

# **AIM OF THE WORK**

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The aim of this work was to evaluate the role of interventional radiology techniques in treatment of patients with hepatic deposits.

**PATIENTS  
AND  
METHODS**

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This study was carried out on 50 patients proved to have liver metastasis (LM) who presented to Radiology Department in *Alexandria University Hospitals*.

### Inclusion criteria

1. Histopathologically confirmed and radiographically evident liver metastases.
2. Liver confined metastases by physical examination and imaging.
3. Karnofsky performance status above 60%.
4. Baseline laboratory studies, these include a complete blood cell count, hemoglobin level, platelet count (WBC and platelets of at least 4,000 and 100,000/cumm respectively), prothrombin time at least 60% of normal, total bilirubin and serum creatinine no more than 2 mg/dl, serum albumin at least 2.5mg/dl and liver enzymes.
5. Prior systemic chemotherapy is allowed.

### Exclusion criteria

1. Poor performance status (Karnofsky status <60%).
2. Nutritional impairment.
3. Extra-hepatic disease, not preferred.
4. Poor laboratory studies.
5. Partial or complete thrombosis of the main portal vein.
6. Contraindication to angiographic and selective visceral catheterization.
7. Cardiovascular and respiratory failure.

### All the patients in our study were subjected to:

1. **History taking:** including age, sex, family history of similar condition, any risk factor for malignancy.
2. **Physical examination.**
3. **Imaging:** Ultrasonography, Triphasic CT scanning, and/or triphasic MRI assessment.
4. **Laboratory investigations:** tumor markers, liver function tests, kidney function tests, Prothrombin time and activity.
5. **Histopathological assessment.**

### Pre-procedure assessment

Cross-sectional imaging (Triphasic MRI and/or Triphasic CT of the Abdomen and pelvis, according to availability).

### Interventional technique selection

Due to the potential toxicity of chemoembolization, especially the local effects caused by hepatic ischaemia, strict criteria for eligibility for appropriate patients must be met. **The following guidelines were used to determine the best line of treatment for each patient:**

1. Any potentially resectable lesions were treated with surgery.
2. Those with fewer than 3 lesions (*each <3 cm*), generally were treated preferentially with **local thermal ablation**, if the location of the tumors makes this technically feasible.
3. **TACE** is recommended when the patients are carefully selected to include those most likely to benefit from the procedure. **The inclusion and exclusion criteria used in our study are demonstrated.** These are generally patients with a good performance status, having liver-predominant disease with symptomatic or rapidly growing tumors (*focal growth pattern is generally preferred rather than diffusely infiltrative tumors*) and a patent PV with hepatopetal flow.

## I- Trans arterial approaches

### Patient preparation

1. Proper explanation of the condition, technique, benefits, and complications was given to the patient or his first degree relatives.
2. Informed consent was obtained.
3. Most patients were hospitalized for a single night for pain control, hydration and monitoring of hepatic function.
4. Premedication included an analgesic, a sedative and an anti-emetic.
5. The groin was shaved (*all cases had femoral approach*).
6. In patients with coagulopathies, all measures were taken to improve the coagulation defect during the procedure e.g. Administration of fresh frozen plasma 1 hour before TACE.

### Materials

1. In all of our patients subjected to conventional TACE the chemoperfusion emulsion consisted of a mixture of:
  - Cytotoxic agents (*Mitomycin, cisplatin, adriamycin*).
  - Water-based contrast agent (*Ultravist*).
  - Ethiodized oil (*Ultra-fluid Lipiodol*).
2. Embolizing Agent: *Gelatin sponge (Gel-foam) particles, or PVA particles*
3. Other drugs commonly used during the procedure include:
  - **Heparinized saline:** To guard against catheter thrombosis.
  - **Local anaesthetic:** (0.5-1% lignocaine).
  - **Vasodilator agent:** (*Vasorin*) to relief arterial spasm.
4. **Drug-Eluting Beads:** The use of drug-eluting microspheres in a new variation of the TACE method is designed to improve the precision of drug delivery. Drug-eluting microspheres are made of polyvinyl alcohol hydrogel and are biocompatible, hydrophilic, and nonresorbable.
5. Yttrium-90 (<sup>90</sup>Y) bearing microspheres act as point sources of radiation that, when delivered via the hepatic artery, are deposited predominantly within tumor tissue.

### Catheters and guidewires

Because the human body has a great variety of arterial curves and branching patterns further complicated by disease states, a wide variety of catheter systems is mandatory to allow free navigation through the vascular tree. Finding a good match between the catheter, the guidewire and the vascular anatomy is the **secret to successful superselective**

**catheterization which:**

1. Provides the Ability to opacify and identify small peripheral hyper-vascular or occult bleeding points not appreciated on standard selective studies.
2. Provides the ability to embolize tumors and bleeding sites without sacrificing adjacent clinically sensitive normal tissue.
3. Minimizes ischemic damage to the duodenum, gallbladder, and central bile ducts from possible reflux embolization .

**Selective catheters (4 -5f):**

In our study, catheterization was achieved using 4-5f **Cordis** (*Cordis, Johnson & Johnson's, Germany*). Different catheters with pig tail, J-shaped, cobra & shepherd-hook curves were found to be very useful for achieving successful catheterization of 3<sup>rd</sup> or 4<sup>th</sup>-order vessels of adequate caliber and fairly simple branching vascular pattern. **These catheters were used as:**

- Primary delivery catheters.
- Guiding conduits for coaxial superselective microcatheters.

**Microcatheter systems (3 F) (co-axial catheters)**

In our study superselective catheterization was achieved using a 3f SP-Terumo (*Terumo, Medi-tech, Tokyo, Japan*) coaxial system (*micro-catheter and guidewire*).

**The guidewires**

In our study standard 0.035 inch stainless steel curved **Cordis** (*Cordis, Johnson & Johnson's, Germany*) guidewires as well as 0.025 & 0.035 inch curved & straight Terumo hydrophilic coated guidewires (*Terumo, Medi-tech, Tokyo, Japan*) were used to achieve super selective catheterization.

**The guidewires pass through the catheter lumen**

- Straight-end guidewires are used to straighten the catheter so that it can be passed beyond the origin of a certain vessel.
- Curved-end guidewires are used to guide the catheter into the lumen of a desired branch.
- Used to advance the catheter in the lumen of the vessel to guard against dissection and prevent catheter recoil out of the vessel.

**The arterial needle**

Thin-walled 18 gauge or 19 gauge arterial needles were used in our study to allow insertion of standard 0.035-inch stainless steel guidewires.

**The Introduction Sheath**

6 or 7f **Cordis** (*Cordis, Johnson & Johnson's, Germany*) Sheaths were used in our study. These are polyethylene tubes that are usually first inserted as a safety precaution, the catheters (*5f or smaller*) are then introduced through the sheath. It allows multiple introductions and replacements of the different catheters without the risk of additional trauma to site of puncture, it also allows painless catheter manipulations and minimization of bleeding and post-procedural haematoma.

## **Technique**

**Hepatic Angiogram**, Diagnostic angiography was performed and consisted of selective celiac and superior mesenteric arteriograms to evaluate the hepatic arterial anatomy.

**For conventional TACE ..... Preparation and injection of the chemoemulsion:** chemotherapeutic agents (usually a combination of doxorubicin, cisplatin, and mitomycin C) are mixed with lipiodol, an iodized oil that acts as a carrier followed by injection of the absorbable gelfoam sponge particles:

### ***Use of Drug-eluting Microspheres***

**Drug Preparation:** The saline suspension in the DC bead microsphere (DEB; Biocompatibles UK, Surrey, UK) was removed and the beads were mixed with chemotherapeutic agent (e.g: irinotecan solution) at least four hours before the procedure depending on the dose that was planned to be delivered.

Slow injection of the irinotecan-loaded DC beads is highly recommended to avoid reflux of embolic material. In addition to that, particular attention into identifying the cystic artery is recommended to ensure that the catheter tip passed this point to avoid extra hepatic infusion into the gallbladder. Additional embolic material is not usually followed after appropriate treatment.

### ***Treatment monitoring***

Treatment is discontinued if any of the following end points is reached:

1. Evidence of hepatic metastases progression by imaging.
2. Development of extrahepatic disease.
3. Intolerance to the chemotherapy.
4. Emergence of any of the exclusion criteria.

### ***Response evaluation***

Patients were followed-up for any treatment-related adverse experiences for 30 days after each treatment and monitored for survival. Follow up imaging after treatment was performed in the first 3 months, then after 6, 9, 12 months, with assessment of:

1. The morphologic tumor response (number, localization and size) by the same cross-sectional imaging used as base line (MRI and/or Triphasic CT of the Abdomen) for the enhancement pattern of the target lesion and tumor response rates measured according to RECIST criteria.
2. General condition and functional status of the patient (Karnofsky Scale of performance status).
3. Laboratory investigations. (tumor markers)

### ***RECIST (Response Evaluation Criteria in Solid Tumors)***

- Imaging modality: CT and/or MR imaging.
- Measurable lesions: Lesions that can be accurately measured in at least one dimension.
- Measurement method: Longest diameter in the axial plane.
- Response category:
  - CR (Complete Response): Disappearance of all lesions; confirmed at 4 weeks.
  - PR (Partial Response): 30% decrease in the sum of the longest diameters of target lesions, with the base line measurements taken as the reference confirmed at 4 weeks.

- SD (Stationary Disease): Neither PR nor PD criteria are met.
- PD (Progressive Disease): 20% increase in the sum of the longest diameters of target lesions, with the smallest sum of the longest diameters recorded since treatment started taken as the reference; appearance of new lesions; or unequivocal progression of non-target lesions.

## II- Local Ablation techniques

Equipment used for RFA was Rita medical system<sup>R</sup> (Mountain view, Calif), the device consists of electrical generator, needle electrode, ground pads. The device made by Rita medical system<sup>R</sup> has a 15 Gauge needle with four to eight retractable curved prongs. The radiofrequency generator was operated at 460k HZ at a power setting of 50-200 W.

The equipment for microwave ablation consists of a microwave generator and needle electrodes (microtaze, Heiwa, Osaka, Japan). A microwave generator is operated at 60 W. needle electrodes are 25 cm long, 18 G monopolar units.

Ultra sonography (US) is the primary modality for guiding the procedure, although both computed tomography (CT) and magnetic resonance imaging (MRI) can also be used.

All patients in our study population required deep sedation or anesthesia. Pre-procedure preparation included 3-6 hours fasting.

## Statistical analysis of the data

Data were fed to the computer using IBM *SPSS software package version 20.0*.

Qualitative data were described using number and percent. Comparison between different groups regarding categorical

Quantitative data were described using mean and standard deviation for normally distributed data while abnormally distributed data was expressed using median, minimum and maximum.

For normally distributed data, comparison between two independent population were done using independent t-test while more than two population were analyzed F-test (ANOVA) to be used.

Significance test results are quoted as two-tailed probabilities. Significance of the obtained results was judged at the 5% level.

a- Mean value  $(\bar{X}) = \frac{X}{n}$ .

**Where** X = the sum of all observations.  
n = the number of observations.

b- The standard deviation S.D. =  $\sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$

**Where**

$\sum (X_i - \bar{X})^2$  = the sum of squares of differences of observations from the mean.

**c- Student (Unpaired-sample) “t” test:**

It is used during comparison between the means of different sample groups. The “t” is calculated as follows:

$$t = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

**Where**

$X_1$  = Mean of first group.

$X_2$  = Mean of second group.

$S_1$  = Standard deviation of the first group.

$S_2$  = Standard deviation of the second group.

$n_1$  = Sample size of the first group.

$n_2$  = Sample size of the second group.

**d- One way analysis of variance (ANOVA) was performed for comparison between more than two groups**

Variance ratio F was computed by the formula.

$$F_{(r-1), (n-1)} = \frac{\text{Means square between classes}}{\text{Mean square within classes}}$$

Where  $r$  = number of groups  $n$  = total sample size

**e- Chi-Square test**

It tests the association between qualitative nominal variables, it is performed mainly on frequencies. It determines whether the observed frequencies differ significantly from expected frequencies.

$$\text{Computed } \chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where  $E$  = expected frequency  $O$  = observed frequency

$$E = \frac{\text{Raw total} \times \text{Column total}}{\text{Grand total}}$$

# RESULTS

## RESULTS

This study was carried out on 50 patients proved to have liver metastasis (LM) who presented to Radiology Department in *Alexandria University Hospitals* (the main university hospital and Elmowasah university hospital).

