SAINT 2012

Onkologische Interventionen

Extrahepatische lokale Tumortherapie – was macht Sinn?

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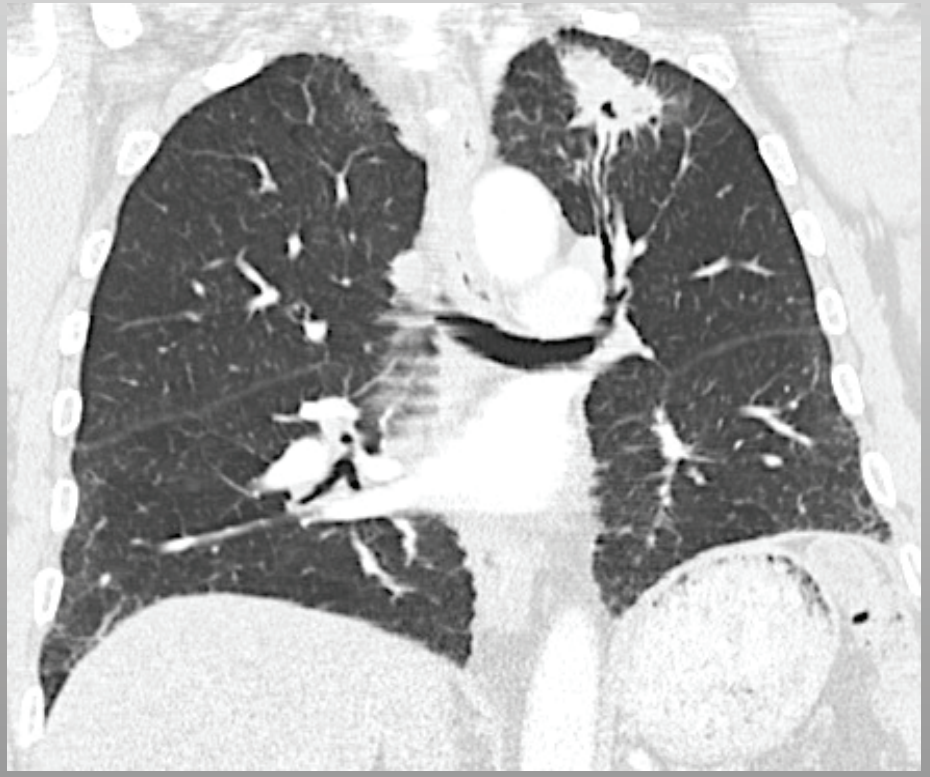
Lokale Tumortherapie

- Leber ✔
- Extrahepatische Tumoren
  - Indikationen
    - Lunge
    - Niere
    - Knochen
  - Ergebnisse

Ablation Lungentumoren



Bronchial CA

Rationale für minimal-invasive TU-Therapie

- Non-small cell lung cancer (NSCLC) 80%
- Chirurgische Resektion Methode der Wahl beim frühen NSCLC
  - Aber: Limitationen aufgrund Komorbiditäten (z.B. COPD etc.)
  - Hohe Rezidivwahrscheinlichkeit bei NSCLC
- Limitierter Outcome von CTx und Radiotherapie

Pulmonale Metastasen

Rationale für minimal-invasive TU-Therapie

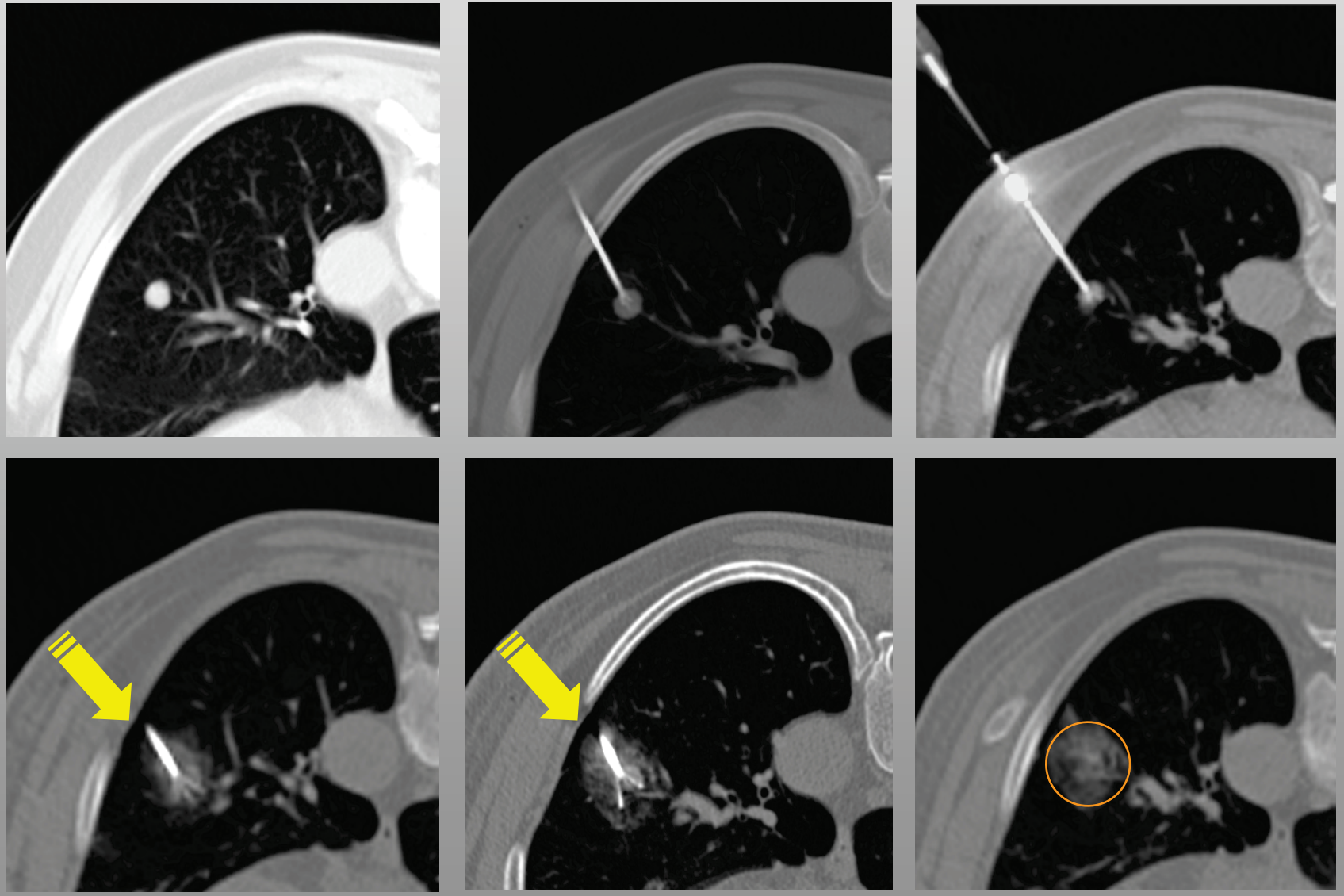
- Lunge 2. häufigster Manifestationsort für Metastasen
- Bekannter Überlebensvorteil nach Rx
- OP limitiert durch
  - Anzahl und Lokalisation der Metastasen
  - Verlust an funktionellem Lungengewebe
  - Relativ hohes Rezidivrisiko

Indikationen IGT

- Sekundäre Malignome + NSCLC
- OP nicht möglich (technisch und/oder allg. med. Gründe; Einzellunge)
- Lebenserwartung > 3 Monate
- Erkennbarer Tu ohne prognosebestimmende Fernmetastasen
- Bis zu 6 + ? Läsionen (beide Lungen)
- Dmax 3 (5) cm (Dmin 0,5 cm?)
- Palliation (Schmerz, Dekompression, Hämoptyse)

Intention:
Potentielle Heilung
Überlebensverlängerung

CT-Fluoroskopie

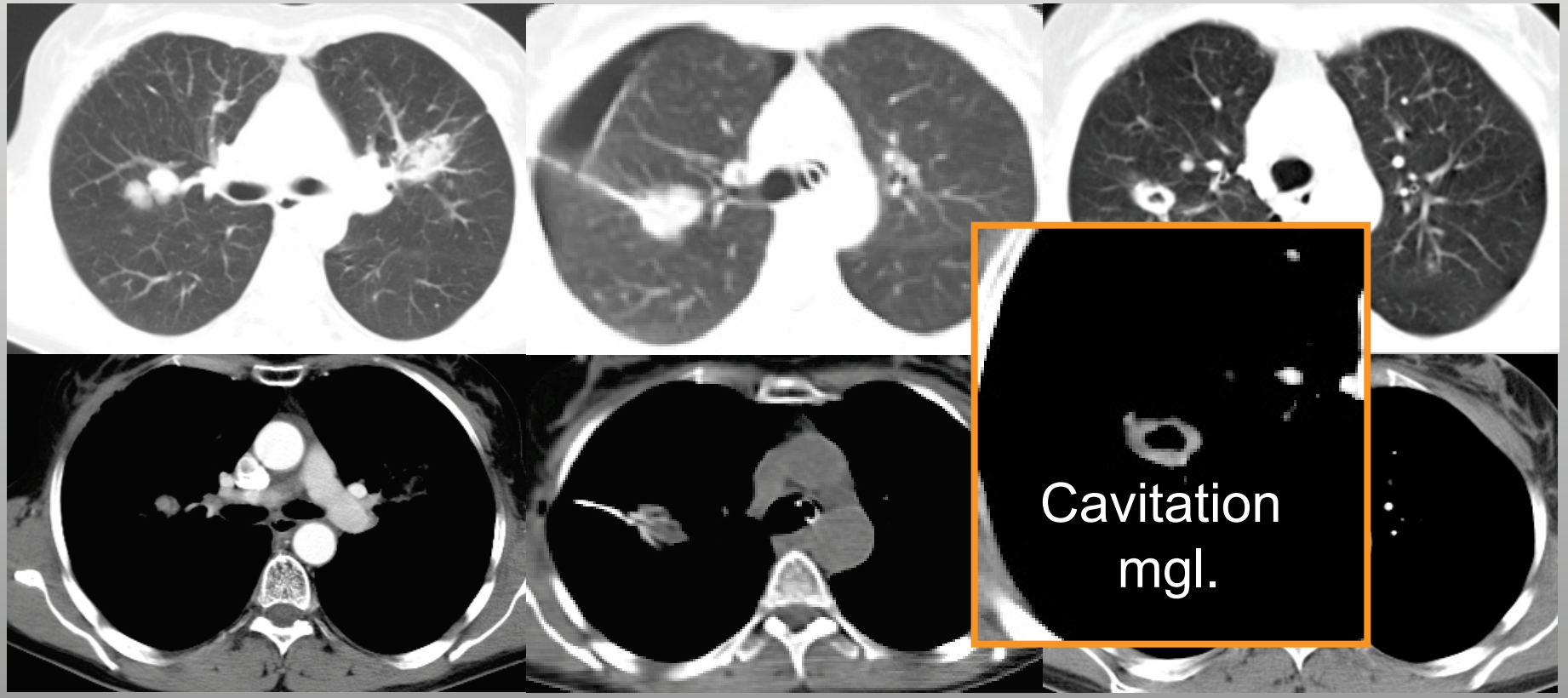


RFA NSCLC Rezidiv

3 Monate post

Lage < 2 cm
von zentralen
Strukturen!

