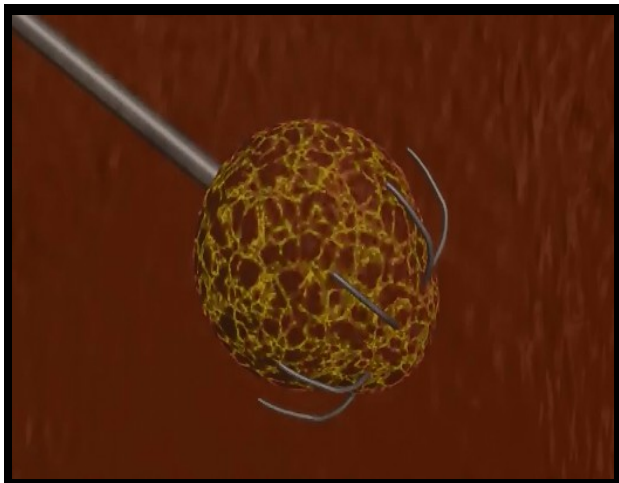
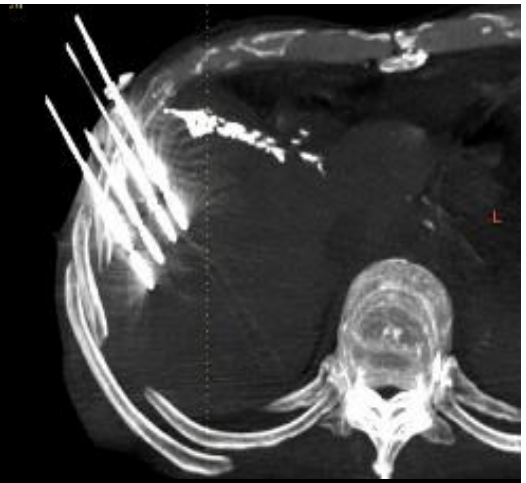




THERMOABLATION ET SUIVI MORPHOLOGIQUE

Marie Cuinet

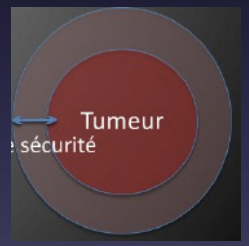
11/03/2017

Place des traitements ablatifs

- **traitements physiques** (RF) > traitements chimiques

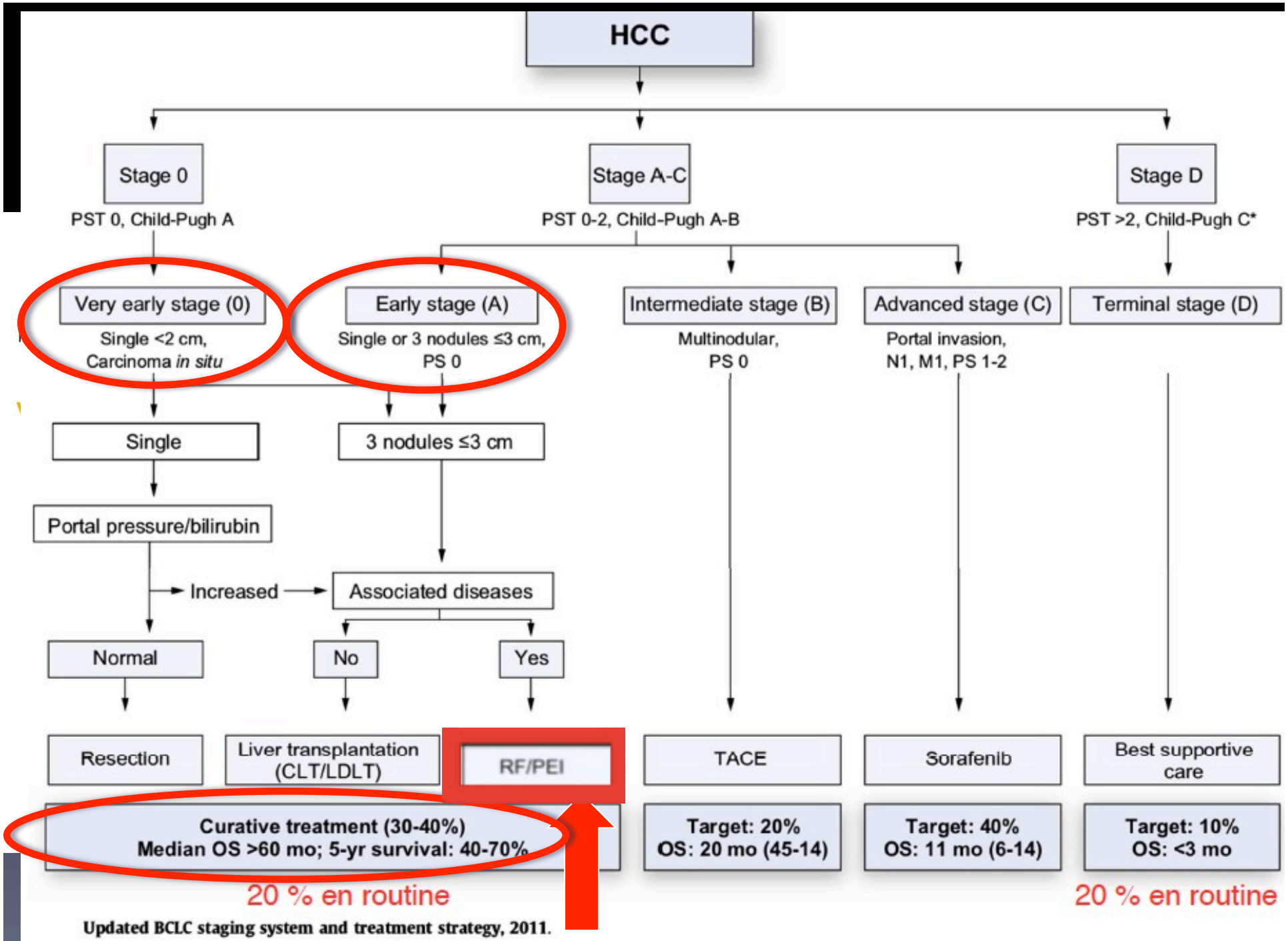
  - plus **grande reproductibilité**

  - idéalement **marge de sécurité > ou = 1 cm** seule à même de garantir régulièrement une réponse complète sur le long terme



- *Seror O and all. Histopathologic comparison of monopolar versus no-touch multipolar radiofrequency ablation to treat hepatocellular carcinoma within Milan criteria. J Vasc Interv Radiol 2014*

- *Livraghi T Sustained complete response and complications rates after radiofrequency ablation of very early hepatocellular carcinoma in cirrhosis: Is resection still the treatment of choice? Hepatology 2008*



Updated BCLC staging system and treatment strategy, 2011.

indications validées : retenir le chiffre 3

<=3 cm et moins de 3 lésions

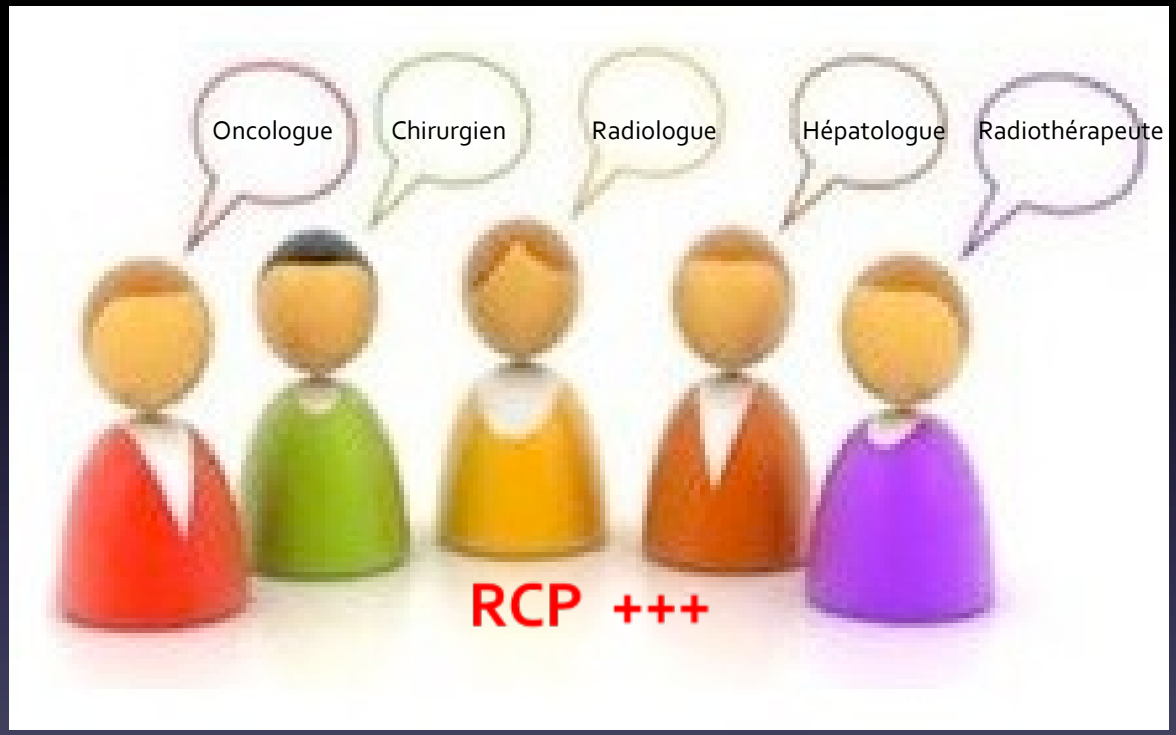
CHC

critères de Milan
attente de greffe
patients non opérables

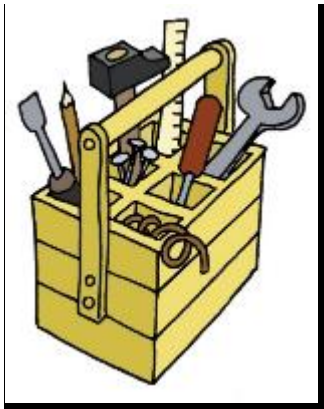
METASTASES HEPATIQUES

hépatectomie (traitement combiné)

Indications validées



Consultation pré interventionnelle
Consultation anesthésie



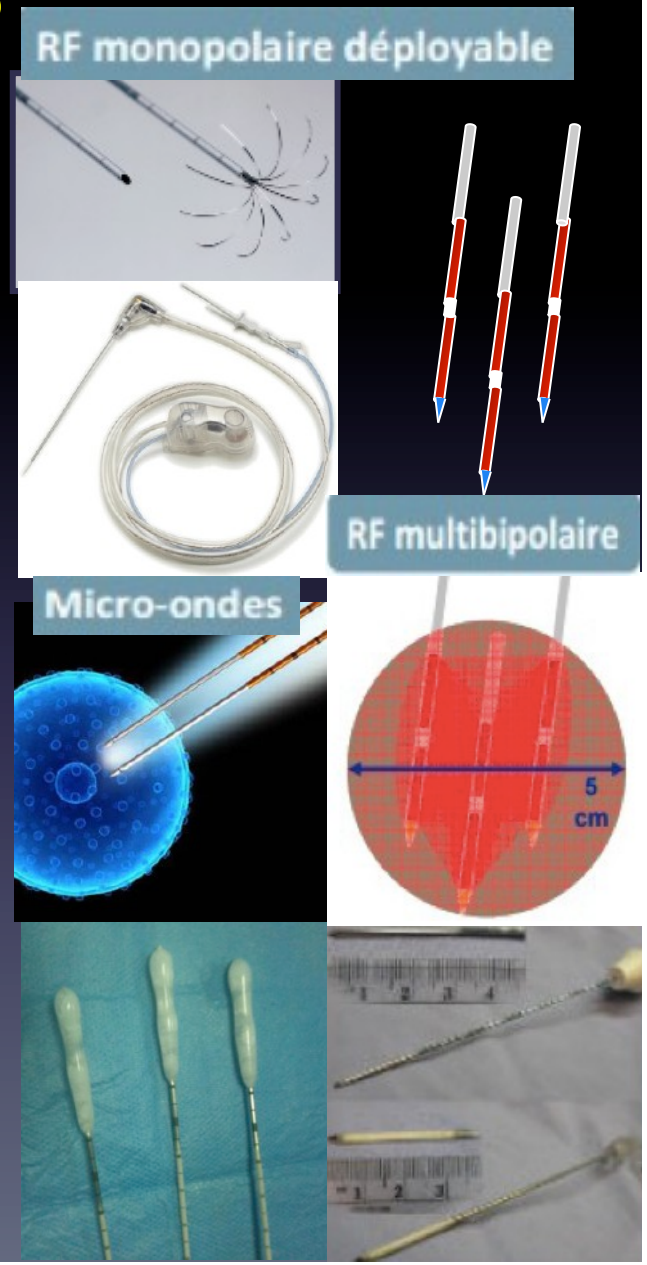
Thermoablations

<u>CENTRIFUGE</u>

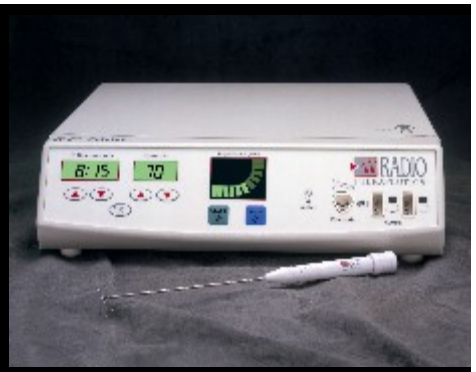
- Radiofréquence monopolaire
- Micro-ondes
- Cryo-ablation

<u>CENTRIPETE</u>

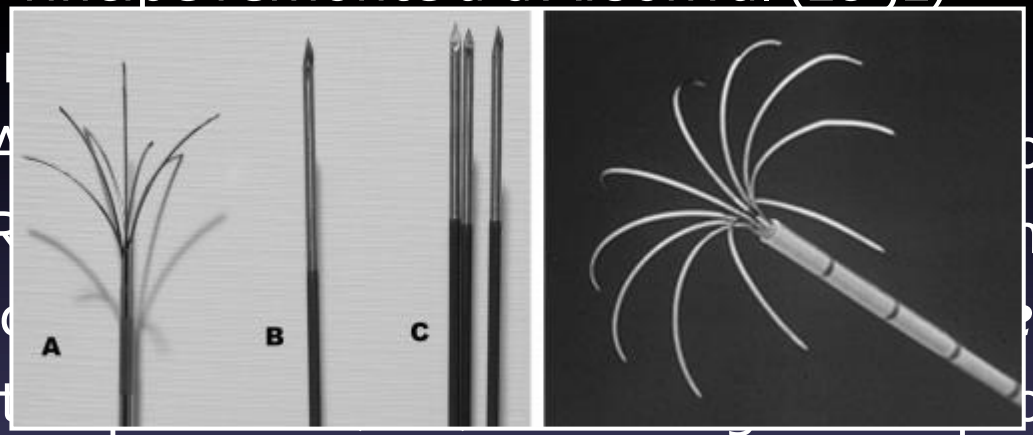
- Radiofréquence multipolaire
- Electroporation irreversible

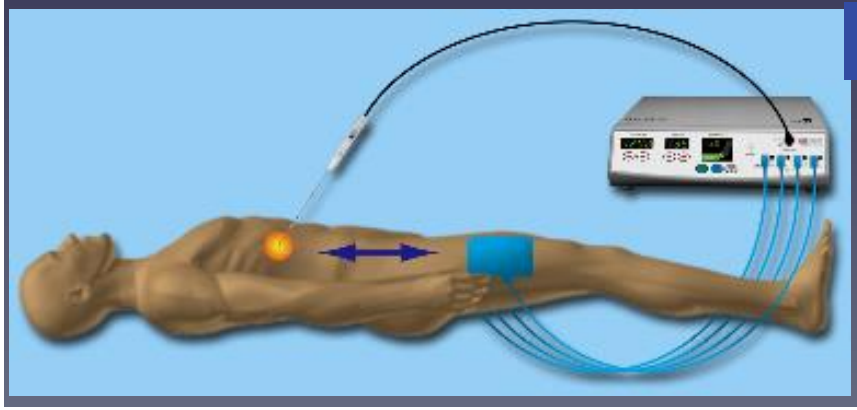


Radiofréquence monopolaire

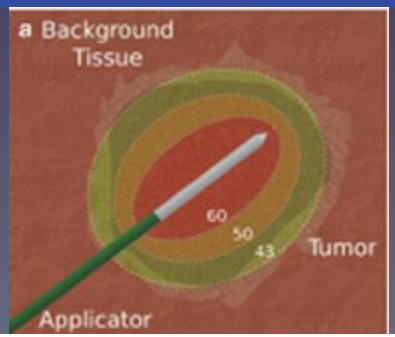


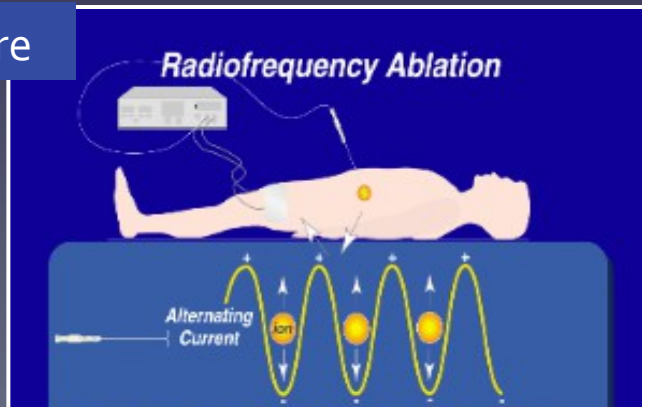
- Principe remonte à d'Arsonval (1891)
- I
- A percutanée.
- R natif 300 et 500 kHz
- c → chaleur .
- t otéique
- Nécrose → stop de la conduction