### Demographics

The study was conducted on fifty patients. The mean age of the patients was fifty one years (the age range was from 2-68 years), thirty six patients were above fifty years (72%) and fourteen patients were below 50 years (28%). (Table VII). The patients were divided into twenty one males (42%) and twenty nine females (58%) (Table VII).

**Table (VII): Demographic data of the studied patients.**

	Number	Percent
<b>Age</b>		
< 50	14	28.0
> 50	36	72.0
<b>Sex</b>		
Male	21	42.0
Female	29	58.0

All the patients in this study were proven to have primary malignant neoplastic lesion with liver metastatic lesions .....different primary malignant lesions were encountered in this study, the most common primary malignant lesion was colo-rectal cancer .Out of fifty patients, twenty one patients suffered from colo-rectal cancer (42%), and ten patients suffered from neuro-endocrine tumors (20%)(Table VIII) ,both Colorectal cancer and neuro-endocrine tumors constituted 62% of the study population ,the non colorectal –non neuroendocrine tumors constituted 38% of the study population. The most common non colorectal –non neuroendocrine malignancy in this study was gastric cancer, seven patients (14%) in this study suffered from cancer stomach.

Other malignant primary lesions were distributed as the following: 2 patients suffered from cancer breast (4%), 2 suffered from cancer esophagus (4%), 2 patients suffered from neuroblastoma (4%), 3 with cancer ovary (6%) and 3 patients with cancer uterus (6%) (Table VIII).

**Table (VIII): Distribution of the studied patients regarding primary site.**

	<b>Number</b>	<b>Percent</b>
Colon	21	42.0
Neuro-endocrine	10	20.0
Stomach	7	14.0
Ovary	3	6.0
Uterus	3	6.0
cancer esophagus	2	4.0
Breast	2	4.0
neuroblastoma	2	4.0
Total	50	100.0

### **Hepatic lesions topographic data**

There was different behavior of the liver metastatic lesions regarding their number, size, pattern of enhancement and distribution of the lesions. Regarding the number of the lesions, there were twenty seven patients (54%) with single metastatic focal hepatic lesion, 8 patients (16%) with 2 metastatic focal lesions, and 15 patients (30%) with multiple metastatic focal hepatic lesions (table IX).

The sites of the focal hepatic metastatic lesions were variable in this study, sixteen patients (32%) suffered from metastatic lesions targeting both lobes of the liver, four patients (8%) in left hepatic lobe, and 30 patients (60%) in right hepatic lobe (table IX).

The lesions were of variable sizes in this study. There were 7 patients with lesions less than 2 cm in maximum diameter, 22 with lesions between 2-5 cm, and 12 patients with lesions between 5-10 cm, and 9 patients with sizable lesions more than 10 cm in maximal diameter.

There were different patterns of enhancement of the metastatic focal lesions encountered in this study .Avid early enhancement ( in the HAP of the study ) were noted in ten patients (20%),delayed enhancement lesions were noted in fourteen patients(28%) ,and poorly enhancing lesions were noted in twenty six patients (52%) .The patterns of enhancement were important factor in assessment of the lesions as guidance for applicability of trans-arterial approaches and for judgement of its effectiveness. (Table X)

**Table (IX): Imaging data of the studied patients.**

	<b>Number</b>	<b>Percent</b>
<b>Number of focal lesions</b>		
Single	27	54.0
Two	8	16.0
Multiple	15	30.0
<b>Site of focal lesion</b>		
Both lobes	16	32.0
Left	4	8.0
Right	30	60.0
<b>Size</b>		
<2	7	14.0
2-5	22	44.0
5-10	12	24.0
>10	9	18.0

**Table (X): Detailed Pre and post contrast CT features of the lesions.**

		<b>Frequency</b>	<b>Percent</b>
<b>Non contrast features</b>	Initially hypo dense	45	90
	Initially hyper dense	2	4
	Initially hypo dense with few calcific foci	3	6
<b>Post contrast features Early enhancement (HAP of the study)</b>	Homogenous hyper dense	8	16
	Hyper dense with central breaking down	2	4
<b>Delayed enhancement</b>	Homogenous	5	10
	Peripheral enhancement with central breaking down	9	18.0
<b>Poor enhancement</b>	Hypo dense	21	42
	Hypo dense With Central Breaking Down	2	4
	Hypo dense With Internal Calcification	3	6

## Clinical data

All the patients in this study suffered from primary malignant neoplastic lesions with secondary hepatic metastatic lesions. The patients first referred to the surgical department for the primary lesion, forty six patients (92 %) underwent surgical approach for the primary malignant lesion and four patients (8%) had negative relevant operative history (Table XI)

**Table (XI): Distribution of the patients according to their relevant operative history.**

Relevant operative history	Number of patients	Percent
Positive	46	92%
Negative	4	8%

There were different chemotherapeutic regimens according to the primary site and the response of the lesions. FOLFOX combination (Leucovorin + Fluorouracil + Oxaliplatin) was the most commonly used in this study; twenty eight patients (56%). (Table XII)

Thirty four patients in this study (68 %) developed isolated hepatic metastatic lesions along the course of the disease (table XIII) while sixteen patients suffered from extra hepatic lesions (32%). From the 16 patients, 12 patients developed extra hepatic lesions along the course of the disease (24%) while four patients (8%) suffered from stable extra hepatic lesions in serial follow up before the interventional procedure. (Table XIII)

The locations of the encountered extra hepatic lesions were variable with 13 were in the chest, while 3 had retroperitoneal nodal metastasis.

**Table (XII): Distribution of the patients according to the chemotherapy given.**

	Number	Percent
5 fluorouracil(5FU)	4	8.0
Carboplatin	3	6.0
carboplatin+Taxol	3	6.0
FAC(5FU+Adriamycin+cyclophosphamide) +carboplatin	2	4.0
FOLFOX	13	26.0
FOLFOX/FOLFIRI(5Fluorouracil,leucovorin, irinotecan)	8	16.0
FOLFOX+5FU	7	14.0
Sandostatin	10	20.0
Total	50	100.0

## Interventional techniques

Two main Interventional radiological procedures were used according to the site, number, enhancement of the lesions: local thermal ablation techniques, and transarterial approaches. (Table XIV)

**Table (XIII): Distribution of the studied patients regarding incidence of extra hepatic lesions.**

	Number	Percent
<b>No</b>	34	68.0
<b>Yes</b>	16	32.0
Denovo in long term follow up after the interventional procedure	12	24
Stable on serial follow up before the procedure	4	8
Total	50	100.0

Local thermal ablation techniques were used in 23 patients out of 50 patients (46%), Radio frequency ablation (RFA) was used in 17 patients (34%) while microwave ablation (MWA) was used in 6 patients (12%), the size of the hepatic lesion was the most important single factor in selection of local thermal ablation technique whether RFA or MWA, and the proximity to major blood vessels was the most important single factor for selection of MWA over RFA. (Table XIV)

Trans-arterial approaches were used in twenty seven patients in this study (54%), the trans-arterial approaches were variable in this study including conventional trans-arterial chemo embolization (TACE), Trans-arterial chemo-embolization using Drug-eluting beads, and trans-arterial radio-embolization using  $Y^{90}$  spheres ... Conventional TACE was used in twenty two patients (44%), embolization with drug eluting beads was used in four patients (8%), and radio-embolization was used in one patient (2%).

**Table (XIV): Distribution of the studied patients regarding Type of interventional procedures.**

	Number	Percent
<b>Local thermal ablation</b>		
• RFA	17	34%
• MWA	6	12
<b>Total</b>	23	46%
<b>Trans-arterial approach</b>		
• Conventional TACE	22	44
• TACE (DC beads )	4	8
• Radio-embolization	1	2
<b>Total</b>	27	54.0
<b>Total</b>	50	100.0

## Follow up

Serial follow up at 1, 3,6,12 months was done for forty seven patients (94%), three patients died within the initial short term follow up period (6%) Important Factors in the follow up were: response of the targeted lesions, survival, quality of life of the patients, time to hepatic progression, time to extra-hepatic progression and toxicity of treatment Initial response of the lesions was assessed after 1 month post procedure ,the parameters for assessing the response were variable in the study including :

- Morphological response (size of the lesions, necrotic areas and enhancement pattern)
- Functional imaging data if available (diffusion MRI study ,PET CT)
- Laboratory results (decrease in the tumor markers level )
- Symptomatic response with improvement of the patient symptoms

## Short term follow up

Follow up after one month revealed complete response in 19 patients (38%) ,partial response was noted in 24 patients (48%),Progressive course was noted in four patients (8%).Three patients died before assessment of the response (6%) .Assessment of the response was done based on Response evaluation criteria in solid tumors (RECIST) criteria (Table XV)

The patient population could be classified into two groups:

- Group A : where response could be assessed ,this group included forty seven patients
- Group B: included three patients died before assessment of lesions response

## Factors affecting the response of the lesions

Many factory were studied for their effect on the response of the lesions including **demographic data** (sex and age of the study population), **the imaging data** (size of the lesions, site and distribution of the lesions, number of the targeted lesions, and pattern of enhancement), **the primary malignant site**, and the interventional technique modality.

**Table (XV): Distribution of the studied group A patients regarding response of the lesion.**

	Number	Percent
Complete response	19	40.4
Partial response	24	51.06
Progressive course	4	8.51
Total	47	100.0

### **I. Demographic data effect on the lesions response**

**Sex effect on the lesion response** was statistically calculated and tabulated, the study included twenty one males and twenty nine females. local thermal ablation techniques were applied on ten males (20%) and thirteen females (26%). Complete response was noted in seven males and ten females. Partial response was noted in three males and two females, progressive course was noted in no patients, and only one female patient died before complete assessment of the response. (Table XVI)

Trans-arterial approaches were applied on twenty seven patients, eleven males and sixteen females, complete response was noted in two females, partial response was noted in seven males and twelve females, progressive course was noted in four males, and two females died before assessment of the response of their lesions (table XVI)

Statistical analytic studies show significant difference with better females response to trans-arterial therapies than males response, complete response was noted in two females ,partial response was noted in twelve females ,while partial response was noted in seven males (P value :0.03).(table XVI).

**Age effect on the lesions response** was statistically calculated and tabulated; the study was applied on fourteen patients less than fifty years (28%) and thirty six patients more than fifty years (72%).

Local thermal ablation techniques were applied on 7 patients less than fifty years (30.4%) and 16 patients (69.6%) more than 50 years ;complete response was noted in 17 patients ; 2 patients less than fifty years group (11.8%) and 15 patients (88.2%) more than fifty years group (table XVII)

Partial response was noted in 5 patients, all of them are below fifty years. One patient more than 50 years died before assessment of the response of the lesion to the procedure.

Trans-arterial approaches were applied on twenty seven patients seven patients less than fifty years (25.9%) and twenty patients (74.1%) more than fifty years; complete response was noted in two patients less than fifty years group. Partial response was noted in nineteen patients, five patients less than fifty years (26.3%) and fourteen patients (73.7%) more than fifty years group (table XVII). Four patients more than fifty years of ages showed progressive course, and two patients more than fifty years died before assessment of the response of the lesions to the therapeutic procedure.

Complete response to transarterial therapies was noted in two patient less than fifty years, no complete response was noted in patients more than fifty years, complete response

below fifty years was significantly better (P value: 0.021) (Table XVII). Complete response to local thermal ablation techniques was significantly better in patients more than fifty years (P value: 0.0001).