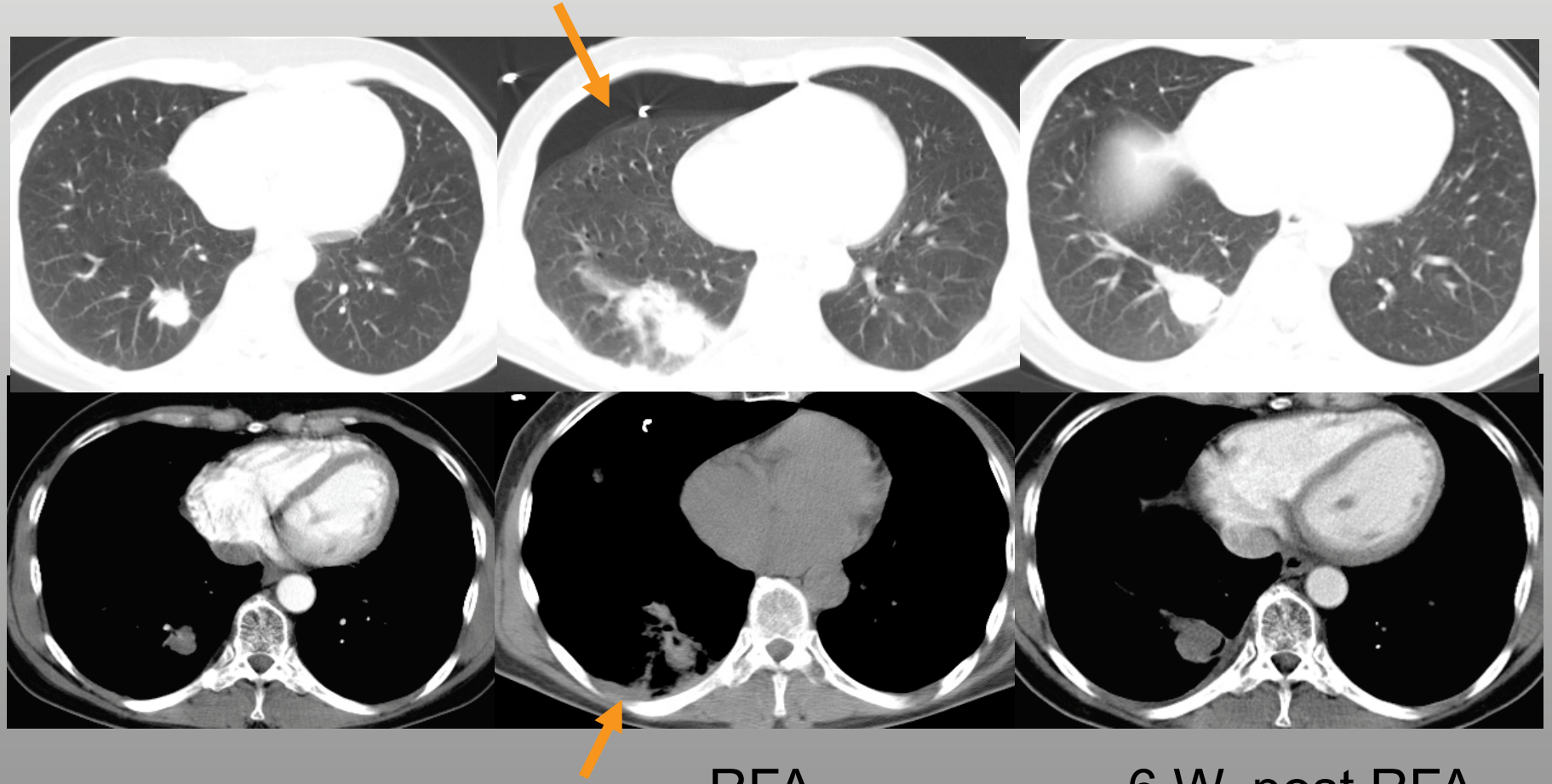
RFA Mamma CA Mets



RFA

6 W post RFA

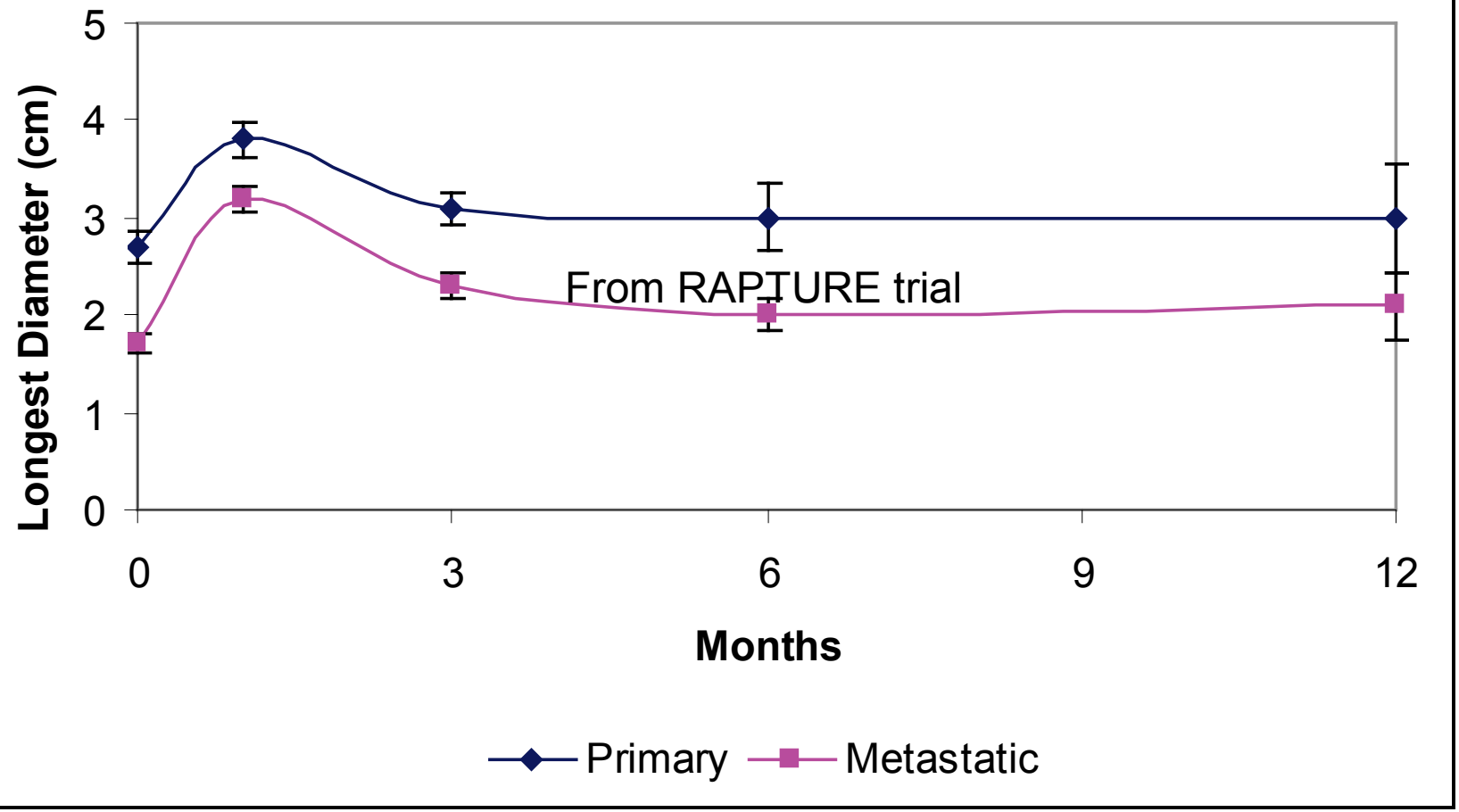
RFA Mamma CA Mets



RFA

6 W. post RFA

Follow-up – “Läsionsreifung”



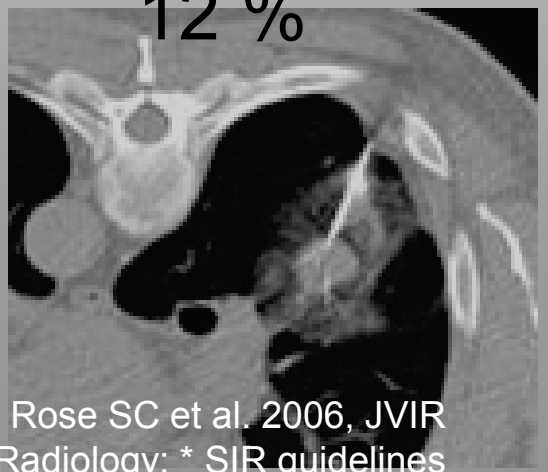
Aus RAPTURE Trial

RFA Komplikationen

Minor complications*

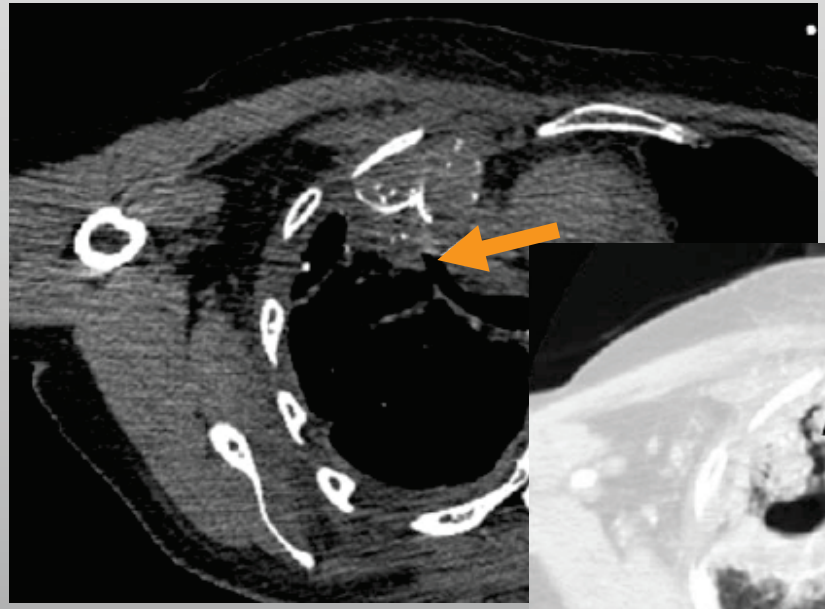
• Pneumothorax	50 %
– Drainage	24 - 50 %
• Pleuraerguß	20 %
• Hämorrhagische Infiltration	7.5 %
• Cavitation	24 %
• Post interv. Schmerz	12 %

Keine major complications*

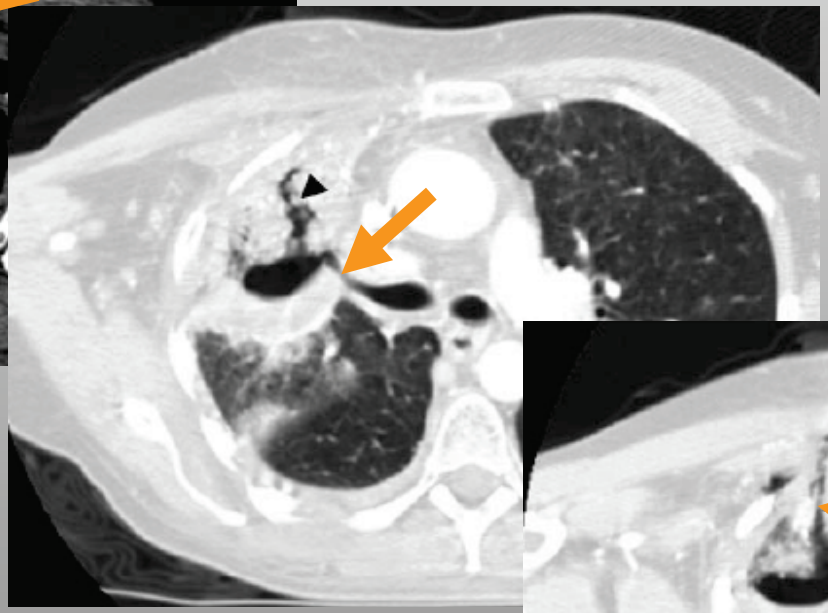


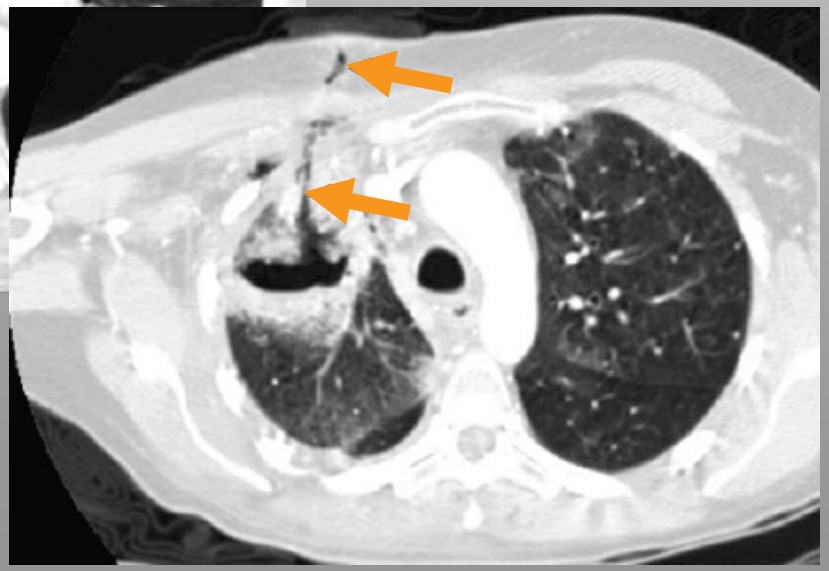
Steinke et al., 2003, JCAT; Hiraki et al., 2006, Radiology; Literaturreview: Rose SC et al. 2006, JVIR 17:927-951; Okuma et a. 2007 CVIR; D. Dupuy 2011, Radiology; * SIR guidelines

Fatale kutane Fistel mit Abszeß



Cave
Zugangsweg!

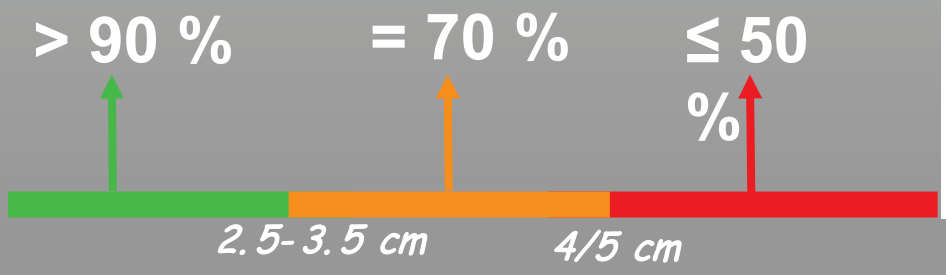


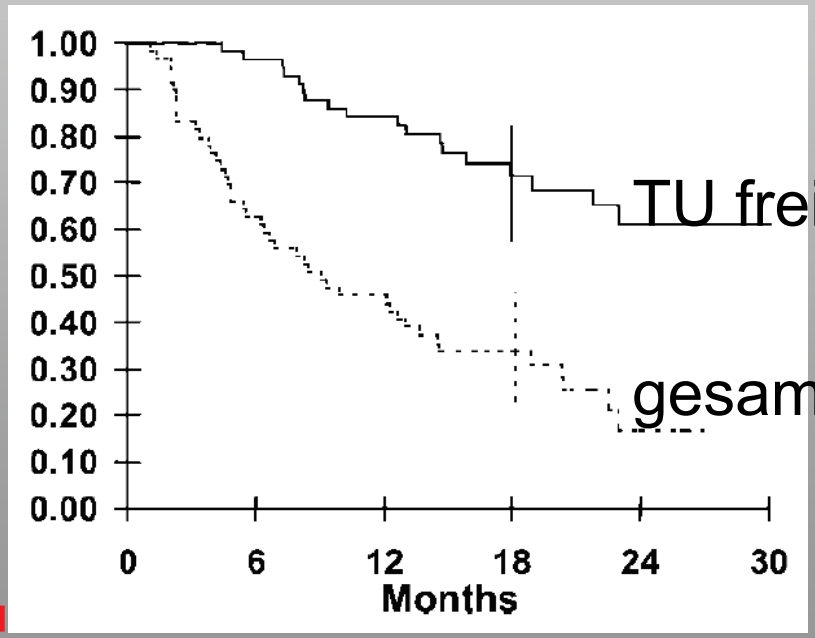


Rose SC et al. 2006, JVIR 17:927-951

Überleben nach RFA$_{Lunge}$

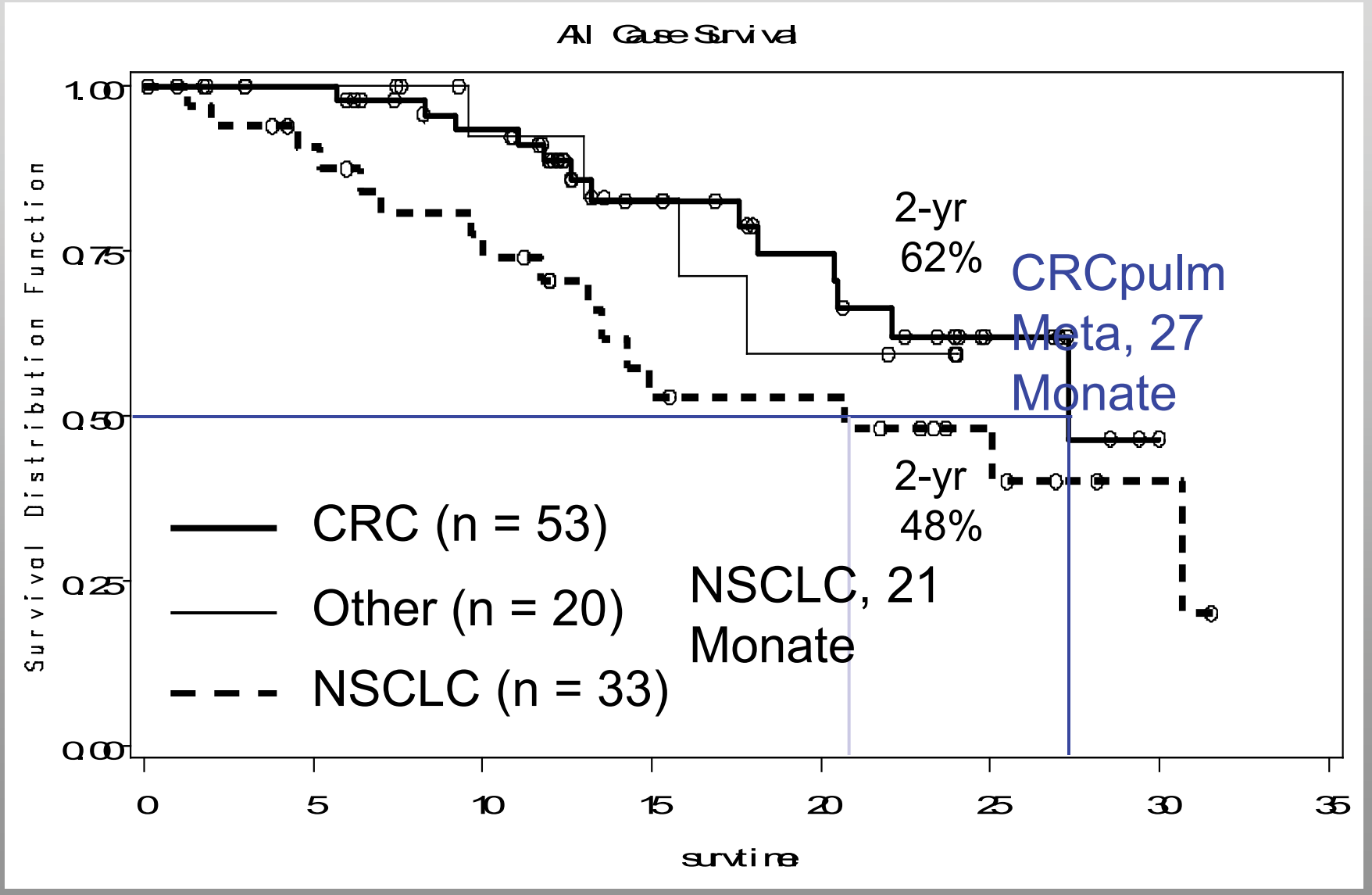
- 60 Pat/100 TU/168 RFA, Ø 17 ± 9 mm (4-42 mm)
  - Inkompl. RFA/18 Mon < 2cm 5 %
    > 2cm 13 %
  - OP-Rezidive 2-12%
    (Kodama K et al.1997, J Thorac Cardiovasc Surg 1997; Yano T et al. J Am Coll Surg 1995)