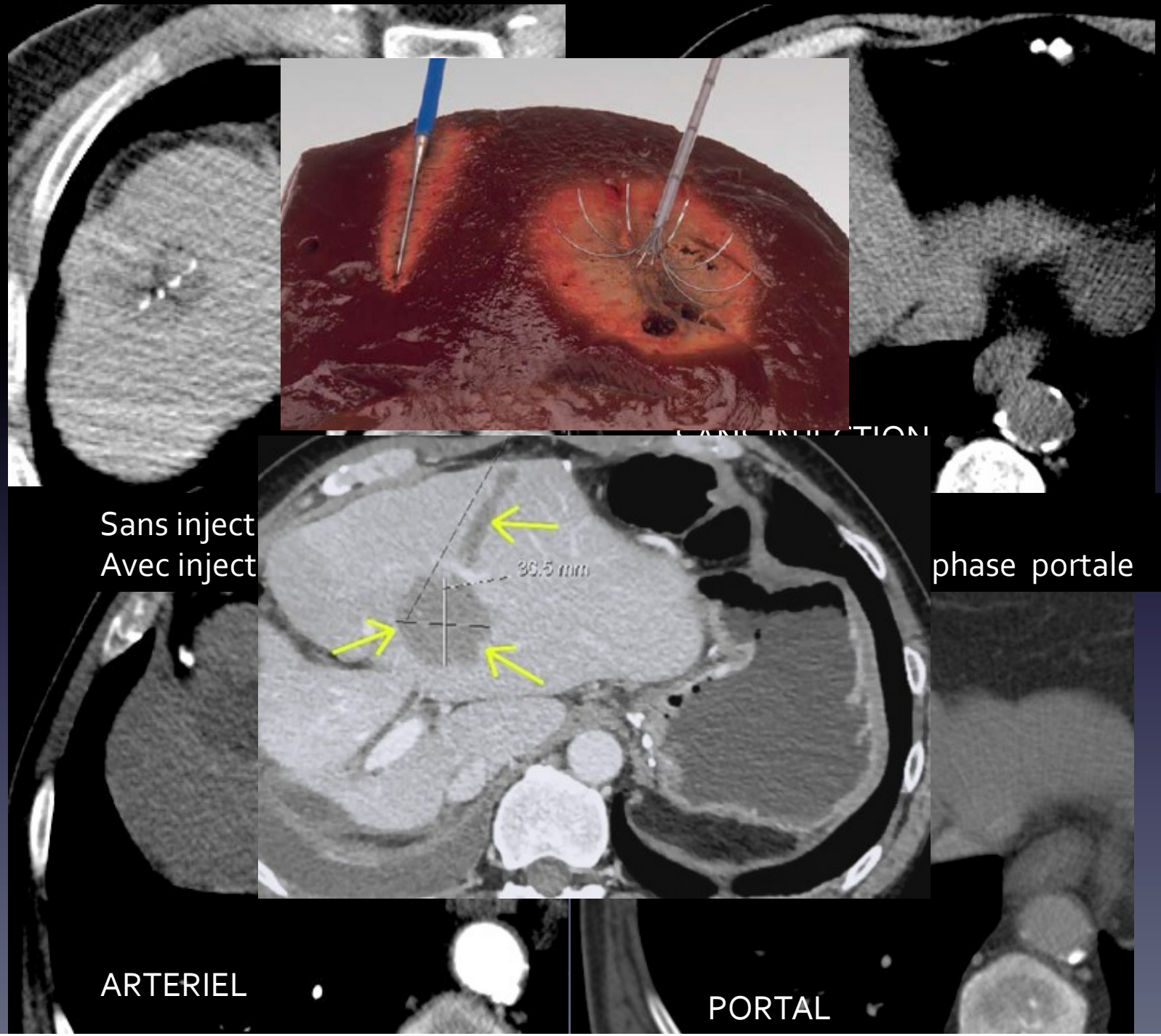




T> 60°C mort cellulaire

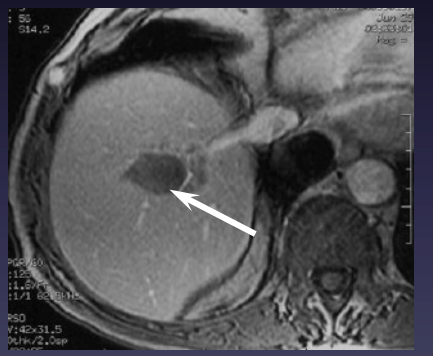





Sans inject
Avec inject
phase portale
ARTERIEL
PORTAL

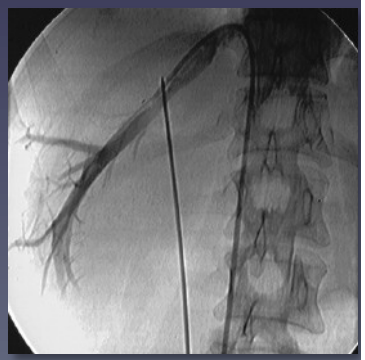
Limitation technique proximité des vaisseaux

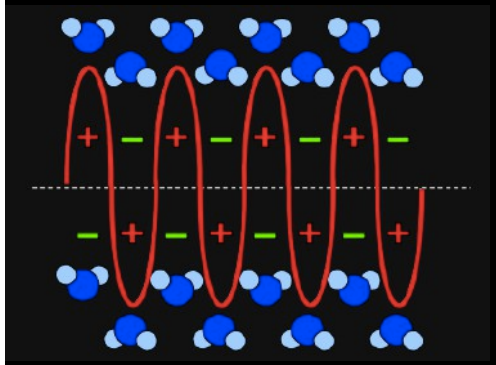
Risque de ne pas détruire des cellules tumorales
au contact des vaisseaux vaisseaux> 4mm
« heat sink effect »



Taux d 'échecs par rapport aux vaisseaux

Pas de Contact	vs Contact	
7%	48%	(D Lu, AJR 2003)
22%	53%	(D Lu, Radiology 2005)
3%	23%	(D Elias, ASO 2004)

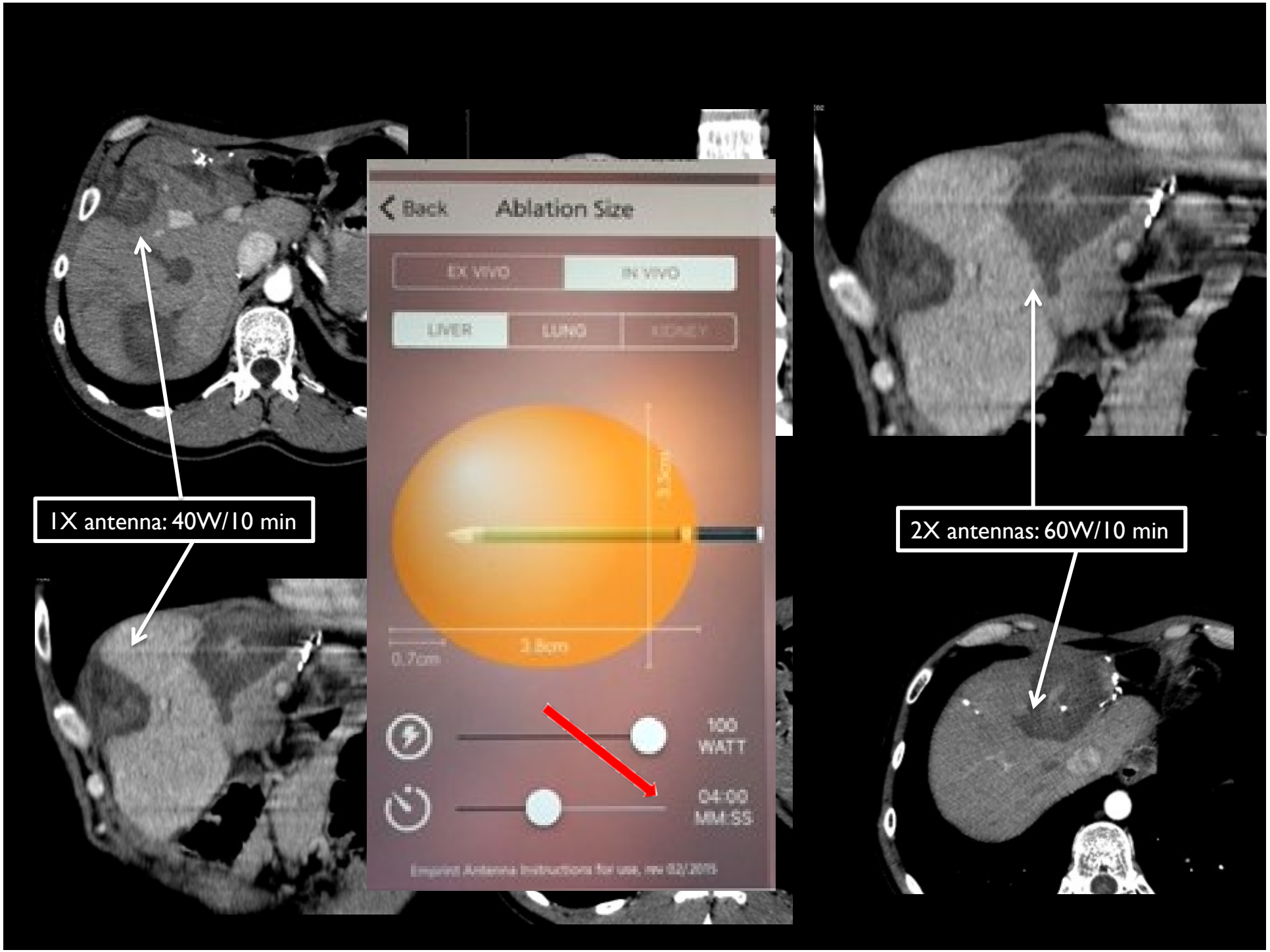




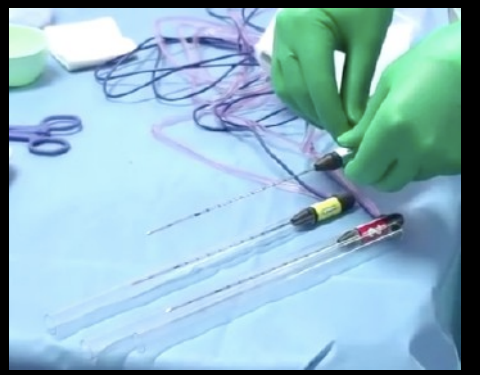
Microondes

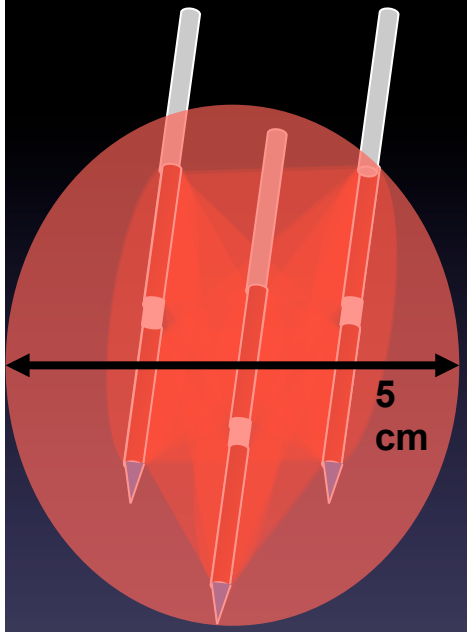
- Décrit en 1986 par Tabuse (Japon) , applications au foie 1990
- **900Mhz à 2450 Mhz**
- Energie cinétique H2O → Energie thermique

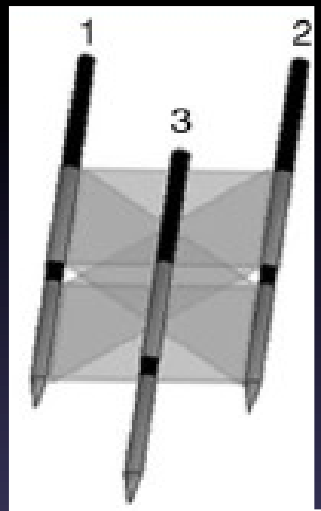
- *plusieurs avantages théoriques* :
- Plus gros (zone ablation)
- Plus chaud **160 à 180°**
- Plus vite environ 10 mn
- Heat sink effect plus modéré


1X antenna: 40W/10 min
2X antennas: 60W/10 min
Back
Ablation Size
EX VIVO
IN VIVO
LIVER
LUNG
KIDNEY
0.7cm
3.8cm
100
WATT
04:00
MM:SS

RF multipolaire





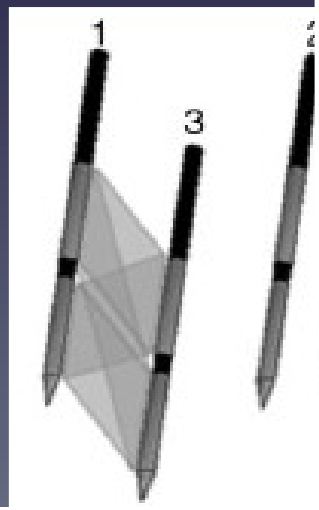


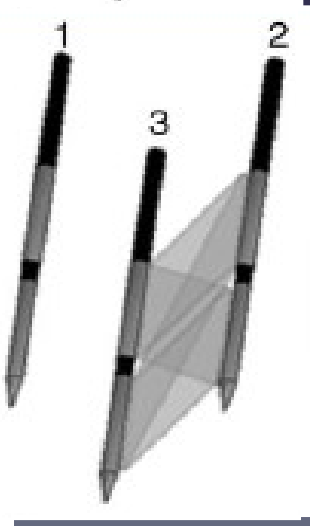
1 à 6 électrodes bipolaire refroidies activees par paires

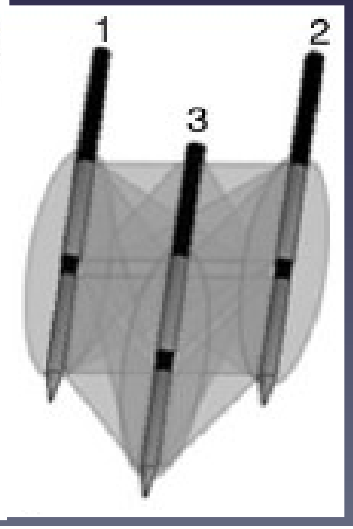
Couple d 'électrodes

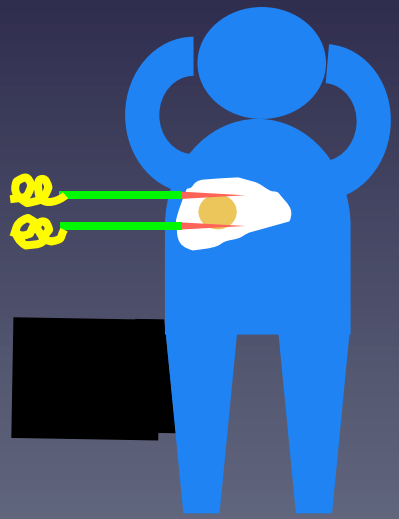
Energie centripète

Ablation no touch

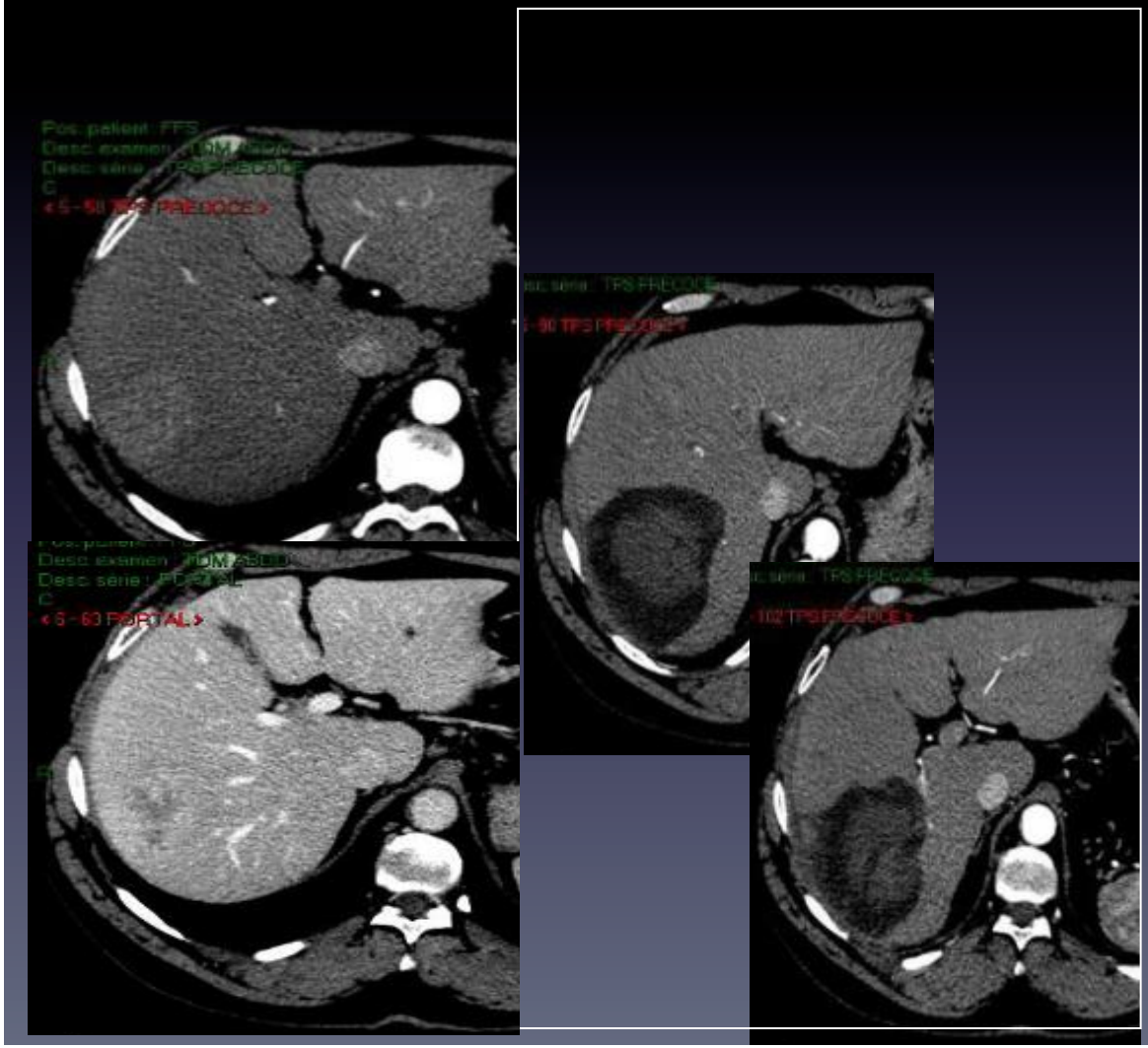








RF multipolaire



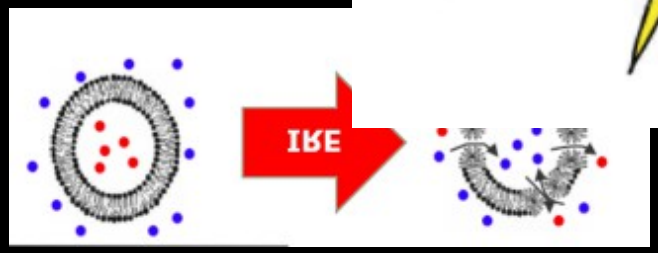
- 6 électrodes
- 33' d'application

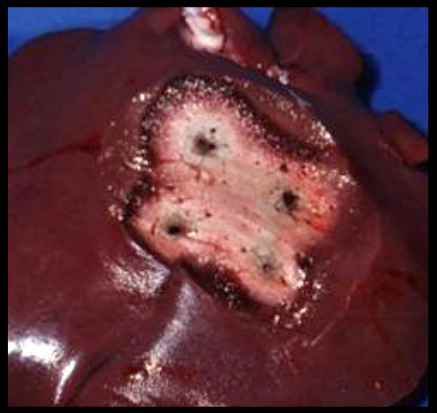
- zones plus larges (5 cm) en une seule séance
- Pas de pénétration intratumorale approche des sous-capsulaires plus sécuritaire