**Table (XVI): Effect of sex on response of the lesions.**

Type of intervention			Response of the lesion			Total	X <sup>2</sup> p
			Complete	Partial	Progressive		
<b>Local thermal ablation</b>	Male	No. %	7 41.2%	3 60.0%	- -	10 45.5%	1.57
	Female	No. %	10 58.8%	2 40.0%	- -	12 54.5%	0.410
	Total	No. %	17 100.0%	5 100.0%	- -	22 100.0%	
<b>Trans-arterial approach</b>	Male	No. %	0 .0%	7 36.8%	4 100.0%	11 44.0%	10.820
	Female	No. %	2 100.0%	12 63.2%	0 .0%	14 56.0%	0.039*
	Total	No. %	2 100.0%	19 100.0%	4 100.0%	25 100.0%	

**Table (XVII): Effect of age on response of the lesion in the two types of interventions.**

Type of intervention				Response of the lesion			Total	X <sup>2</sup> p
				Complete response	Partial response	Progressive course		
Local thermal ablation	Age group	< 50	No. 2 % 11.8%	5 100.0%	- -	7 31.8%	14.78	
		> 50	No. 15 % 88.2%	0 .0%	- -	15 68.2%		
	Total		No. 17 % 100.0%	5 100.0%	- -	22 100.0%		
Transarterial approach	Age group	< 50	No. 2 % 100.0%	5 26.3%	0 .0%	7 28.0%	8.252	
		> 50	No. 0 % .0%	14 73.7%	4 100.0%	18 72.0%	.021*	
	Total		No. 2 % 100.0%	19 100.0%	4 100.0%	25 100.0%		

## II. Pre-procedure imaging and topographic data:

- A- Number of the lesions.
- B- Site of the lesions.
- C- Size of the lesions.
- D- Pattern of enhancement of the lesions.

The number of metastatic lesions and effect of the number on tumor response was calculated, statistically analyzed and tabulated (table XVIII).

Local thermal ablation was applied on 23 patients , 16 patients (69.6%) with single focal lesion, 6 with 2 focal lesions (26.1%) and one patient (4.3%) with 3 lesions, complete response was noted in seventeen patients; fourteen patients with single focal lesions (82.4%) and three patients (17.6%) with two focal lesions.

Partial response was noted in five patients; two patients with single focal lesions (40%) and three patients with two focal lesions (60%). One patient died before assessment of the response of the lesions after local thermal ablation procedure.(table XVIII)

Trans-arterial approaches were applied on twenty seven patients, 11 patients (40.7%) with single focal lesion, two patients with two focal lesions in each patient (7.4%) and fourteen patients (51.9%) with multiple focal metastatic lesions.

Complete response was noted in 2 patients with single focal lesions. Partial response was noted in nineteen patients; nine patients with single focal metastatic lesions (47.4%), two patients with two hepatic lesions in each patient (10.5%) and eight patients with multiple hepatic lesions (42.1%).

Progressive course was noted in four patients with multiple focal lesions. (Table XVIII).

Response of solitary focal lesions to local thermal ablation was significantly better (P value 0.021).

**Table (XVIII): Effect of number of focal lesions on response of the lesions in the two types of interventions.**

Type of intervention				Response of the lesion			Total	X <sup>2</sup> p
				Complete	Partial	Progressive		
Local thermal ablation	number of focal lesions	Single	No. %	14 82.4%	2 40.0%	- -	16 72.7%	12.41
		Two	No. %	3 17.6%	3 60.0%	- -	6 27.3%	
		Multiple	No. %	0 .0%	0 .0%	- -	0 0.0	
Total		No. %	17 100.0%	5 100.0%	- -	22 100.0%		
Transarterial approach	number of focal lesions	Single	No. %	2 100.0%	9 47.4%	0 .0%	11 44.0%	9.00
		Two	No. %	0 .0%	2 10.5%	0 .0%	2 8.0%	.15
		Multiple	No. %	0 .0%	8 42.1%	4 100.0%	12 48.0%	
Total		No. %	2 100.0%	19 100.0%	4 100.0%	25 100.0%		

The size of the metastatic lesion was important factor in predicting the prognosis of the patient, effect of the size on tumor response was calculated, statistically analyzed and tabulated. (Table XIX)

**In Trans-arterial approaches:** six patients (24.2%) had lesions size between 2-5 cm in maximal diameter ,10 patients (40.4%) with lesions at a range of 5-10 cm in maximal diameter and nine patients with lesions more than 10 cm in maximal diameters (36.3%),(Table XIX )

Complete response after trans-arterial approaches was noted in two patients with lesions size between 5-10 cm in maximal diameter. Partial response was noted in nineteen patients; four patients with lesions sizes between 2-5 cm in maximal diameter (21.1%),six patients with lesions between 5-10 cm in maximal diameter (31.6%),and nine patients (47.4%) with lesion sizes more than 10 cm in maximal diameter .

Progressive course was noted in four patients, two patients with lesions sizes between 2-5 cm in maximal diameter (50%), and two patients(50%) with lesions sizes between 5-10 cm in maximal diameter. Two patients with lesions sizes between 5-10 cm in maximal

diameters died before complete assessment of the lesion response following the trans-arterial approach. (Table XIX)

**In Loco-regional ablation techniques:** 7 patients had lesions smaller than 2 cm in diameter (14%), sixteen patients (32%) with lesion size between 2 and 5 cm in diameter.

Complete response was noted in seventeen patients, seven patients (41.2%) with lesion sizes smaller than 2 cm in maximal diameter, and ten patients (58.8%) with lesion sizes between 2-5 cm in maximal diameter.

Partial response was noted in five patients, all within a lesion size range between 2 and 5 cm in diameters, and one patient died before response assessment. (Table XIX)

**Table (XIX): Effect of size of lesion on response of the lesions in the two types of interventions.**

Type of intervention				Response of the lesion			Total	X <sup>2</sup> p
				Complete response	Partial response	Progressive course		
Local thermal ablation	Size	<2	No. 7 % 41.2%	0 .0%	- -	7 31.8%	5.22  .007*	
		2-5	No. 10 % 58.8%	5 .100%	- -	15 68.2%		
		5-10	No. 0 % 0%	0 0.0%	- -	0 0%		
		>10	No. 0 % .0%	0 00.0%	- -	0 0%		
	Total	No. 17 % 100.0%	5 100.0%	- -	22 100.0%			
Trans arterial approach	Size	2-5	No. 0 % .0%	4 21.1%	2 50.0%	6 24.0%	10.14  .092	
		5-10	No. 2 % 100.0%	6 31.6%	2 50.0%	10 40.0%		
		>10	No. 0 % .0%	9 47.4%	0 .0%	9 36.0%		
	Total	No. 2 % 100.0%	19 100.0%	4 100.0%	25 100.0%			

**The pattern of enhancement and its effect on the lesions response** was also studied, and calculated in this study, Table (XX) described the pattern of enhancement in details; collectively the lesions in fifty patients could be classified into ten patients with early avidly enhancing deposits (20%), twenty six patients with poor or non enhancing lesions (52%), and fourteen patients with delayed enhancing lesions (28%).

Local thermal ablation techniques were applied on twenty three patients (46%), the pattern of enhancement was variable in these lesions, seven patients with delayed enhancing lesions (30.4%) and sixteen patients (69.9%) with poor enhancing lesions. (Table XX)

Complete response was noted in seventeen patients; seven patients with delayed enhancing focal lesions (41.2%), and ten patients with poor enhancing focal lesions (58.8%). Partial response was noted in five patients with poor enhancing lesions, and one patient with poor enhancing lesion died before assessment of the response after the procedure.

Trans-arterial approaches were applied on twenty seven patients (54 %), the pattern of enhancement was variable in these lesions, seven patients with delayed enhancing lesions (25.9%), ten patients with avid early enhancing lesions (37%) and ten patients with poorly enhancing lesions (37%). (Table XX)

Complete response was noted in two patients with avidly enhancing deposits. Partial response was noted in nineteen patients; seven patients with delayed enhancing lesions (36.8%), four patients (21.1%) with early avidly enhancing deposits and eight patients with poorly enhancing lesions (42.1%). Progressive course was noted in four patients with avidly early enhancing lesions. Two patients with poorly enhancing lesions died before assessment of response after the procedure. (Table XX)

**Table (XX): Effect of pattern of enhancement on response of the lesions in the two types of interventions.**

Type of intervention				Response of the lesion			Total	X <sup>2</sup> p
				Complete response	Partial response	Progressive course		
Local thermal ablation	pattern of enhancement	Delayed Enhancement	No. 7 % 41.2%	0 .0%	0 .0%	7 31.8%	5.11	
		Poor enhancement	No. 10 % 58.8%	5 100.0%	0 .0%	15 68.2%		
	Total		No. 17 % 100.0%	5 100.0%	0 .0%	22 100.0%		
Trans arterial approach	pattern of enhancement	Delayed Enhancement	No. 0 % .0%	7 36.8%	0 .0%	7 28.0%	19.14 .003*	
		Early enhancement	No. 2 % 100.0%	4 21.1%	4 100.0%	10 40.0%		
		Poor enhancement	No. 0 % .0%	8 42.1%	0 .0%	8 32.0%		
	Total		No. 2 % 100.0%	19 100.0%	4 100.0%	25 100.0%		

Response of early enhancing lesions to trans-arterial therapies was significantly better (P value: 0.003).

**The site of the lesions and their distribution and its effect on the lesions response** was also studied. Table (IX) illustrates the distribution of the metastatic lesions according to their site in the liver.

Local thermal ablation was applied on twenty three patients, four patients (17.4%) with lesions targeting both lobes of the liver, another four patient (17.4%) with lesions targeting the left lobe of the liver, and fifteen patients (65.2%) with lesions targeting the right lobe of the liver.

Complete response was seen in seventeen patients, three patients (17.6%) with lesions targeting both lobes of the liver, four patients with lesions targeting the left lobe of the liver (23.5%) ,and ten patients (58.8%) with lesions targeting the right lobe of the liver. (Table XXI)

Partial response was achieved in five patients with lesions targeting the right lobe of the liver .one patient with lesions targeting both lobes of the liver died before assessment of the response.

Trans-arterial approaches were applied on twenty seven patients, twelve patients with lesions targeting both lobes of the liver (44.4%), and fifteen patients with lesions targeting the right lobe of the liver (55.6%)

Complete response was noted in 2 patients, one with lesions targeting both lobes of the liver (50%) and one with lesions targeting the right lobe of the liver (50%).(Table XXI)

Partial response was noted in nineteen patients; five patients with lesions targeting both lobes of the liver (26.3%) and fourteen patients with lesions targeting the right lobe of the liver (73.7%). Progressive course was noted in four patients with lesions targeting both lobes of the liver and two patients with lesions targeting both lobes of the liver died before assessment of the response. (Table XXI)

**Table (XXI): Effect of site of focal lesion on response of the lesion in the two types of interventions.**

Type of intervention				Response of the lesion			Total	X <sup>2</sup> p	
				Complete response	Partial response	Progressive course			
<b>Local thermal ablation</b>	site of focal lesion	Both lobes	No. 3 % 17.6%	0 .0%	- -	3 13.6%	8.175 .086		
		Left	No. 4 % 23.5%	0 .0%	- -	4 18.2%			
			Right	No. 10 % 58.8%	5 100.0%	- -		15 68.2%	
	Total		No. 17 % 100.0%	5 100.0%	- -	22 100.0%			
	<b>Trans-arterial approach</b>	site of focal lesion	Both lobes	No. 1 % 50.0%	5 26.3%	4 100.0%		10 40.0%	13.41 .004*
			Right	No. 1 % 50.0%	14 73.7%	0 .0%		15 60.0%	
Total		No. 2 % 100.0%	19 100.0%	4 100.0%	25 100.0%				

Response of the right hepatic lobe lesions was significantly better (p value :0.004).

### III. Relation between the primary malignant site and the lesion response

The primary malignant site and its effect on the lesions response was also studied, and calculated in this study. Table (VIII) illustrates the distribution of the metastatic lesions according to their primary malignant site.

Local thermal ablation techniques were applied on twenty three patients; fifteen patients (62.2%) with colo-rectal liver metastasis ,two patients with breast cancer liver metastasis (8.7%),two patients with ovarian cancer liver metastasis (8.7%), two patients with neuroblastoma liver metastasis (8.7%) and finally two patients with esophageal liver metastasis(8.7%) .(Table XXII)

**Table (XXII): Effect of primary sites on response of the lesions in the two types of intervention.**

Type of intervention				response of the lesion			Total	X <sup>2</sup> p
				Complete response	Partial response	Progressive course		
<b>Local thermal ablation</b>	primary site	Breast cancer	No.	2	0	-	2	9.175 .228
			%	11.8%	.0%	-		
		esophagus	No.	2	0	-	2	
			%	11.8%	.0%	-		
		Colon	No.	11	3	-	14	
			%	64.7%	60.0%	-		
		neuroblastoma	No.	0	2	-	2	
			%	.0%	40.0%	-		
Ovary	No.	2	0	-	2			
	%	11.8%	.0%	-				
			No.	17	5	-	22	
			%	100.0%	100.0%	-	100.0%	
<b>Trans-arterial approach</b>	primary site	Colon	No.	0	6	0	6	14.89 .275
			%	.0%	31.6%	.0%		
		neuro-endocrine	No.	2	6	2	10	
			%	100.0%	31.6%	50.0%		
		Ovary	No.	0	1	0	1	
	%	.0%	5.3%	.0%				
Stomach	No.	0	3	2	5			
	%	.0%	15.8%	50.0%				
Uterus	No.	0	3	0	3			
	%	.0%	15.8%	.0%				
Total			No.	2	19	4	25	
			%	100.0%	100.0%	100.0%	100.0%	

Complete response was noted in seventeen patients; eleven patients with colorectal deposits, two patients with breast deposits, two patients with esophageal hepatic deposits, and two patients with ovarian hepatic deposits .