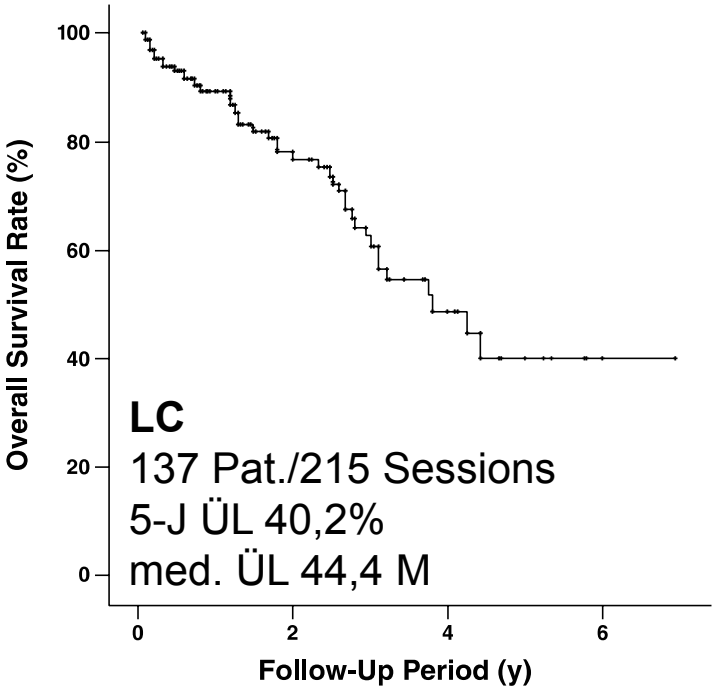


De Baère T et al. 2006, Radiology, 240:587-596

Rapture - Gesamtüberleben



RFA Komplikationen & ÜL



LC
137 Pat./215 Sessions
5-J ÜL 40,2%
med. ÜL 44,4 M

Metas
283 Pat./785 Sessions
5-J ÜL 35,9%
med. ÜL 36,0 M

Grade 2	277 (27.7)

Kashima, M., et al., Complications after 1000 lung radiofrequency ablation sessions in 420 patients: a single center's experiences. AJR Am J Roentgenol, 2011. 197(4): W576-80

LC: RFA vs Rx +/- CTx

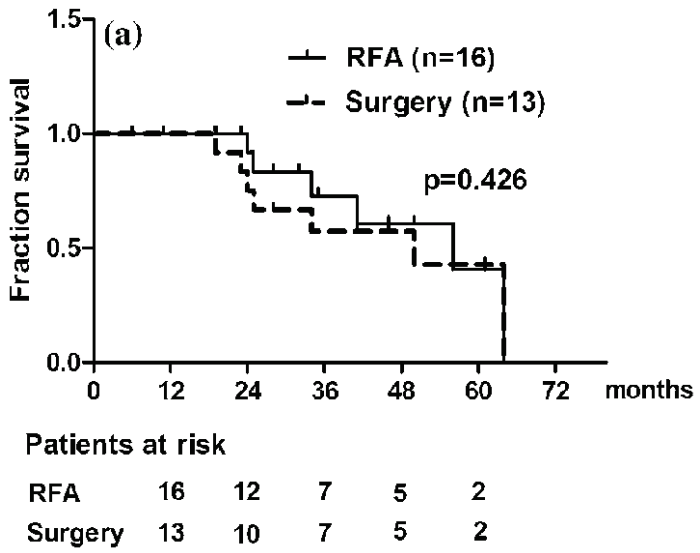
Demographic factor	RFA group ($n = 40$)	Comparison group ($n = 37$)	P
Stage III and IV	37 (3–33)	46 (6–53)	
Histology (%)			0.914
Squamous cell Ca	20 (50)	17 (45.9)	
Adenocarcinoma	20 (50)	20 (54.1)	

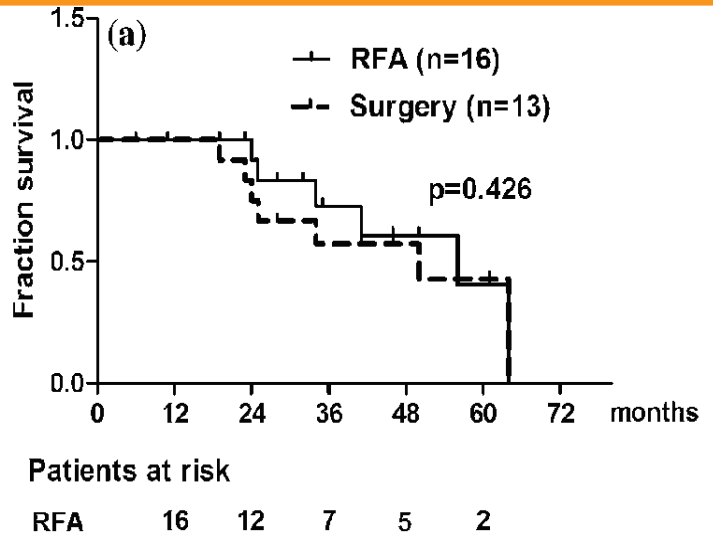
Demographic factor	Stage I to II			Stage III to IV		
	RFA alone ($n = 16$)	Surgery ($n = 13$)	P	RFA with chemotherapy ($n = 12$)	Chemotherapy alone ($n = 18$)	P
Age (years)	72.8 ± 7.89	67.5 ± 5.9	0.008	69.4 ± 6.4	67.6 ± 5.2	0.238
Sex (%)			0.772			0.201
Male	12 (75.0)	11 (84.6)		10 (83.3)	14 (77.8)	
Female	4 (25.0)	2 (15.45)		2 (16.7)	4 (22.2)	
WHO performance status (%)			0.576			0.141
0	7 (43.7)	8 (61.5)		4 (33.3)	2 (11.2)	
1	8 (50.0)	3 (23.1)		6 (50.0)	10 (55.5)	
2	1 (6.3)	2 (15.4)		2 (16.6)	6 (33.3)	
Histology (%)			0.650			0.315
Squamous cell cancer	11 (68.7)	10 (76.9)		7 (58.3)	7 (38.8)	
Adenocarcinoma	5 (31.3)	3 (23.1)		5 (41.7)	11 (61.2)	
Tumor size (cm)	3.8 ± 1.5	3.8 ± 2.2	.7890	4.6 ± 1.6	5.2 ± 0.3	0.6360

Lee, H., et al., Comparison of survival rate in primary non-small-cell lung cancer among elderly patients treated with radiofrequency ablation, surgery, or chemotherapy. Cardiovasc Intervent Radiol, 2012. 35(2): p. 343-50

LC: Rx vs RFA +/- CTx

Survival	Treatment					
	Stage I to II		Stage III to IV			
	RFA (n = 16)	Surgery (n = 13)	No (n = 6)	RFA without chemotherapy (n = 12)	RFA with chemotherapy (n = 12)	Chemotherapy (n = 18)
MS (months)	28.2	33.8	Undefined	Undefined	42	29
1 year (%)	100	85.7			100	77.8
2 years (%)	76.9	70.1			83.3	63.3
5 years (%)	18.7	0			0	0
	P = 0.426 (log-rank = 5.40)				P = 0.031 (log-rank = 5.19)	





Lee, H., et al., Comparison of survival rate in primary non-small-cell lung cancer among elderly patients treated with radiofrequency ablation, surgery, or chemotherapy. Cardiovasc Intervent Radiol, 2012. 35(2): p. 343-50

RFA vs RTx, St I NSCLC

Study	*n* of patients	Schedule	BED[a]	Median follow-up (months)	Actuarial local control	Complications	Remarks
Baumann et al. [50]	138	30–48 Gy in 2–4 fractions	60–120 Gy	33	3-yr, 85%	Atelectasis grade >2, 2%; pneumonitis grade >2, 1%; rib fracture, 4%	Multicenter with variety of dose schedules
Lagerwaard et al. [51]	197	3 × 20 Gy; 5 × 12 Gy	180 Gy; 132 Gy	12	2-yr, 94%	Pneumonitis grade >2, 3%; rib fracture, 2%	
Nagata et al. [48]	45	4 × 12 Gy	106 Gy	30	2-yr, 98%	Pneumonitis grade >2, 0%	
Nyman et al. [96]	45	3 × 15 Gy	113 Gy	43	80%[b]	Pneumonitis grade >2, 0%; rib fracture, 4%	
Onishi et al. [52]	257	18–75 Gy in 1–22 fractions	Variety	38	5-yr BED ≥100, 84%; 5-yr BED <100, 37%	Pneumonitis grade >2, 5%	Multicenter with variety of dose schedules
Timmerman et al. [55]	70	3 × 20 Gy; 3 × 22 Gy	180 Gy; 211 Gy	18	2-yr, 96%	Pericardial effusion grade V, 1%; bleeding grade V, 1%; bacterial pneumonia grade V, 6%	All observed health problems qualified as radiation toxicity
Uematsu et al. [97]	50	50–60 Gy in 5–10 fractions	Variety	36	94%[b]	Pneumonitis grade >2, 0%; rib fracture, 4%	In some patients SRT was given after conventional radiation treatment
Xia et al. [98]	43	5 × 10 Gy	100 Gy	27	3-yr, 95%	Pneumonitis grade >2, 2%	25 stage I and 18 stage II primary lung

Haasbeek, C. J., S. Senan, et al. (2008). "Critical review of nonsurgical treatment options for stage I non-small cell lung cancer." Oncologist 13(3): 309-19.

NSCLC: sRTx vs RFA

- Metaanalyse: 16/219 (2004 -2011)

	sRTx	RFA
1-J ÜL	81-85.7%	68.2-95%
3-J ÜL	42.7-56%	36-87.5%
5-J ÜL	47%	20.1-27%
Lokaler Progress	3.5-14.5%*	23.7-43%
Komplikationen		
– Pneumothorax	-	19.1-63%
– Fatigue	31-32.6%	
– Pneumonitis	2.1-12.5%	
– TH-Wand Schmerz	3.1-12%	

*Tu-Kontrollrate für 3 cm >> 5 cm

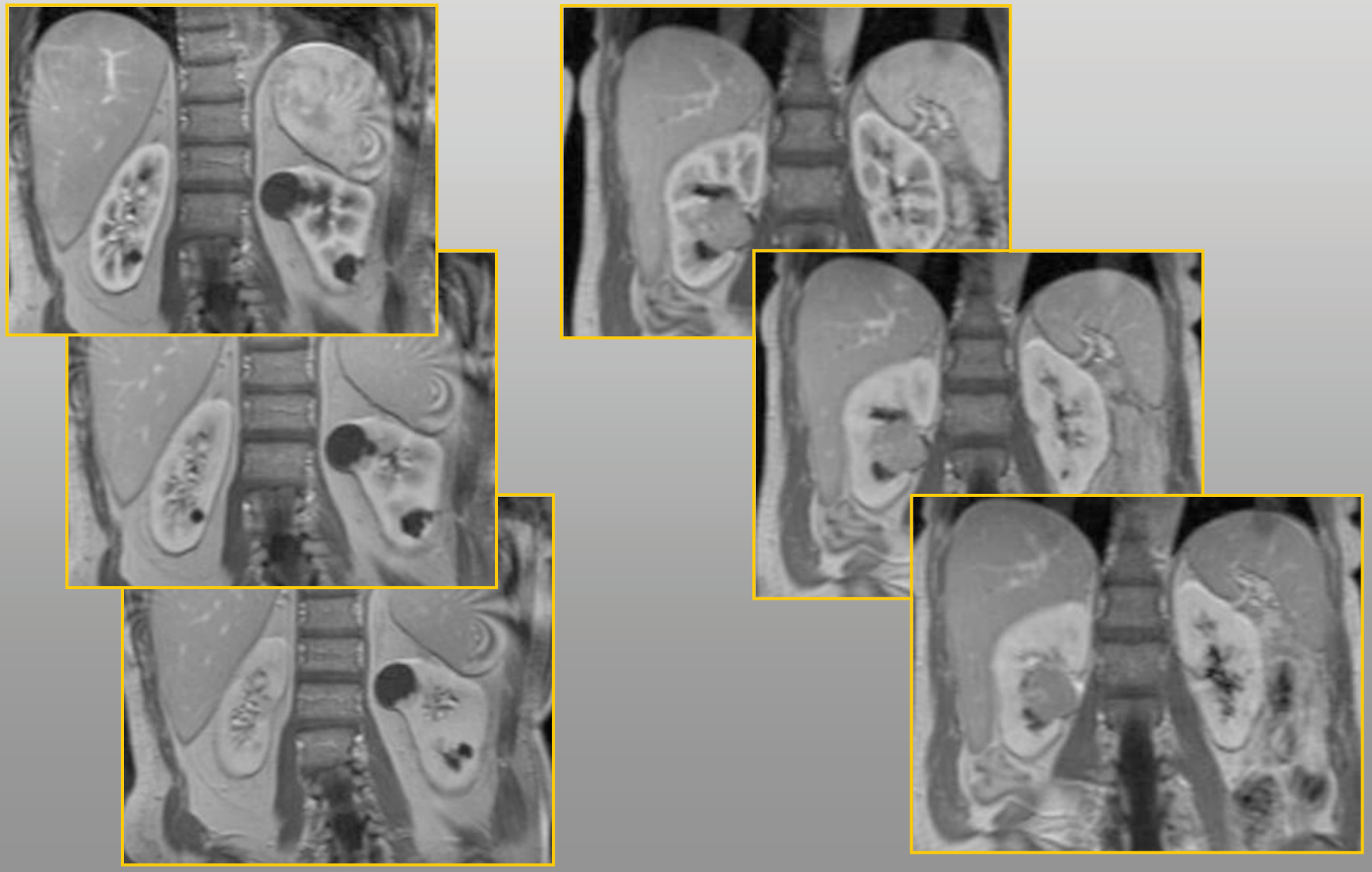
Bilal, H., et al., Is radiofrequency ablation more effective than stereotactic ablative radiotherapy in patients with early stage medically inoperable non-small cell lung cancer? Interact Cardiovasc Thorac Surg, 2012. 15(2): 258-65

∑ - Lungenablation

- Alternative Behandlung für nicht-chirurgische TU
  - Komplementär zu CTx/RTx
- Einfach, sicher, wiederholbar
- Suffiziente TU-Kontrolle (< 2,5-3 cm)
- Niedrige Komplikationsrate

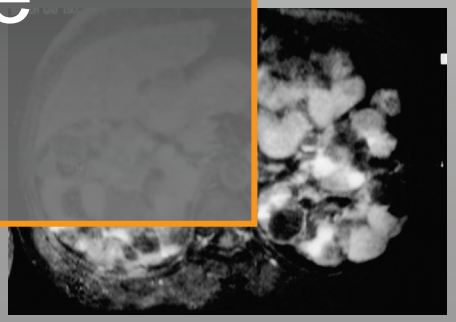
- Offene Fragen
  - Indikationen
  - Änderung der Prognose
  - Multimodale Therapiekombinationen
  - Kompetition mit anderen minimal-invasiven Verfahren (z.B. SRTx, VATS)

Ablation Nierentumoren



Indikation für lokale Ablation

- Komorbiditäten
- Einzelniere
- Multi
- Von Hippel Lindau S.
- Familiäres RCC
- Niere nfunktionseinschränkungen
- Lebenserwartung > 1 J
- Ablehnung OP

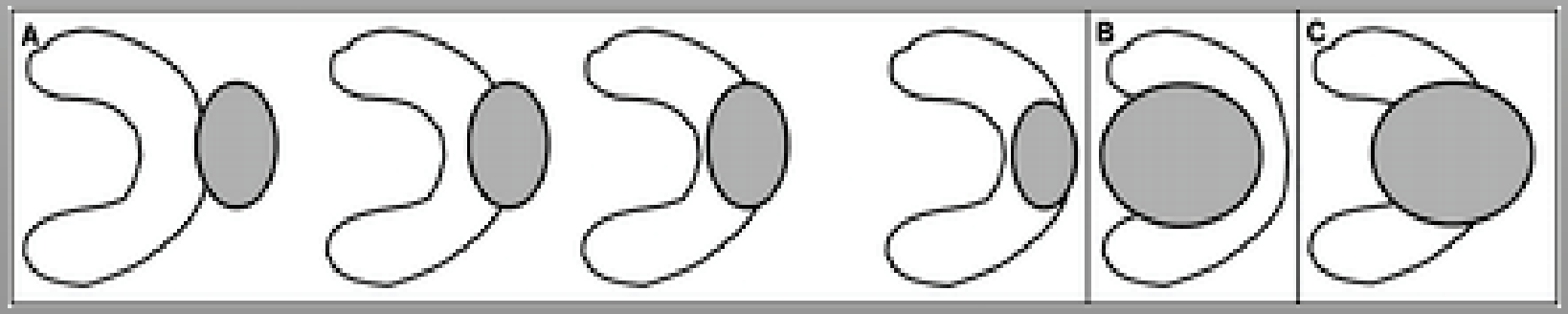


Interdisziplinäre Entscheidung

- Urologie
- Interventionelle Radiologie
- Onkologie

Indikation für lokale Ablation

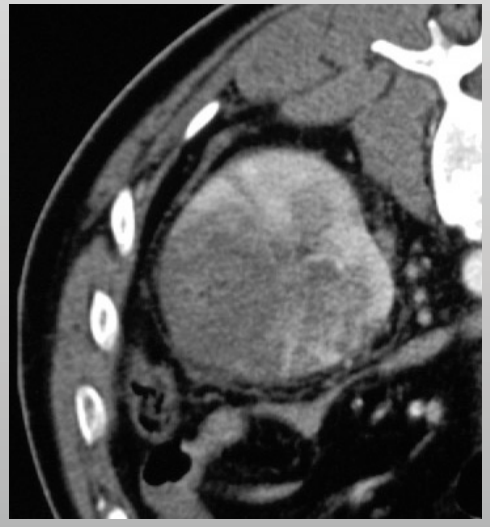
- TU Diameter < 5 cm
- Exophytische oder parenchymale Lokalisation
- Zentrale Lokalisation bei Hämaturie*
- Extrarenale Metastasierung, ohne Beeinträchtigung der Lebenserwartung, z.B. durch Immunotherapie kontrollierte Mikro-noduläre Lungenmetas