Seror O, and all N. Histopathologic comparison of monopolar versus no-touch multipolar radiofrequency ablation to treat hepatocellular carcinoma within Milan criteria. 2014;

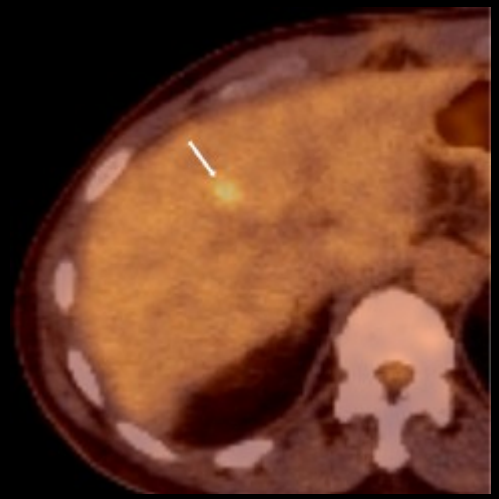
Electroporation irreversible

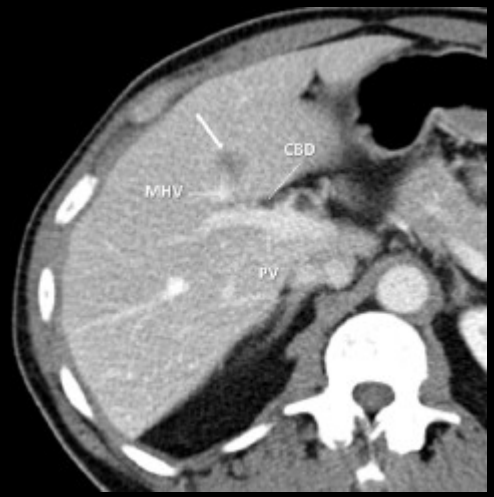
- Thomson
- Applicatio ge 100 à 200 volts très
- Altération
- Aptose ce
- Anesthés
- Applicatio
- respect d