Partial response was noted in five patients ;three patients with colo-rectal liver metastasis (60%) ,and two patients with neuroblastoma hepatic deposits (40%).One patient with colo-rectal liver metastasis died before assessment of the response of the lesion. (Table XXII)

Trans-arterial techniques were applied on twenty seven patients ;six patients with colo-rectal liver metastasis (CRLM) (22.2%), ten patients with neuro-endocrine liver metastasis (37%), seven patients with gastric cancer liver metastasis (25.9%), three patients with uterine liver metastasis (11.1 %) and finally one patients with ovarian liver metastasis(3.7%) .(Table XXII)

Complete response was noted in two patients with neuro-endocrine liver metastasis, partial response was noted in nineteen patients; six patients with colorectal deposits

(31.6%) ,six patients with neuro-endocrine deposits (31.6%), three patients with gastric hepatic deposits (15.8%), and three patients with uterine hepatic deposits (15.8%) ,and one patient with history of ovarian hepatic deposit (5.3%).

Progressive course was noted in four patients; two patients with neuro-endocrine liver metastasis (50%), and two patients with gastric liver metastasis (50%). Two patients with gastric liver metastasis died before assessment of the response of the lesion. (Table XXII)

#### IV. Effect of the type of the interventional techniques on response of the lesions

Out of 47 patients; complete response was noted in nineteen patients, partial response was noted in twenty four patients, with over all response rate (complete response and partial response) of about 86%, of the nineteen patients showing complete response, local thermal ablation techniques were used in seventeen patients (89.5%), and trans-arterial approaches were used in two patients (10.5%), partial response was noted in twenty four patients ;local thermal ablation was applied on five patients (20.8%) and trans-arterial approaches were applied on nineteen patients (79.2%). Progressive course was noted in four patients after trans-arterial approaches, three patients died before assessment of the response after the interventional procedure. (Table XXIII)

**Table (XXIII): Comparison between the lesions response in the two types of intervention.**

Type of intervention		Response of the lesion			Total	X <sup>2</sup> p
		Complete response	Partial response	Progressive course		
Local thermal ablation	No.	17	5	0	22	13.974 .0001*
	%	89.5%	20.8%	.0%	46.8	
Trans-arterial approach	No.	2	19	4	25	
	%	10.5%	79.2%	100.0%	53.2	
Total	No.	19	24	4	47	
	%	100.0%	100.0%	100.0%	100.0%	

Response of the lesions to local thermal ablation techniques was significantly better than response to trans-arterial approaches (p value: 0.0001)

Conventional TACE procedure was done in twenty two patients; complete response was noted in one patient, partial response was noted in seventeen patients progressive course was noted in three patients and one patient died before assessment of the lesions response.

Embolization using Drug eluting beads was applied on four patients; complete response was noted in one patient, partial response was noted in two patients, and progressive course was noted in one patient. Radio-embolization was applied on one patient unfortunately, the patient died before assessment of the lesion response. (Table XXIV)

**Table (XXIV): response in relation to the Interventional techniques.**

Response of the lesion		Interventional technique				Total
		DC beads	TACE	MWA	RFA	
Complete response	No.	1	1	5	12	19
	%	25.0	4.8%	83.3	75.0	40.4
Partial response	No.	2	17	1	4	24
	%	50.0	81.0%	16.7	25.0	51.1
Progressive	No.	1	3	0	0	4
	%	25.0	14.3%	0.0	0.0	8.5
Total	No.	4	21	6	16	47
	%	100.0%	100.0%	100.0%	100.0%	100.0%
X <sup>2</sup>		2.38		0.17		
p		0.303		0.67		

(Table XXIV) showed that There is no statistically significant difference between results obtained from conventional TACE and TACE using DC beads (P value: 0.3), also there is no statistically significant difference between results obtained from RFA and MWA (p value: 0.6).

Radio–frequency ablation technique was applied on seventeen patients; complete response was noted in twelve patients, partial response was noted in four patients and one patient died before assessment of the lesion response. Microwave ablation technique was applied on six patients, five patients showed complete response after the procedure and one patient showed partial response after the procedure

### Number of sessions

Decision of multiple sessions was taken based on the initial response of the lesions and after discussion with the medical oncologist, twenty patients were subjected to more than one treatment session , the mean number of session was 1.4 (table XXV)

**Table (XXV): Comparison between the two studied groups regarding the number of sessions.**

	Local thermal ablation	Transarterial approaches
Mean	1.411	1.38
S.D.	0.106	0.21
p	0.485	

### Long term follow up

Further 3months, 6 months & 9months and 12 months follow up were done according to patient's condition; the main concerns in follow up were assessment of hepatic progression, and extra-hepatic progression.

Twelve patients (25.5%) developed extra-hepatic deposits regardless of the response of the hepatic lesions, and four patients (8%) suffered from stable extra-hepatic lesions on commencement of the hepatic interventional procedure.

Some cases show local hepatic progression either the same lesions or denovo hepatic lesions (hepatic progression), other cases shows denovo extra-hepatic lesions during the follow up. The mean time to progression (progression free survival) was 6 months.

At the end of follow up period the final outcome was variable among the study population. Among the study population according to the RECIST considering the targeted hepatic lesion and non targeted extra hepatic lesions; four patients (8.5%) showed complete response, fifteen patients (32%) showed progressive course (either denovo development of extra-hepatic lesions (eleven patients out of fifteen), or local recurrence in the targeted hepatic lesions (three patients or in combination (seen in one patient), and twenty eight patients (59.5%) showed stable disease. (Table XXVI)

**Table (XXVI): Comparison between the outcome at the end of follow up in the two types of interventions.**

Type of intervention		Out come at end of follow up			Total	X <sup>2</sup> p
		Complete response	Progressive	Stable disease		
<b>Local thermal ablation</b>	No.	4	5	13	22	8.71
	%	100.0	33.3	46.5.0	46.8%	
<b>Transarterial approach</b>	No.	0	10	15	25	0.07
	%	0.0	66.7	53,5.0	53.19%	
<b>Total</b>	No.	4	15	28	47	
	%	100.0%	100.0%	100.0%	100.0%	

### Complications and side effects

Abdominal pain, nausea, vomiting, and fever (i.e., post-embolization syndrome) were common, almost in every patient subjected to trans arterial approaches, Liver abscess occurred in only one patient in this study subjected to RFA, and drained by pigtail catheter

insertion. The post embolization syndrome included fever that subsides in a couple of days, leukocytosis, abdominal pain sometimes requiring morphine, and a transient increase in liver enzymes predominantly transaminases and LDH which generally comes down within a few days to 2–3 weeks. Increased bilirubin levels was noted in four patients. The best possible way to reduce post embolization syndrome is to keep the patient well hydrated and in supportive care post procedure medications were used in our study to overcome the expected post embolization syndrome symptoms including analgesics, antipyretics, anti emetics and antibiotics.

## **Case presentation**

### **Case no I**

#### **Clinical data**

66y old male patient with history of cancer colon and CRLM

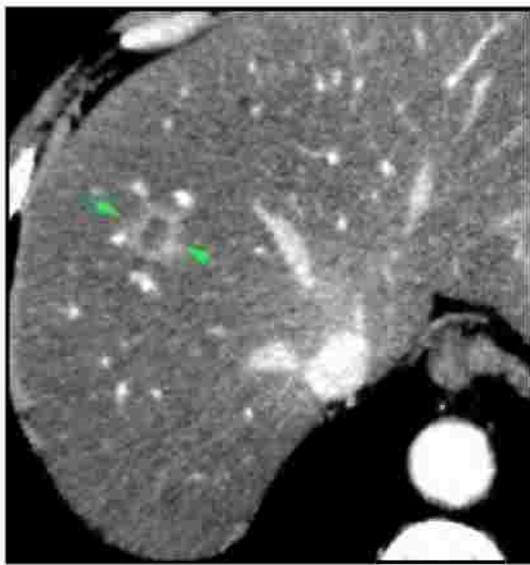
#### **Prior Treatment**

Surgery for cancer colon. Systemic Chemotherapy: 5FU + Leucovorin, FOLFIRI and FOLFOX; Progressive ↑ Tumor markers, the general condition of the patient limited the accessibility of hepatic surgery

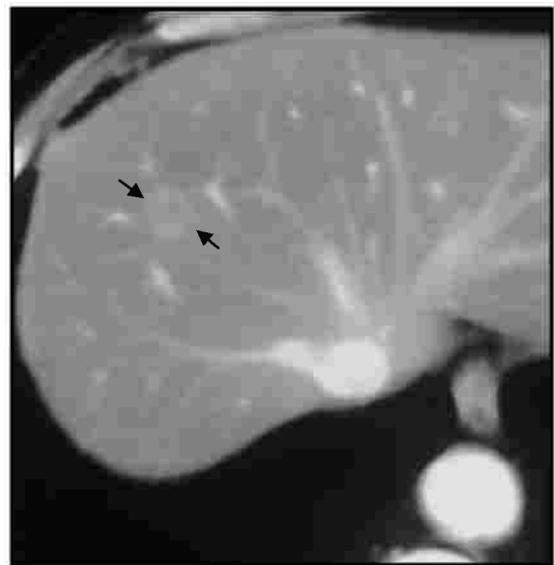
#### **Number of Liver Lesions**

Single lesion in the right lobe (segments VIII), measuring 1.3x1.3 cm in diameter.

**MDCT before the procedure**



**A**



**B**



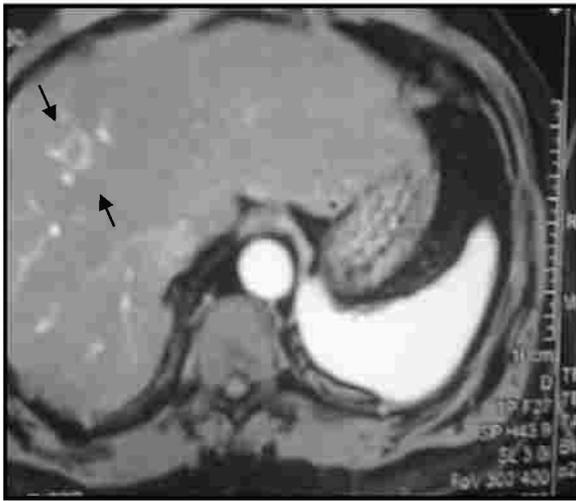
**C**



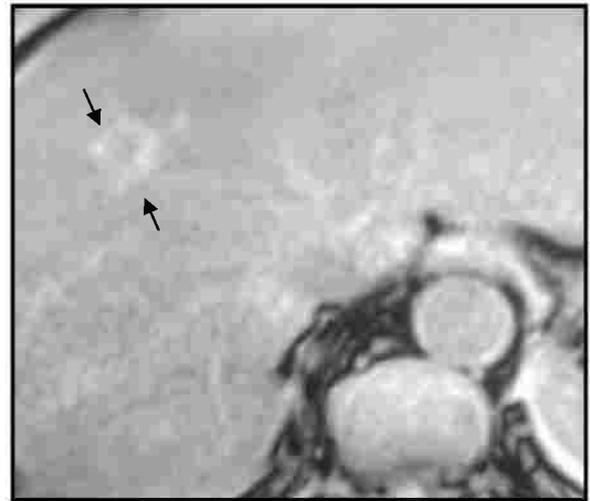
**D**

**Fig. (8):** A) &(B) Triphasic CT liver study with arterial phase (A) and venous phase (B) showing a marginally enhancing metastatic lesion targeting segment VIII of the liver. (c) coronal MIP showing the intimate relation of the lesion to the right hepatic vein. (D) sonographic study showing the hypoechoic nature of the lesion