*Wood BJ et al., J Urol 2001, 166; Gervais DA et al., Radiology, 2000, 217

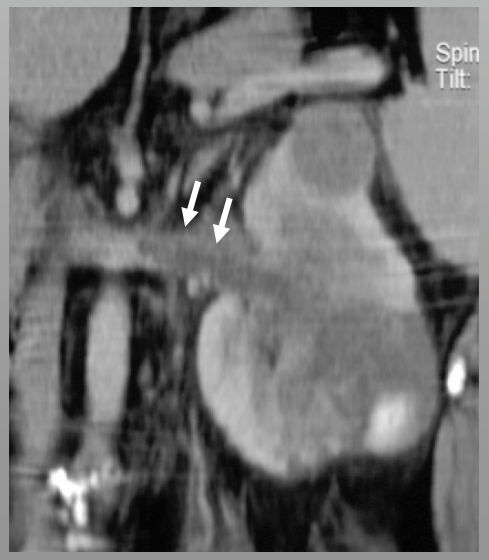
Kontraindikationen

- Multiple große Tumoren
- Signifikante extrarenale Metas
- Lebenserwartung < 3 M

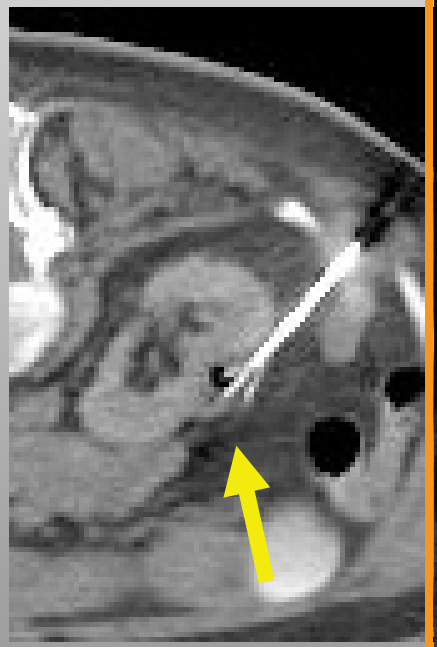


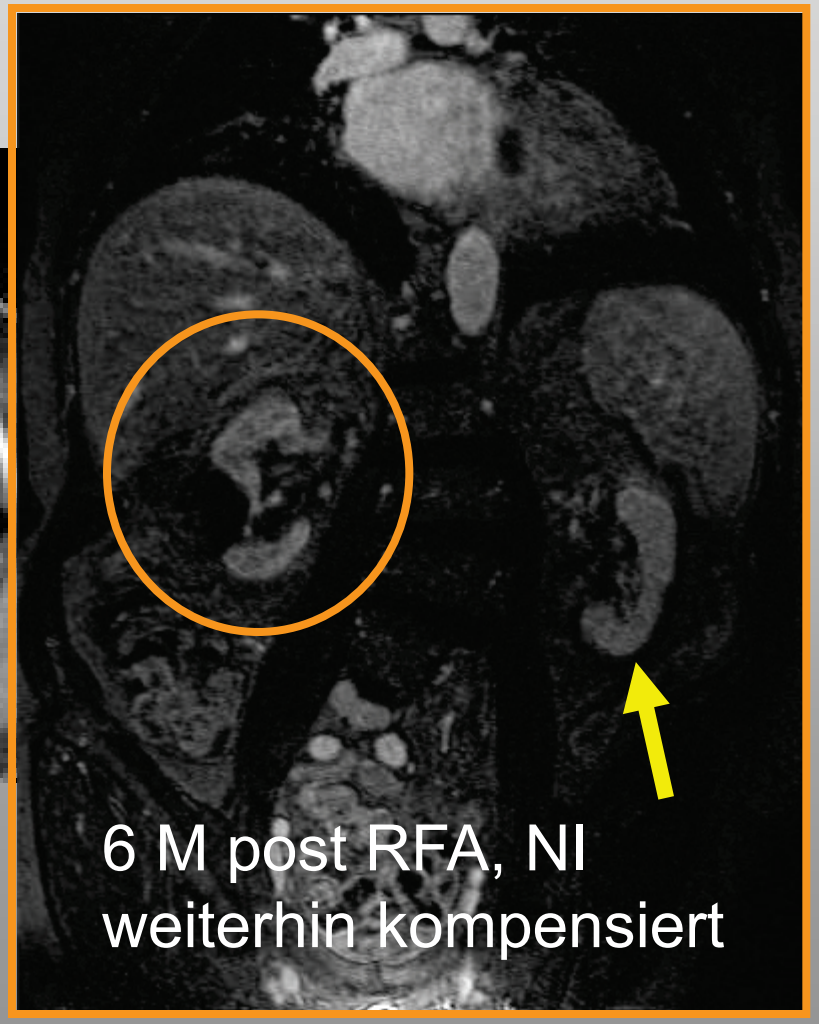
Relativ

- Thrombozyten< 50.000
- Akute Infektion
- Akuter Harnwehsinfekt



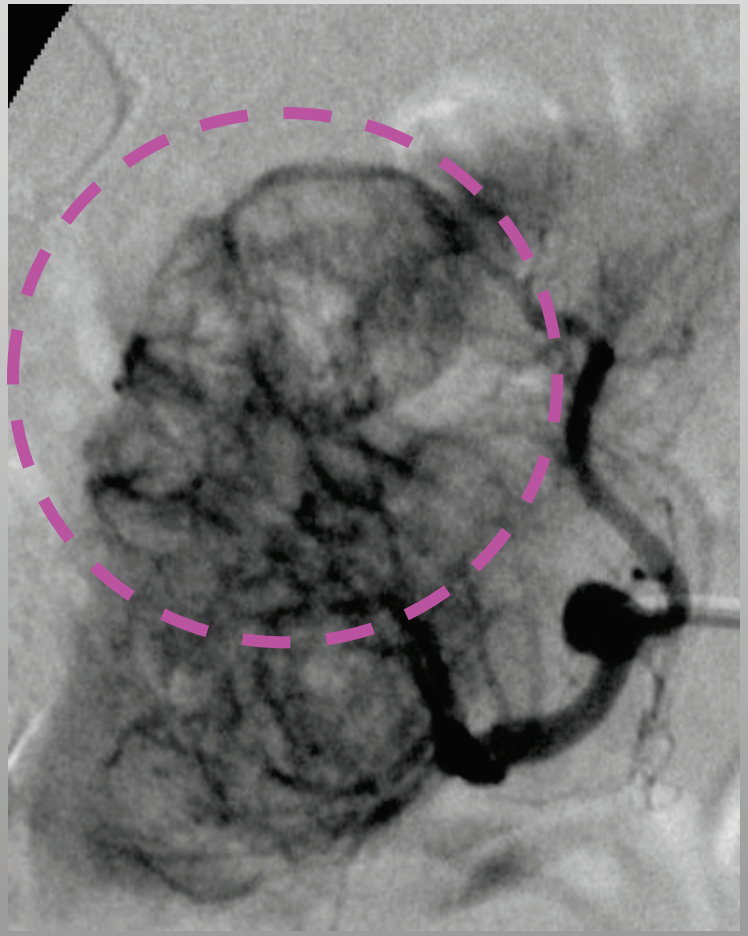
RFA, 2cm RCC

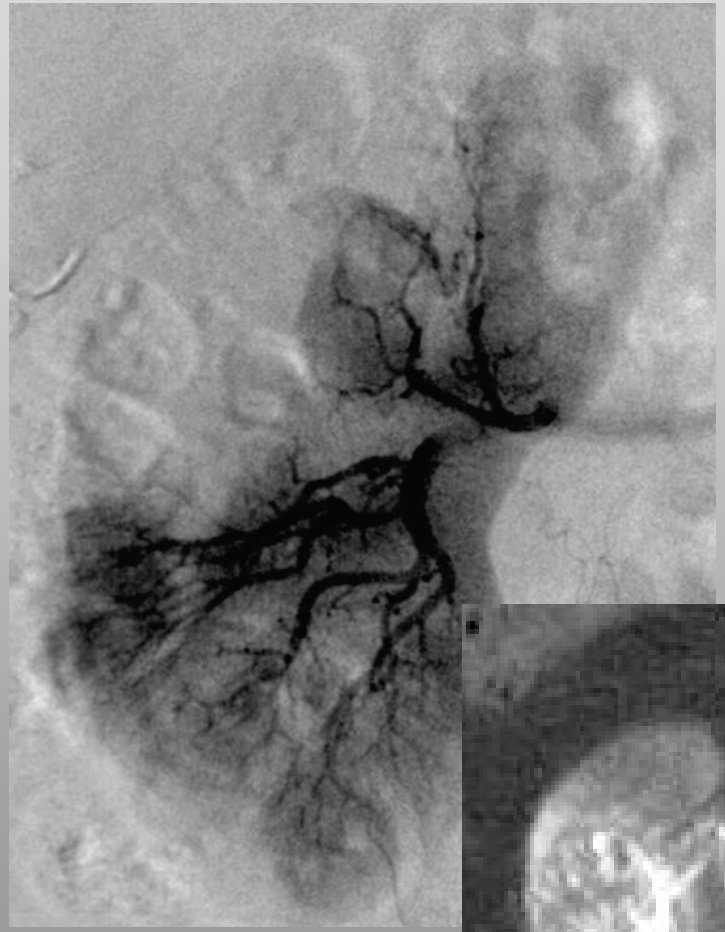




78j. ♂, Diabetes mell.,
kompensierte NI

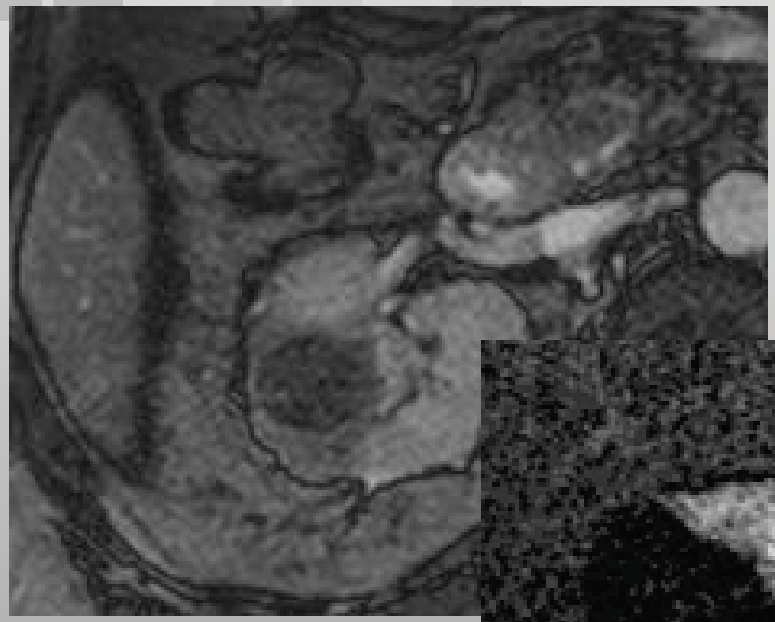
3 cm RCC





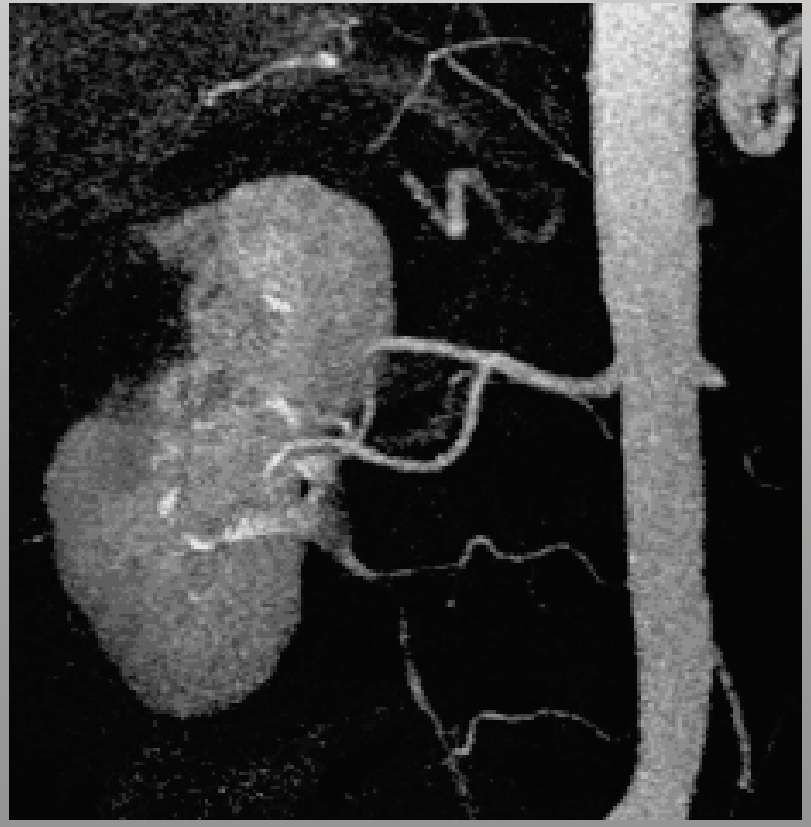
Superselektive Partikel-
Lipiodol-Embolisation vor RFA

3 cm RCC



3 d post RFA

9 m f-up



Technischer Erfolg

Unabhängige Prognosefaktoren für komplette Ablation

	Größe	periphere Lokalisation
• Einzelablation	.0001	.0049
• Multiple Ablationen	.059	.015

Tumor Size (cm)	No. (%) of Tumors with Complete Necrosis	No. (%) of Tumors with Complete Necrosis After		
		One Ablation Session	Two Ablation Sessions	Three Ablation Sessions
≤ 3	52/52 (100)	48/52 (92)	4/52 (8)	NA
3–5	36/39 (92)	19/36 (53)	16/36 (44)	1/36 (3)
> 5	2/8 (25)	0/2 (0)	1/2 (50)	1/2 (50)

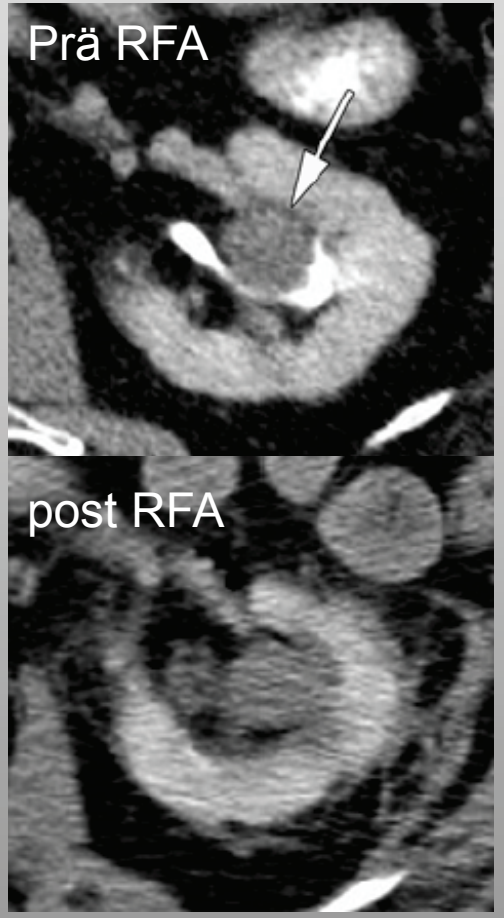
Gervais DA et al., AJR 2005, 185

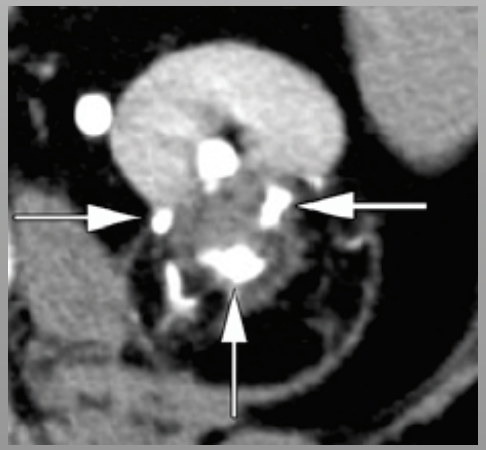
RFA nahe NBKS

- **Kein** erhöhtes Risiko für **inkomplette Ablation** durch Nähe zu Kelchsystem oder NB

