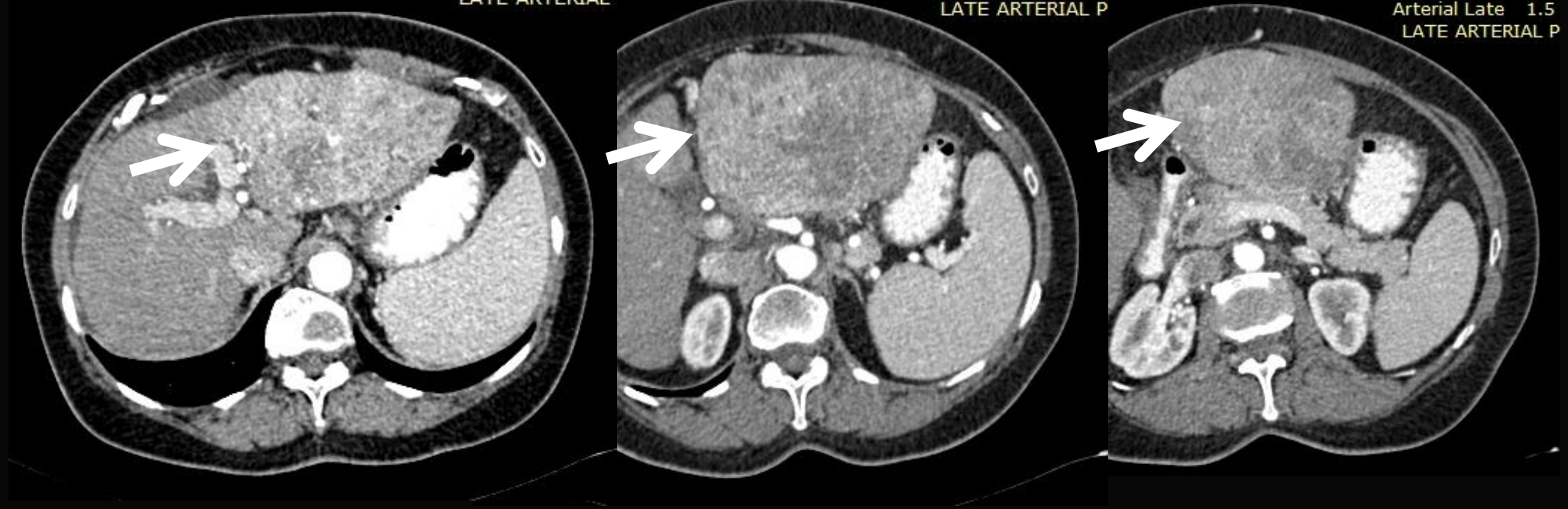
- 33 patients with intermediate stage HCC
- Categorized as well-differentiated (n=15) and moderately/poorly differentiated (n=18)
- Statistically significant correlation between histological grade and 3-month outcome

PGI study, ISVIR, 2025

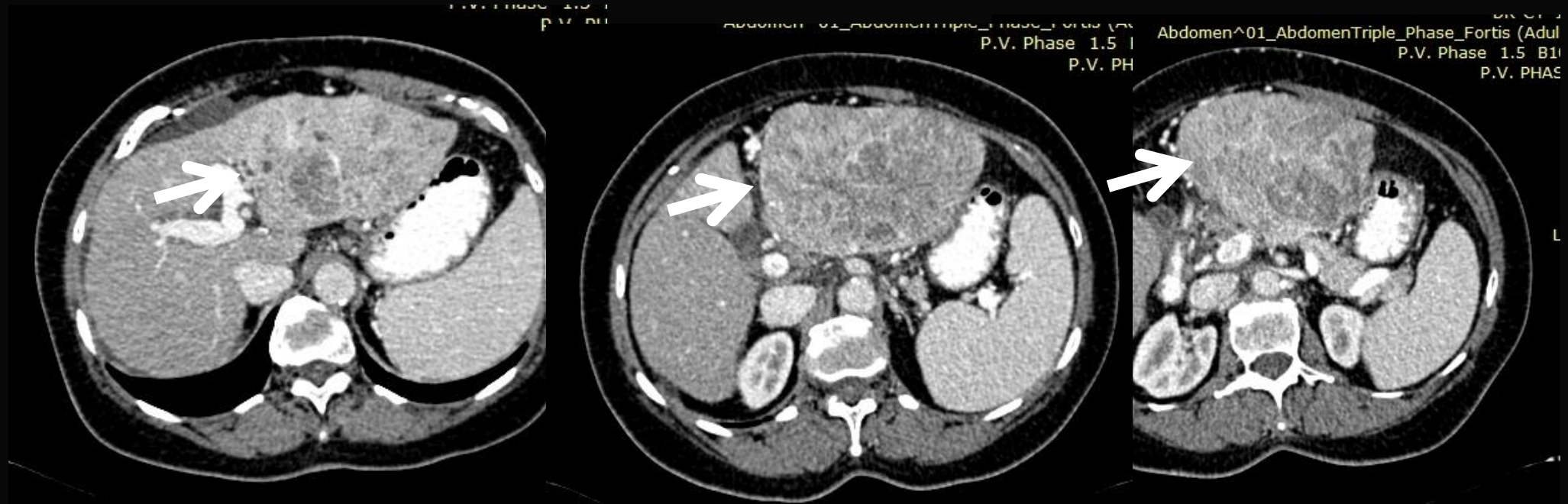
TARE

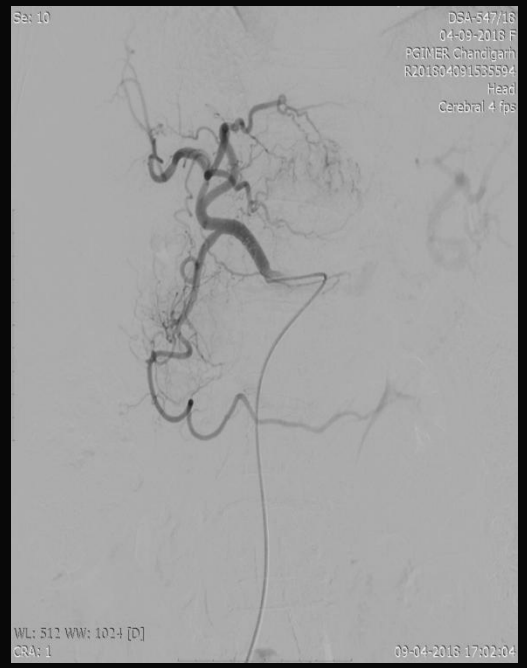
- Microspheres, 25 microns, get trapped in the tumor capillary bed
- Beta radiation; half-life 64.2 hrs
- Higher doses of radiation to smaller volumes and greater tumoricidal effect
- Mean penetration- 2.5 mm, can't penetrate > 11mm
- Minimal damage to non-tumor tissue, LSF <20%, lung dose less than 30Gy
- Nonembolic therapy