### Triphasic MRI study before the procedure



**E**



**F**

**Fig. (8):** E) &(F) Triphasic MRI liver study with arterial phase (E) and venous phase (F) showing the lesion .

### The procedure: US guided RFA



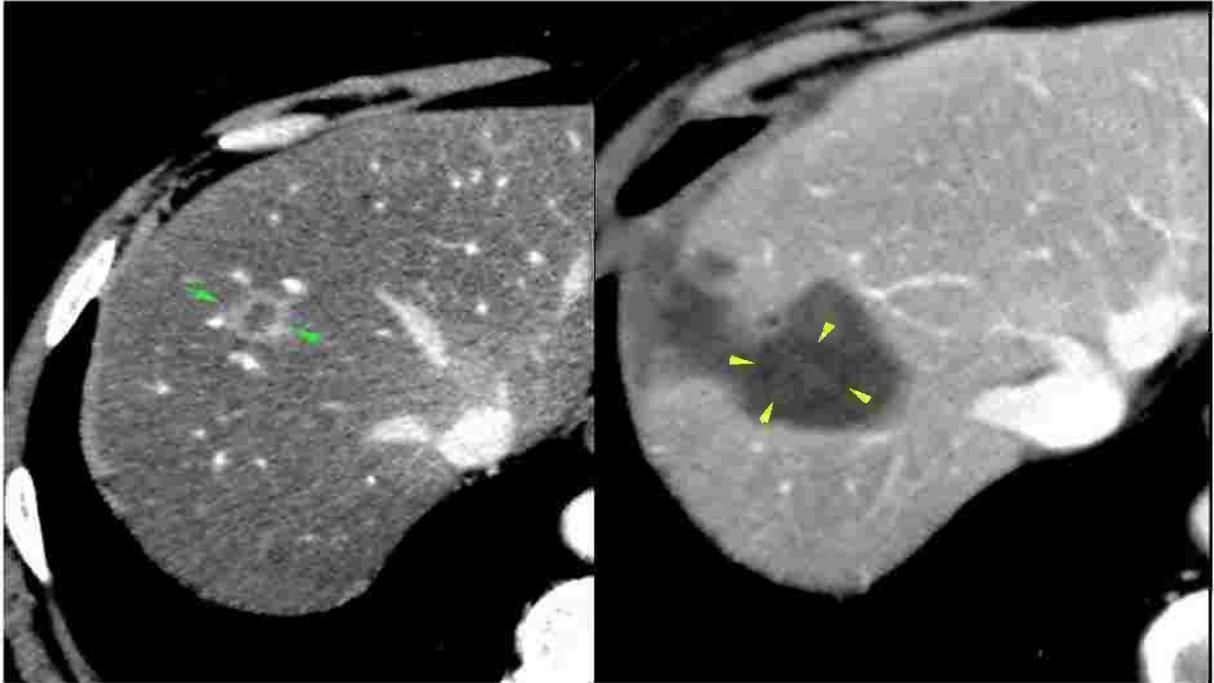
**G**



**H**

**Fig. (8):** (G) Under general anaesthesia The RFA electrode was introduced under sonographic guidance into the lesion (H) sonographic study of the lesion following the RFA technique.

**One month post procedure (Radiofrequency ablation)**



**I**

**Fig. (8):** (I) MDCT study venous phase showing a post-RFA zone is noted encompassing the previously described solitary segment VIII hepatic deposit.

**Case no 2**

**Clinical data**

60y old male patient with history of cancer colon and CRLM

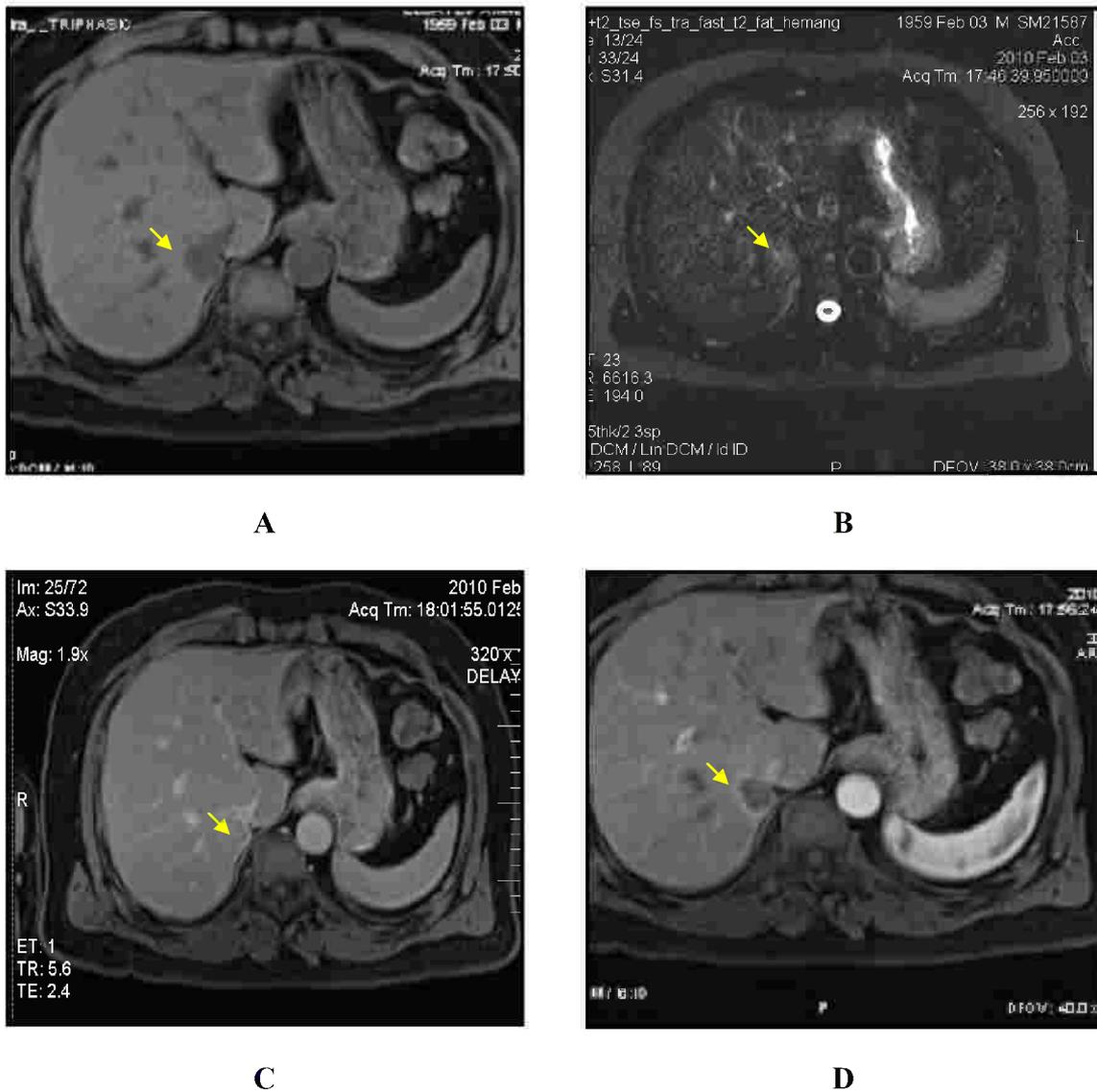
**Prior Treatment**

- Surgery for cancer colon.
- Systemic Chemotherapy: 5FU + Leucovorin, FOLFIRI and FOLFOX; Progression ↑ Tumor markers, the general condition of the patient limited the accessibility of hepatic surgery

**Number of liver lesions:**

Single lesion Close to the IVC intra hepatic segment measuring 2x 2 cm in diameter

**MRI before the procedure**



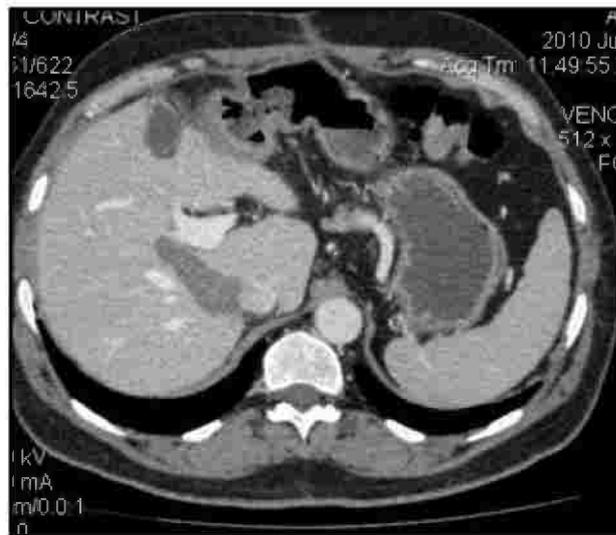
**Fig. (9):** MRI study before the procedure ( A) precontrast T1WI axial image showing a solitary hypointense lesion close to the IVC (B) an axial T2WI image showing the lesion displaying hyperintense signal (C) and (D) showing post contrast MRI axial images in venous and arterial phases showing continuous marginal enhancement of the lesion in the HAP of the study with relative filling in enhancement pattern in the PVP of the study.....metastatic lesion.

**The procedure: Microwave ablation**

***MDCT after the procedure (Microwave ablation)***



**E**



**F**

**Fig. (9):** (E) &(F) two axial images obtained in the venous phase of triphasic CT liver scan showing an ablation zone encompassing the previously described hepatic deposit with normal tumor markers level.

### Case no 3

#### Clinical data

60y old female patient with history of cancer breast and LM

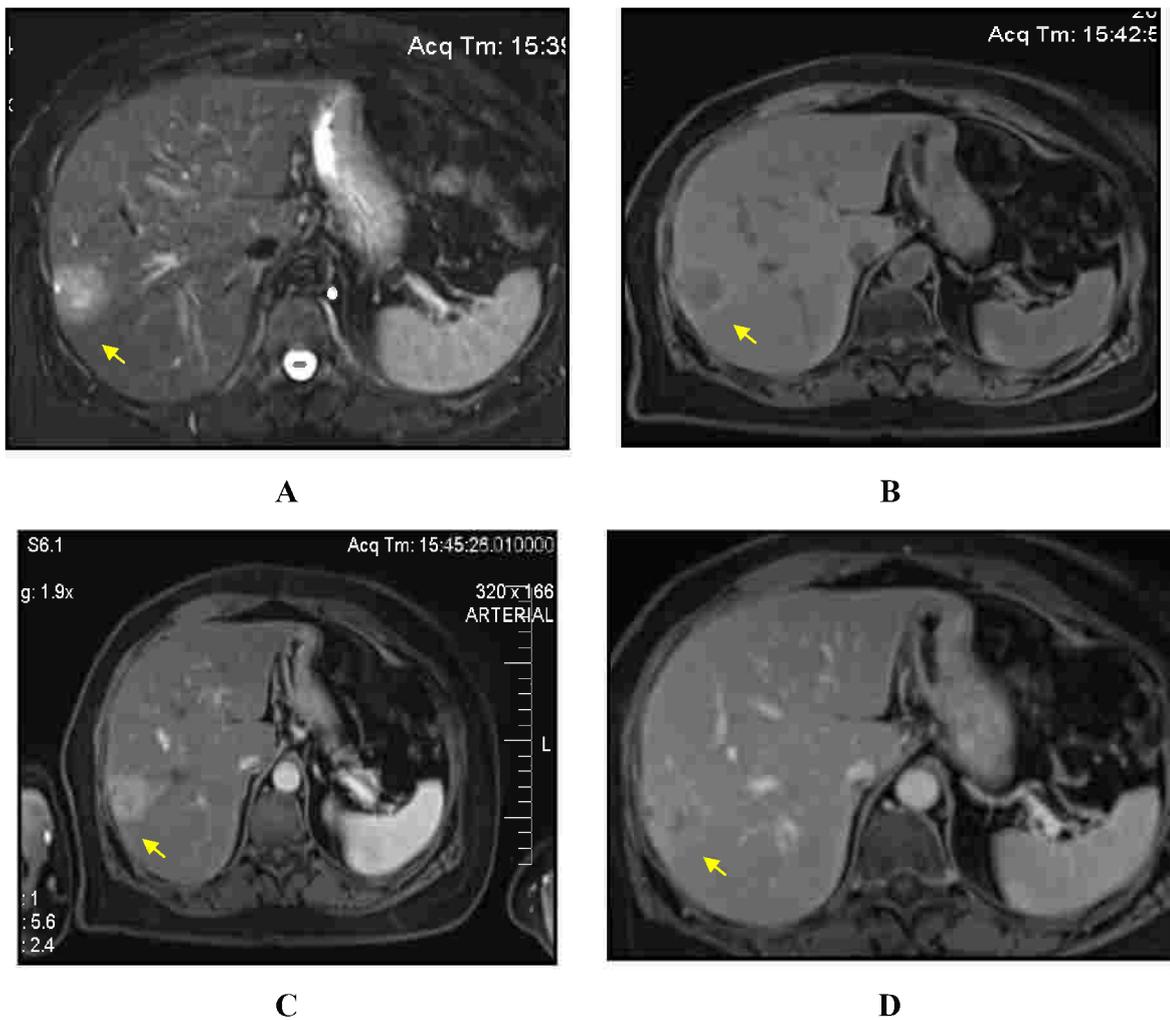
#### Prior Treatment

- Right modified radical mastectomy
- Systemic Chemotherapy: FAC and carboplatin

#### Number of Liver Lesions:

Single lesion targeting segment VII/VIII interface measuring 2x 2 cm in diameter.