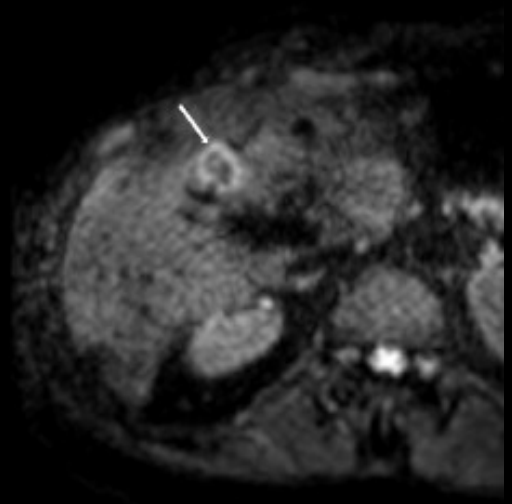


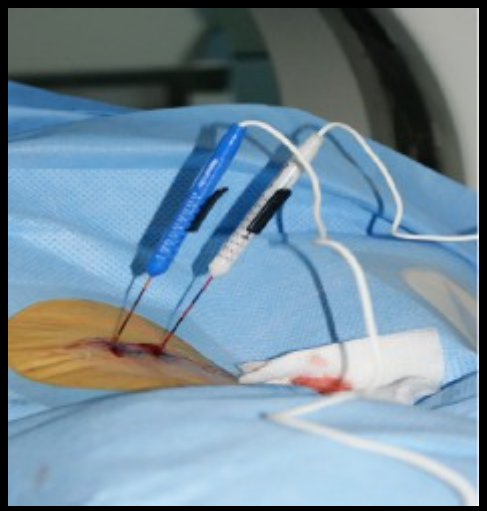


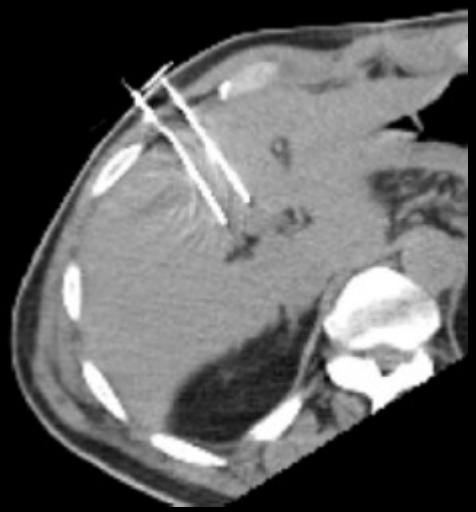
Pallier aux contre indications

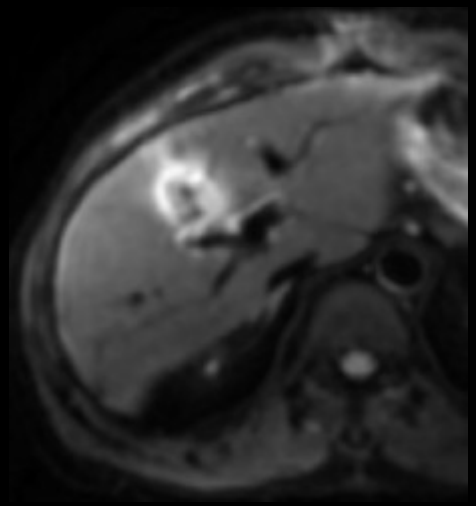




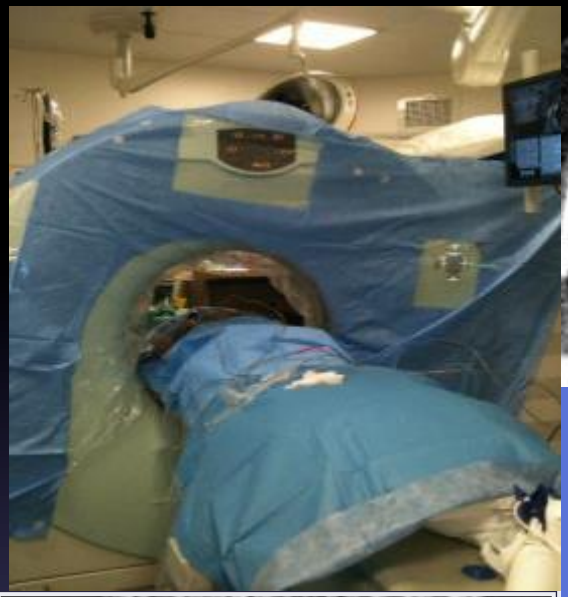


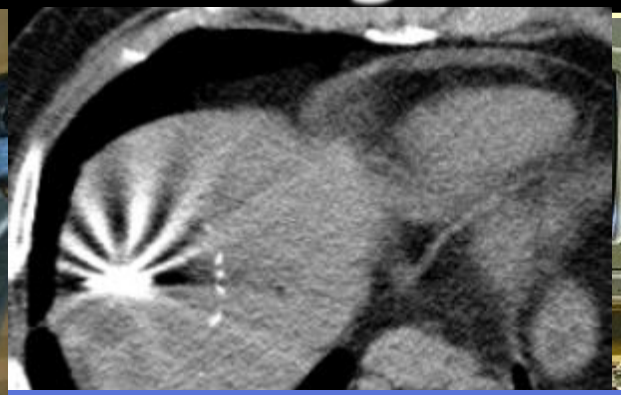




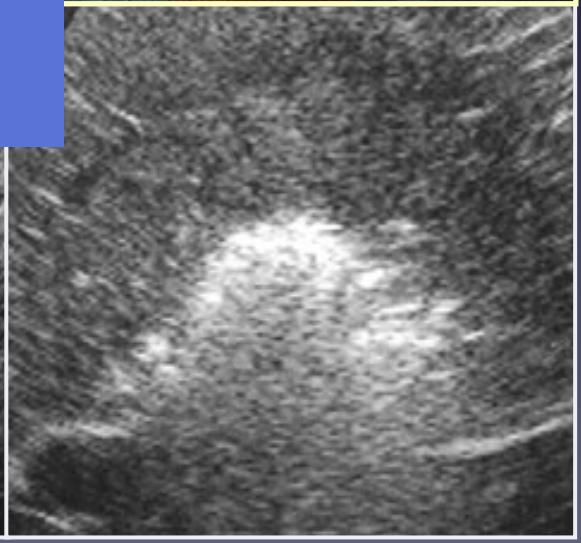


Mode de guidage

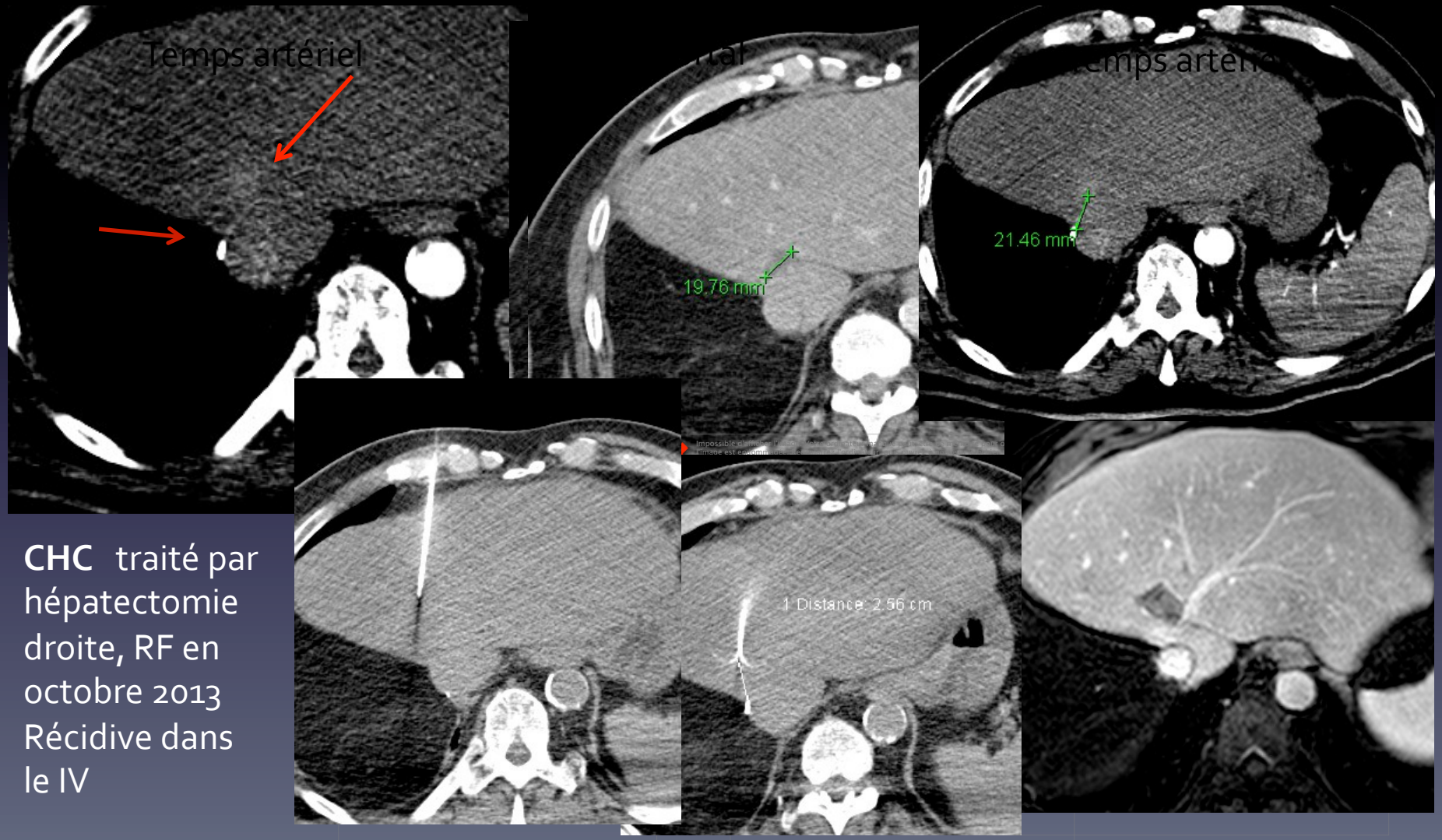




- Sous anesthésie générale
- Conditions d'asepsie
- Hospitalisation brève

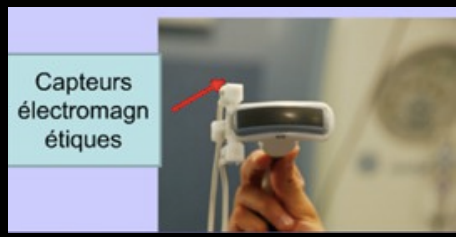


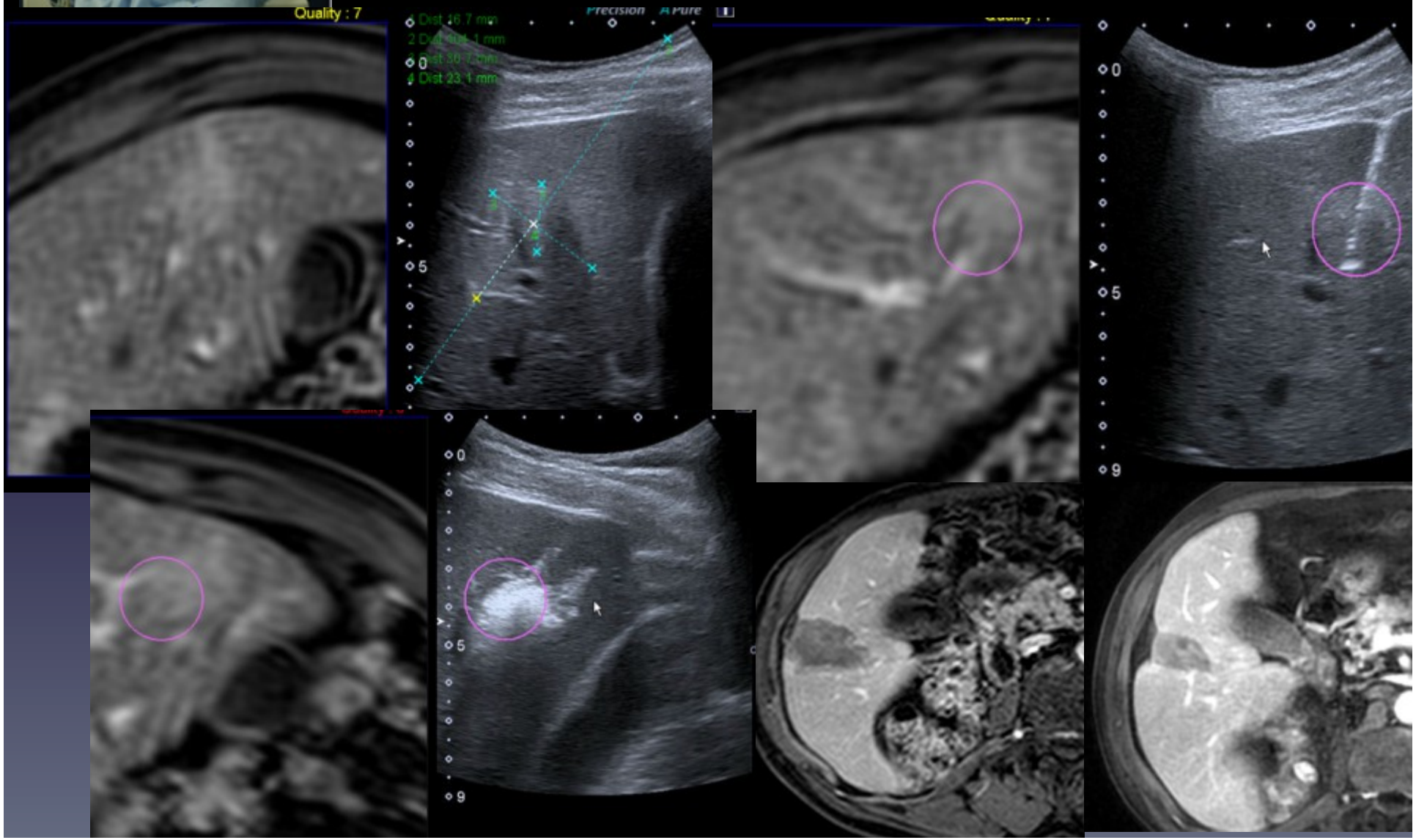
Localisation difficile



CHC traité par hépatectomie droite, RF en octobre 2013
Récidive dans le IV

Mode de guidage

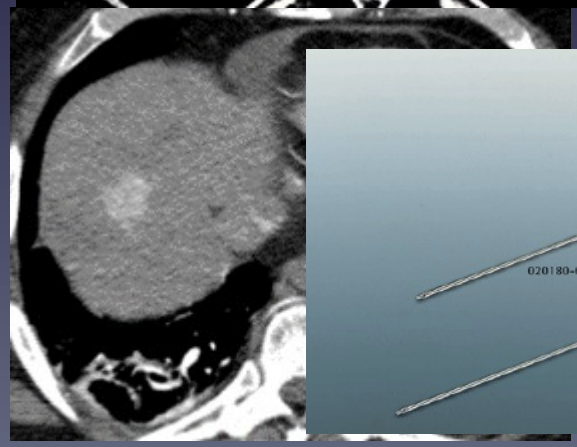


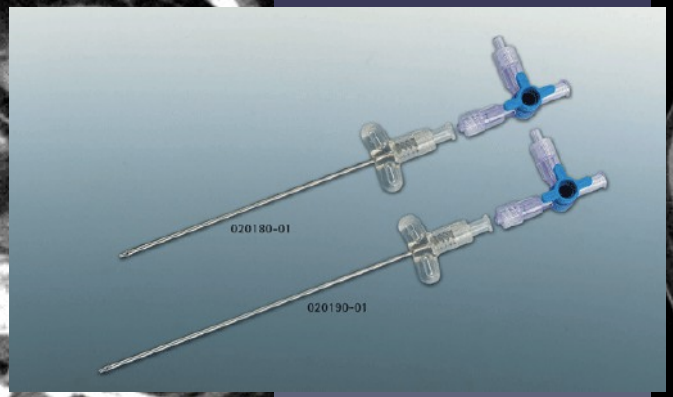


Voie d'abord

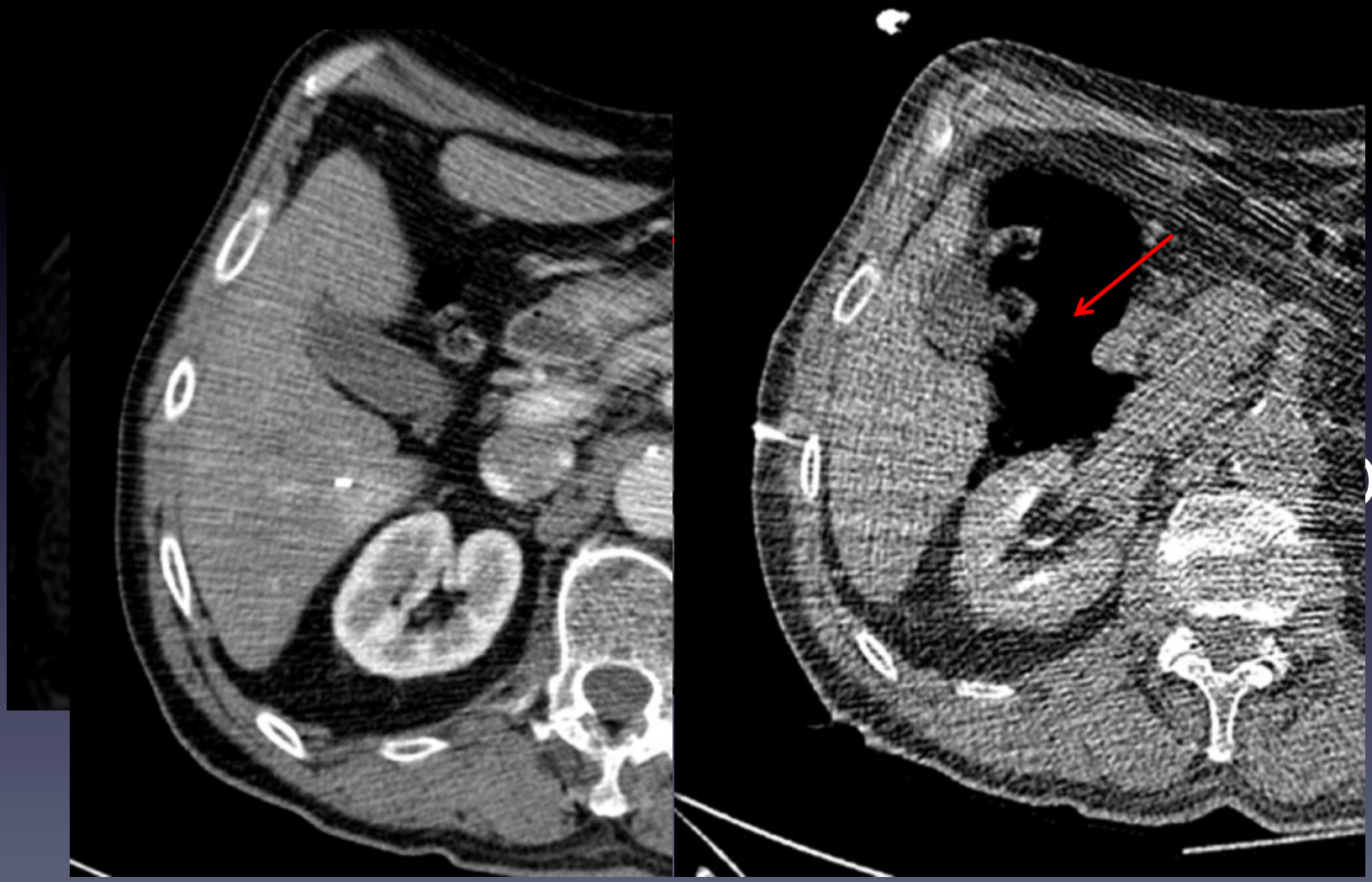
Foie gauche récidive de CHC sur hémochromatose

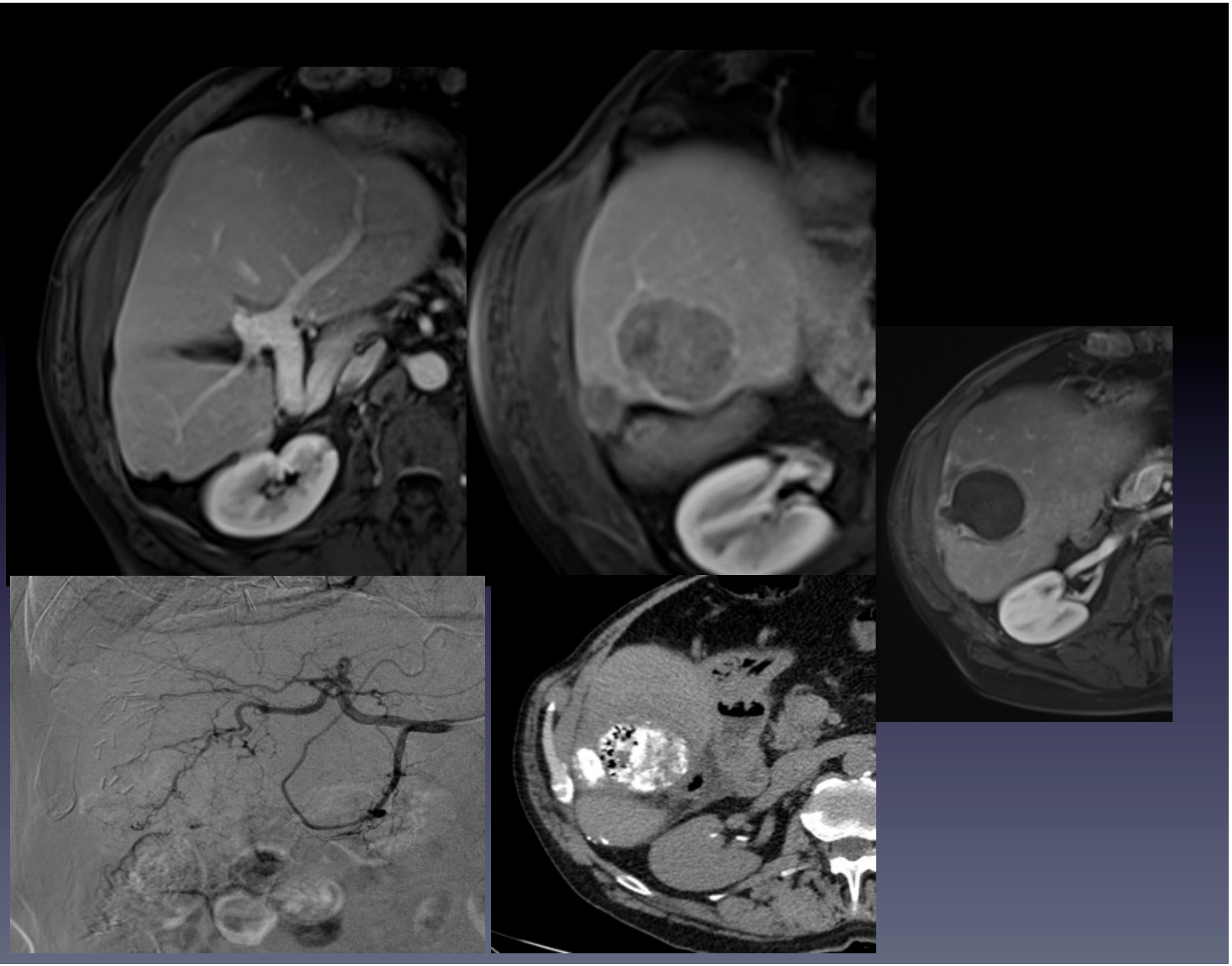
Décalage en OADt

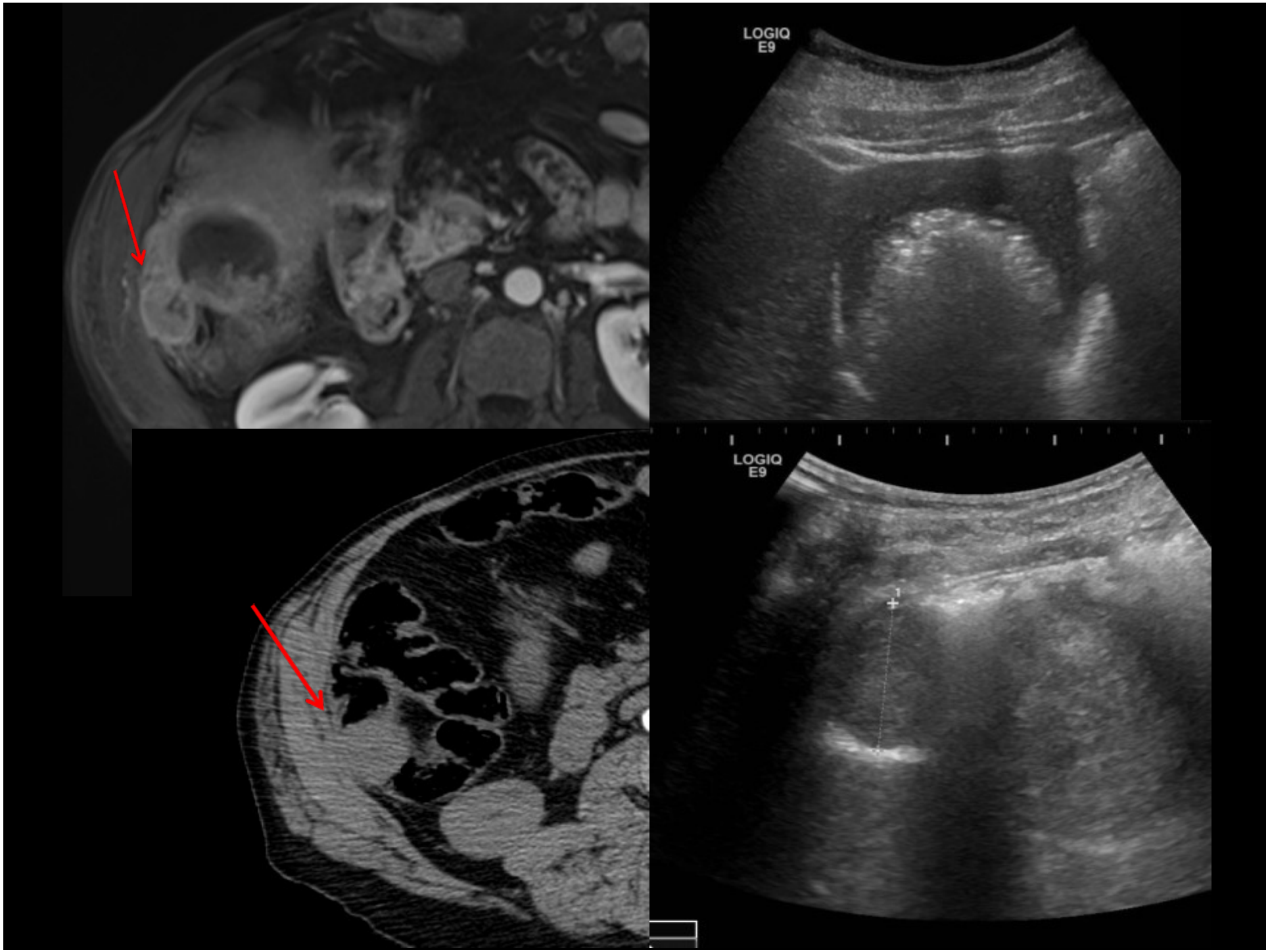


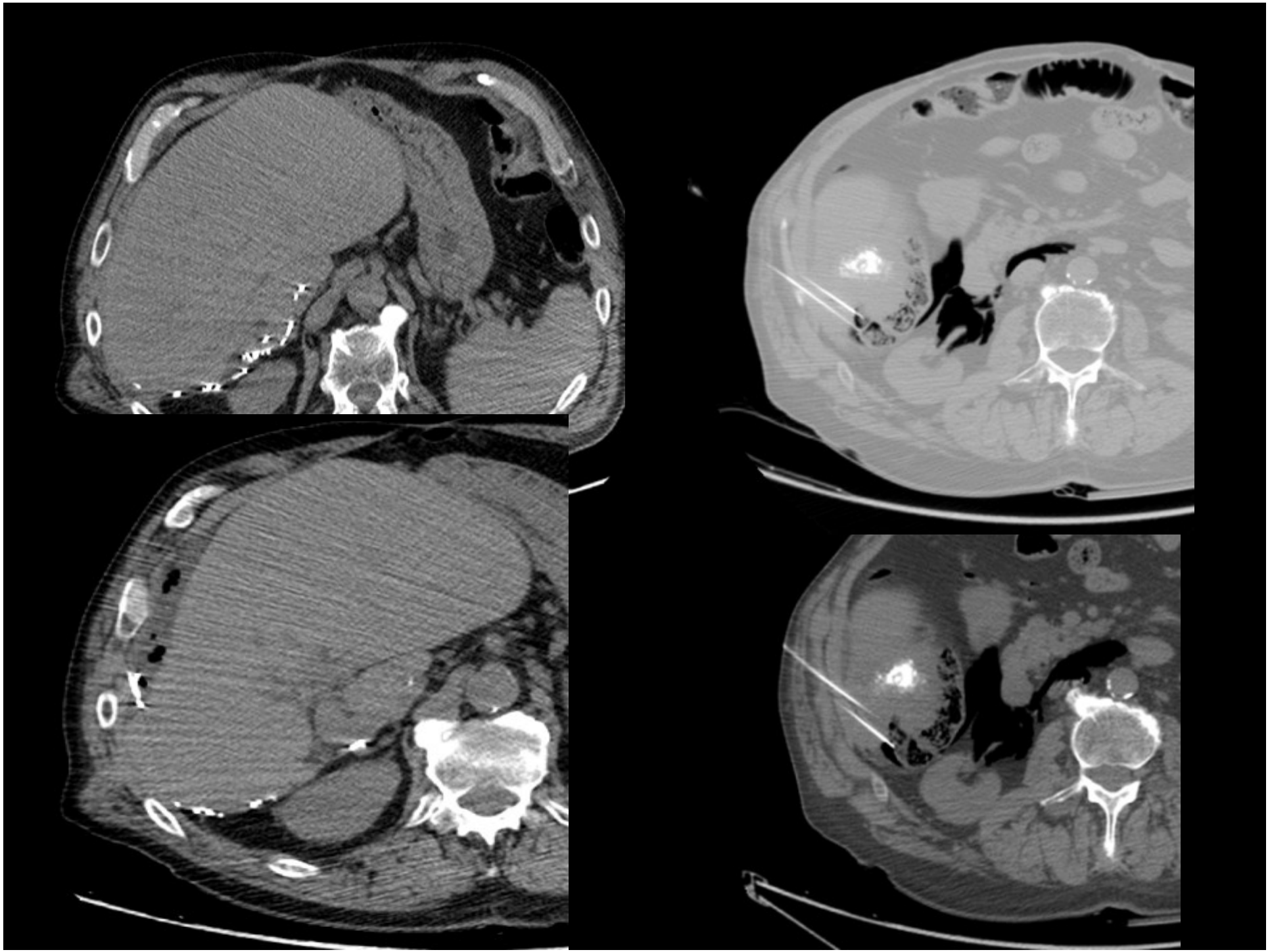


Limitation technique

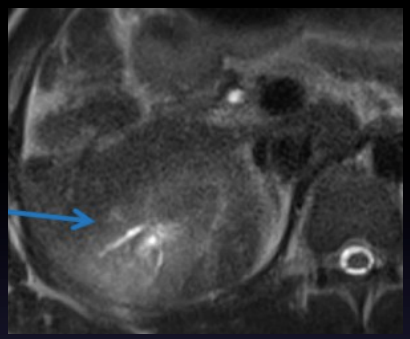





LOGIQ
E9
LOGIQ
E9



Contre- indications

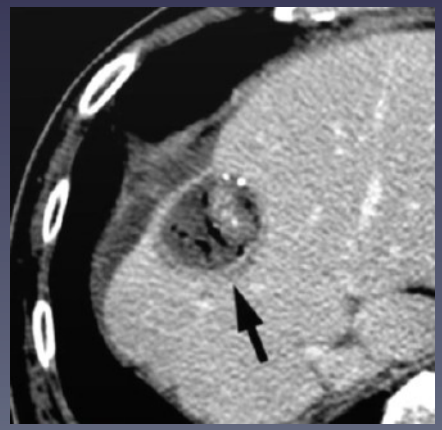


- ***propres à la ponction hépatique***
  coagulopathies sévères,ascite, ..