- Aber: erhöhtes Blutungsrisiko

- Ureterstrikturen
- Leckage

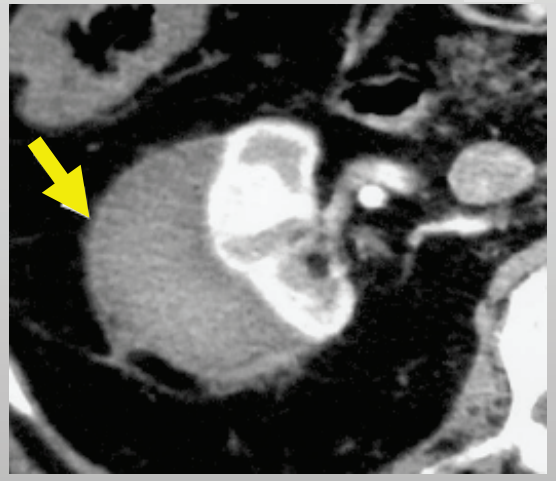


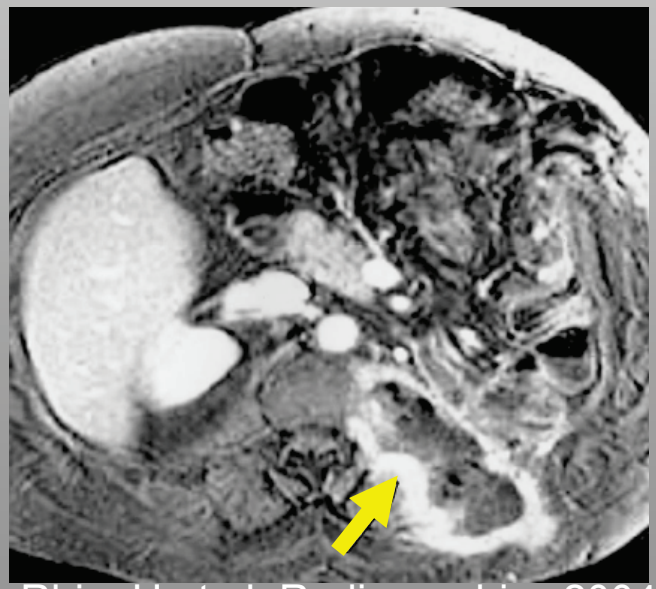


Gervais D et al., AJR 2005; 185:72-80

RFA - Komplikationen

- Hemorrhagie
  - Perirenal
  - In NBKS (cave: Koagelobstruktion!)
- NBKS Komplikationen
  - Striktur, Urinom, Leackage
- Paraesthesie der anterioren Bauchwand
  - Kurzfristig und selbstlimitierend
- Sonstige
- **Insgesamt < 2 %**





Rhim H et al. Radiographics 2004;
Venkatesan, A.M., B.J. Wood, and D.A. Gervais, Percutaneous ablation in the kidney. Radiology, 2011. 261(2): p. 375-91

Perkutan – laparoskopisch?

- PubMed 1996 - 2006
- 46 Studien (>1 Fall, RFA/Cryo, FU, Komplikationen)

	28 perk.	18 lap.	
Prim. Erfolg	87%	94%	(p<0.05)
Kum. Erfolg	92%	95%	(n.s.)
Komplikationen	3%	7%	(p>0.05)

Hui GC, Tuncali K, Tatlis S et al.:Comparison of percutaneous approaches to renal tumor ablation: metaanalysis of effectiveness and complication rate J Vasc Interv Radiol. 2008 Sept;19(9):1311-20

Outcome RFA

- 151 Pat/163 TU, MW F-up 18 M(1.5-70)
- Tumor 1 - 5,4 cm (MW 2,3 cm)
- RCC 70%

- Komplette primäre Ablation 97%
  - Vitaler Tumor 5/163
  - Lokalrezidiv 3.3%
  - Metastases 1.3%

- Gesamt Rez.-freies ÜL 97%/1a 92%/3a

Gupta A, Raman JD, Leveillee RJ et al. General anesthesia and contrast-enhanced computed tomography to optimize renal percutaneous radiofrequency ablation: multi-institutional intermediate-term results. J. Endourol.2009 Jul:23(7):1099-105

Nierenfunktion nach RFA

- 63 Pat. (4 ASA 1, 59 ASA II)*
- Solitäre TU — 1,0 -4,0 cm (Med 2.1)
- Zuvor Biopsie in — 89 % (75% RCC)
- MW F-up — 34 M (1 - 80)
- Lokalrezidiv — 1/63 (55 M post RFA)

- Kompensierte NI — 20%
- eGFR — pre RFA 76,3 mL/min/m2
  post RFA 74,3 mL/min/m2

Stern JM et al. Radiofrequency ablation of small renal cortical tunours in healthy adults
Renal function preservation and intermediate oncological outcome BJU. 2009; 104:786-789

Cryo - RFA

- Medline: 47 Studien (1375 TU)
- Cryoablation (86% lap.)
- RFA (94% perk.)
- Kein Unterschied bzgl.
  - Patientenalter (P = .17)
  - Läsionsgröße (P = .12)
  - Follow-up (P = .53)
- Erneute RFA >> Cryo (8.5% vs 1.3%; P<.0001)
- Rezidiv RFA >> Cryo (12.9% vs 5.2%; P<.0001)

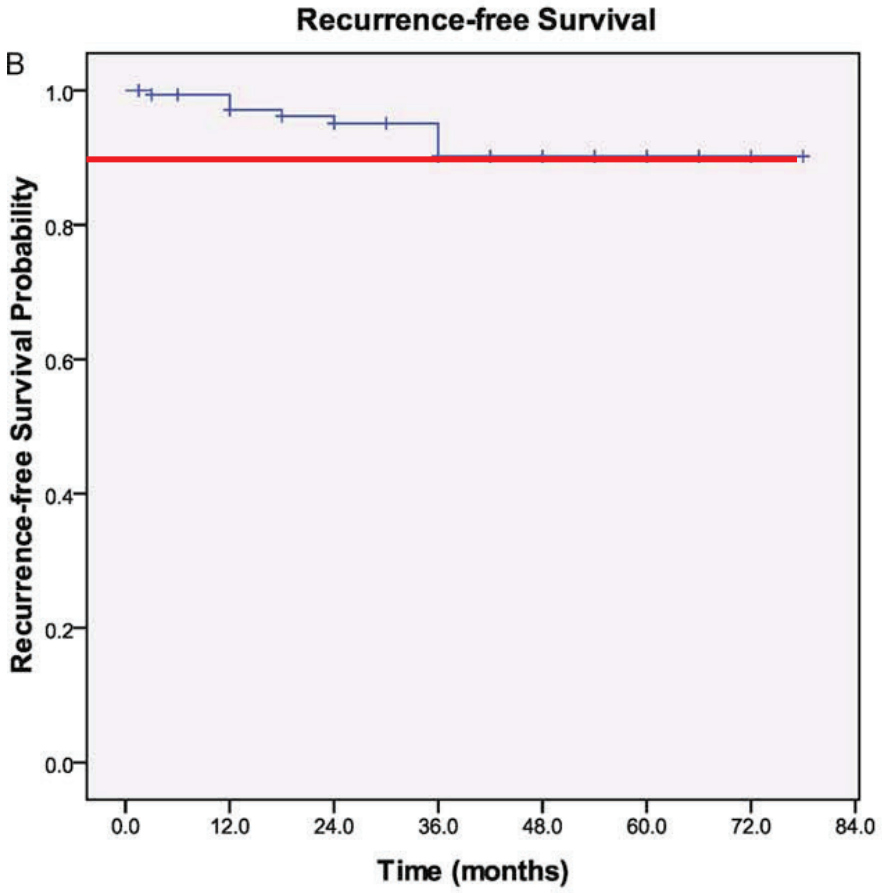
Kunkle DA,Uzzo RG: Cryoablation or radiofrequency ablation of the small renal mass: a meta-analysis. Cancer. 2008 15;113

RFA Langzeiterfahrung

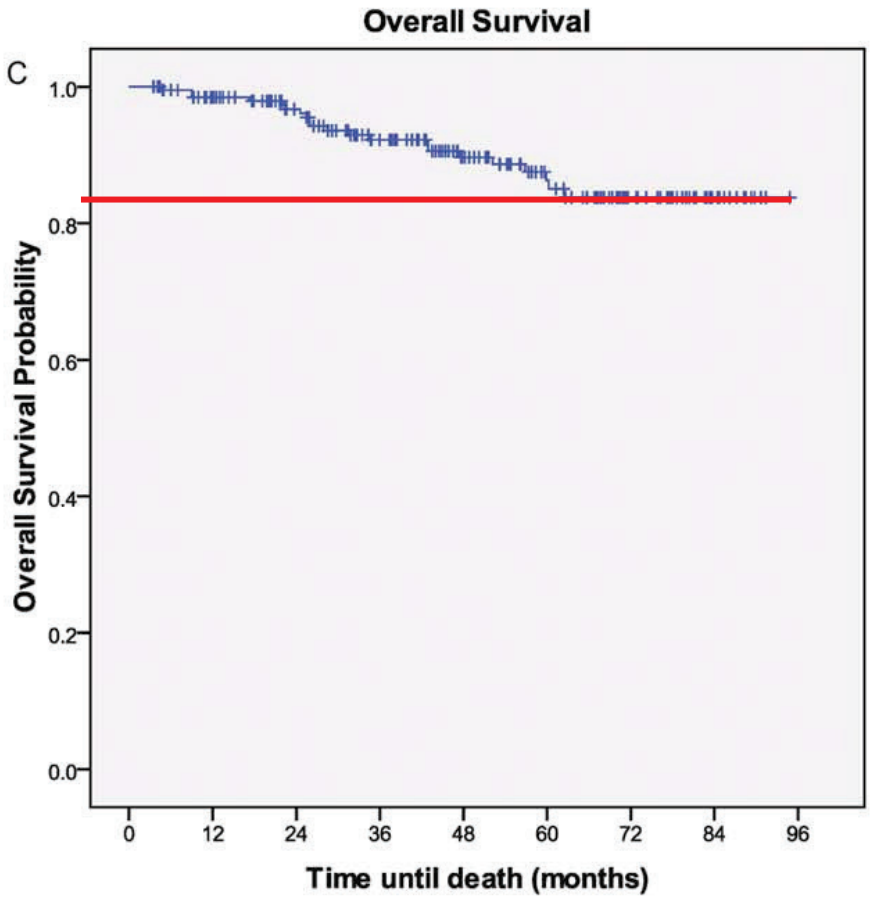
Characteristic	All Ablations	≥3 Years of Follow-Up	*P*
No. of tumors ablated	243	84	
No. of patients	208	66	
No. of tumors in men/women[a]	156/87	54/30	.99[b]
Mean±SD age [range], y[a]	64±12.5 [18-84]	64±13.5 [20-85]	.78[c]
No. of right-sided/left-sided tumors[a]	139/104	44/40	.16[b]
Surgical approach: No. of tumors (%)[a]			
Percutaneous	172 (71)	55 (65)	.36[b]
Laparoscopic	68 (28)	26 (31)	.36[b]
Open	3 (1)	3 (4)	.17[b]
Mean±SD tumor size [range], cm	2.4±0.8 [1.0-5.4]	2.4±0.9 [1.0-5.4]	.65[c]
Mean±SD follow-up [range], mo	27±23 [1.5-90]	53±15 [36-90]	<.001
No. of patients with hereditary conditions (%)	5 (2)	4 (6)	.005
No. of tumors in patients with hereditary conditions (%)	14 (6)	13 (15)	

Tracy, C.R., et al., Durable oncologic outcomes after radiofrequency ablation: experience from treating 243 small renal masses over 7.5 years. Cancer, 2010. 116(13): 3135-42

RFA Langzeiterfahrung



Month follow-up	≤ 12	13-24	25-36	37-48	49-60	61-72	73-84
Events	5	2	2	0	0	0	0
Patients at risk	179	108	67	48	26	12	3



Month follow-up	≤ 12	13-24	25-36	37-48	49-60	61-72	73-84	85-96
Events	3	3	7	3	4	1	0	0
Patients at risk	208	181	159	127	96	70	43	11

Tracy, C.R., et al., Durable oncologic outcomes after radiofrequency ablation: experience from treating 243 small renal masses over 7.5 years. Cancer, 2010. 116(13): 3135-42

Review

- Medline 1/2003 – 5/2011: 717 : 17 Studien
- Patho gesicherte RCCs 82,3 %
- Lokale Erfolgsrate 67 – 100 %
  - Wiederholte RFA (8,8 %) 89,7 – 100 %
- Komplikationen 13,2 %
  - Minor (Grad I, II) 10 %
  - Major (Grad III, IV) 3,2 %
- PFS 79,9 – 93,8 % (53 – 61,2 M F-up)
- Cancer-specific ÜL 98 – 100 %
- Ges ÜL 58,3 – 85 %

Joniau, S., M. Tsivian, and P. Gontero, *Radiofrequency ablation for the treatment of small renal masses: safety and oncologic efficacy.* Minerva Urol Nefrol, 2011. **63**(3): 227-36

Ergebniss PubMed - 2012

Autor	TU/Pat	Mean FU	Mean TU (cm)	Biopsie %	RCC %	Primär Erfolg	3&5y Rez. frei	3&5J TU abh ÜL	3&5J ges ÜL
McDougal 2005	23/19	55	3.1	100%	87%	69%	n.a.	100%& 100%	64%& 55%
Levinson 2008	34/31	62	2.1	100%	51%	97%	90% @ 31 M	100% @ 57 M	58% @ 57 M
Tracey 2010	243/208	27	2.4	93%	79%	93%	93% & 93%	95% & 99%	n.a.& 85%
Takaki 2010	51/51	34	2.4	n.a.	n.a.	82%	n.a. & 98%	100% & 100%	n.a.& 75%
Ferakis 2010	39/31	61	3.1	0%	n.a.	98%	92% & 89%	n.a.	n.a.
Ji 2011	106/106	32	n.a.	100%	85%	98%	98% @ 32 M	100% @ 32 M	100% @ 32 M

AUA Guideline

Standards are presented in green boxes; Recommendations are presented in yellow boxes; Options are presented in red boxes.

Key: AS, active surveillance; CKD, chronic kidney disease; CT, computed tomography; FNA, fine needle aspiration; MRI, magnetic resonance imaging; PN, partial nephrectomy; RFA, radiofrequency ablation; RN, radical nephrectomy; TA, thermal ablation

Patient with clinical T1 renal mass

EVALUATION

- High-quality cross-sectional imaging study (CT or MRI) with and without contrast (in the presence of adequate renal function) to assess contrast enhancement, exclude angiomyolipoma, assess for locally invasive features, define the relevant anatomy and evaluate the status of the contralateral kidney
- Percutaneous renal mass core biopsy with or without FNA for patients in whom it might impact management, particularly patients with clinical or radiographic findings suggestive of lymphoma, abscess or metastasis

COUNSELING

- Review the current understanding of the natural history of clinical T1 renal masses, the relative risks of benign vs. malignant pathology and the potential role of AS
- Review the available treatment options and the attendant benefits and risks, including oncologic considerations, renal functional considerations and potential morbidities
- Discuss the potential advantages of a nephron-sparing treatment approach in the imperative and elective settings, including the avoidance of dialysis and reduced risk of CKD with its attendant morbidity and mortality

INDEX PATIENT 1: Healthy; Clinical T1a

STANDARD - PN: Complete surgical excision by PN is a standard of care and should be strongly considered.