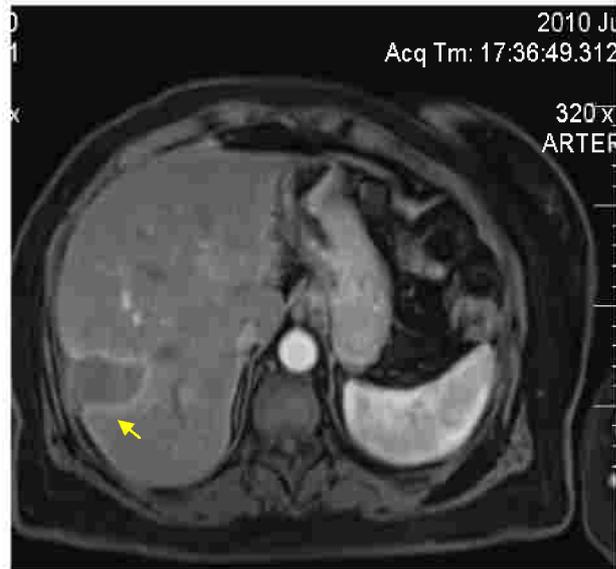
#### MRI before the procedure



**Fig. (10):** MRI study before the procedure ( A ) an axial T2WI image showing T2WI hyperintense lesion targeting segment VII/VIII of the liver (B) precontrast T1WI axial image showing a solitary hypointense lesion (C) and (D) showing post contrast MRI axial images in arterial and venous phases showing positive enhancement of the lesion in the HAP of the study with relative contrast fading in the PVP of the study .....biopsy proven metastatic lesion

**The procedure: RFA**

**MRI after the procedure (RFA)**



**E**



**F**

**Fig. (10):** 1 month Post procedure triphasic MRI study in arterial (E) & venous (F) phases showing an ablation zone encompassing the previously described hepatic deposit .there is marginal enhancement noted mostly reflecting reactive hyperemia no lesional enhancement is noted with normal tumor markers level reflecting complete response.

## Case no 4

### Clinical data

50 y old female patient with history of cancer colon and LM ...with right lobe predominance

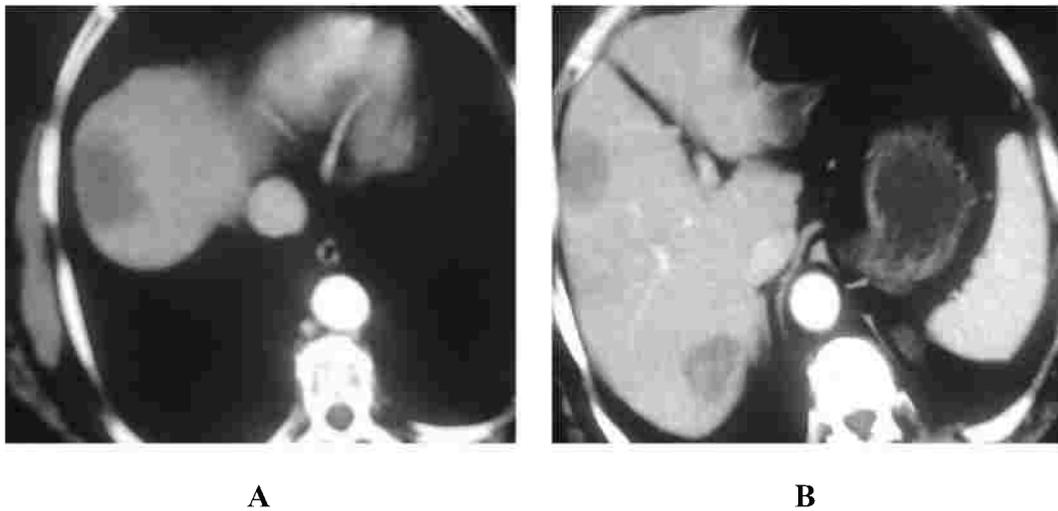
### Prior Treatment

Surgery for cancer colon

Systemic Chemotherapy: FOLFOX, FOLFIRI

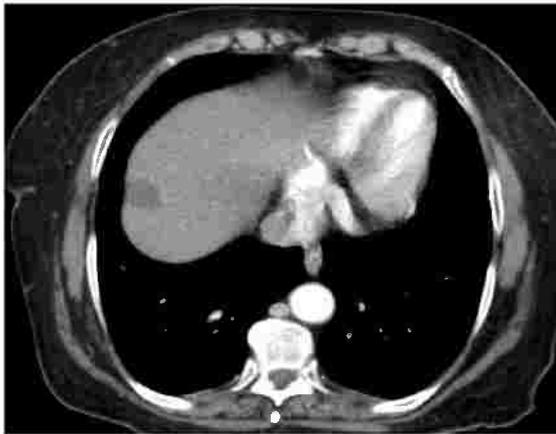
**Number of Liver Lesions:** multiple hypo dense lesions targeting mainly the right lobe of the liver the largest in segment VIII of the liver measuring 3x3 cm in diameter.

### Pre procedure MDCT study

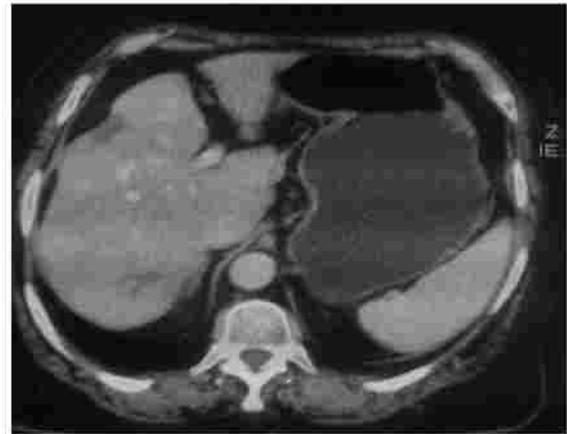


**Fig. (11):** (A) and (B) axial post contrast MDCT axial images showing three hypodense focal lesions targeting the right hepatic lobe ,the largest targeting segment VIII.

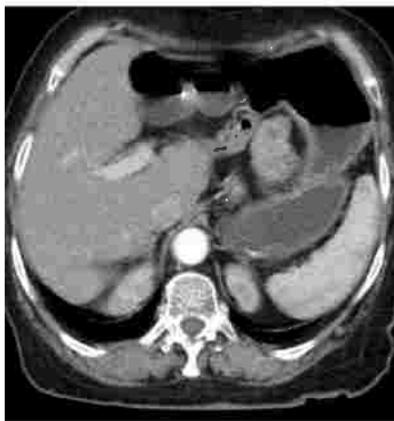
**The procedure:** Conventional TACE ...right hepatic artery lobar embolization.



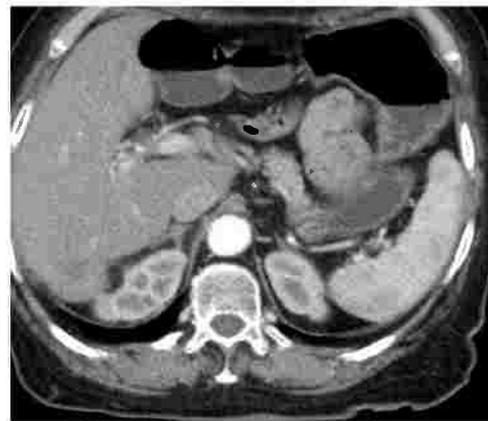
**C**



**D**



**E**



**F**

**Fig. (11): 3 months post procedure triphasic CT follow up (C) –(F) axial post contrast MDCT axial images showing decrease in the size of the targeted three hypodense focal lesions .**

**Response:** Partial response.

## Case no 5

### Clinical data

55 y old female patient with history of cancer ovary and LM (hepatic dominant)

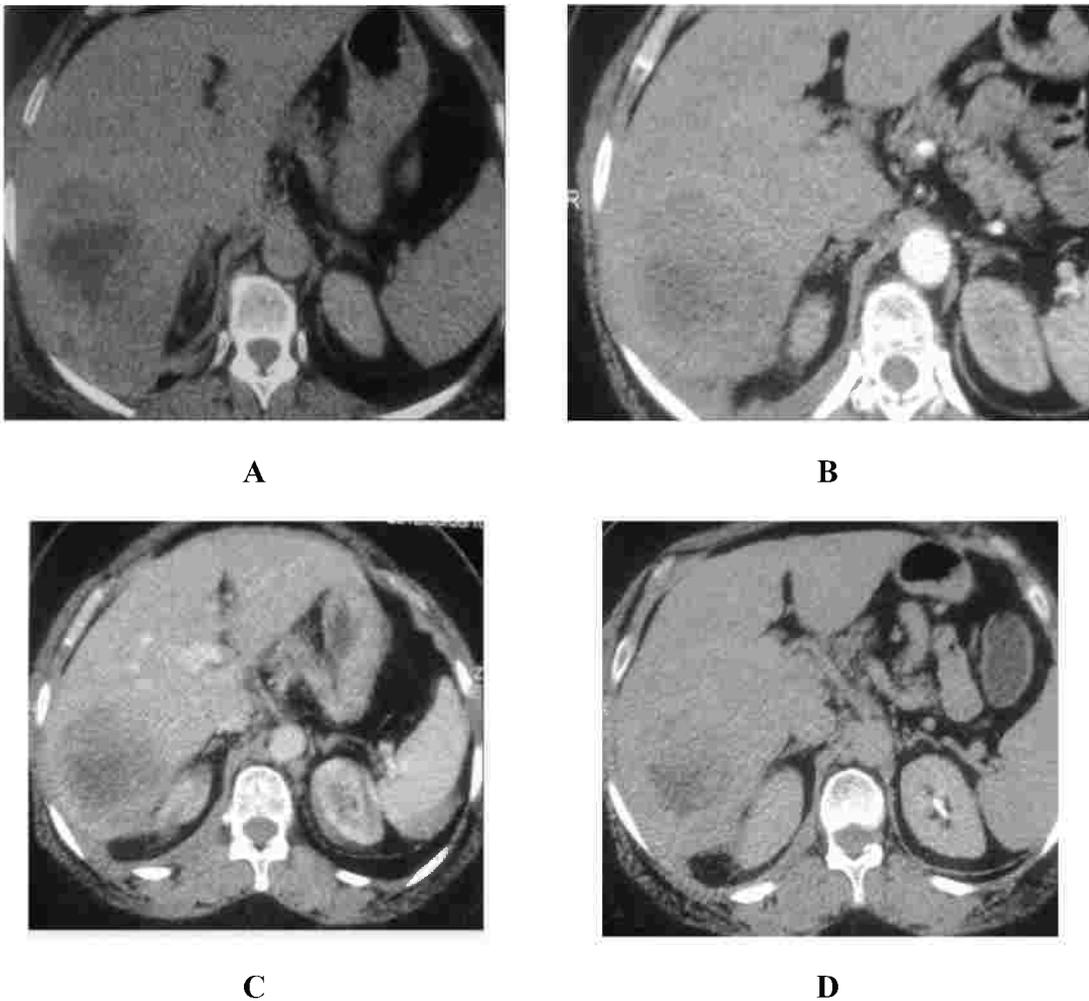
### Prior Treatment

Operative history: TAH, BSO

Systemic Chemotherapy: Carboplatin, Taxol

**Number of Liver Lesions:** single hypo dense focal lesion targeting the right lobe of the liver segment VI/VII measuring 8x10 cm in diameters