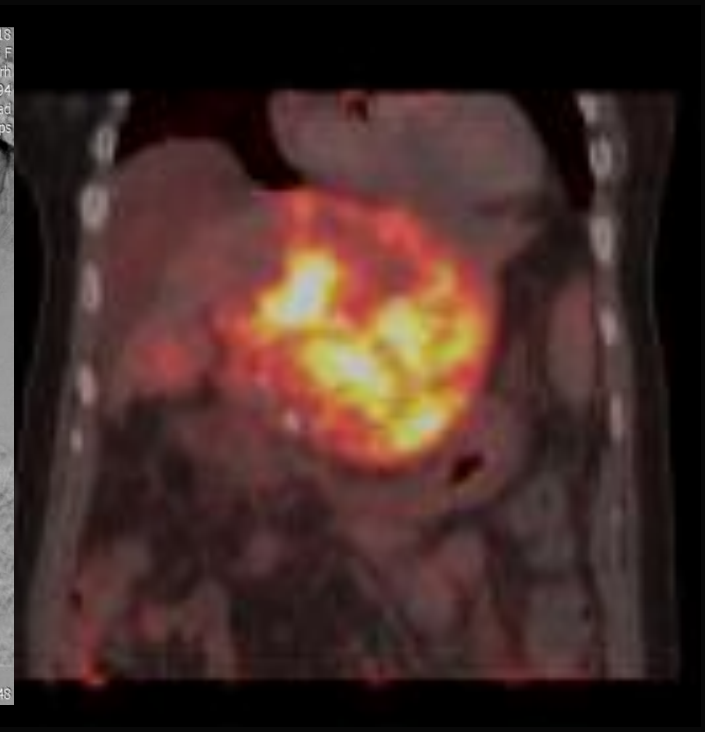




63-year-old female, HBsAg+

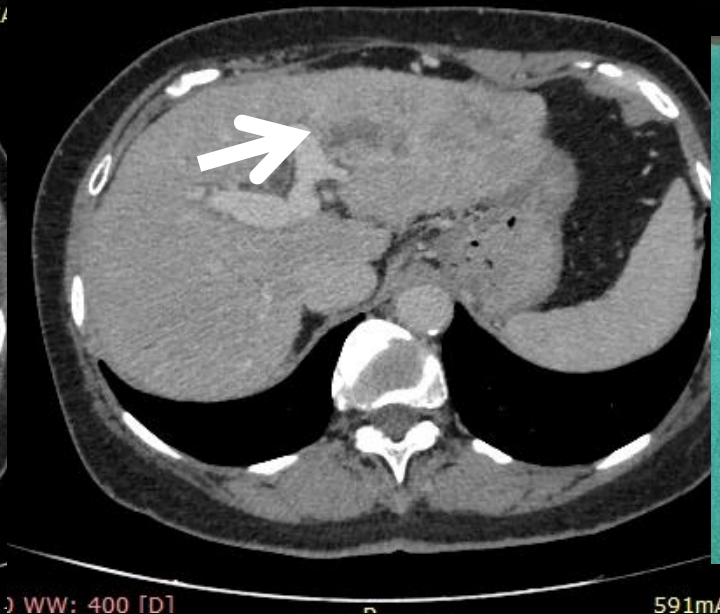






VENOUS THIN

ARTERIA



WW: 400 [D]

591mA 120kV

CYTOLOGY+HISTOPATH.
HISTOPATHOLOGY LARGE RADICAL EXCISION*

RESULT

I. Right lobe periphery lower.
J. Porta.
K. Tumor
L to Q : Tumor with capsule inked black.
R to U : Tumor full thickness composite section.
V : One single portal lymph node, bisected.
W : Second portal lymph node.

Procedure : Total hepatectomy.
Tumor Characteristics ; Solitary.
Tumor Site : Left lobe.
Tumor Size : Greatest dimension of viable tumor - 4.8 cm.
Additional dimensions - 3.7x3.5 cm.
Treatment Effect : Incomplete necrosis (viable tumor present)
Percentage tumor necrosis 60% approximately.
Histologic Type : Hepatocellular carcinoma.
Histologic Grade : G2 - Moderately differentiated.
Tumor confined to liver. Visceral peritoneum 0.1 cm away.
Porta - uninvolved by tumor - Tumor 2.0 cm from porta.
Vascular Invasion : Not identified.
Perineural Invasion : Not identified.
Additional Pathologic Findings :
Fibrosis - Calcification and cholesterol clefts with in the residual tumor.
Cirrhosis.
Chronic hepatitis.
Multiple representative sections from the liver show replacement by vari

TARE-Our Experience

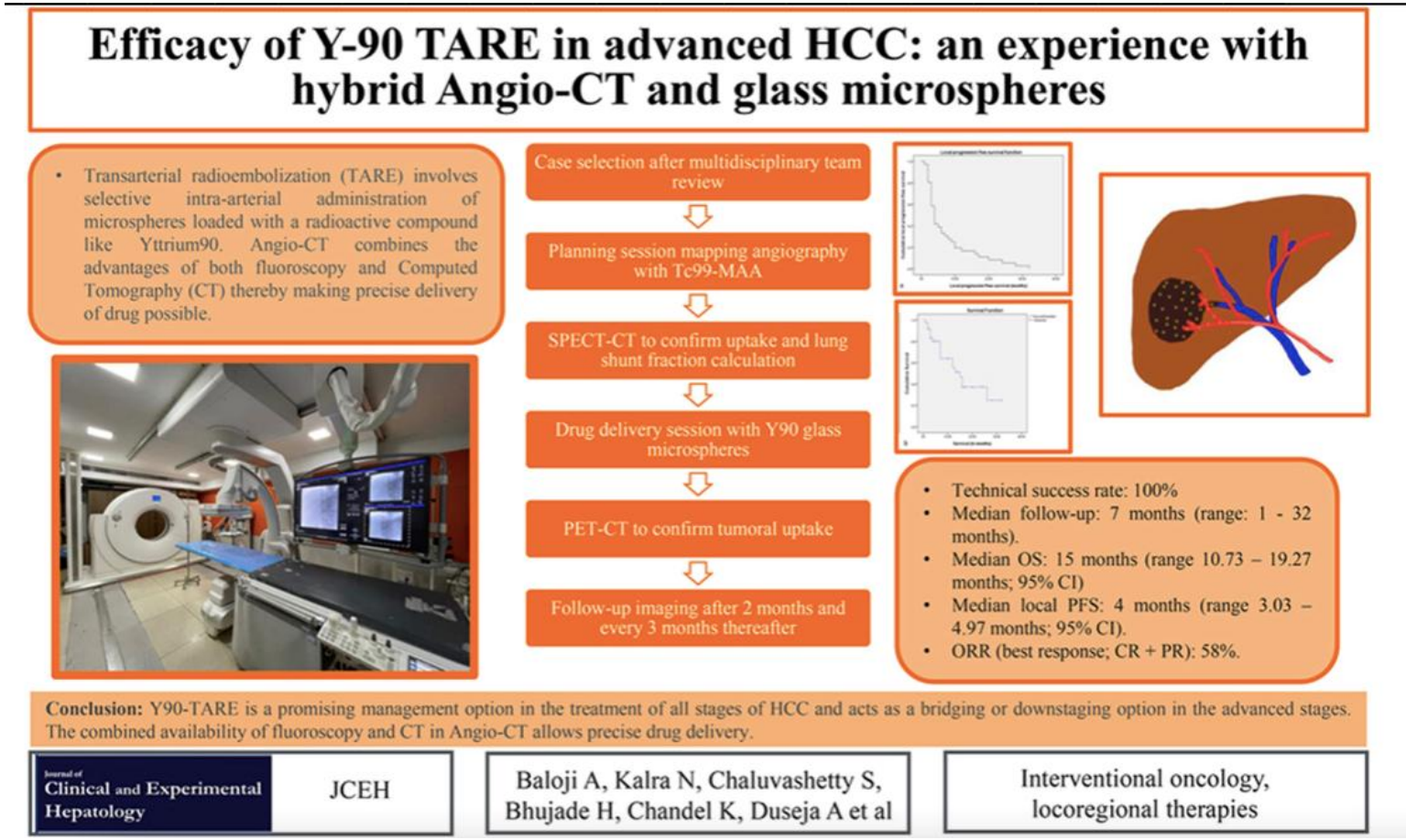
Our Experience in Y-90 TARE

Journal of Clinical and Experimental Hepatology

Efficacy of Yttrium-90 Transarterial Radioembolisation in Advanced Hepatocellular Carcinoma: An Experience With Hybrid Angio-Computed Tomography and Glass Microspheres

Abhiman Baloji [1], Naveen Kalra [1], Sreedhara Chaluvashetty [1], Harish Bhujade [1], Karamvir Chandel [1], Ajay Duseja [2], Sunil Taneja [2], Ujjwal Gorsi [1], Rajender Kumar [3], Harmandeep Singh [3], Ashwani Sood [3], Anish Bhattacharya [3], Baljinder Singh [3], Bhagwant R Mittal [3], Virendra Singh [2], Manavjit S Sandhu [1]

- Median OS was 15 months
- Median local PFS was 4 months
- ORR was 58%



J Clin Exp Hepatol 2024;14:101342

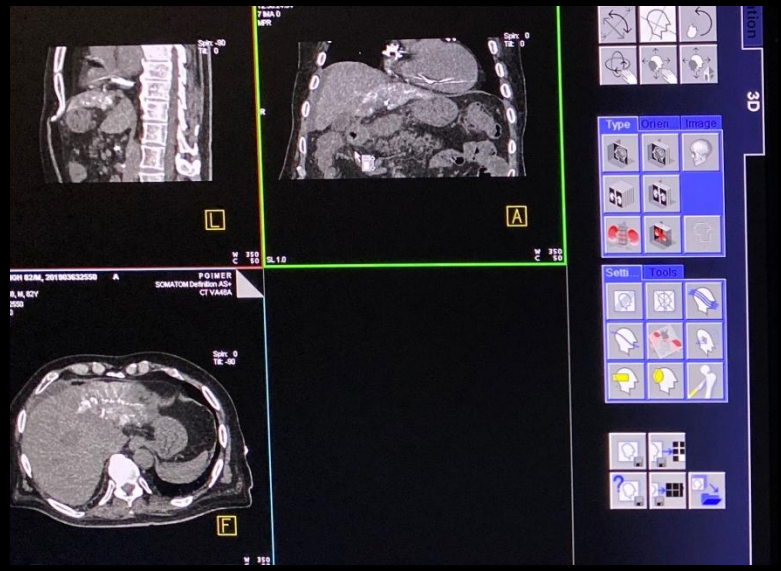
Hybrid Angio-CT:

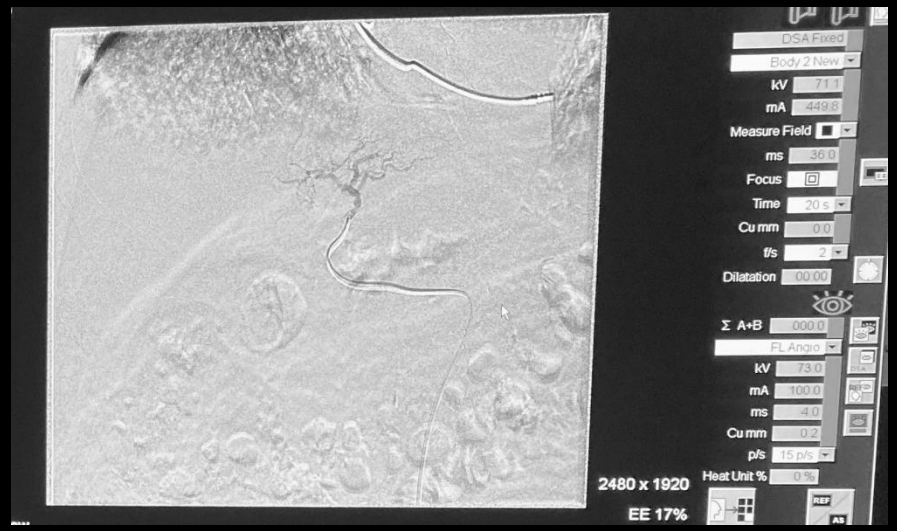
Artis Q plus

Somatom Definition

AS

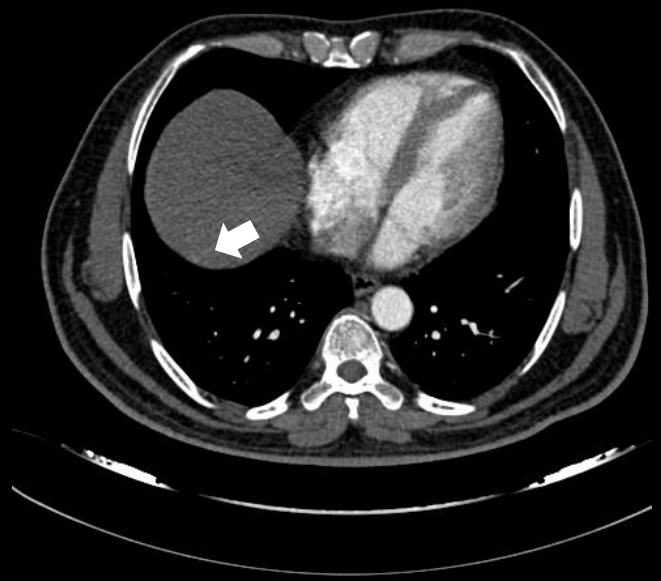
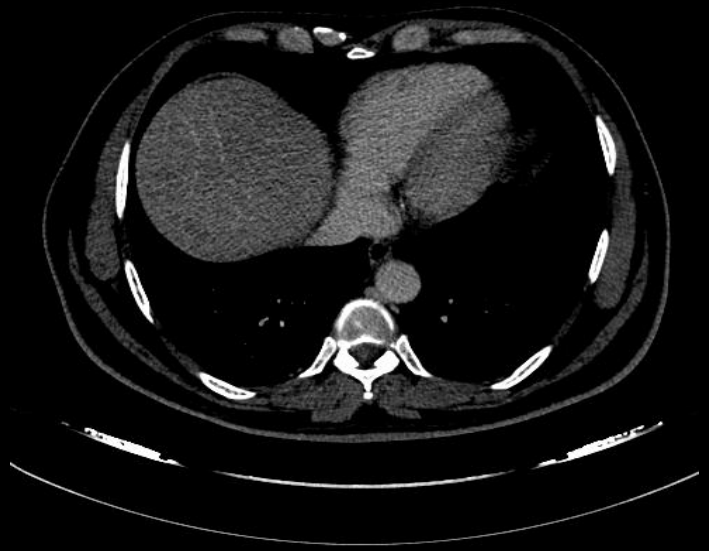
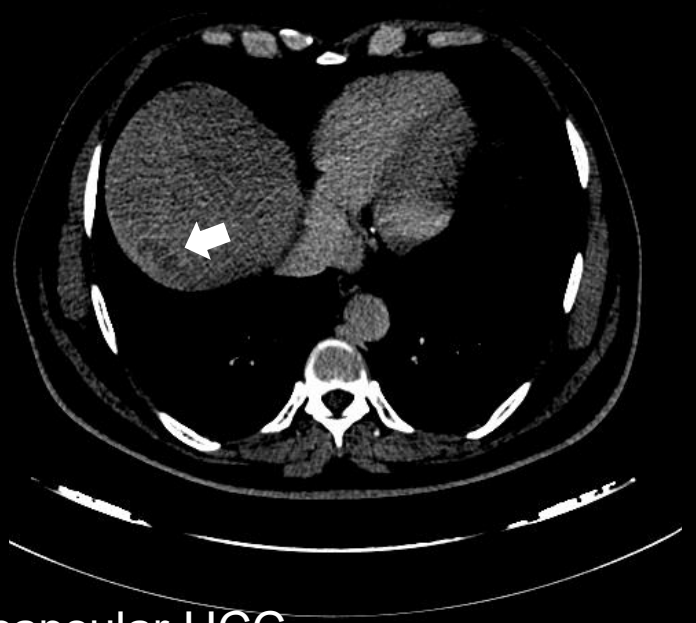
Improved workflow with seamless intraprocedural utilization of both CT and fluoroscopy in their native advanced forms