STANDARD - RN: Should be discussed as alternate standard of care if PN is not technically feasible as determined by the urologic surgeon.

OPTION - TA: Cryoablation or RFA should be discussed as less-invasive treatment options, but local tumor recurrence is more likely, measures of success are not well defined, and surgical salvage may be difficult.

OPTION - AS: AS with delayed intervention should be discussed as option for patients wishing to avoid treatment and willing to assume oncologic risk.

INDEX PATIENT 2: Major comorbidities Increased surgical risk Clinical T1a

STANDARD - PN: Complete surgical excision by PN should be discussed as a standard of care with increased surgical risk in this patient.

STANDARD - RN: Should be discussed as standard of care with increased risk of CKD and surgical complications in this patient.

RECOMMENDATION - TA: Cryoablation or RFA should be discussed as less-invasive treatment options which may be advantageous in this high surgical risk patient, acknowledging the increased risk of local tumor recurrence compared to surgical excision.

RECOMMENDATION - AS: Should be offered as an acceptable approach which can delay or avoid the need for intervention in this high-risk patient.

INDEX PATIENT 3: Healthy; Clinical T1b

STANDARD - RN: Should be discussed as standard of care for patients with a normal contralateral kidney.

STANDARD - PN: Complete surgical excision by PN should be discussed as an alternative standard of care, particularly when there is a need to preserve renal function.

OPTION - TA: Cryoablation or RFA can/may be discussed as a treatment option which is less effective due to an increased risk of local recurrence. TA may represent suboptimal management for this healthy patient.

OPTION - AS: AS with delayed intervention can/may be discussed as an option in patients who want to avoid surgery and are willing to accept an increased risk of tumor progression compared to RN or PN. AS may represent suboptimal management for this healthy patient.

INDEX PATIENT 4: Major comorbidities; Increased surgical risk; Clinical T1b

STANDARD - RN: Should be discussed as standard of care for patients with a normal contralateral kidney, although it can be associated with surgical morbidity and an increased risk of CKD in this patient.

RECOMMENDATION - PN: Complete surgical excision by PN should be discussed as a recommended modality when there is a need to preserve renal function, although it can be associated with increased urologic morbidity in this patient.

RECOMMENDATION - AS: AS should be discussed with patients who want to avoid surgery or who are considered high risk for surgical therapy.

OPTION - TA: Cryoablation or RFA can/may be discussed as a treatment option which is less effective due to an increased risk of local recurrence.

EUA Guideline

	GR
Patients with small tumours and/or significant co-morbidity who are unfit for surgery should be considered for an ablative approach, e.g. cryotherapy and radiofrequency ablation.	A
Pre-treatment biopsy has to be carried out as standard.	C
Other image-guided percutaneous and minimally invasive techniques, such as microwave ablation, laser ablation and high-intensity focused ultrasound ablation, are still experimental in character. The experience obtained with radiofrequency ablation and cryoablation should be considered when using these related techniques.	B

… Compared to RFA, *cryoablation* is more likely to be performed *laparoscopically*. The laparoscopic approach is more effective but has a higher complication rate. Repeat ablation is necessary more frequently following RFA. *Local tumour progression is significantly higher with RFA*. Cancer-specific survival rates for cryotherapy and RFA are poorer than survival rates for surgical procedures

∑ - Nierenablation

- Umfangreiche Datenlage (urologisch + radiologisch)
- Perkutane RFA
  - Sicher, effizient
  - Tumorkontrollrate ≈ PN >> 90 %/5a
- HiFU, IRE etc. Datenlage schwach, bisher schlechtere Ergebnisse

- **TA effizienten minimalinvasive Alternative**

Ablation Knochentumoren

IR Therapie bei Knochentumoren

- Kausale, definitive Therapie von Osteoid osteomen

- Symptomatisch, supportive (palliativ) Therapie bei malignen Knochentumoren

RFA bei Osteoid Osteom

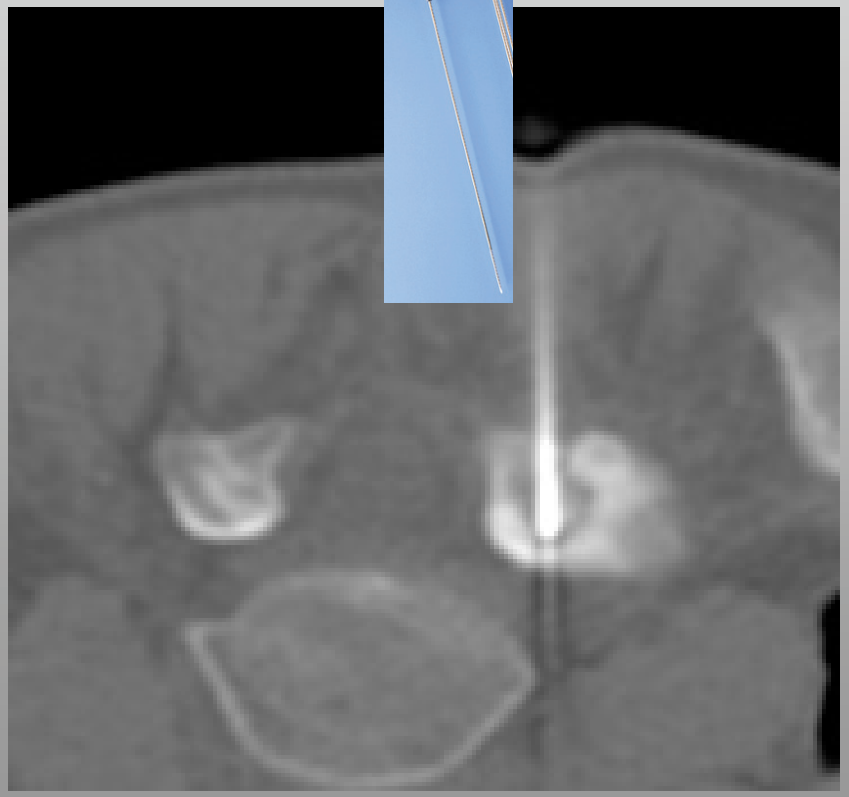
- Komplette Destruktion des Nidus
- Indikation
  - Typische Anamnese, Aspirin Test nicht immer positiv
  - Nidus muß erkennbar sein
- Ablation
  - Aktive Elektrodenspitze im Nidus
  - Leistung 3-10 W/4-10 Min.

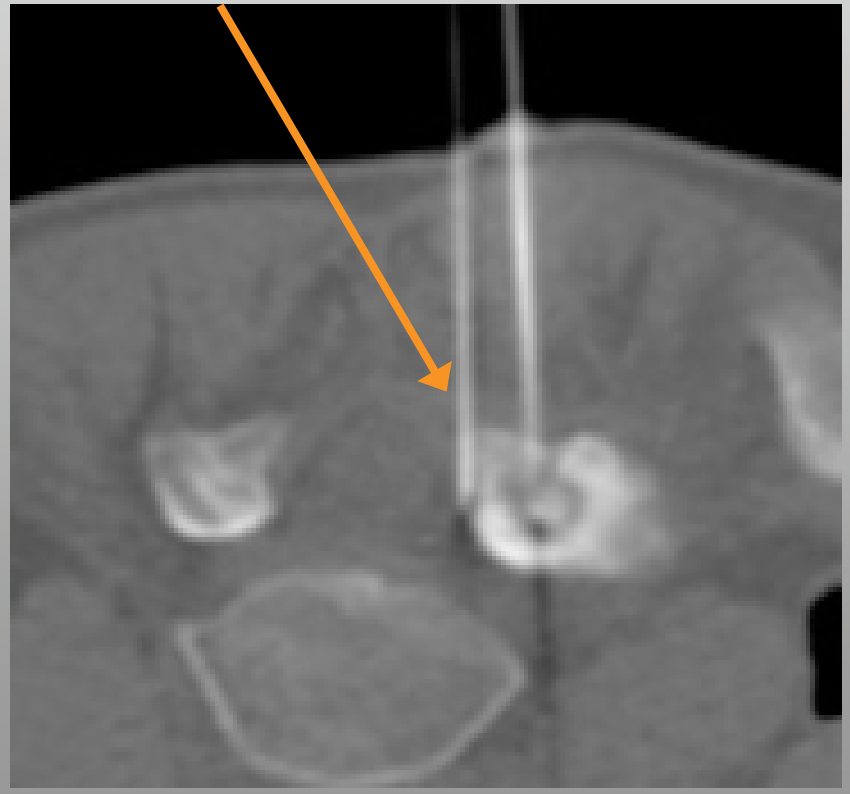
Pinto et al.; AJR (2002); 179:1633-1642
Rosenthal et al.; J Knochen Joint Surg Am (1998); 80:815-82
Rosenthal et al. (1992) Radiology 183:29-33

RFA bei Osteoid Osteom

Single Elektrode

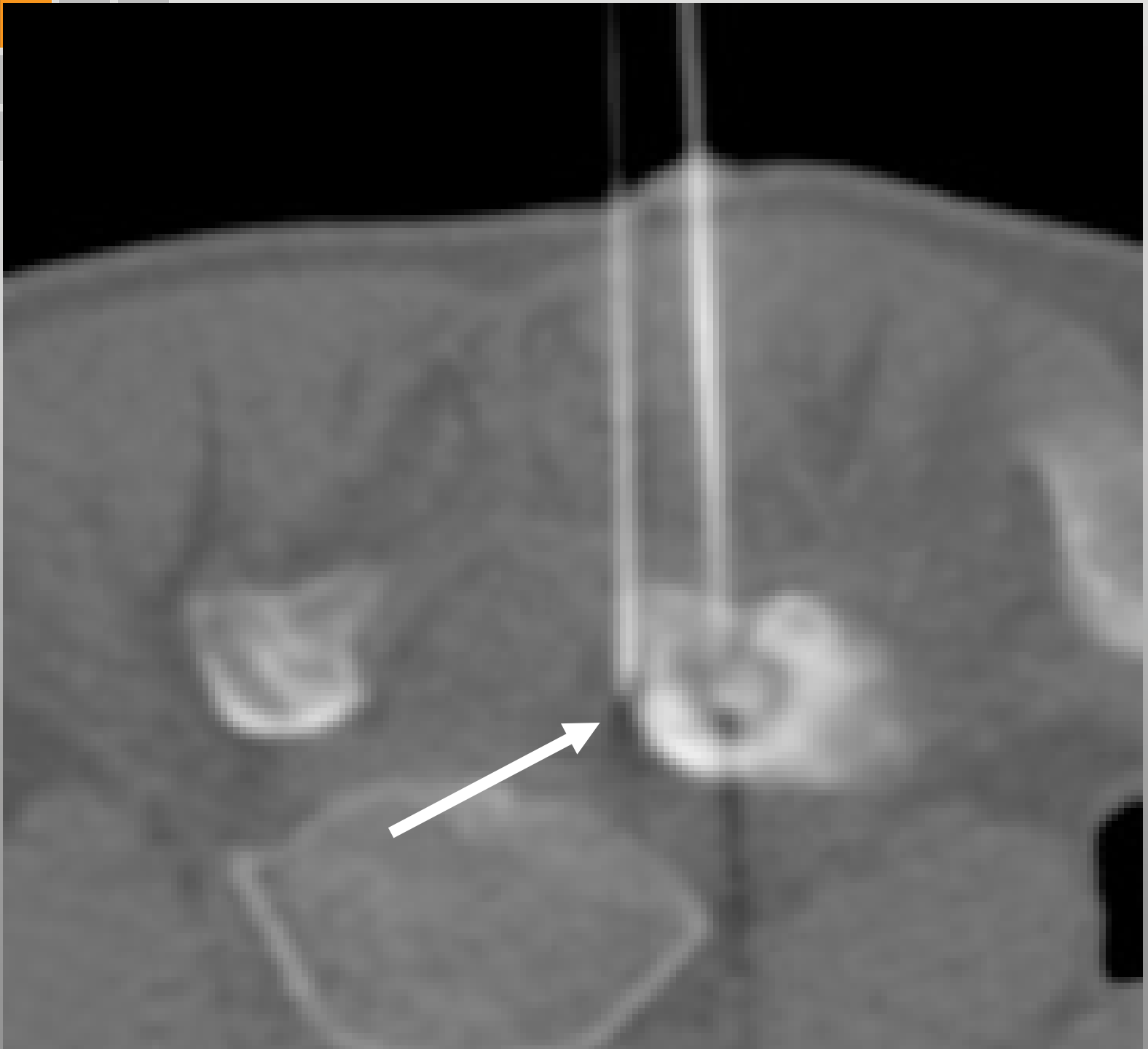
Kühlung mit Glucose





11-j. Mädchen

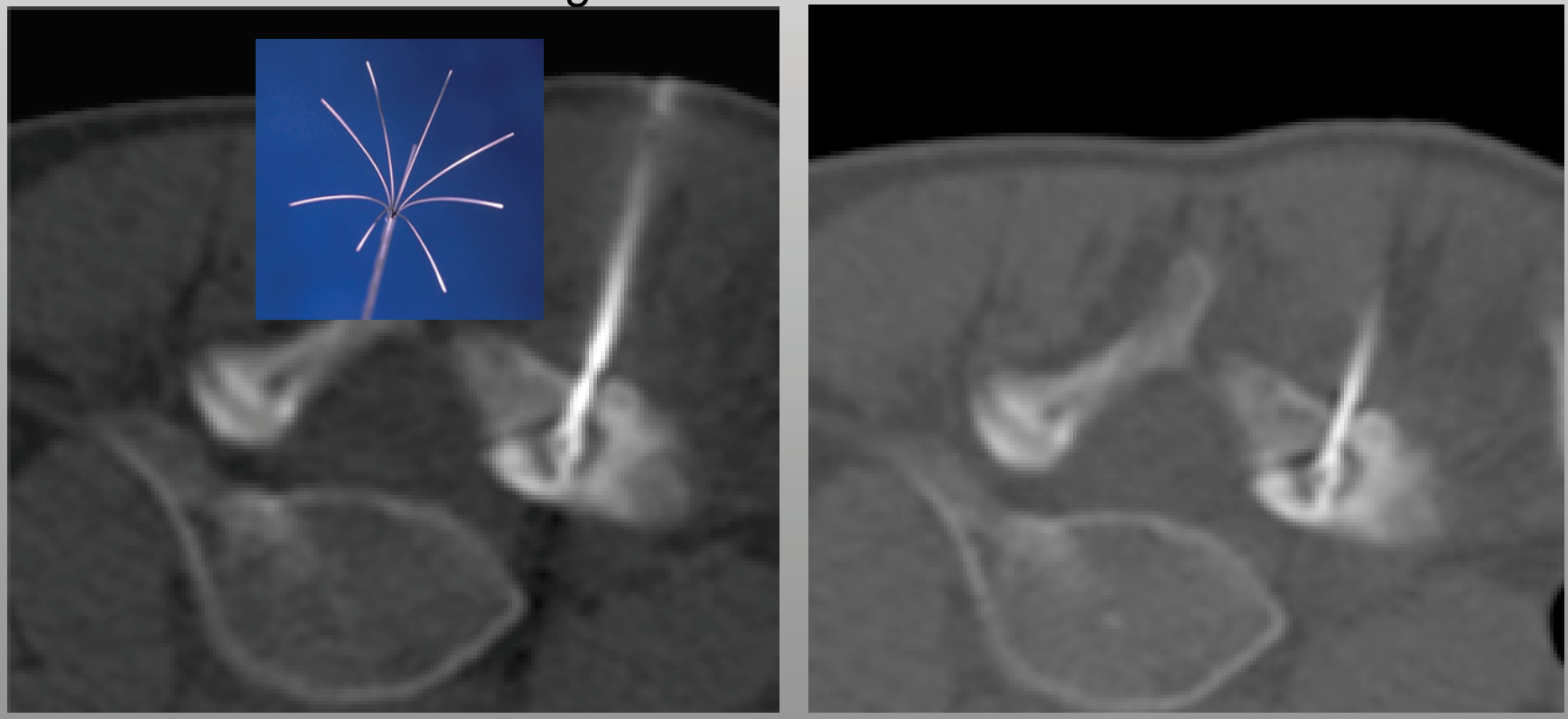
Aspirin-positiver Schmerz seit 6 Monaten