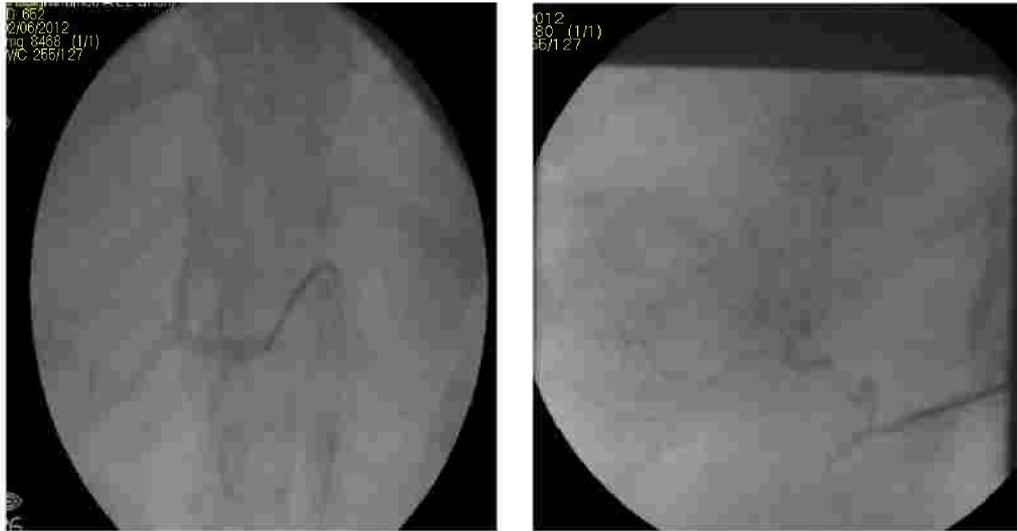
### Pre procedure Imaging



**Fig. (12):** Preprocedure triphasic CT liver study axial images obtained in (A) pre contrast (B) HAP of the study (c) PVP of the study and (D) delayed phase of the study showing a sizable hypodense focal lesion targeting segment VI/VII of the liver showing no appreciable enhancement in the study and proved histopathologically to be metastatic.

**The procedure:**

Conventional TACE ....right hepatic artery posterior segmental embolization.

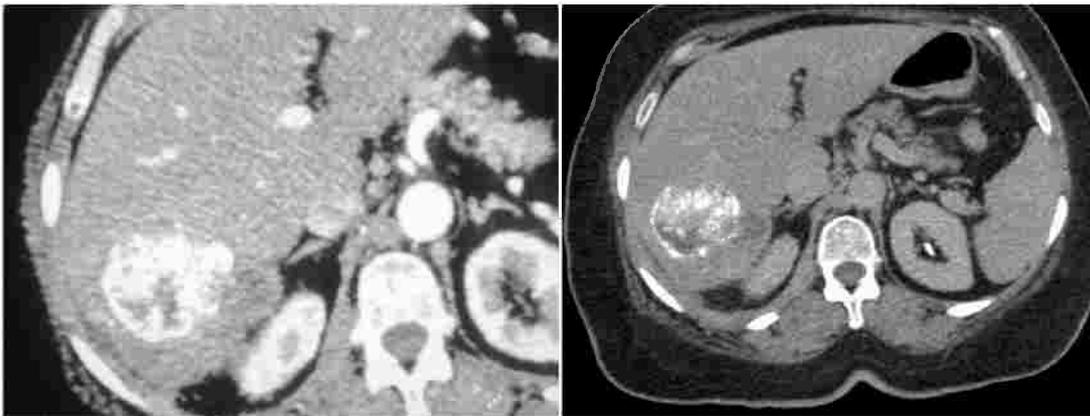


**E**

**F**

**Fig. (12): (E) and (F)** catheterization of the right hepatic artery to the posterior segmental division was done then conventional TACE was done.

**Post procedure 1 month follow up**



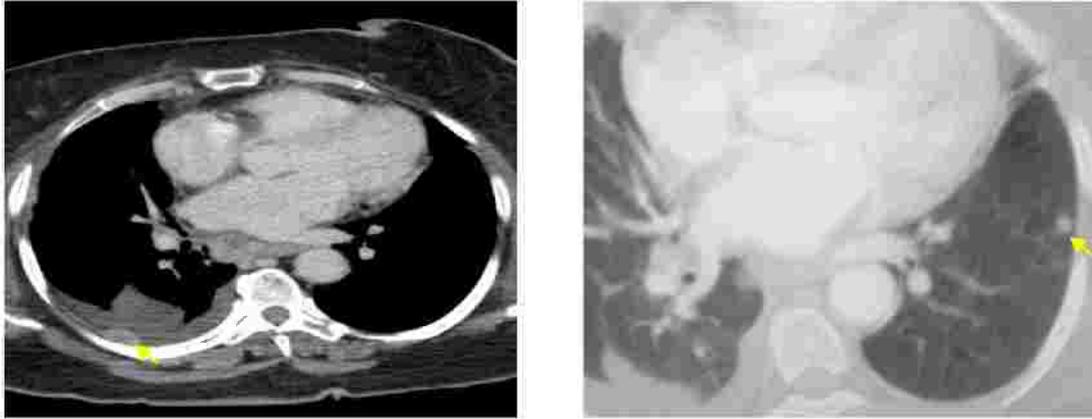
**G**

**H**

**Fig. 12: Triphasic CT follow up (G)** axial image in the HAP of the study (H) axial image obtained in the delayed phase of the study ....showing dense retained lipiodol particles within the lesion ...

**Laboratory study:** ....decrease level of CA125

**Long term follow up (6 months)**



**I**

**J**

**Fig. (12): triphasic CT follow up (I)** basal chest scans mediastinal window showed denovo right pleural effusion with denovo righth basal pleural based enhancing nodule (J) basal chest scans lung window setting showed denovo left basal pulmonary parynchmal nodule .....the De-novo development of right basal pleural based enhancing nodules and pulmonary parynchmal left basal nodules denoted **Progressive course of the disease.**

## Case no 6

### Clinical data

62 y old female patient with history of cancer ovary and LM

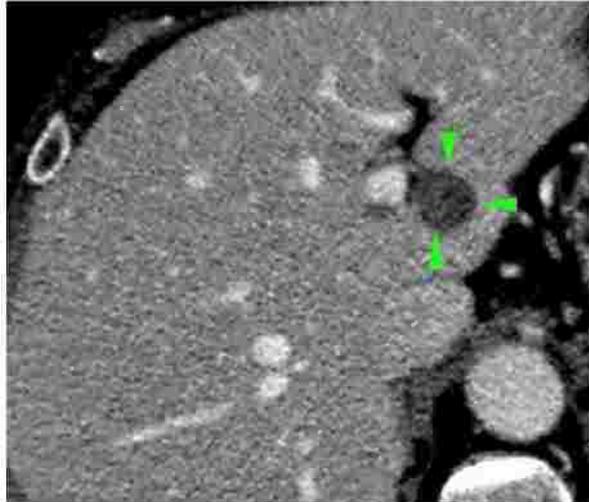
### Prior Treatment:

- TAH, BSO.
- Follow up revealed multiple hepatic deposits.
- Then the patient was treated by chemotherapy.
- All the lesions have vanished except one lesion in the caudate lobe/segment III interface, that regressed for some time after chemotherapy then started to grow again.

**Systemic Chemotherapy:** Carboplatin, Taxol

**Number of Liver Lesions:** single hypo dense focal lesion targeting the caudate lobe/segment III interface measuring 2x2 cm in diameters The lesion is very critically located, in contact with the left portal vein and few mm anterior to the IVC.

### Pre-procedure imaging:

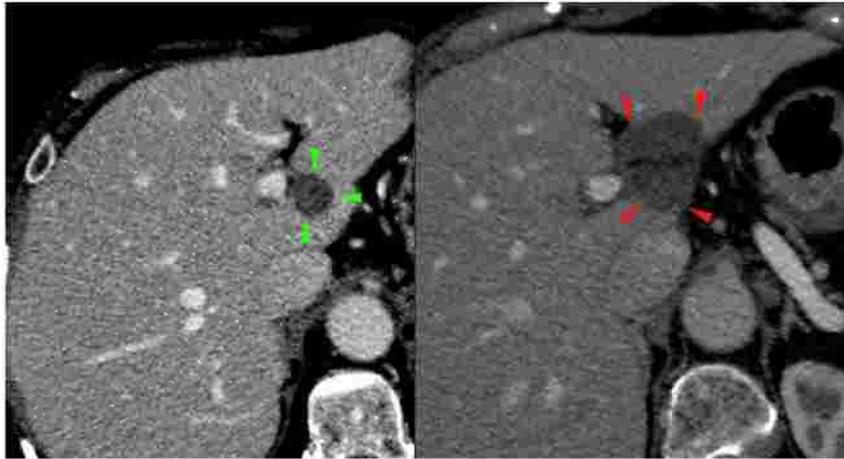


A

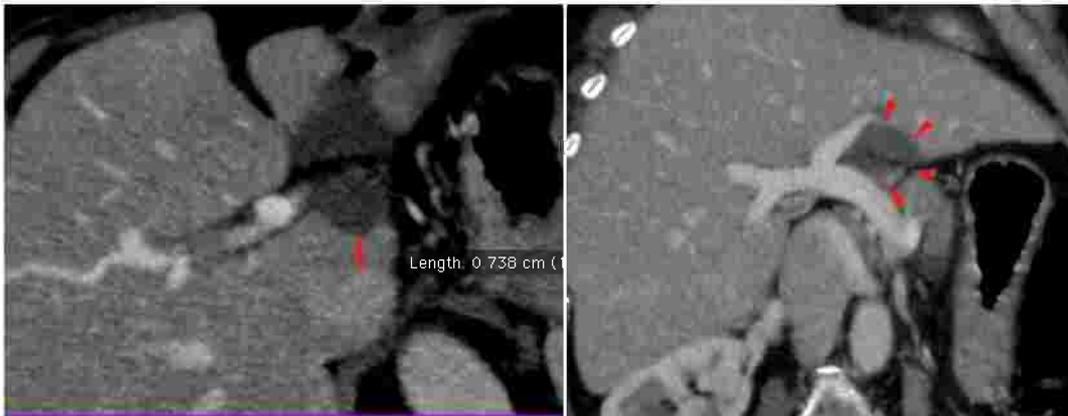
**Fig. (13):** (A) axial MDCT study ; venous phase of triphasic CT study showing a hypodense lesion in segment III /caudate lobe interface.

**Procedure: intra-operative micro-wave ablation**

**Post procedure 1 month follow up:**



**B**

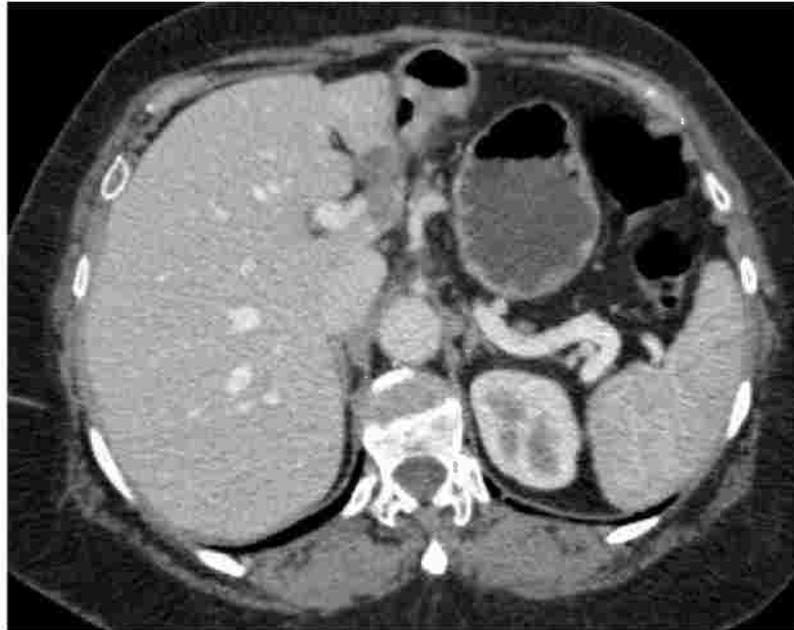


**C**

**D**

**Fig. (13): (B)** The anatomical location of the lesion is replaced by a hypo dense post-ablation scar (C) and (D) axial and coronal contrast enhanced CT study images showed that All adjacent veins (portal and IVC ) are intact

**7 months post procedure follow up:**



**E**

**Fig. (13):** (E) axial CT image in the venous phase of the study showed mild decrease in the ablation scar size, no residual masses with normal CA125 level denoting Maintained satisfactory follow up.