- ***propres à la RF***
  limites proximité < 1cm de la convergence ou de la voie biliaire principale

- ***relatives*** : Pace-makers (CI monopolaire)

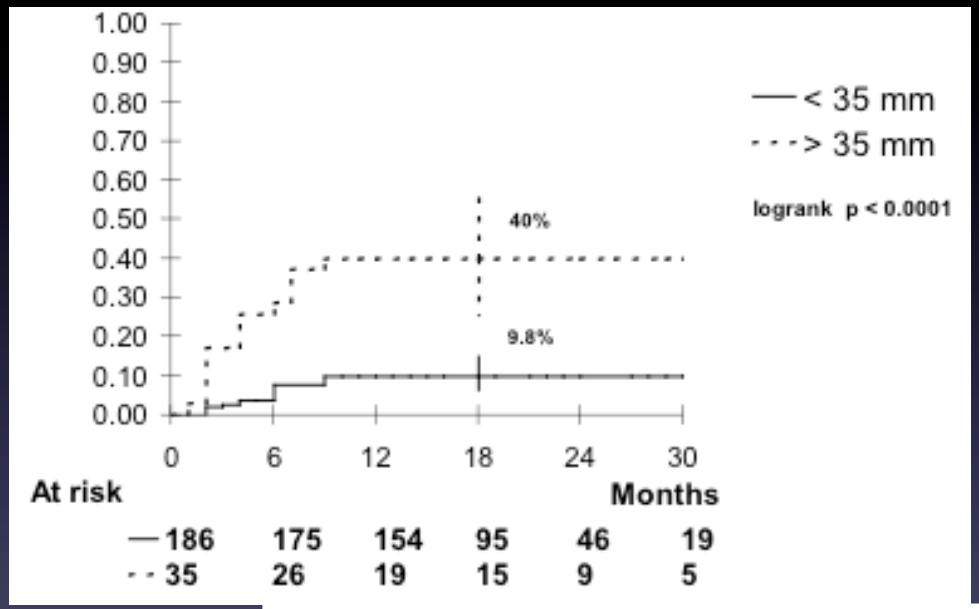
- ***précautions*** : anastomose biliodigestive *Risque 50% abcès*
  sphinctérotomie endoscopique



Résultats

Taux ablation complète de la RF : de **58 % à 98%**

(*Stang A.Eur J Cancer 2009;45:1748-56*)



= 80/90 % = 60/70 % ≤ 50 %

2.5-3 cm *4/5 cm*

De baere T. Radiology 2008

Résultats

OS 1an Chirurgie = RF

OS 3 - 5 ans Chirurgie > RF

11 meta-analysis

Study or Subgroup	RFA Events	RFA Total	HR Events	HR Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Chen 2006	68	71	83	90	2.6%	1.91 [0.48, 7.67]
Cho 2005	95	99	59	61	2.5%	0.81 [0.14, 4.53]
Guglielmi 2008	90	109	76	91	12.3%	0.93 [0.44, 1.96]
Guo 2013	89	94	91	102	4.0%	2.15 [0.72, 6.44]
Hiraoka 2008	99	105	57	59	3.6%	0.58 [0.11, 2.96]
Hong 2005	55	55	91	93	0.5%	3.03 [0.14, 64.33]
Huang 2011	355	413	600	648	55.9%	0.49 [0.33, 0.73]
Lu 2006	48	51	49	54	2.4%	1.63 [0.37, 7.21]
Lupo 2007	40	42	55	60	1.8%	1.82 [0.34, 9.85]
ueno 2008	152	155	121	123	2.2%	0.84 [0.14, 5.09]
Vivarelli 2004	62	79	66	79	12.1%	0.72 [0.32, 1.60]
Total (95% CI)		1273		1460	100.0%	0.76 [0.58, 1.00]
Total events	1153		1348			

Heterogeneity: $Chi^2 = 12.96$, df = 10 (P = 0.23); $I^2 = 23\%$

Test for overall effect: Z = 1.97 (P = 0.05)

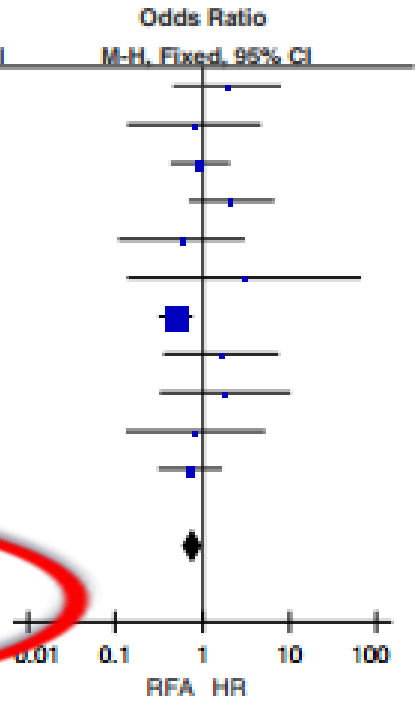


Figure 2 Comparison of the 1-year overall survival rate between radiofrequency ablation (RFA) and hepatic resection (HR). CI, confidence interval; M-H, Mantel-Haenszel.

*RF versus resection for early stage **HCC** Milan criteria metaanalysis*
Duan W J Surg Oncol 2013

Résultats

The long-term outcomes of radiofrequency ablation versus liver resection for single BCLC early stage HCC

Studies	Overall survival rates (%)				Disease-free survival rates (%)			
	3-year		5-year		3-year		5-year	
	RFA	LR	RFA	LR	RFA	LR	RFA	LR
Hiraoka et al31	87.8	91.4	59.3	59.4	58.7	64.3	24.6	22.4
Huang et al23	77.2	95.0	61.4	82.2	NA	NA	NA	NA
Wang et al26	73.5	87.3	57.4	77.2	28.3	59.9	14.	
Imai et al28	84.6	92.5	59.4	87.5	36.3	58.7	23.	
Wong et al32	91.0	97.0	72.8	84.6	34.8	65.8	14.	
Pompili et al27	80.9	81.9	NA	NA	48.9	55.1	NA	
Yang et al33	90.9	96.0	86.6	93.6	NA	NA	26.8	54.4
Fang et al24	82.5	77.5	NA	NA	55.4	41.3	NA	NA
Kim et al34	74.4	92.3	NA	NA	39.6	60.0	NA	NA
Kang et al35	92.4	93.4	85.5	90.9	43.8	71.5	31.7	61.1

Réponse complète >90%
OS à 5 ans Résection = RF CHC < 2 cm
DSF 5 ans Résection > RF

Radiofrequency ablation versus resection for Barcelona clinic liver cancer very early/early stage hepatocellular carcinoma: a systematic review 2016 *Zhen-Xin He*

Résultats

Size of the colorectal mets	≤ 3cm	3-5 cm	> 5cm
237 mets in 100 patients	n=135/143	n=62/77	n=10/17
Complete treatment at 29 months	**94.4%**	**80.5%**	**58.8%**

Van Tilborg. Br J Radiol 2010.

TAILLE FACTEUR PREDICTIF

Métastases Colorectales

Radiofréquence *vs.* Resection?

Radiofrequency Ablation Versus Resection for Liver Tumours: An Evidence-Based Approach to Retrospective Comparative Studies

Gravante J Gastrointest Surg 2011

Table 3 Results of the meta-analysis for colorectal metastases

Parameter	Time interval	Tumour characteristics	RFA	HR	OR (95%CI)	*p*	Ref.
OS	3 years	–	46.8% (109/233)	71.4% (410/574)	0.390 (0.283–0.538)	<0.0001	18,21,22,24,26,27
		Solitary	46.6% (69/148)	73.5% (222/302)	0.375 (0.245–0.575)	<0.0001	18,22,24,26
		Small (<4 cm)	46.2% (43/93)	73.5% (97/132)	–	–	18,22
	5 years	–	31.5% (80/254)	51.3% (311/606)	0.525 (0.381–0.724)	<0.0001	18,22,25–27,39
		Solitary	33.1% (53/160)	60.3% (240/398)	0.401 (0.270–0.595)	<0.0001	18,22,26,39
		Small (<4 cm)	32.5% (40/123)	59.6% (168/282)	0.407 (0.258–0.642)	<0.0001	18,22,26
DFS	3 years	–	63% (39/62)	88.6% (140/158)	–	<0.0005	18,39
	5 years	–	35.9% (33/92)	68.5% (211/308)	0.095 (0.048–0.190)	<0.0001	18,26,39

	RFA	Hepatic resection	
OS 5 years	31.5%	51.3%	p < 0.001
DFS 5 years	35.9%	68.5%	p < 0.001

RF moins invasive

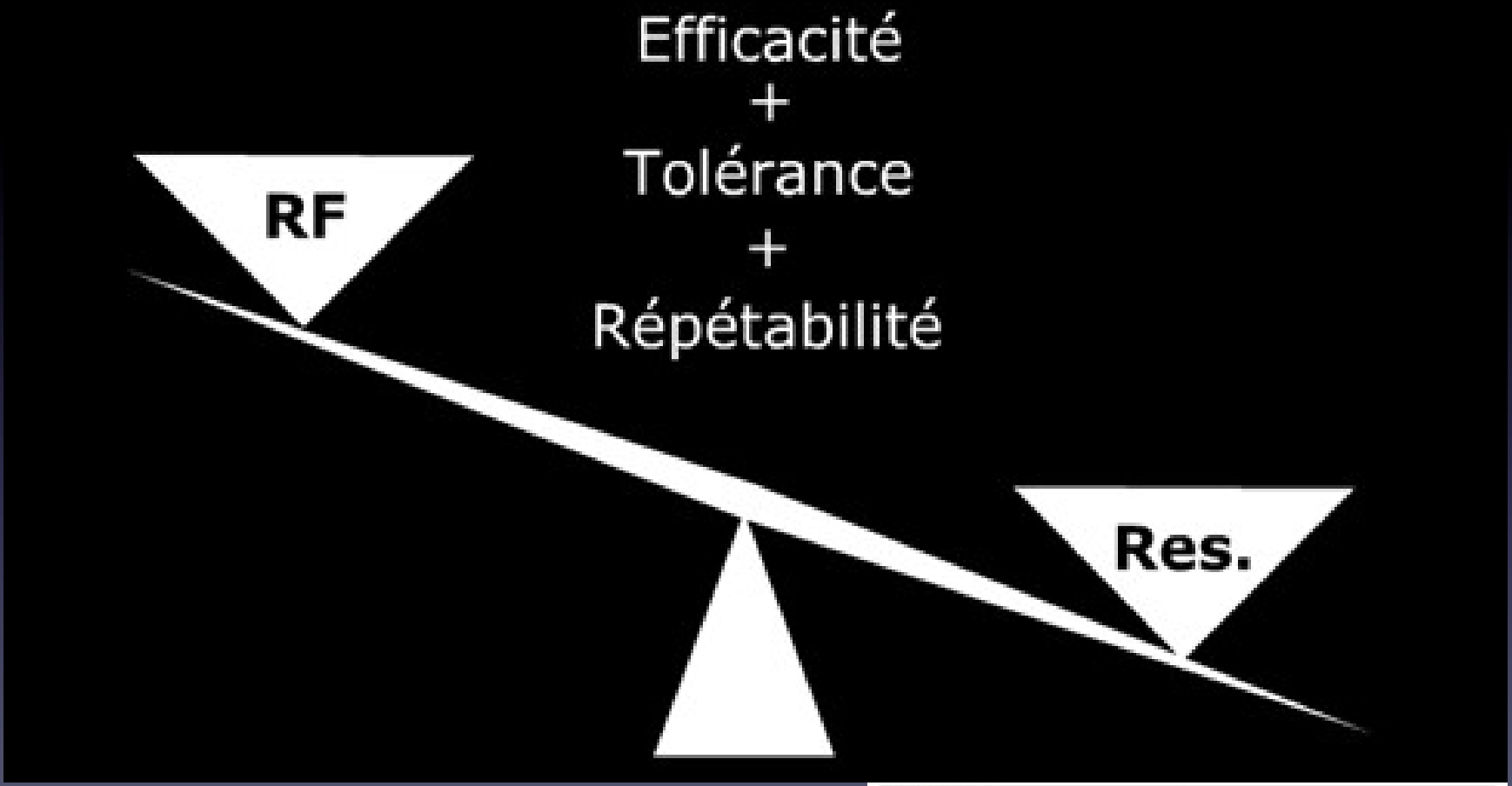
- Préservation parenchymateuse
- Possibilité de traitements répétés
- Meilleure morbidité et mortalité par rapport à résection

RF percutanée : 4.6% vs Chirurgie : 17-37% (morbidité)

RF percutanée : 0-0.5% vs Chirurgie : 0-6.6% (mortalité)

Flanders Vl, JVIR 2010

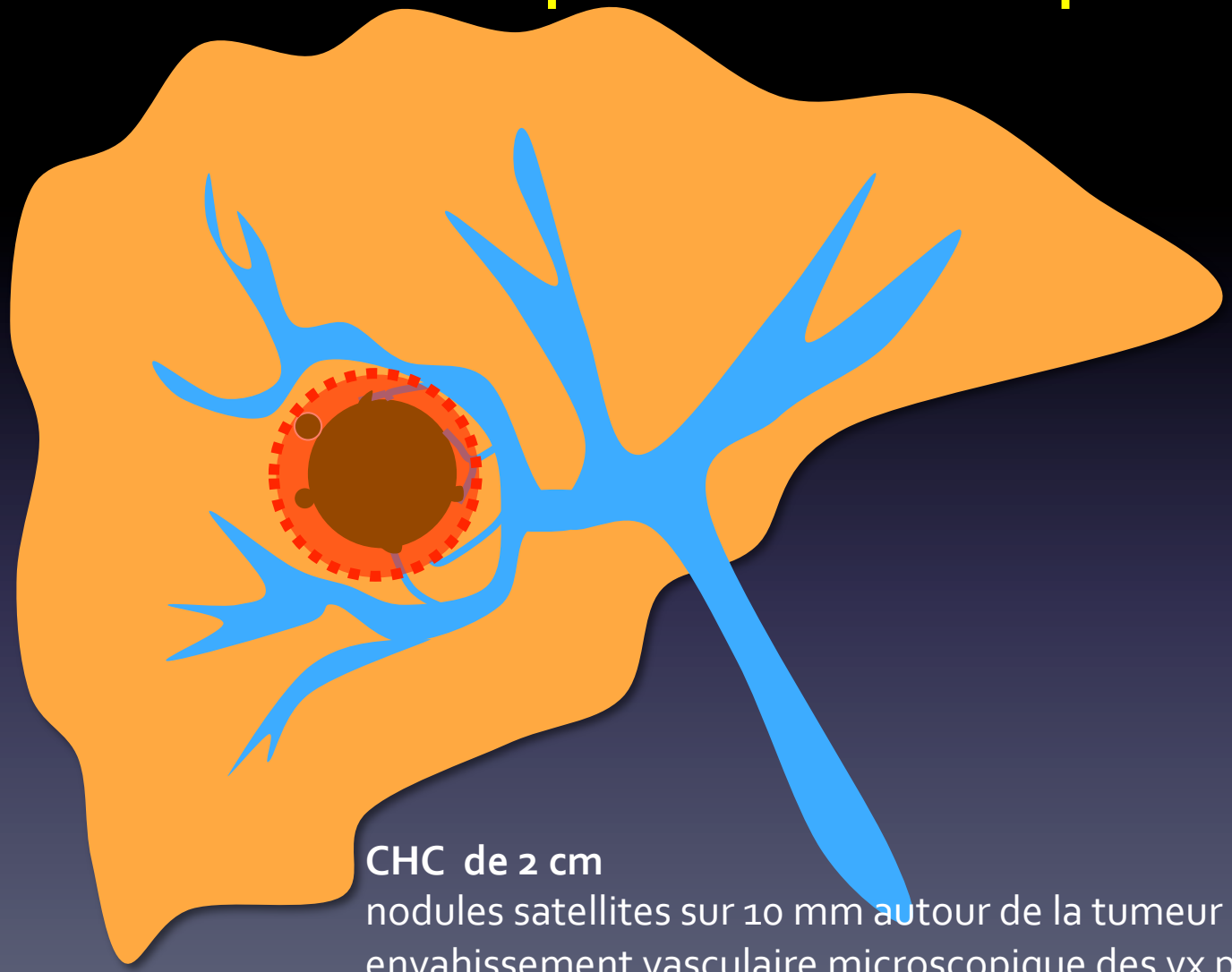
RF moins invasive



INTERVENTIONAL

Thermal ablation of colorectal liver metastases: a position paper by an international panel of ablation experts, the interventional oncology sans frontières meeting 2013

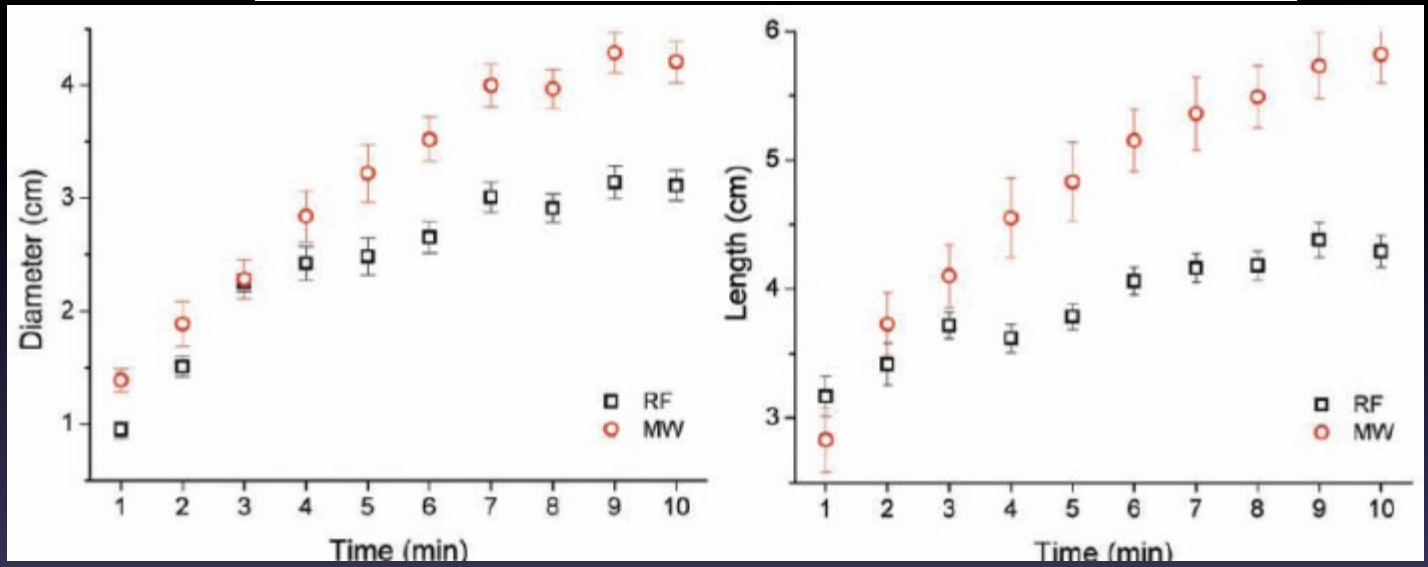
Facteurs de risque tt incomplet



CHC de 2 cm
nodules satellites sur 10 mm autour de la tumeur (10%)
envahissement vasculaire microscopique des vx portes (25%)
(***Kojiro. Liver Transpl 2004)***

Augmenter la taille de l'ablation

Volume of necrosis : **MWA** *vs.* **RFA**



Imaging Measurements of Final RF and Microwave Ablation Zones

Measurement	RF Ablation*	Microwave Ablation*	*P* Value
Diameter (cm)	3.11 ± 0.40	4.21 ± 0.56	<.001
Length (cm)	4.29 ± 0.38	5.82 ± 0.66	<.001
Volume (cm^3)	13.92 ± 5.72	32.46 ± 5.22	<.001
Aspect ratio	0.72 ± 0.08	0.73 ± 0.09	>.99

Note.—Nine samples each were obtained for RF ablation and microwave ablation.