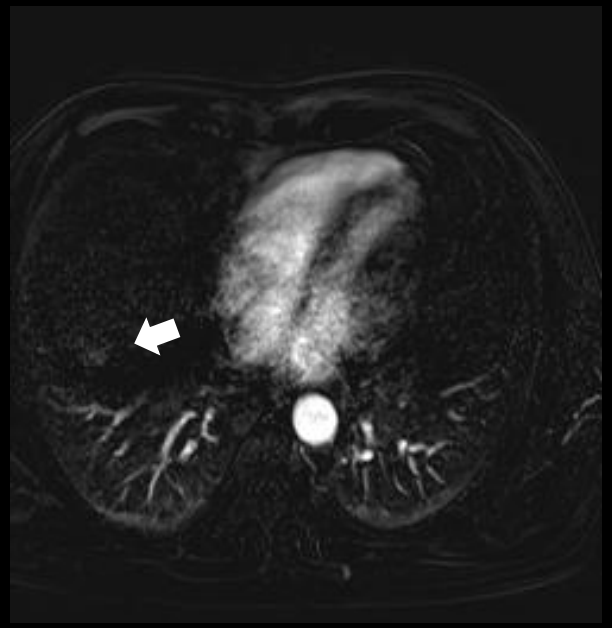


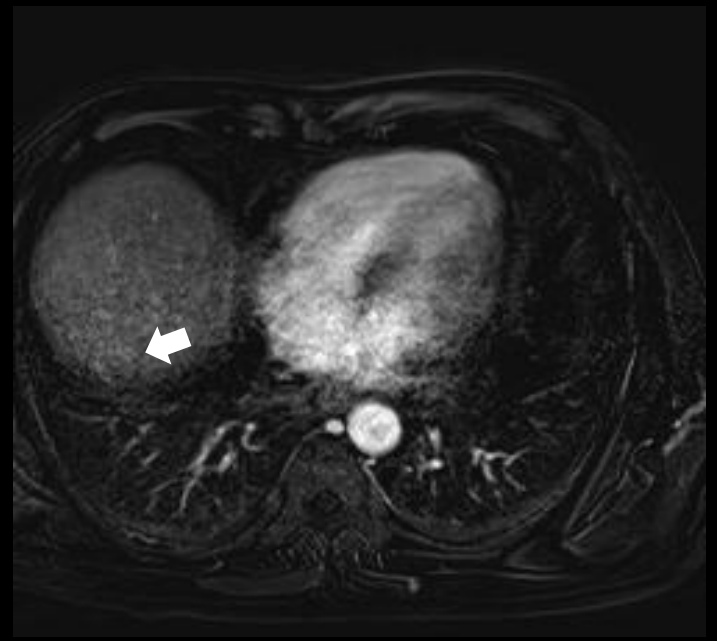
Advantages of the Hybrid System

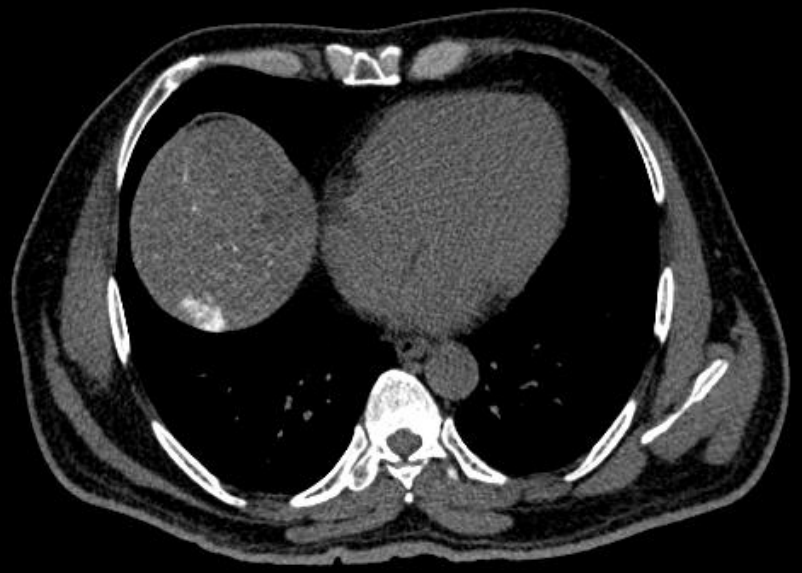
- Large field of view (50 cm)
- Faster acquisition without breath-holding
- Less susceptible to motion artifact
- CT images of diagnostic quality with rapid multiplanar and 3D reconstructions

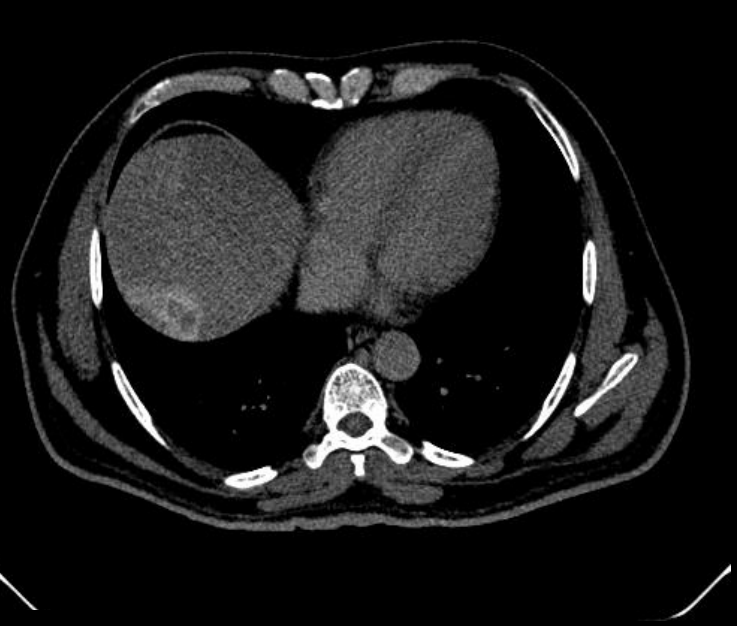




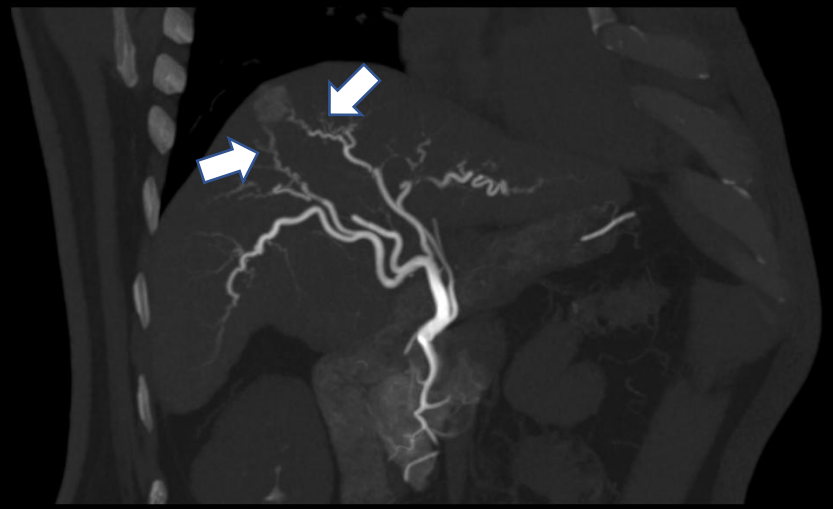
Case : 68-year-old male, ethanol-related cirrhosis with subcapsular HCC











Advanced tumor visualization and treatment guidance

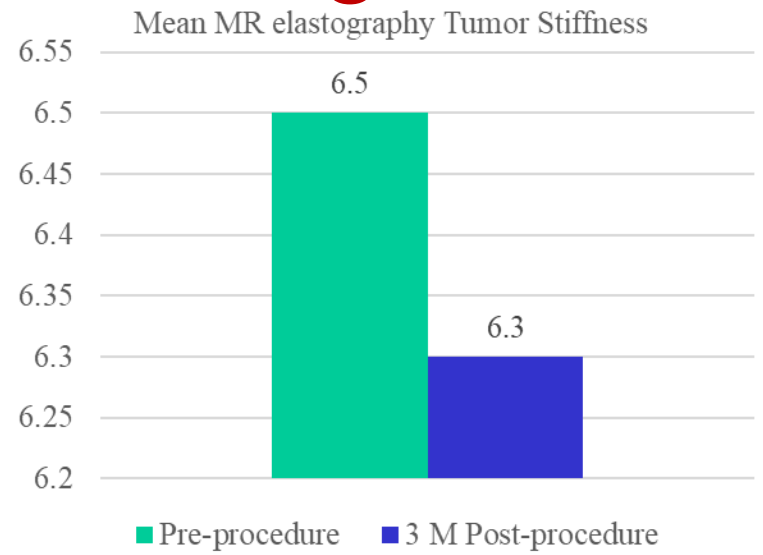
Arterial feeders for the subcapsular observation

PGIMER Study (Unpublished Data)

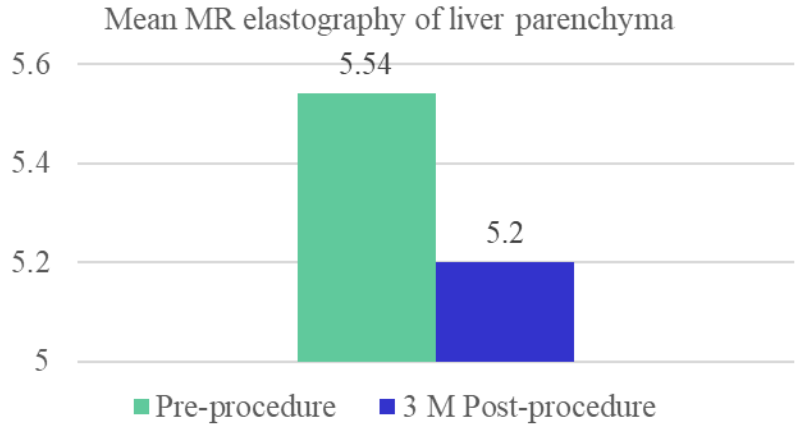
- 40 patients who underwent endovascular treatment for HCC were evaluated for incidental observations
- Pre-treatment TPCT and Angio-CT images were compared
- 158 observations were detected by Angio-CT compared to 71 on TPCT
- 16.1% of the new 87 observations were either LR 4 (probably HCC) or LR 5 (definitely HCC) on follow-up CEMR