### **Case no 7**

#### **Clinical data**

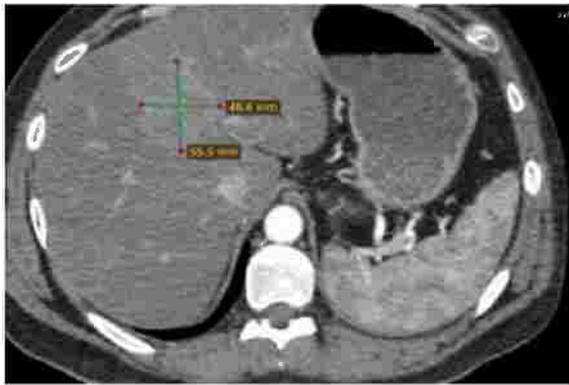
43 y old male patient with history of cancer colon and LM (hepatic dominant)

#### **Prior Treatment**

Right hemicolectomy, Systemic Chemotherapy: FOLFOX, FOLFIRI

**Number of Liver Lesions:** two hypo dense focal lesions were targeting the liver segment VI and IV A measuring 4.5 x 4 cm and 6x4 cm in diameters.

**Pre-procedure imaging:**



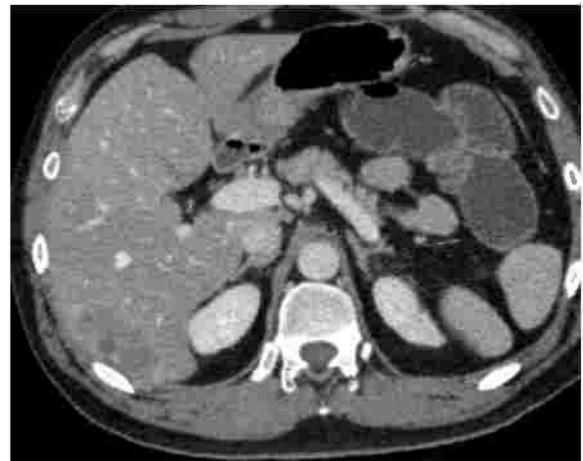
**A**



**B**



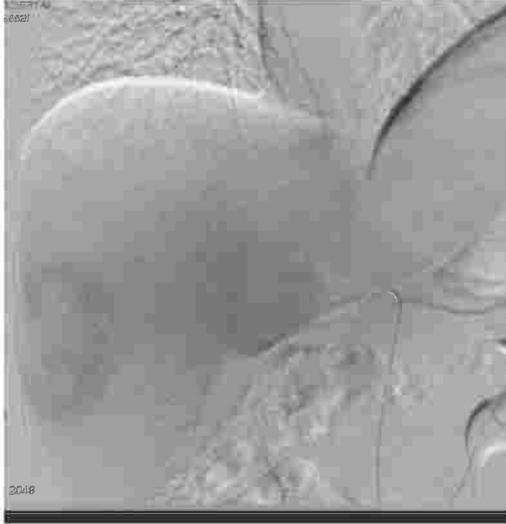
**C**



**D**

**Fig. (14):** Preprocedure triphasic CT liver study axial images obtained in (A) and (B) HAP of the study showing two enhancing lesions noted in the segments IVA and VI of the liver ,(C) and (D) in the PVP of the study the lesions show relative washout in the PVP of the study .....proved histo pathologically to be metastatic CRC lesions.

**Procedure:** TACE with DC beads (DEBIRI)



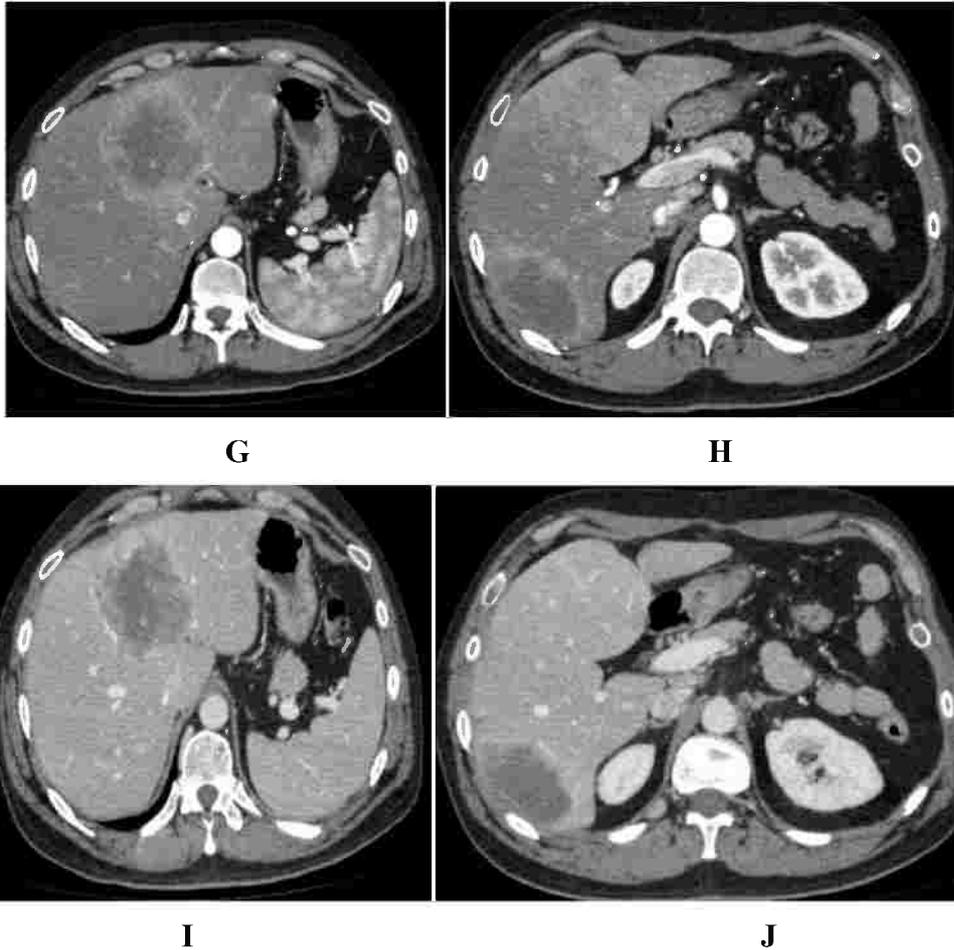
**E**



**F**

**Fig. (14): (E) and (F) pre-embolization angiography showing segment VI and segment IVA lesions blush.**

## Post procedure imaging



**Fig. (14):** One month Post procedure triphasic CT liver study axial images obtained in (G), ( H) HAP of the study and (I) ,(J) PVP of the study (showing extensive necrotic changes, still with residual marginal enhancement with associated decrease in the CEA level

**Response:** .....partial response.

## Case no 8

### Clinical data

46 y old male patient with history of neuro-endocrine tumor liver metastasis

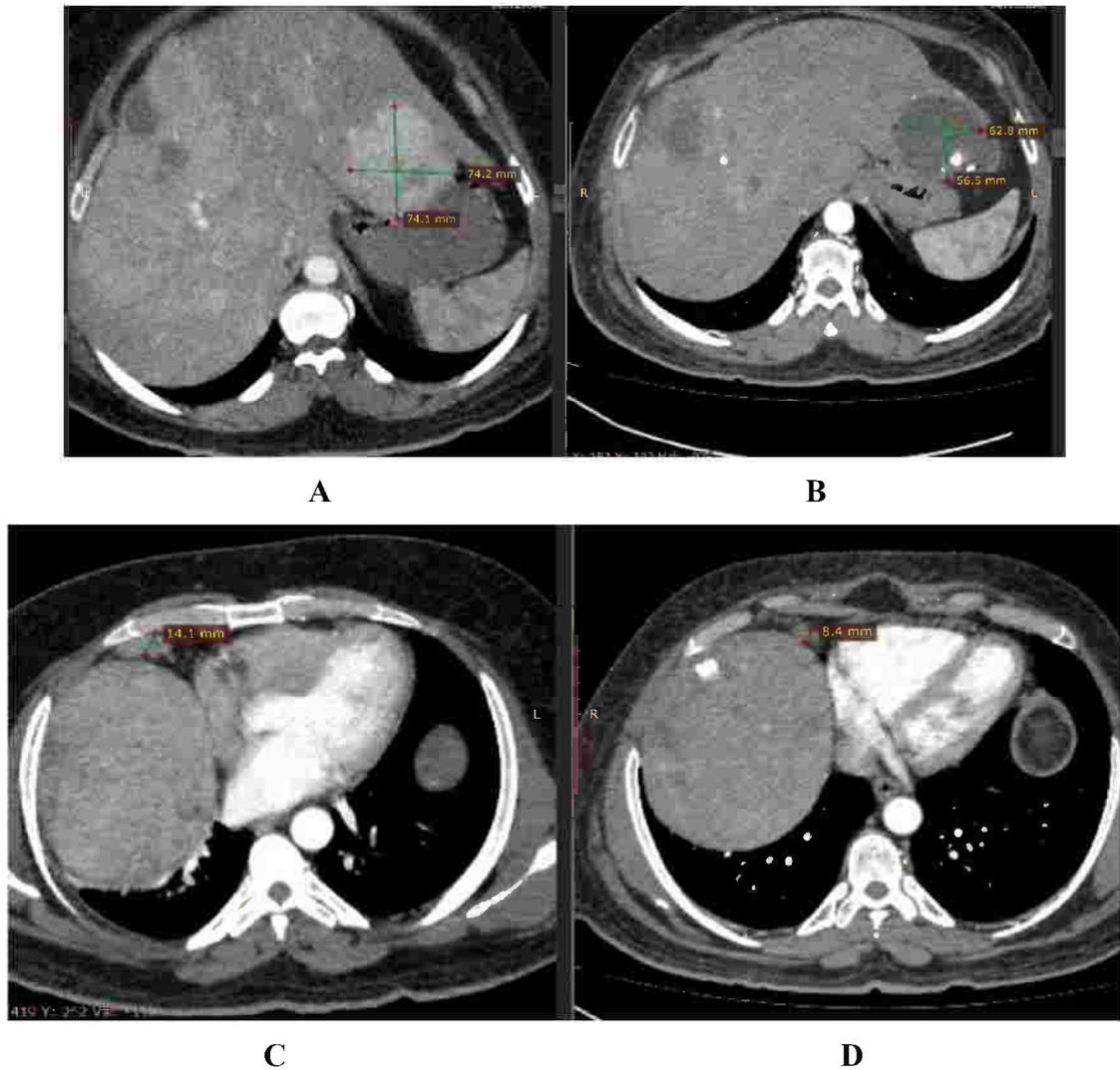
### Prior Treatment

Sandostatin

**Number of Liver Lesions:** multiple targeting both lobes of the liver, the largest in the left lobe measuring 7x7 cm in diameter, and the largest in the right lobe measuring 12x12 cm in diameters

**Procedure:** Conventional TACE

**Pre and post procedure imaging:**



**Fig. (15):** Preprocedure triphasic CT liver study axial images in (A) showing two avidly enhancing lesions noted in segments II and VIII/VII segments of the liver proved histo pathologically to be metastatic NET (B) post procedure (TACE) axial CT study in HAP showing segment II lesions near total necrotic changes and absent enhancement this is associated with dense retained lipiodol particles within , the other lesion in the right lobe shows residual enhancement denoting residual activity(C) pre procedure and (D) post procedure axial CT images showing decrease in the size of previously noted pathological epiphrenic lymph node measuring 1.4 cm in short axis in (C) and in the follow up CT study (D) measuring 8 mm in short axis.

**.....Partial response coupled with clinical symptomatic improvement**