(Brace, Radiology 2009)

Microondes

Comparison of clinical outcomes across published series of hepatocellular carcinoma patients for microwave ablation over radiofrequency

Lu et al[78]	MWA	Percutaneous, US	49	98	50.1	5 min	3 (25/49)	94.9	11.8	81.6	61.2	50.5	36.8	-	32.5
	RFA	Percutaneous, US	53	72	54.5	10 min	3 (32/53)	93.1	20.9	71.7	47.2	37.6	24.2		27.1
Qian et al[63]	MWA	Percutaneous, US	22	22	52	-	4.8	95.5	18	-	-	-	-	-	-
	RFA	Percutaneous, US	20	20	56	-	3.5	95	15	-	-	-	-	-	-
Zhang et al[86]	MWA	Percutaneous, US	77	105	54	8 min	< 3 (36), 3.1 to 5 (41)	86.7	10.5	92.2	-	51.7	-	38.5	-
	RFA	Percutaneous, US	78	97	54	6-20 mi					-	64.1	-	41.3	-
Abdelaziz et al[79]	MWA	Percutaneous	66	-	53.5	-					62	-	-	-	-
	RFA	Percutaneous	45	-	56.8	-	2.95 ± 1.03	94.2	13.5	67.6	47.4	-	-	-	-
Ding et al[81]	MWA	Percutaneous	85	98	59	10	< 3	98.5	10.9	98.7	92.3	82.7	77.8	-	45.34
	RFA	Percutaneous	113	131	58.6	12	< 3	99	5.2	98	90.7	77.6	77.6	-	52.99
Ohmoto et al[80]	MWA	Percutaneous	49	56	64		< 2		19	89	70	49	39	-	-
	RFA	Percutaneous	34	37	67		< 2		9	100	83	70	70	-	-

OS RF = MW

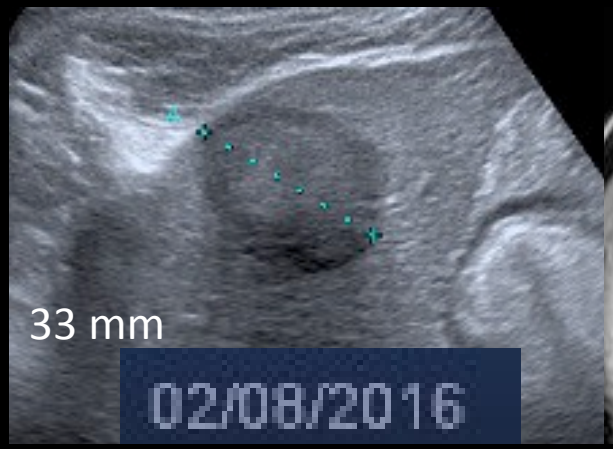
World J Hepatol

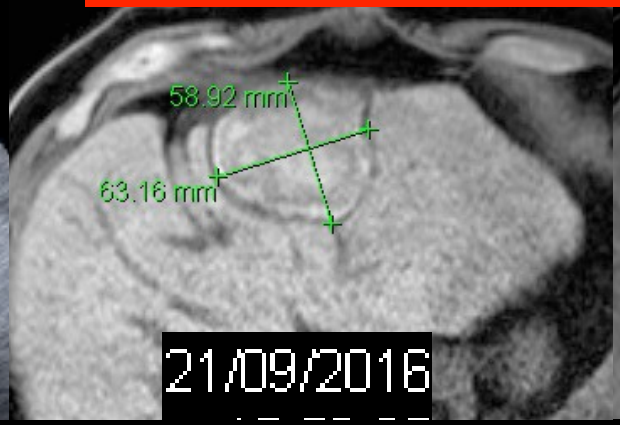
	RFA	Percutaneous	45	-	56.8	-	2.95 ± 1.03	94.2	13.5	67.6	47.4	-	-	-	-
Ding et al[81]	MWA	Percutaneous	85	98	59	10	< 3	98.5	10.9	98.7	92.3	82.7	77.8	-	45.34
	RFA	Percutaneous	113	131	58.6	12	< 3	99	5.2	98	90.7	77.6	77.6	-	52.99
Ohmoto et al[80]	MWA	Percutaneous	49	56	64		< 2		19	89	70	49	39	-	-
	RFA	Percutaneous	34	37	67		< 2		9	100	83	70	70	-	-

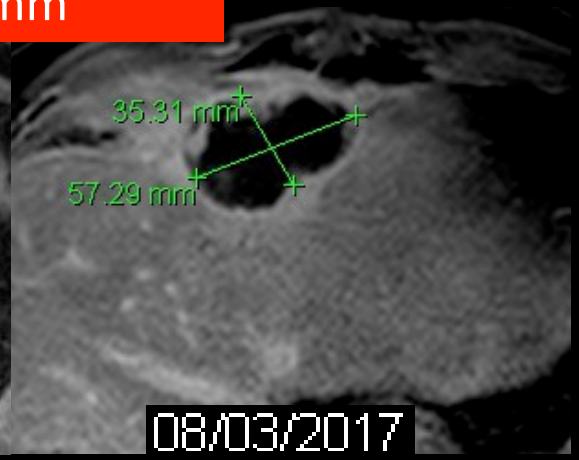
World J Hepatol. 2015 May 18; 7(8): 1054–1063.

Microondes

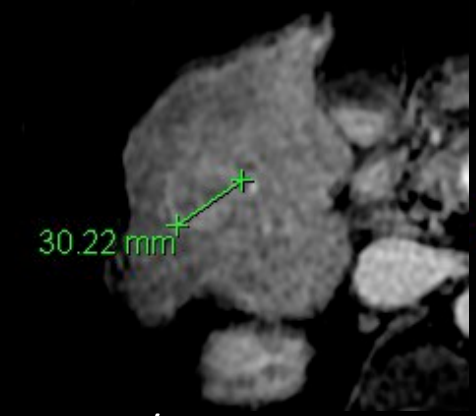
8 min/80 W /63 x 58 mm

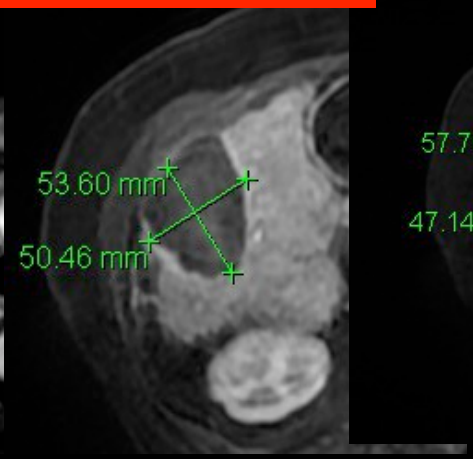


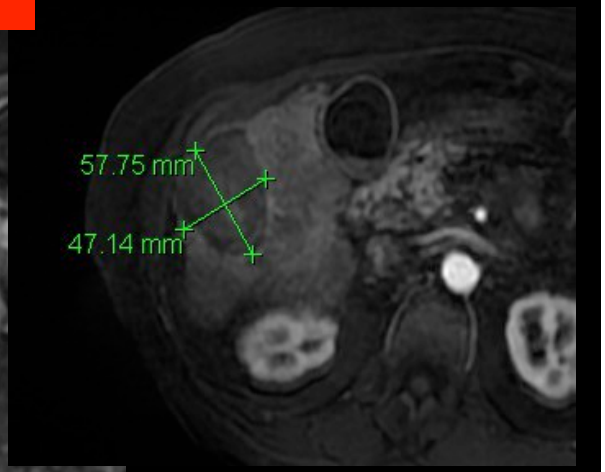




10 minutes /60 W/ 53 X 57 mm



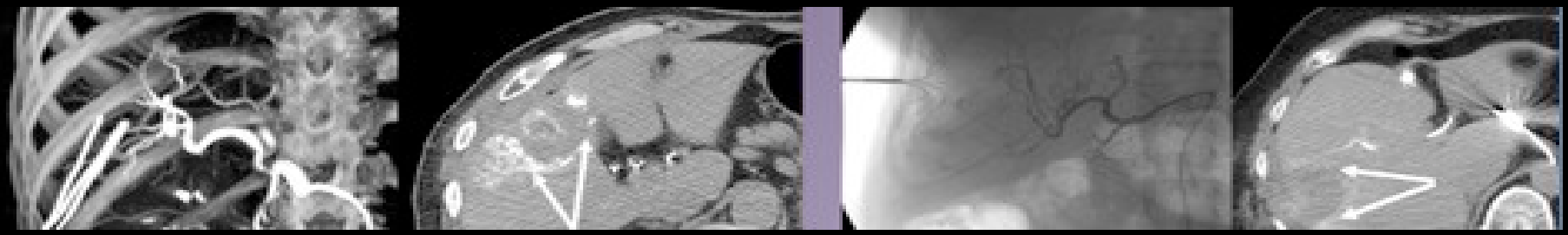




30 /28 mm

Augmenter la taille de l'ablation

- RF +CEL



Traite les micronodules satellites

- CEL + RF

aide pour guidage et augmente la taille de destruction

Kang JVIR 2009

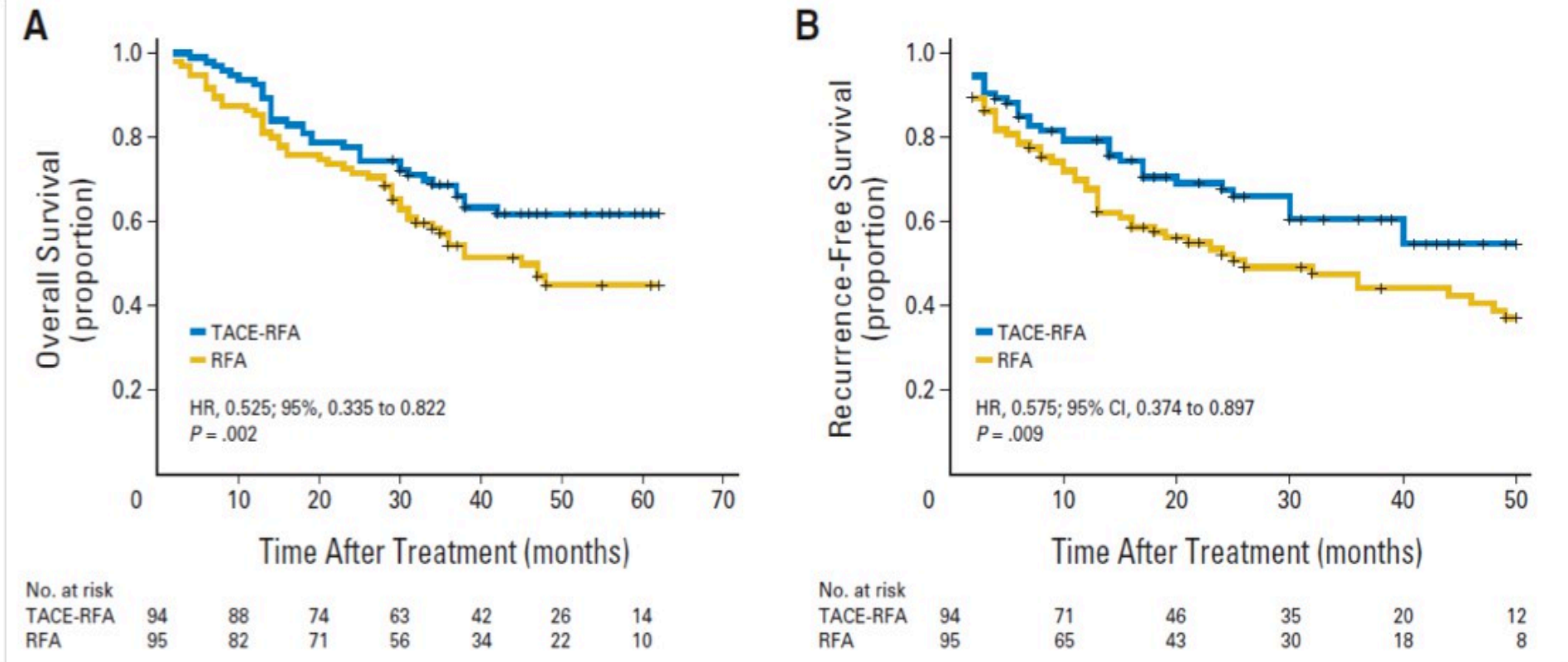


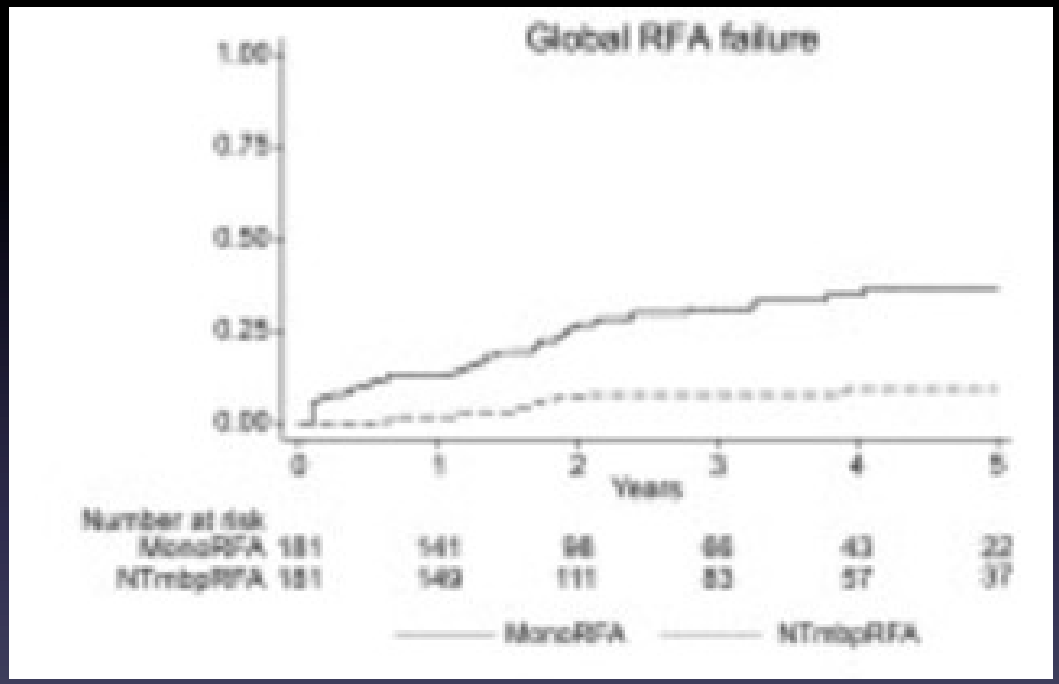
Fig 2. Overall (A) and recurrence-free (B) survival curves for the transcatheter arterial chemoembolization (TACE) plus radiofrequency ablation (RFA) and RFA groups HR, hazard ratio.