Response Assessment of HCC to Locoregional Therapy

- Mean change in MR elastography of the lesion (post-procedure) was -0.19 ± 2.07
- Mean change (post-procedure) in the stiffness value of the rest of liver parenchyma was -0.34 ± 0.87
- Tumor stiffness was significantly lower in treated versus untreated tumors

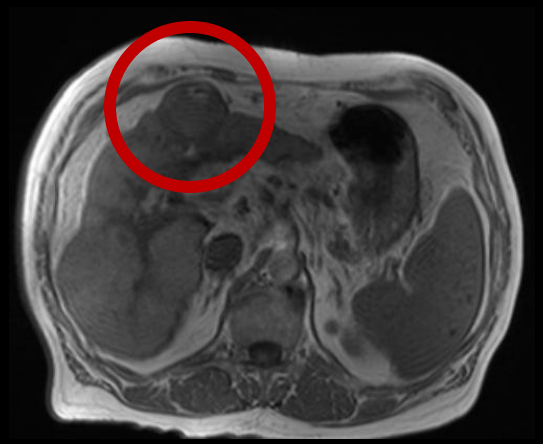


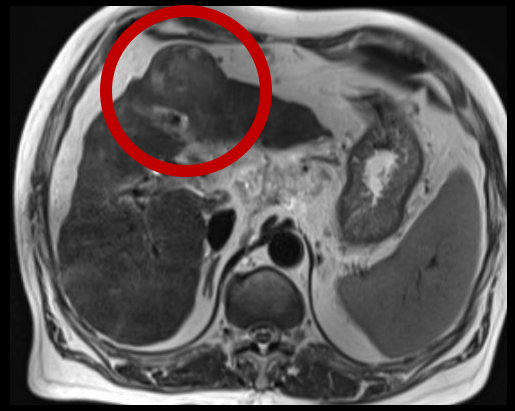
N=20

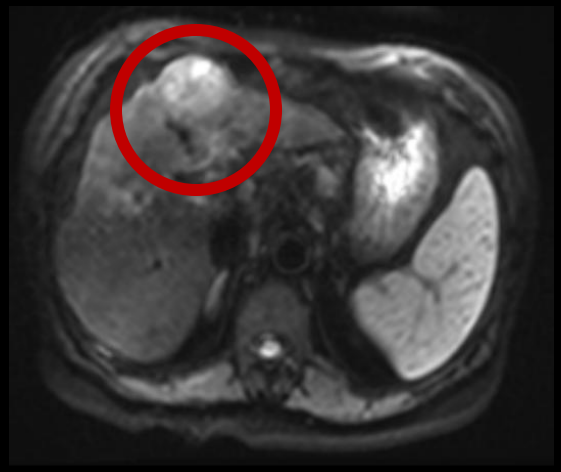


PGI study, ISVIR, 2024

PREPROCEDURE DCE MRI



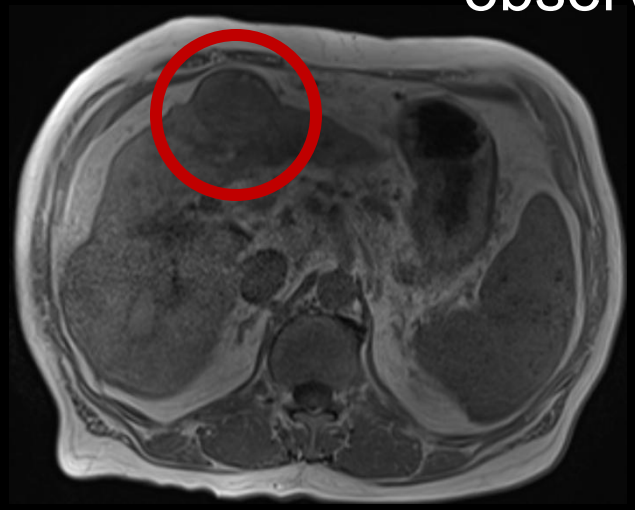


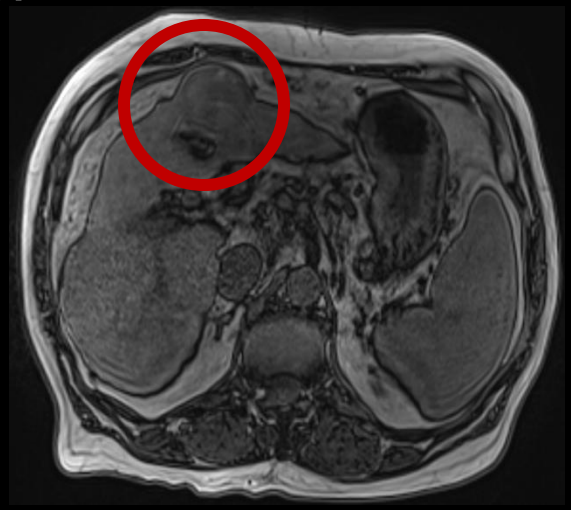


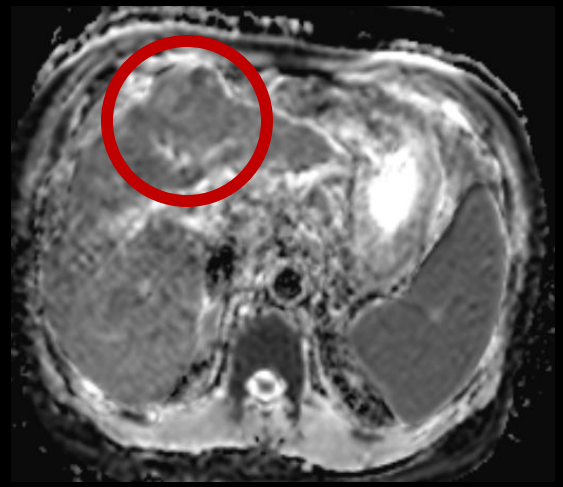
T1 and T2WI

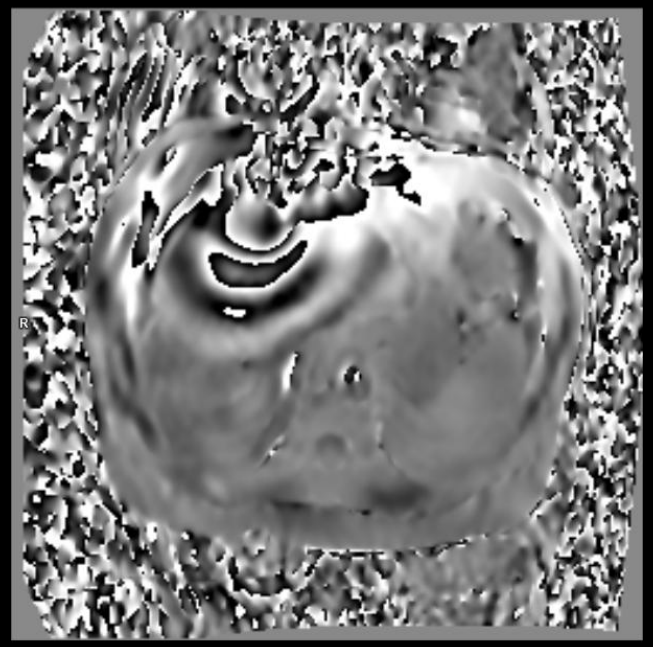
66-year-old male with MetALD and LR-5 observation