RFA bei Osteoid Osteom

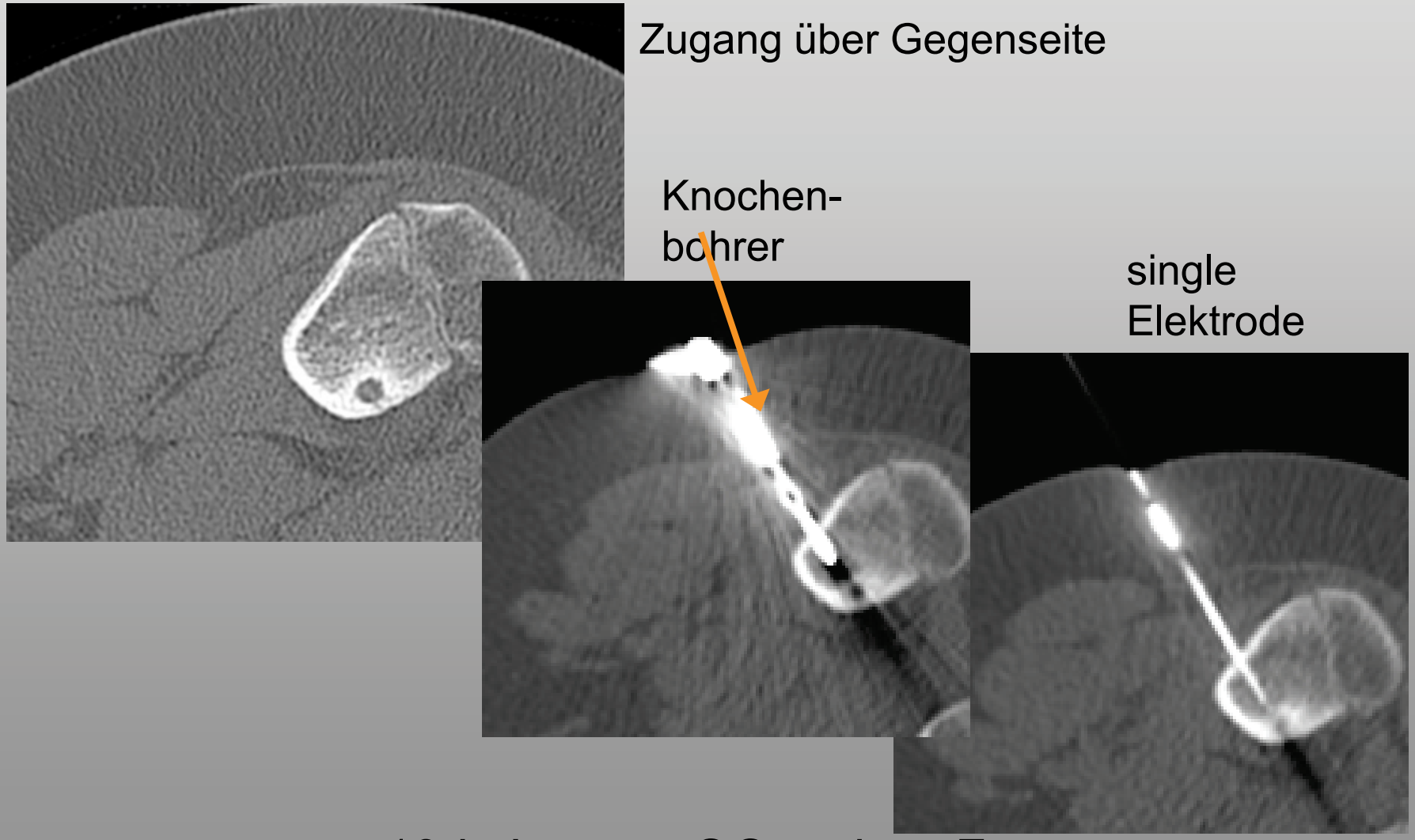
Reduzierter, aber noch persistierender Schmerz - inkomplette Ablation

2. Versuch mit Schirmartiger Elektrode



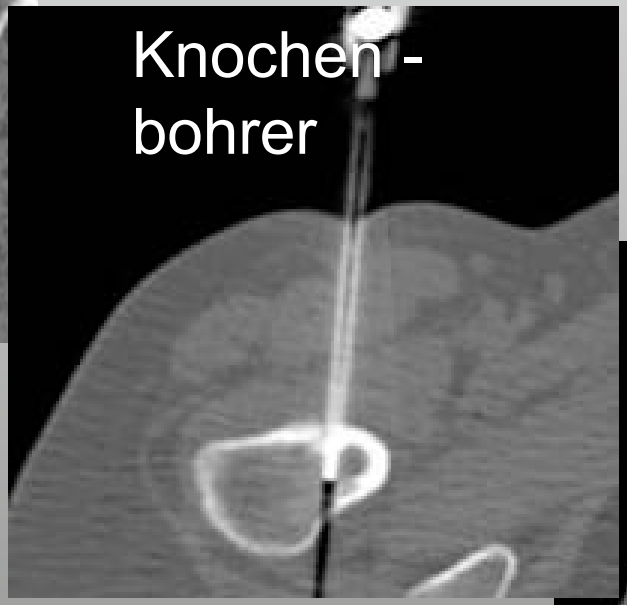
11-j. Mädchen
Aspirin-positiver Schmerz seit 6 Monaten, nach 1. RFA

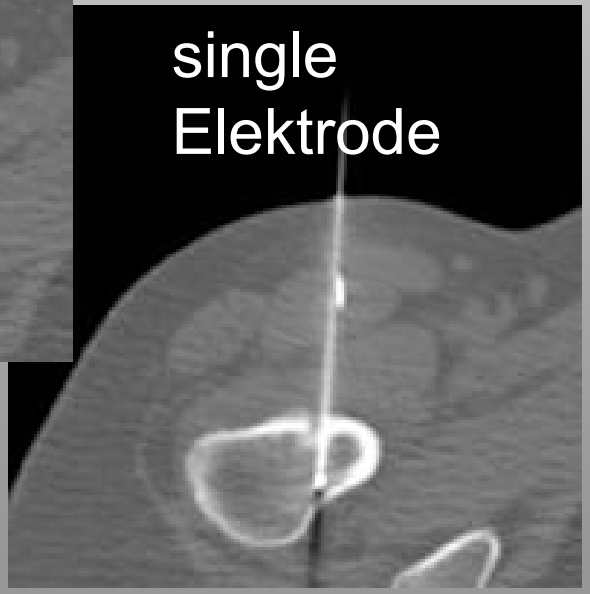
RFA bei Osteoid Osteom



10-j. Junge – OO rechter Femur

RFA bei Osteoid Osteom





49-j. Frau, OO rechter Oberschenkelhals

Unmittelbare Schmerzfreiheit

RFA bei Osteoid Osteom

Author	Pat/Prozed.	Prim. Erfolg	Sek. Erfolg	Ges. Erfolg	Komplikationen	F-up/Mon.
Barei 2000 (16)	11/11	10/11 (90,9 %)	–	10/11 (90,9 %)	–	18,7
Lindner 2001 (e12)	58/61	55/58 (94,8 %)	3/3 (100 %)	58/58 (100 %)	Burns (n=1)	23 (6–41)
Vanderschueren 2002 (19)	97/121	74/97 (76 %)	15/23 (65 %)	89/97 (92 %)	Burns (n=1) Broken needle (n=1)	41 (5–81)
Venbrux 2003 (e16)	9/13	5/9 (55,5 %)	3/4 (75 %)	8/9 (88,8 %)	Burns (n=1) transient Paresthesia (n=1)	10,3 (1–26)
Rosenthal 2003 (13)*	263/271	107/117 (91 %)	–	112/126 (89 %)	Anesthesia (n=1) sympathic Dystrophy (n=1) Cellulitis (n=1)	24
Cioni 2004 (e17)	38/44	30/38 (78,9 %)	5/6 (83,3 %)	35/38 (92,1 %)	Burns (n=1) Osteomyelitis (n=1)	35,5 (12–66)
Mastrantuono 2005 (e18)	21/21	21/21 (100 %)	–	21/21 (100 %)	–	11,1 (0–24)
Martel 2005 (14)	38/39	37/38 (97,4 %)	1/1 (100 %)	38/38 (100 %)	Burns (n=1) Tendinitis (n=1)	3–24
Rimondi 2005 (e19)	97/114	82/97 (84,5 %)	13/15 (86,7 %)	95/97 (98 %)	Burns (n=1) Phlebitis (n=1)	3–12
Gesamt	**632/695**	**421/486 (86,6 %)**	**40/52 (76,9 %)**	**466/495 (94,1 %)**	**2,2 % (n = 15)**	**3–81**

*126/263 pat. evaluated over 2 years, case histories and redundant studies were not considered

Mahnken et. al, Dt. Ärzteblatt 103, 2006

RFA bei Osteoid Osteom

- Erfolg
  - Primär 60 – 85 %
  - Sekundär (2. RFA 2 w nach 1.) 90 – 100 %

- Komplikationen (minor & major < 2.5 %)
  - Blutung
  - Mechanischer und thermischer Schaden
  - Hautverbrennung
  - Inkomplette Ablation mit Rezidivbeschwerden

RFA bei Knochentumoren

Rationale für Schmerzlinderung

- Thermische Denaturierung von Nozizeptoren (Periost + Umgebung)
- Reduktion der Tumormasse mit sekundärer Reduktion von
  - Intrinsischem Gewebedruck innerhalb der Umgebung
  - Tumornekrosefaktoren und Interleukinen
- Hemmung von Osteoklast

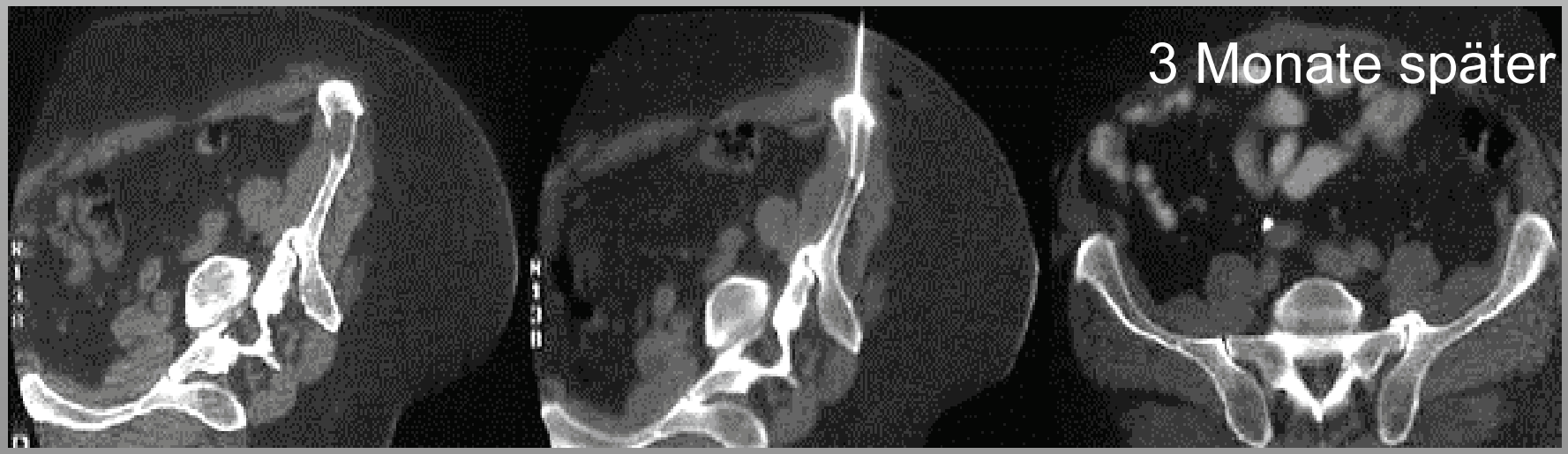
Cleeland et al., (1994) N Engl J Med, 330:559-596
Mannion et al., (2000) Clin J Pain, 16:144-156

IR Therapie bei Knochentumoren

- Indikationen
  - OP nicht möglich
  - Radiatio nicht möglich oder noch nicht geplant/gewünscht
  - Schmerztherapie
  - Vorbereitung zur Kombination mit Osteooplastie
    - Vorbereitung der TU Matrix für Injektion
  - Adjuvant zu anderen Therapien (Radiatio, CTx)
- (Relative) Kontraindikationen
  - Infiltration von Neuro-Strukturen

RFA bei Knochentumoren

- Vor/anstatt Radiatio
- Vor Osteoplastie
- Vor/anstatt OP
- Ausschließlich?



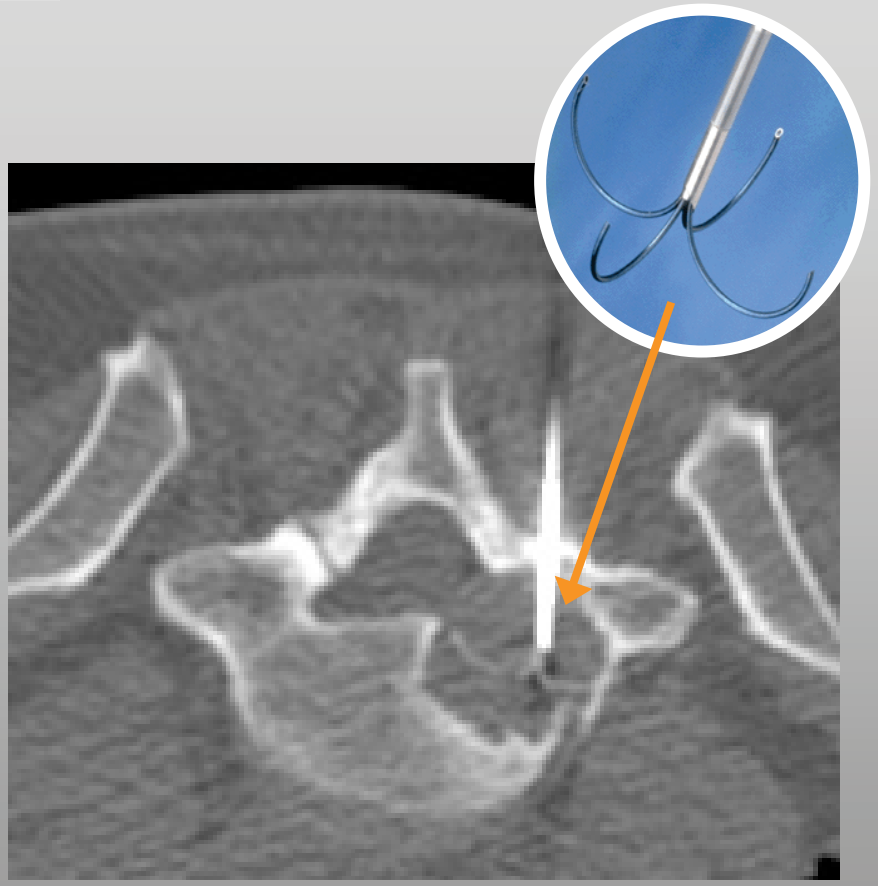
Anamnese: Radiatio des Beckens mit 56 Gy