Radiofrequency Ablation With or Without Transcatheter Arterial Chemoembolization in the Treatment of Hepatocellular Carcinoma: A Prospective Randomized Trial

- 189 patients CHC < 7 cm
- **TACE –RF**(n 94) **OS 1** an : 92,6%,OS 2 ans : 66,6% ,OS 3 ans : 61,8%
- **RF seule** (n 95) **OS** 1 an : 85,3%,OS 2 ans : 59% ,OS 3 ans : 45,0%
- **TACE –RF** **DFS** 79.4%, 60.6%, 54.8%
- **RF seule** **DFS** 66.7%, 44.2%, 38.9%,

Zhen –Wei Peng oncology 2013

Augmenter la taille de l'ablation pour obtenir un traitement complet

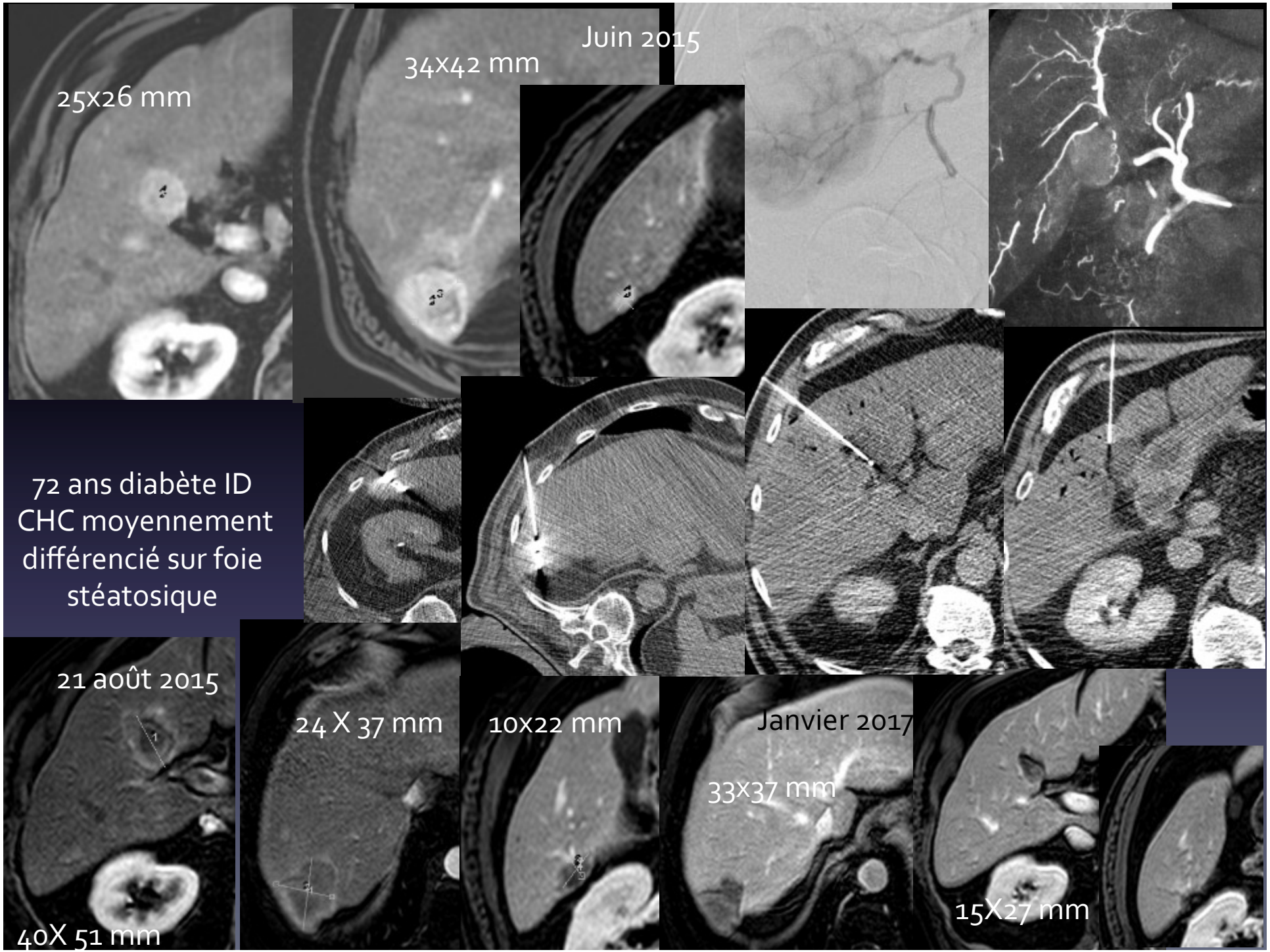


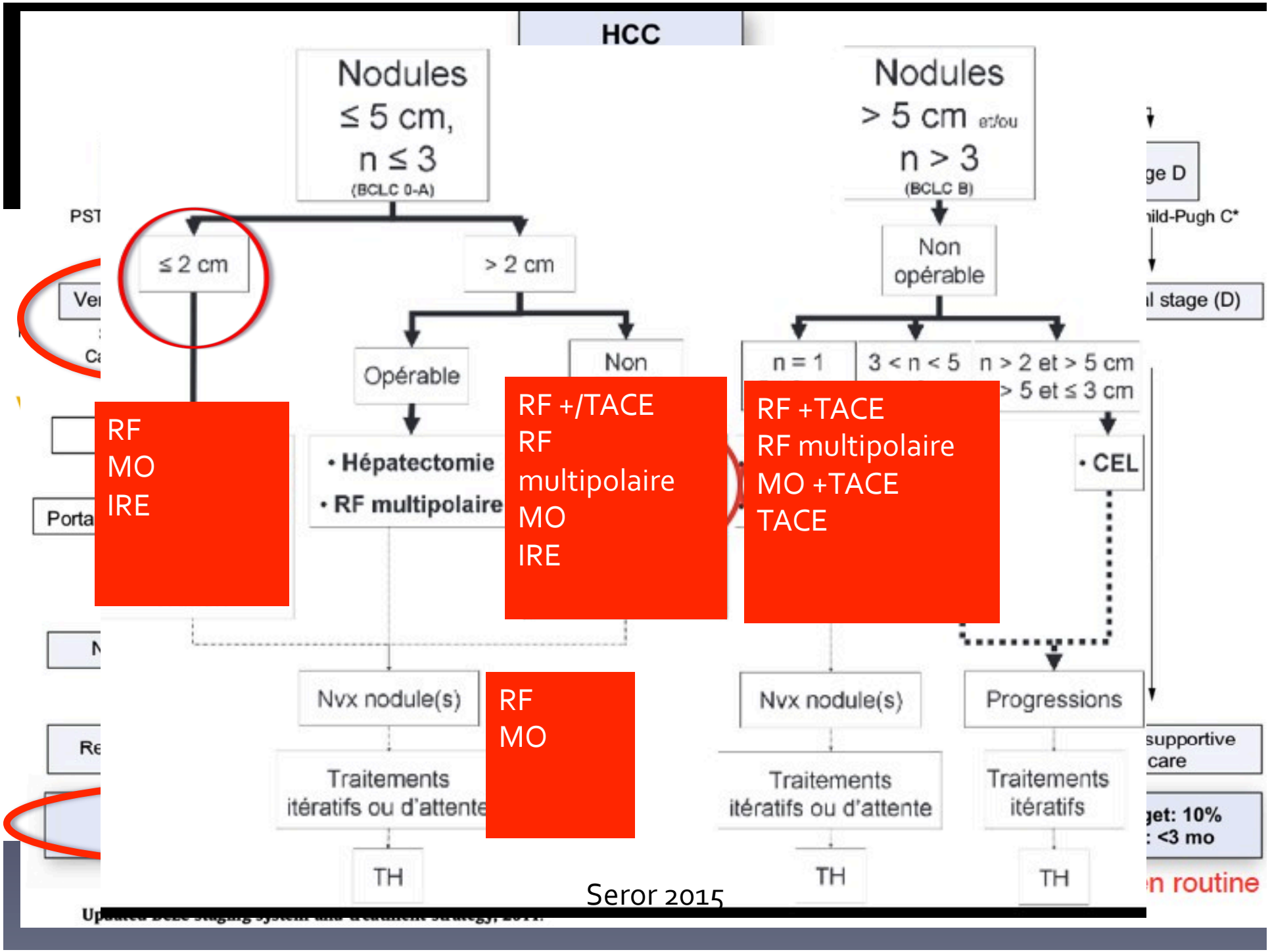
Comparison of no-touch multi-bipolar *vs.* monopolar radiofrequency ablation for

small HCC

Seror 2017

- 362 patients HCC < 5 cm 1 DC RF MP et 7,2 % complications pour 2 groupes
- Taux échecs 1 an , 3 ans ,5 ans :13.3%, 31% 36.7% MonoRFA vs 0.02% , 7.9%, 9.2% MultiRFA
- 5 ans OS 37.2% MonoRFA < 46.4% multiRFA (p = 0.378)

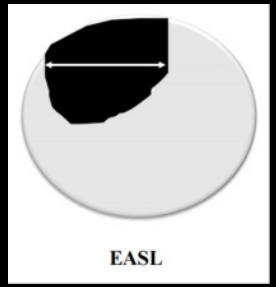

Juin 2015
25x26 mm
34x42 mm
72 ans diabète ID
CHC moyennement
différencié sur foie
stéatosique
21 août 2015
40X 51 mm
24 X 37 mm
10x22 mm
Janvier 2017
33x37 mm
15X27 mm


HCC
Nodules ≤ 5 cm, n ≤ 3 (BCLC 0-A)
Nodules > 5 cm et/ou n > 3 (BCLC B)
≤ 2 cm
> 2 cm
Opérable
Non
Non opérable
n = 1
3 < n < 5
n > 2 et > 5 cm
> 5 et ≤ 3 cm
• Hépatectomie
• RF multipolaire
• CEL
RF
MO
IRE
RF +/TACE
RF multipolaire
MO
IRE
RF +TACE
RF multipolaire
MO +TACE
TACE
RF
MO
Nvx nodule(s)
Nvx nodule(s)
Progressions
Traitements itératifs ou d'attente
Traitements itératifs ou d'attente
Traitements itératifs
TH
TH
TH
supportive care
routine

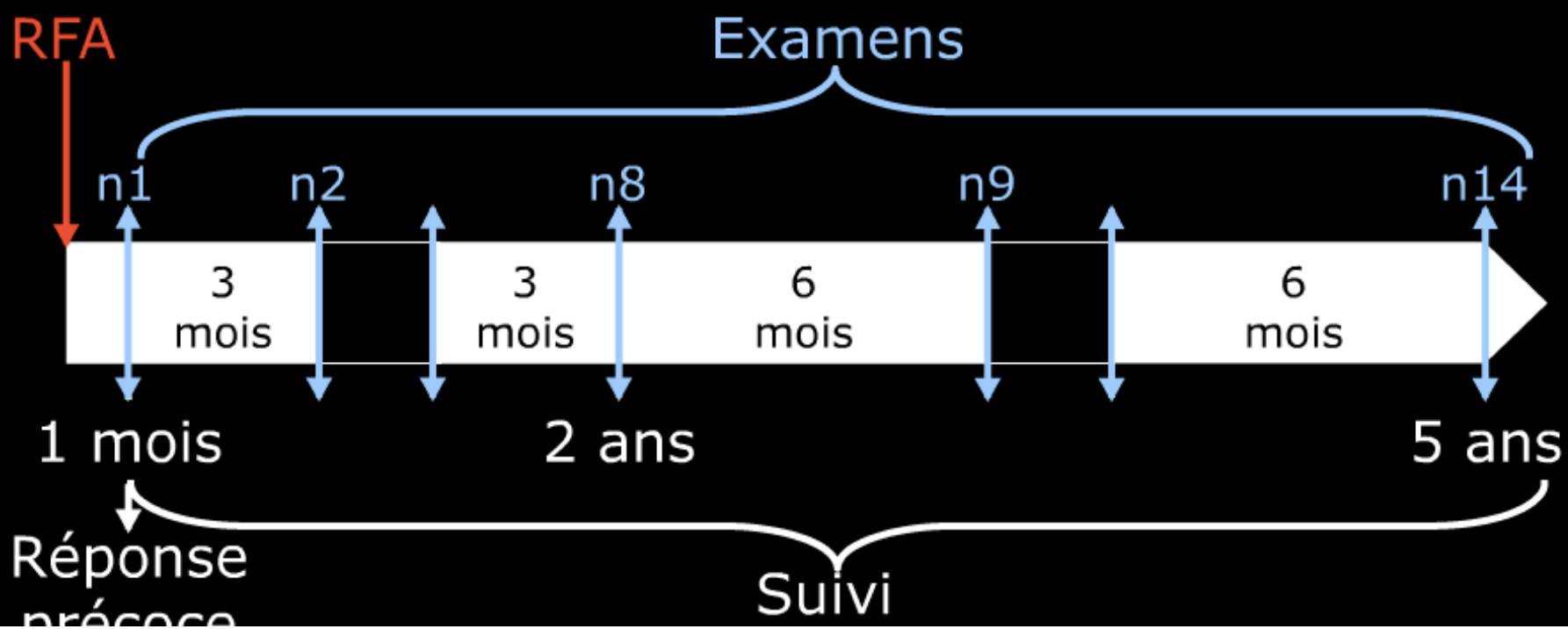
Seror 2015

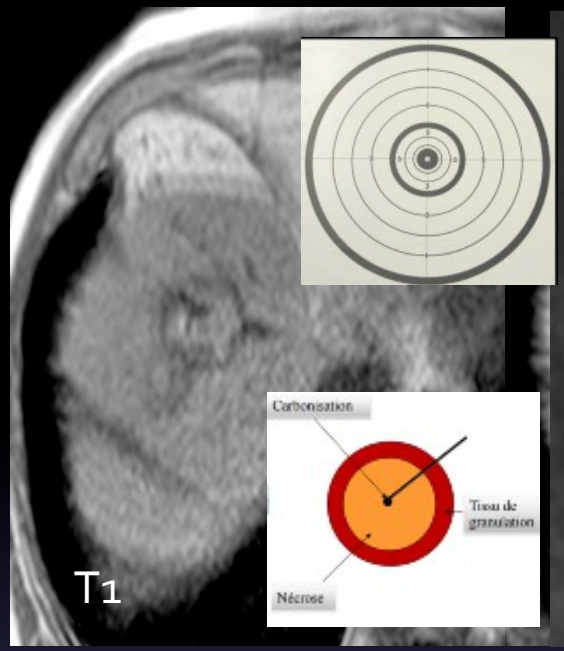
Traitements percutanés

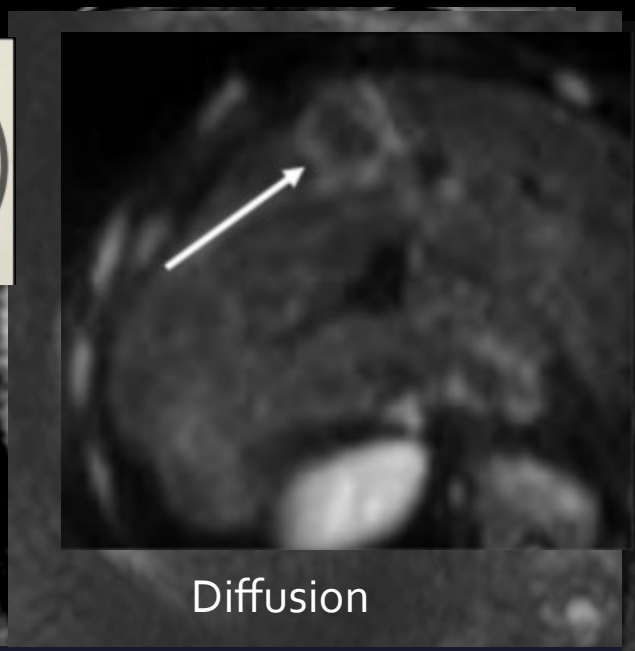
Evaluation par imagerie

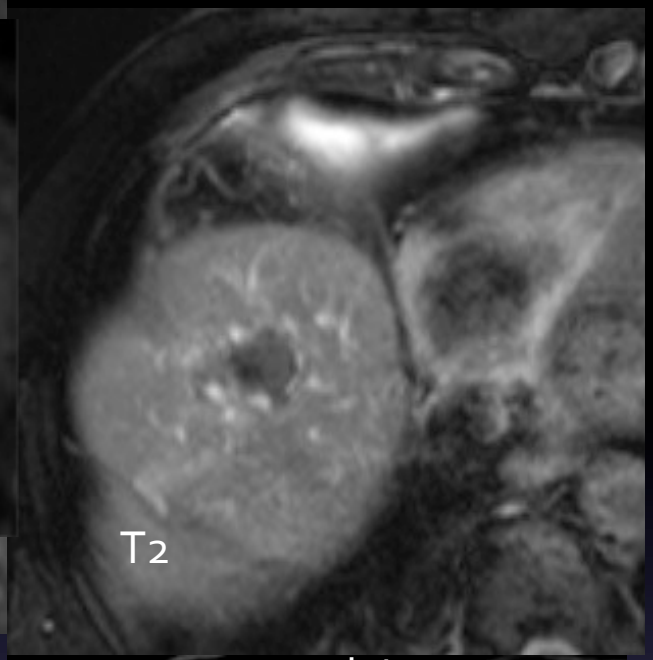


- **Imagerie en coupes** +++ (TDM ou IRM +++avec injection multiphasique)
- intérêt majeur des séries en soustraction