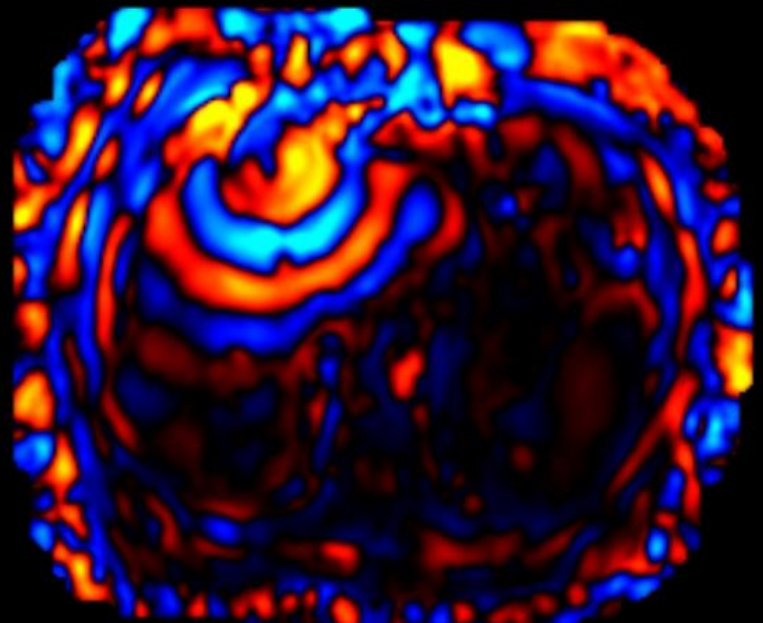
DWI



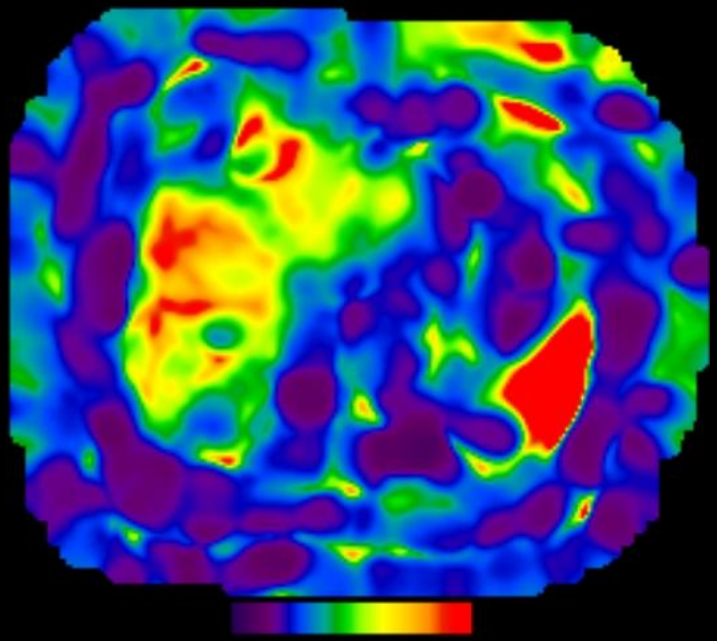




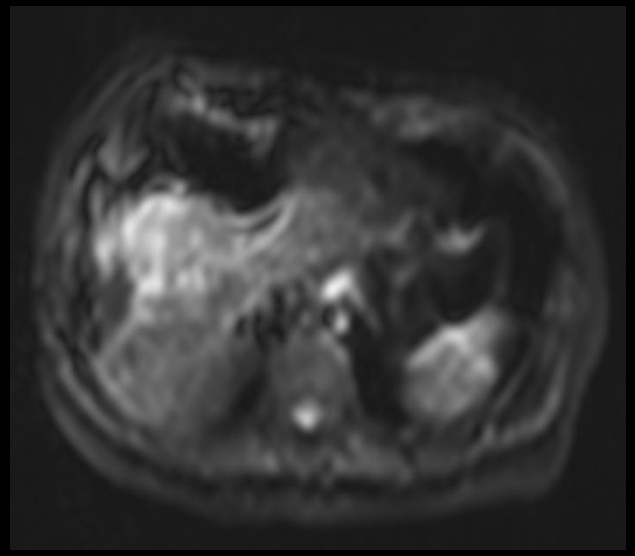


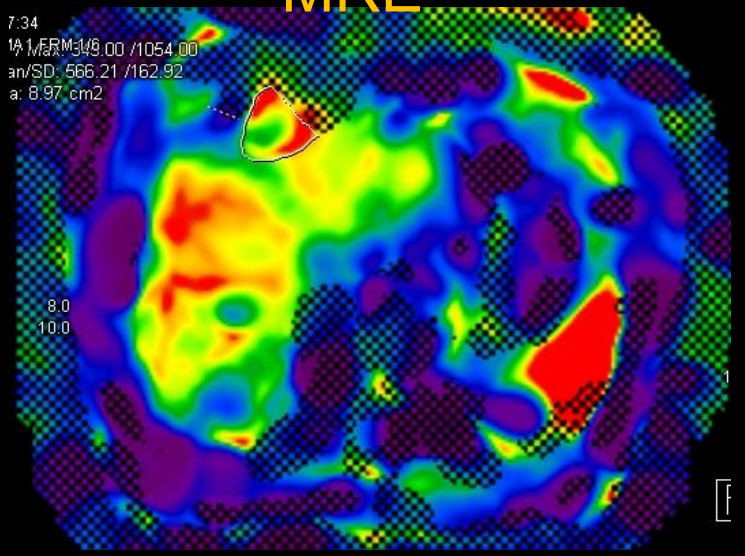


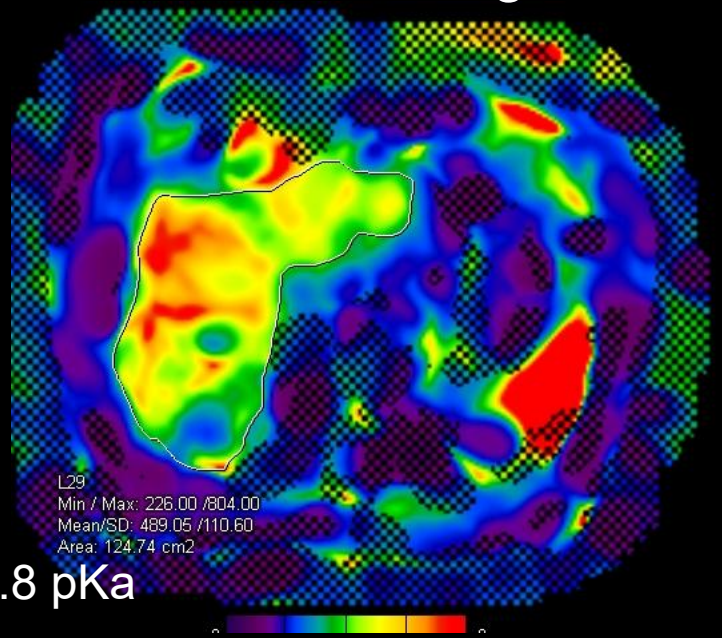
PRE-PROCEDURE
MRE



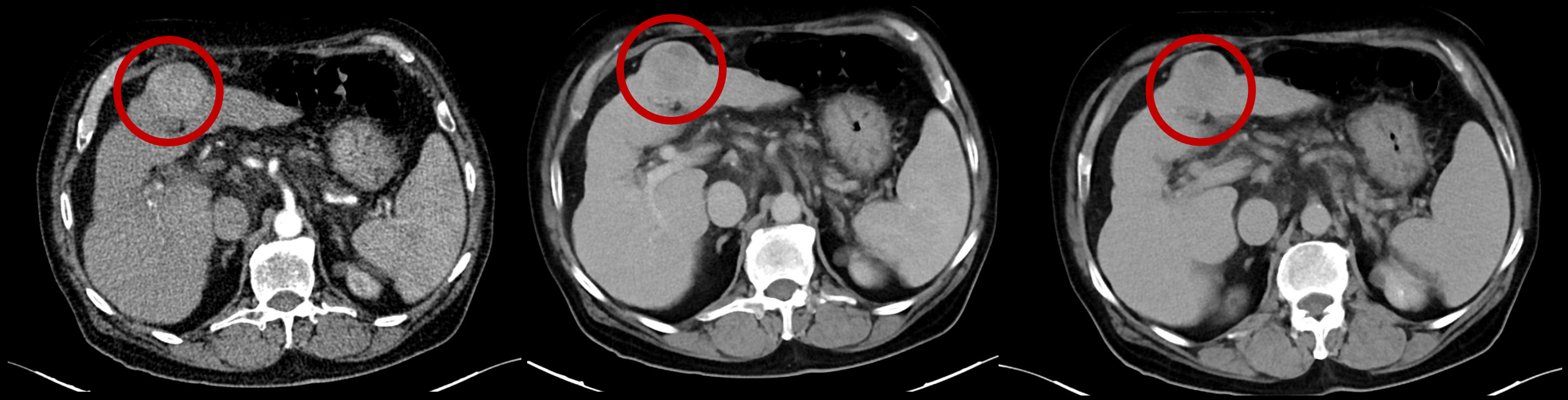
Color Elastograms



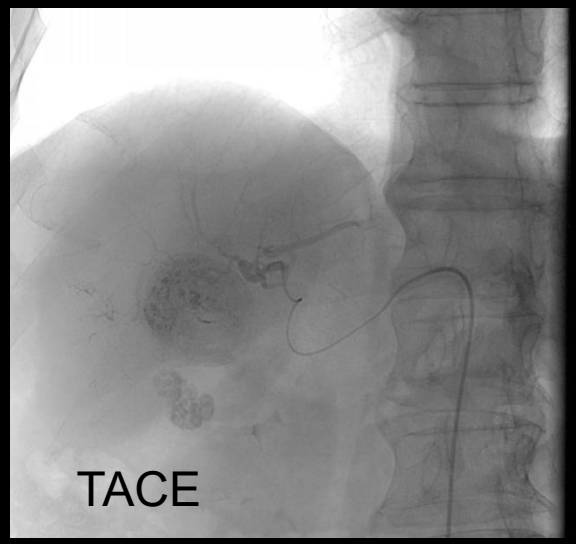


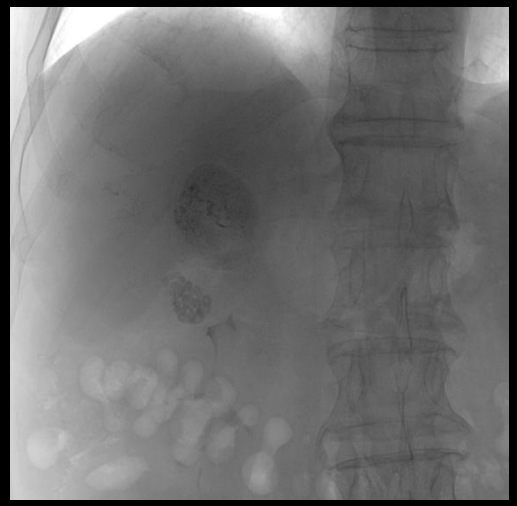


Lesion mean shear stiffness values pre-procedure – 6.8 pKa

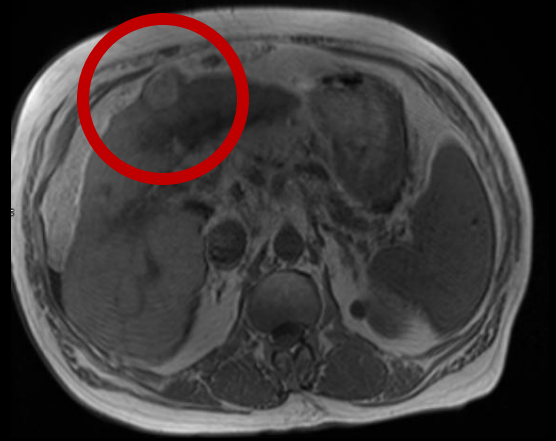


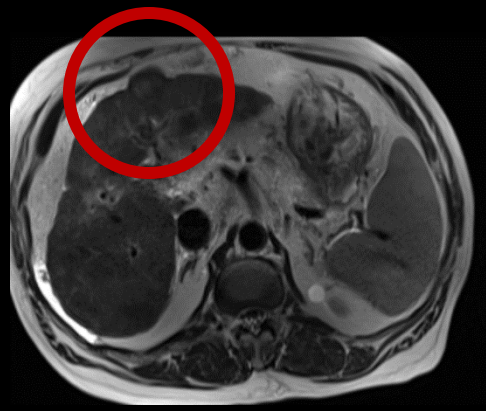
CT and Transarterial Chemoembolization (TACE)