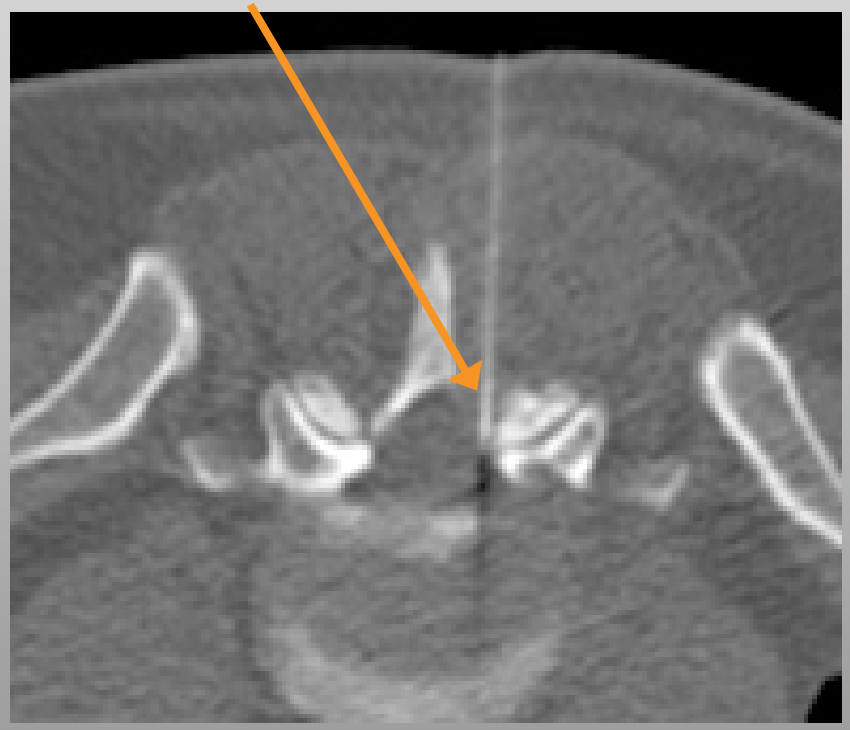
RFA bei Knochen Metastasen

58-j. Mann, metastasierendes RCC, L5, Schmerz

Knochen noch stabil

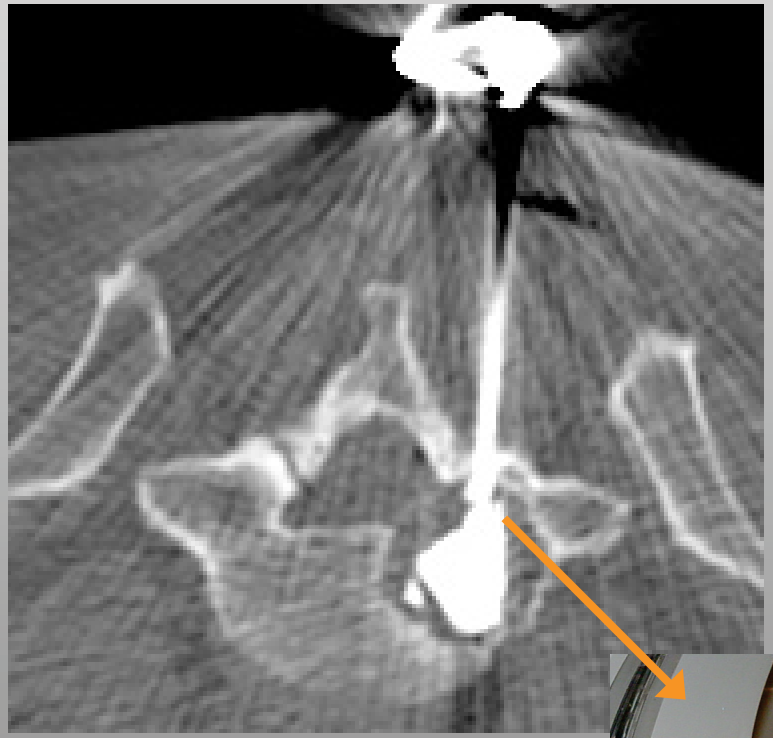
RFA bei Knochen Metastasen

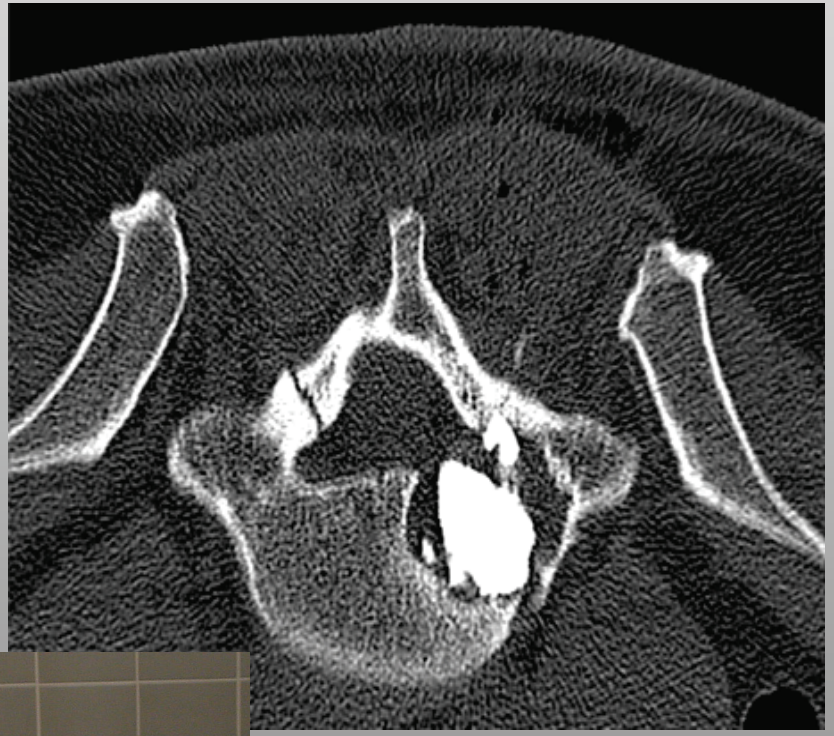




58-j. Mann, metastasierendes RCC, L5, Schmerz
Knochen noch stabil

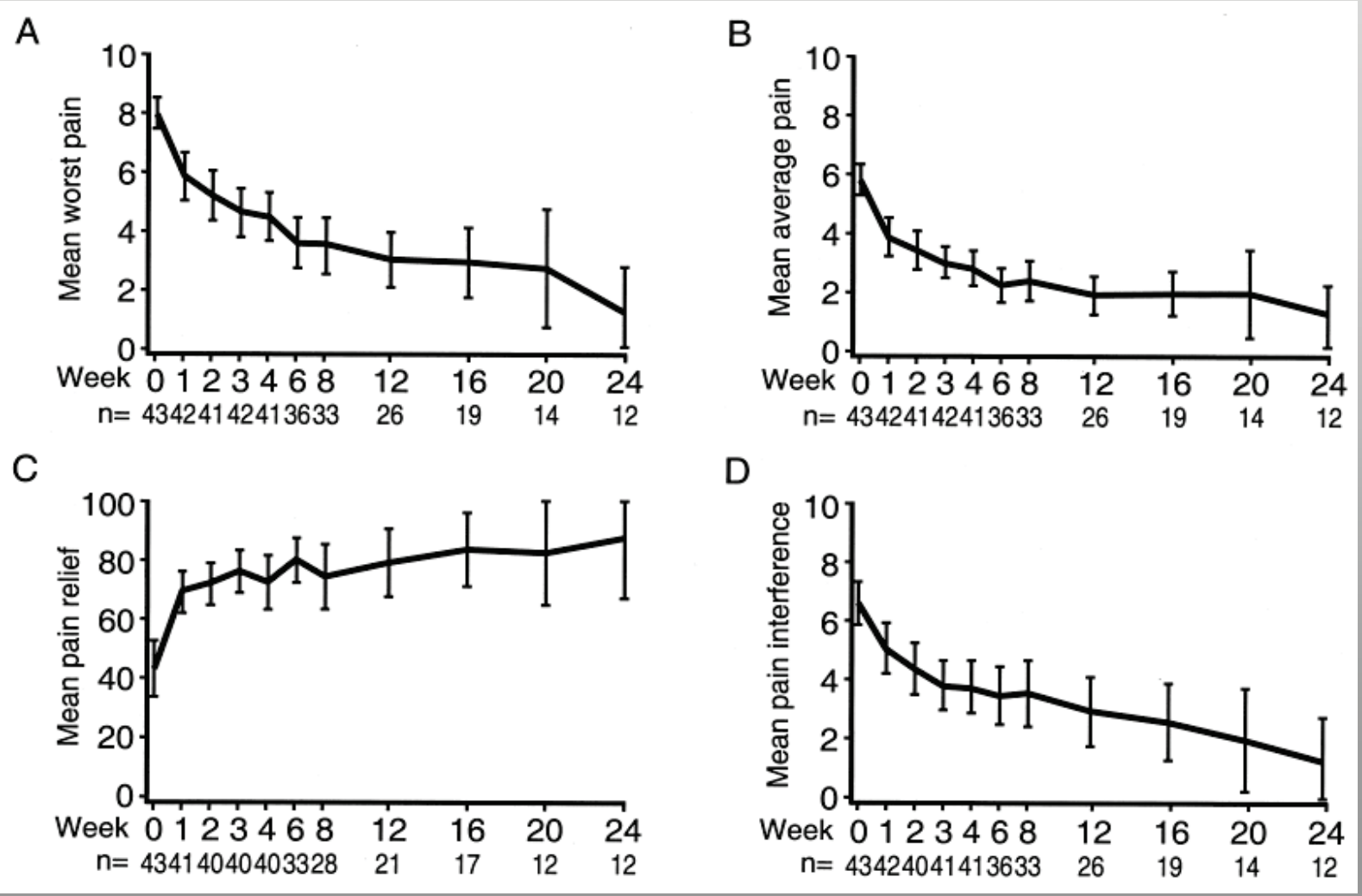
Adjuvante Osteoplastie





Zusätzliche Stabilisierung
mit PMMA Zement

Schmerzlinderung nach RFA



Göetz et al. J of Clinical Oncology, 22, 2004

RFA bei Knochen Metastasen

- Daten bisher noch sehr begrenzt
- Keine RCT‘s

Author	Technik	Patienten	Erfolg
Callstrom et al. (Radiology, 2002)	RFA	12	12/12
Charboneau (SIR, 2004) Goetz et al. (J Clin Oncol, 2004)	RFA	43	41/43
Eigene Daten (RSNA, 2003) (ESSR, 2004)	RFA	18	16/18

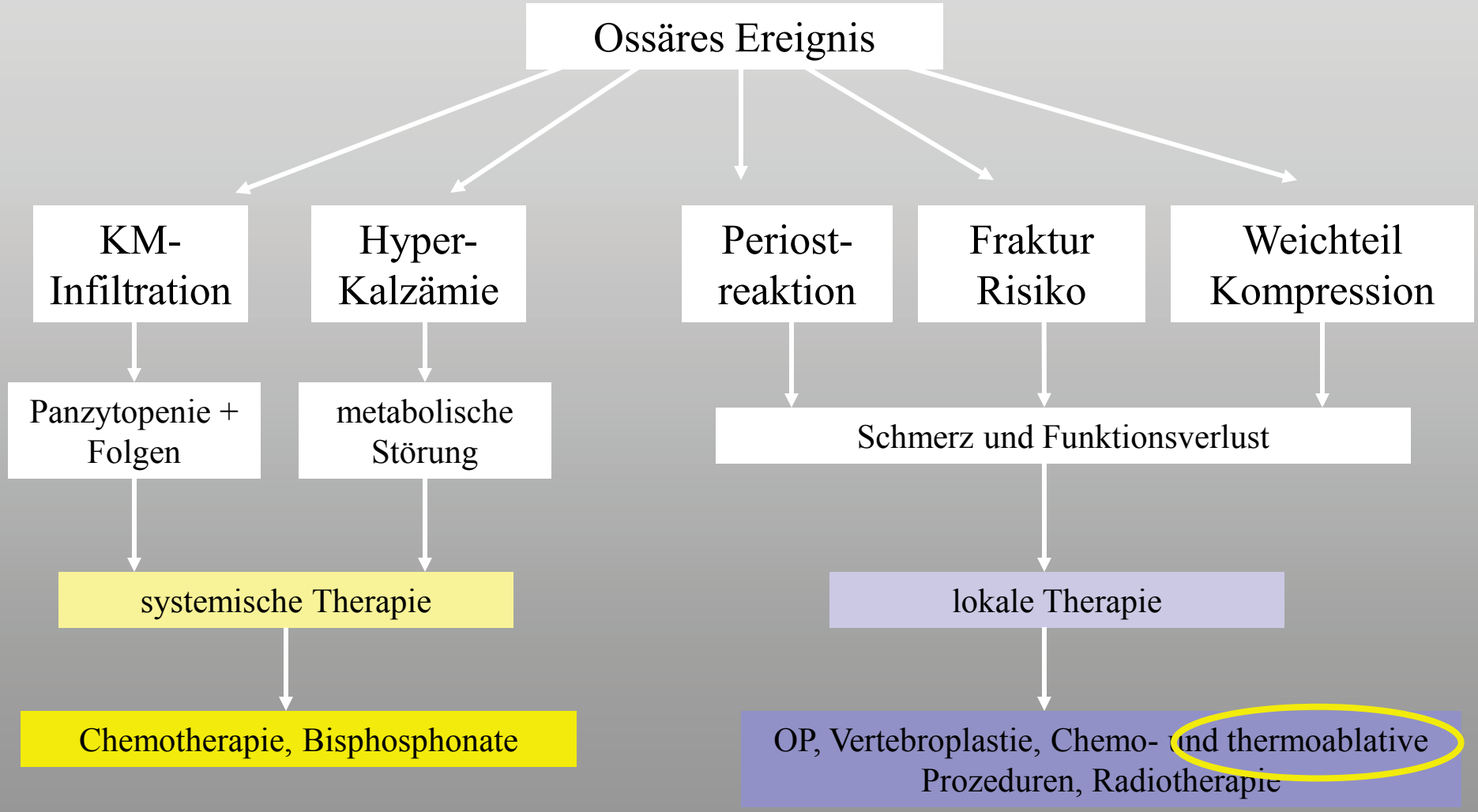
Schmerzlinderung nach RFA

	Baseline (N = 43)	Day 1 (n = 31, US cohort)	Week 1 1 (n = 42)	Week 4 4 (n = 41)	Week 8 8 (n = 33)	Week 12 12 (n = 26)	Week 24 24 (n = 12)
Worst pain (0–10)							
Score	7.9	7.3	5.8	4.5	3.5	3.0	1.4
P		.2	< .0001	< .0001	< .0001	< .0001	.0005
Average pain (0–10)							
Score	5.8	4.6	3.9	2.8	2.4	1.9	1.2
P		< .0001	< .0001	< .0001	< .0001	< .0001	.0005
Pain interference (0–10)							
Score	6.6	5.6	5.0	3.7	3.5	2.9	1.3
P		.08	.0001	< .0001	< .0001	.0008	.002
Pain relief (0–100)							
Score	43	64	69	73	74	79	84
P		.0007	< .0001	< .0001	.0002	< .0001	.003
Morphine-equivalent dose							
Score	99.0	97.5	105.7	95.5	40.4	45.4	93.0
P					.01	.01	.5

NOTE. *P* values are signed rank tests of the null hypothesis that the difference in the current time period minus the baseline value is equal to zero.

Göetz et al. J of Clinical Oncology, 22, 2004

Knochen Metastasen



ASPO LMU

∑ -Knochenablation

- Methode der Wahl beim Osteidosteom
- Potente therapeutische Option bei Malignomen
  - Nicht-radiosensitive Tumoren
  - Strahlendosis schon erschöpft
  - Chemo-insensitive Tumoren
  - Reduktion von Nebenwirkungen von Opiaten

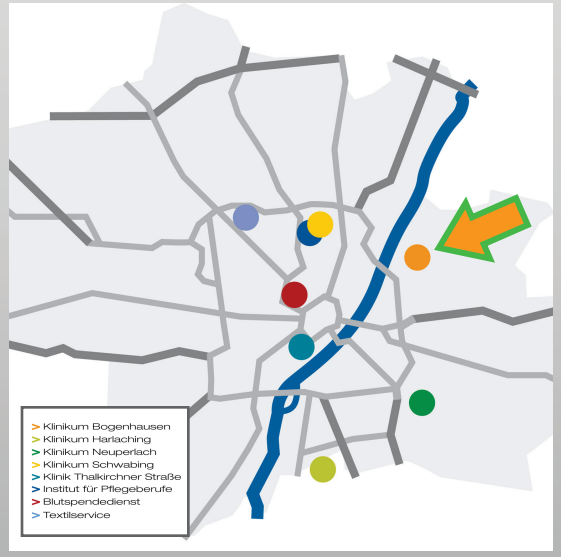
- Effektivität bei Schmerzlinderung > 90%
- Sehr niedrige Komplikationsrate < 5%

Extrahepatische Ablation

- Ablative Verfahren
  - Sicher
  - Einfach
  - Effektiv
  - Indikation muß in MDBs abgestimmt sein

- „Wenn resektabel, dann auch abladabel“
- Keine Angst, wenn‘s nicht die Leber ist

Vielen Dank !


Klinikum Bogenhausen
Klinikum Harlaching
Klinikum Neuperlach
Klinikum Schwabing
Klinik Thalkirchner Straße
Institut für Pflegeberufe
Blutspendedienst
Textilservice