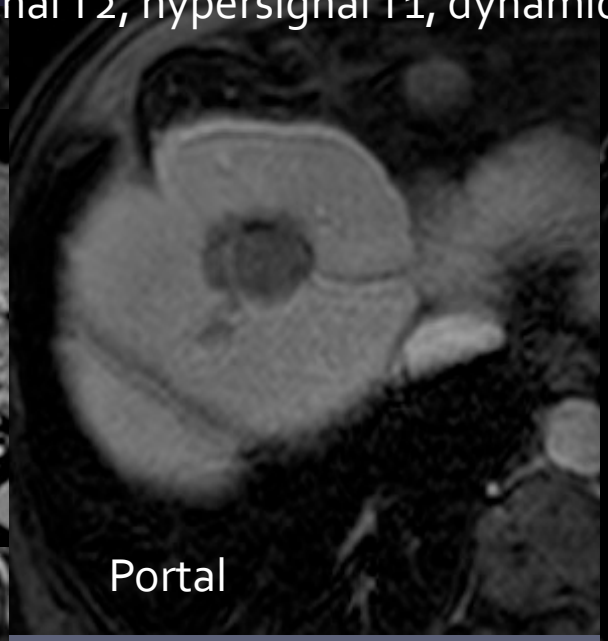




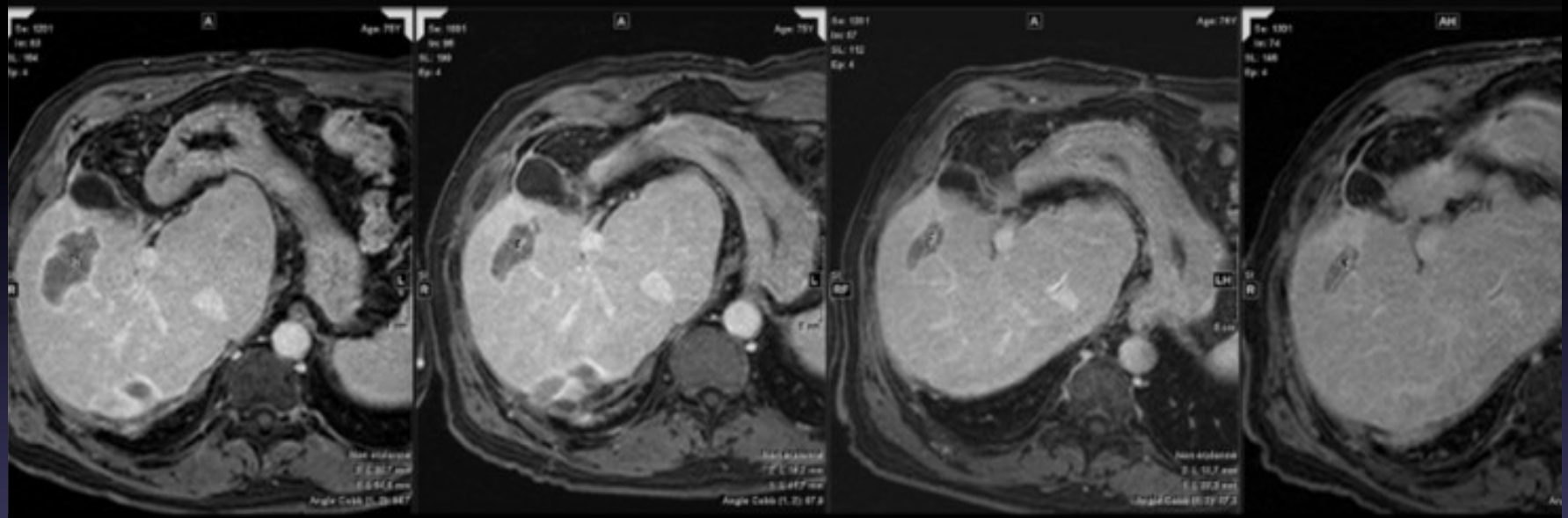




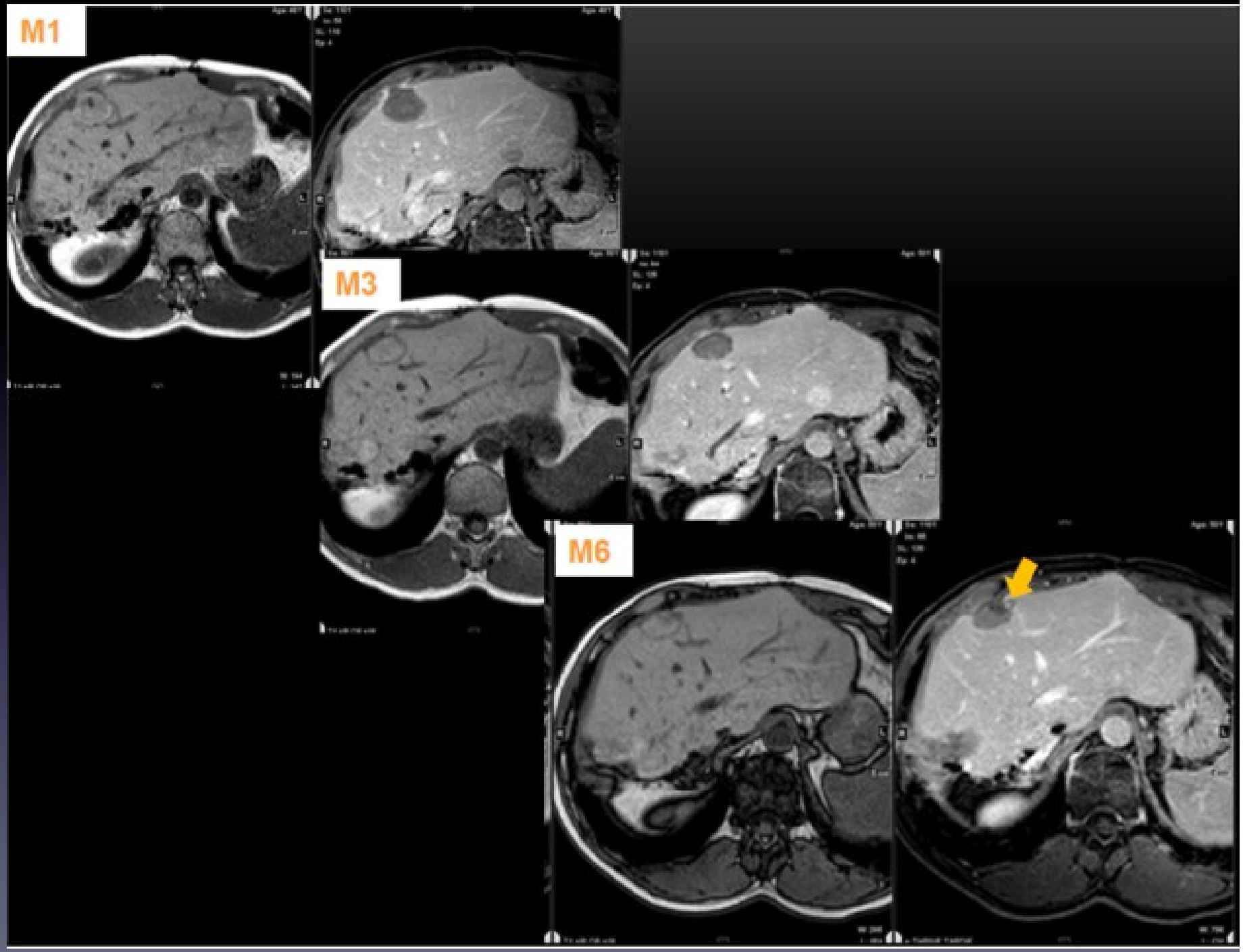
Sans injection hyposignal T2, hypersignal T1, dynamiques zone avasculaire

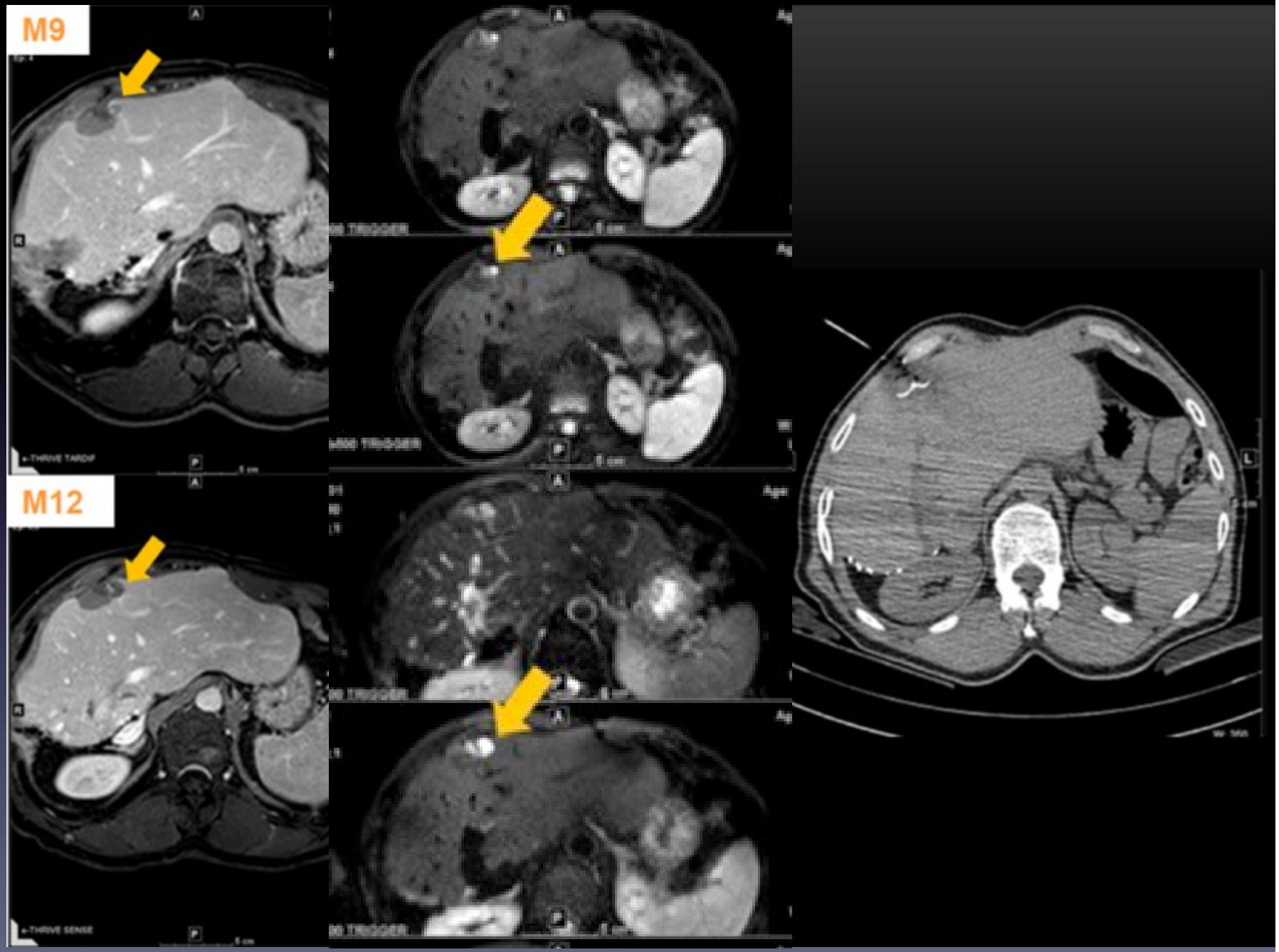


Evolution dans le temps

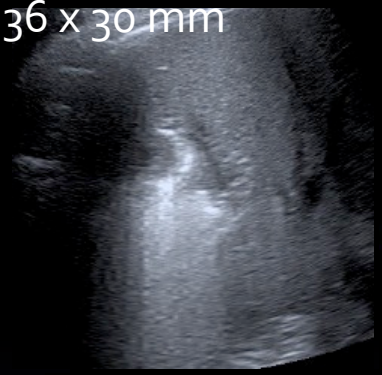


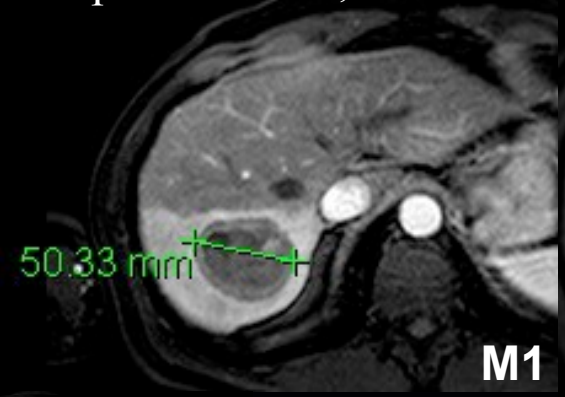
AVRIL 2013 JUILLET 2013 MARS 2014 JANVIER 2015

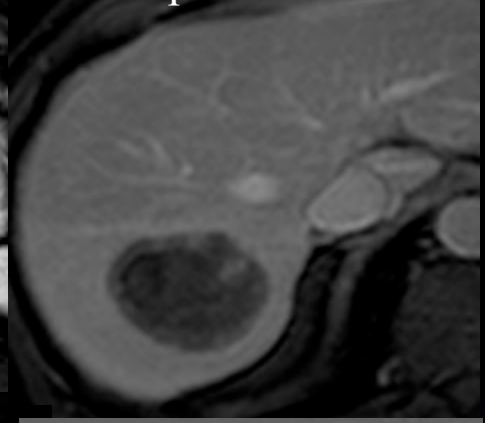

M1
M3
M6

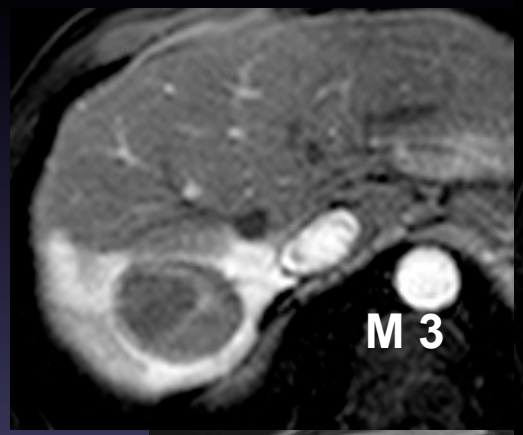

M9
M12

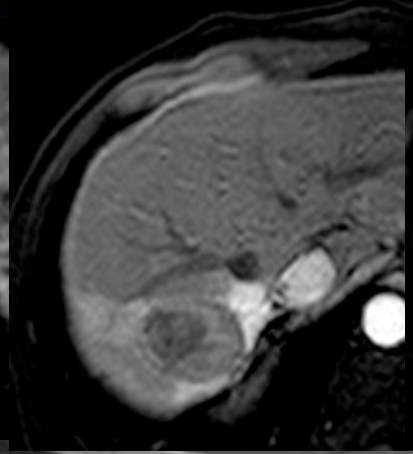
hépatite chronique à virus B traité depuis 2004 par antivlraux, avec absence de réplication virale
segment VII nodule de 36 x 30 mm

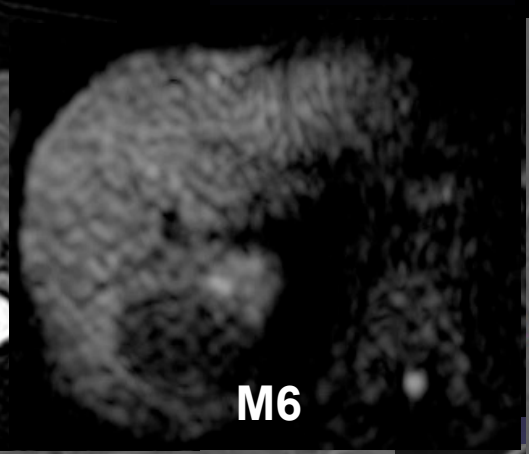


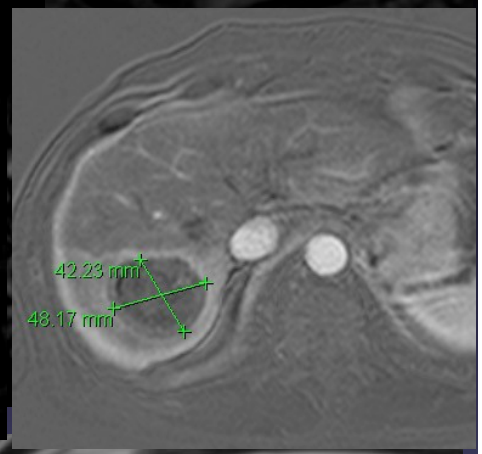


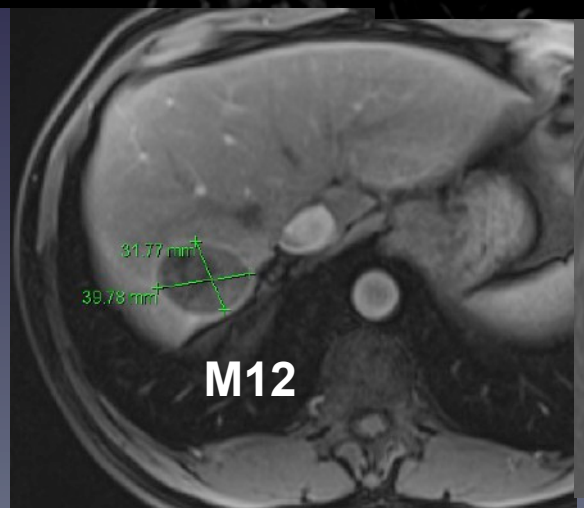


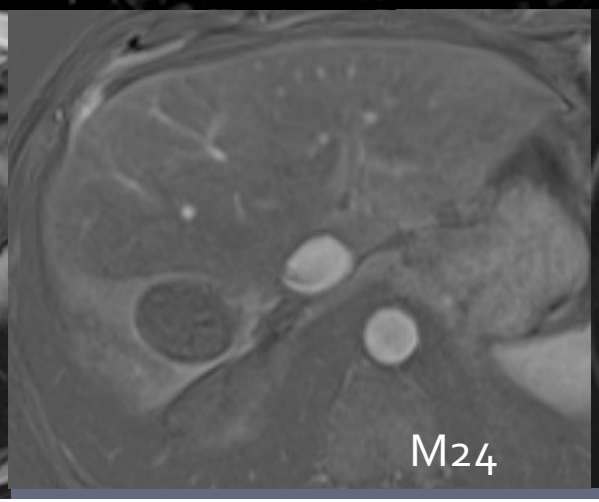


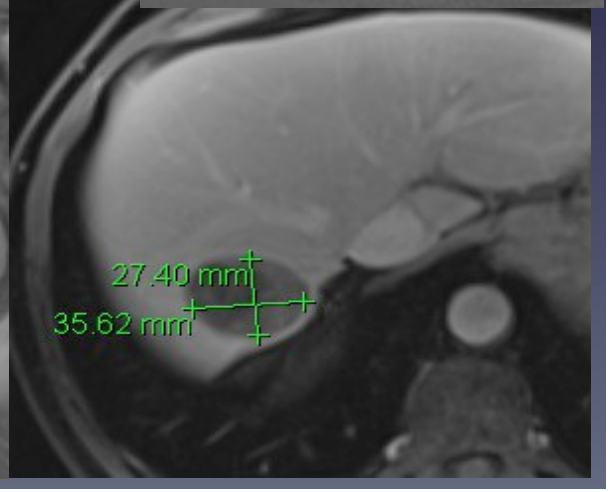












Conclusion

- **Diversité des thermoablations** : indications élargies
- Amélioration des **moyens de guidage :précision**
- **Prise en charge structurée** multidisciplinaire
- Faible morbidité , courte hospitalisation: coût -
- Importance de **l'imagerie de suivi**

Merci
De votre attention

M9 M12 M18

scanner