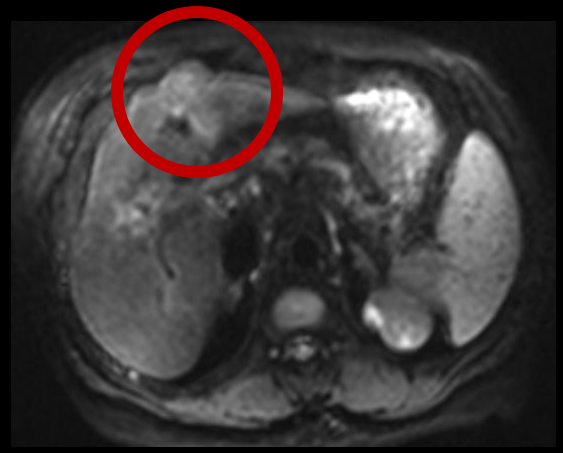




POST-PROCEDURE DCE MRI AT 12 WEEKS

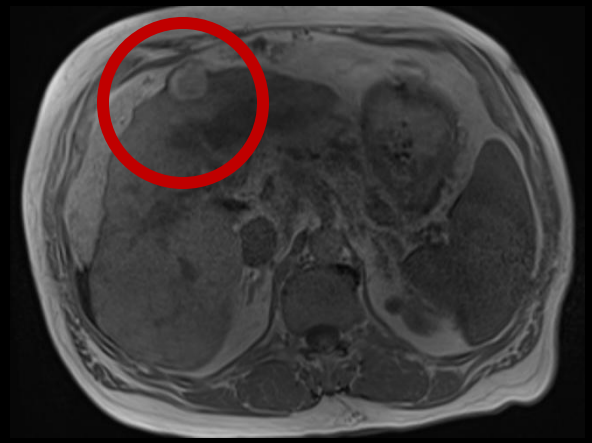


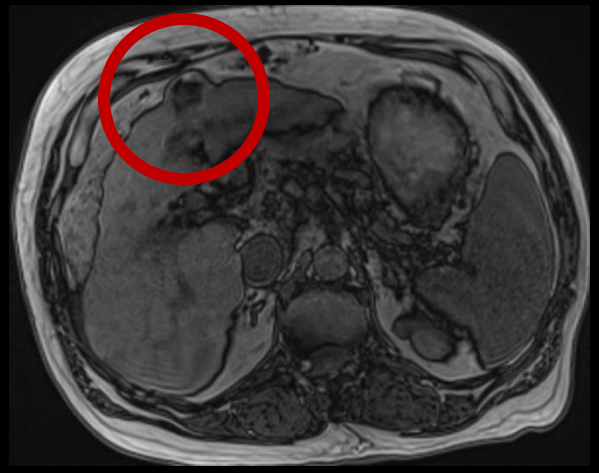


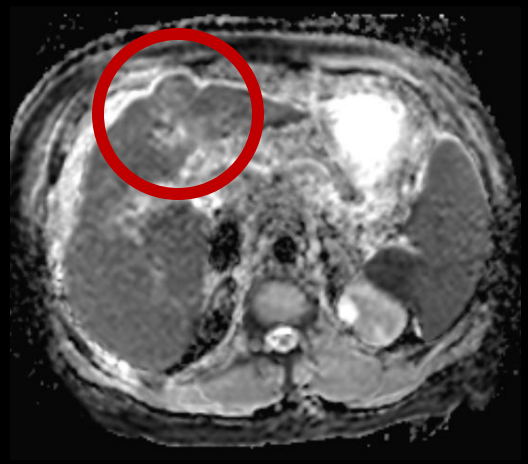


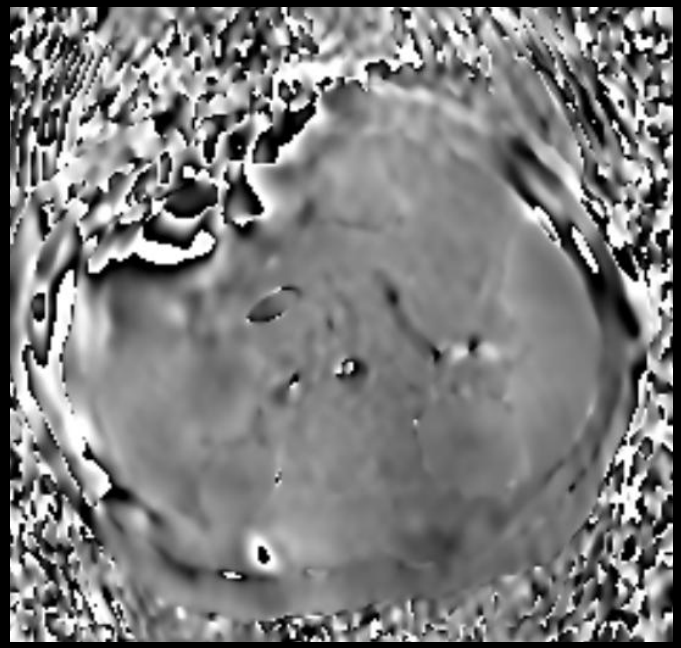
T1 and T2WI

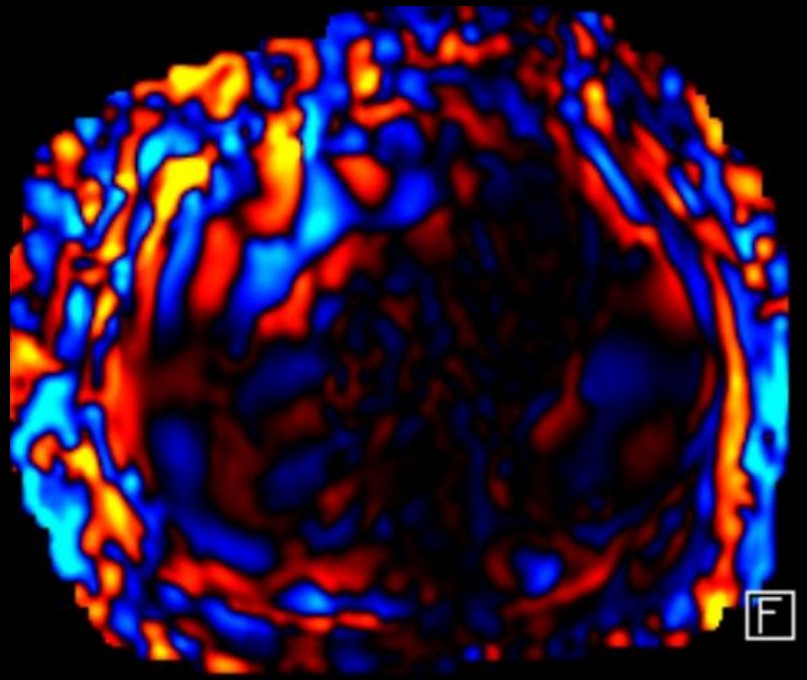
DWI

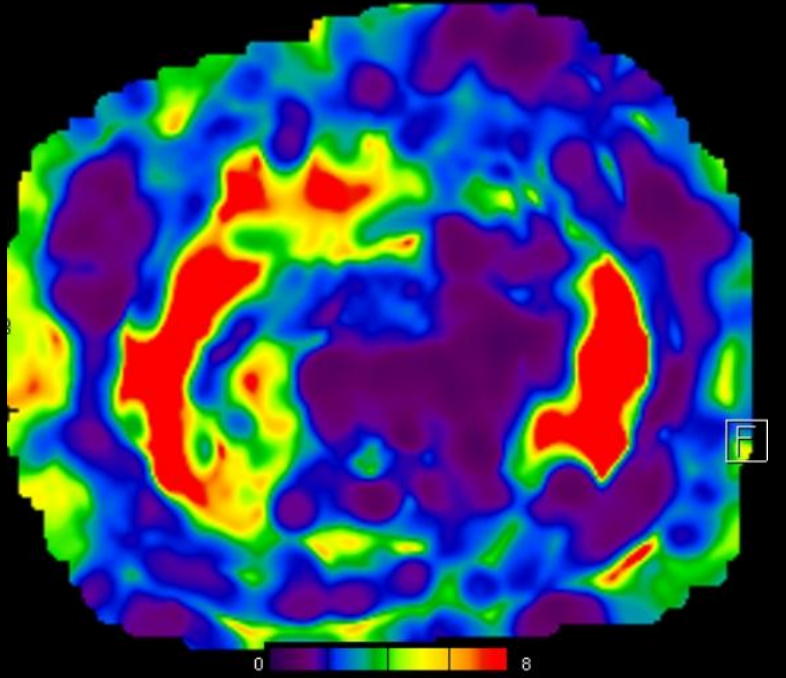






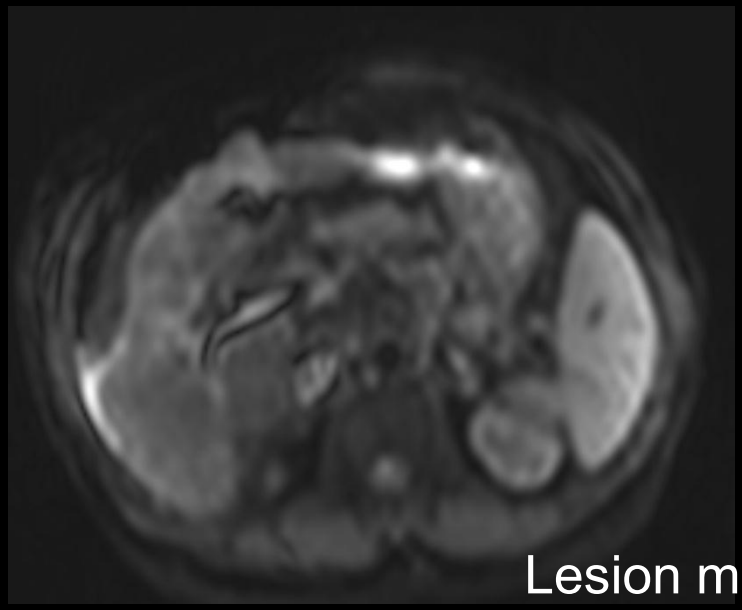


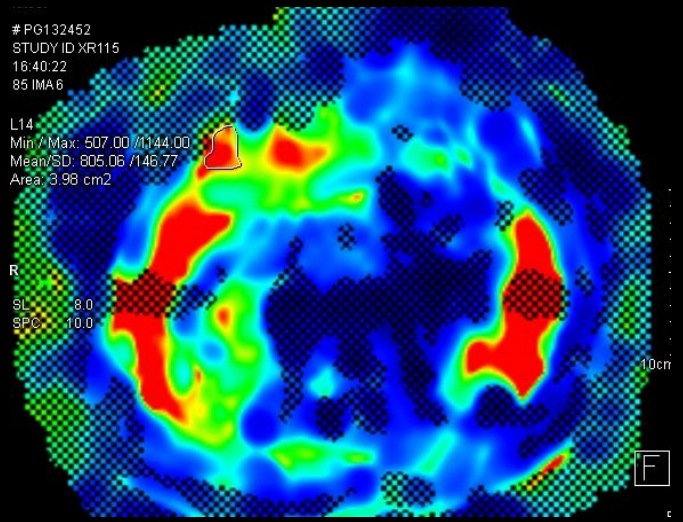


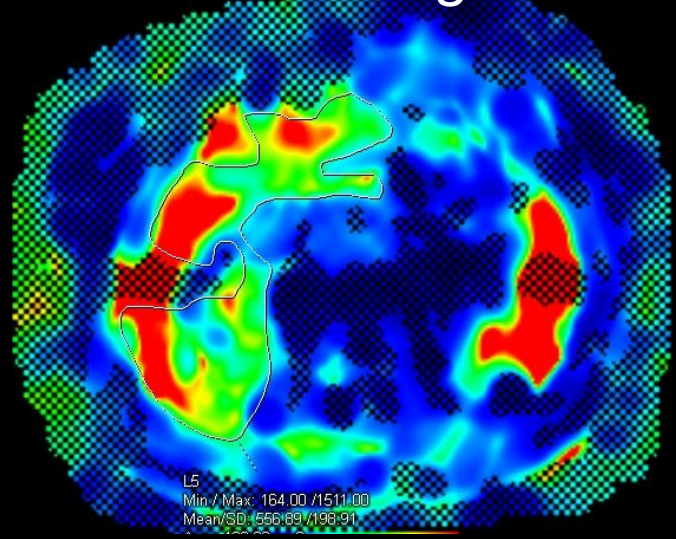


Color Elastograms

POST-PROCEDURE MRE







Lesion mean shear stiffness values post-procedure – 6.2 pKa

Conclusion

- Locoregional therapy for HCC plays an integral part in its management
- Targeted treatment with ablations and endovascular therapies are required for different stages of HCC
- A combination of various therapies may be used in different stages of HCC at different times
- Outcome evaluation post treatment is also evolving

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WJR World Journal of Radiology

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EDITORIAL

Locoregional treatment for hepatocellular carcinoma: The best is yet to come

Naveen Kalra, Pankaj Gupta, Yogesh Chawla, Niranjan Khandelwal

World J Radiol 2015;7:306-18

My Family

IR Team

Strong bond with the
Hepatology Department

Thank you

navkal2004@yahoo.com