Renal embolization: current indications and techniques
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Disclosure

I do not have any potential conflict of interest
History

Since the 1970s technical advances have expanded the indications

- Symptomatic hematuria in renal cancer
- Preoperative tumor embolisation
- Treatment of Angiomyolipomas
- Vascular malformation
- Medical renal deseases
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Malignant renal tumors: palliation

- Hematuria, flank pain

Symptomatic relief in patients with unresectable renal cell carcinoma

Partial or total embolization
Malignant renal tumors: prior to surgery

Some study have shown long term prognostic benefits...


Benefits:

- Decreased operative blood loss
- Ease of dissection secondary to edema
- Beneficial effect of decreasing the size or extent of tumor thrombus
Malignant renal tumors: prior to surgery

Many large studies on the use of RAE were conducted in 80s and 90s...


Sprayregen S. et al. Value of preoperative renal artery embolization in reducing blood transfusion during nephrectomy for RCC. JVIR 1993
Many large studies on the use of RAE were conducted in the 80s and 90s...
Malignant renal tumors: prior to surgery

Opinions on the role of preoperative RAE are controversial

There is not a consensus on the benefits and morbidity associated with RAE

Homayoun et al. Renal artery embolisation prior to nephrectomy for locally advanced renal cell carcinoma. ANZ J Surg 2014


All published studies are non-randomized and subject to selection bias, so the true role of RAE has not been determined

There is not evidence in the literature that the benefits outweigh the risks
Malignant renal tumors: prior to surgery
Malignant renal tumors: prior to IR

CRYO-RFA
Malignant renal tumors: prior to IR

2 problems:

Heat sink effect

Tumor dimension
Malignant renal tumors: prior to IR

HEAT SINK EFFECT

RFA and MW: induce coagulative necrosis through heat deposition

Cryoablation: induce osmotyc lysis via repeated freeze and thaw cycles

Heat sink effects of renal vessels limit the effectiveness of heat based ablative techniques

Role of RAE

Nakasone Y et al. Radiofrequency ablation in a porcine kidney model: effect of occlusion of the arterial blood supply on ablation temperature, coagulation diameter and histology

JVIR 2011
Small tumors (to 3 cm)

CRYO and RF similar outcomes

(Pirasteh et al. Cryoablation vs Radiofrequency ablation for small renal tumors

Acad Radiology 2011)
Malignant renal tumors

Percutaneous ablation of renal masses measuring 3.0 cm and smaller: comparative local control and complications after radiofrequency ablation and cryoablation.

RESULTS: There were five (1.1%) technical failures, including one (0.4%) among tumors treated with RFA and four (2.1%) among tumors treated with cryoablation (p = 0.17). Of the 218 tumors treated with RFA and with follow-up beyond 3 months, seven (3.2%) developed local tumor recurrence, at a mean of 2.8 years after treatment (range, 1.2-4.1 years). Of the 145 tumors treated with cryoablation and with follow-up beyond 3 months, four (2.8%) developed local tumor recurrence at a mean of 0.9 years after treatment (range, 0.3-1.6 years). For biopsy-proven renal cell carcinoma, estimated local recurrence-free survival rates at 1, 3, and 5 years after RFA were 100%, 98.1%, and 98.1% respectively, compared with 97.3%, 90.6%, and 90.6%, respectively, after cryoablation (p = 0.09). Major complications occurred after 4.3% (10/232) of RFAs and 4.5% (8/176) of cryoablation procedures (p = 0.91).

CONCLUSION: RFA and cryoablation are both effective in the treatment of renal masses measuring 3 cm or smaller. Major complications with either procedure are infrequent.
Malignant renal tumors: prior to IR

What about tumors larger than 3cm?

RF

Such tumors often necessitate additional RF ablation sessions with lower technical success rates than those reported for smaller tumors


Gervais DA et al. RF ablation of renal cell carcinoma. Indications, results, and role in patient management over a 6Y period and ablation of 100 tumors. AJR Am J Roentgenol 2005

Clark TWI et al. Reporting standards for percutaneous thermal ablation of renal cell carcinoma. JVIR 2009
Malignant renal tumors: prior to IR

CRYOABLATION

Higher morbidity is associated with the larger, more peripheral lesions

Lehman DS et al. Laparoscopic renal cryoablation: efficacy and complications for larger renal masses
Acta Radiol 2012

Significant hemorrhage requiring transfusion is a known complication of percutaneous cryoablation

Schmit et al. Ice ball fracture during percutaneous renal cryoablation: risk factors and potential implications JVIR 2010
Malignant renal tumors: prior to IR
Malignant renal tumors: prior to IR

Percutaneous cryoablation of renal tumors superior to 5cm: RAE can provide a decrease post-procedural cryoablation related hemorrhage
Woodrum DA et al. Role of intraarterial embolisation before cryoablation of large renal tumors: a pilot study JVIR 2010

Arterial embolization prior to cryoablation of large renal cell carcinoma significantly decreases complications, such as hemorrhage
Miller et al. The role of embolization in reducing the complications of cryoablation in renal cell carcinoma Clin Radiol 2014
Renal Malignancy: Conclusions

REA for palliation: valid therapy, commonly performed

RAE prior to surgery: ??????? Rutine use is NOT justified

RAE prior to IR: large tumors (more than 4cm):
- Reducing the heat sink effect
- Reducing the risk of hemorrhage
Benign Renal Tumors: Angiomyolipoma

Benign renal neoplasm composed of adipose tissue, blood vessels and smooth muscle cells

- 1-2% of all tumors in the kidney

- 0.3-3% of incidence (20% in association with tuberous sclerosis)

- Strong female predilection F:M 4:1

- 40% acute debut with hemorrhage

- Risk of bleeding is proportional to size (4cm)
Angiomyolipoma

Benign renal neoplasm composed of adipose tissue, blood vessels and smooth muscle cells

Small tumors (less than 4cm): conservatively managed but FU necessary

Tumors over 4cm or symptomatic tumors: resected or embolized

Anti-proliferative drugs (Everolimus)
Angiomyolipoma

Benign renal neoplasm composed of adipose tissue, blood vessels and smooth muscle cells

Tumors over 4cm

Technical success of RAE 80-90%

Tumor recurrence rate 30% (43% in patients with tuberous sclerosis)

Kothary et al. Renal Angiomyolipoma: long term results after arterial embolization J Vasc Int Radiol 2005
Angiomyolipoma

Benign renal neoplasm composed of adipose tissue, blood vessels and smooth muscle cells

Tumors over 4cm

- There are no evidence-based recommendation to prophylactic embolization of non symptomatic AML

- If the tumor is predominantly composed fat, poorly vascularized and without aneurysms the bleeding risk is low
Angiomyolipoma
Angiomyolipoma: Conclusions

Tumors over 4cm

Indication for RAE

Highly vascularized tumors

Presence of pseudo aneurysms

History of bleeding
Embolization techniques

Embolicization technique

- Proximal embolization: coils, Amplatzer plug, micro-plug...
- Distal embolization: micro particles, gelfoam,
- Liquid embolic agents: onyx
Embolization techniques

- Vascular anatomy
- Presence of intra lesion micro shunt or fistula
Complications

- Coils migration
- Artery dissection
- Non target embolization
- Pulmonary embolism in presence of AVF
- Contrast nephrotoxicity
Complications: post-embolization syndrome

- 90% of patients
- Mild flank pain
- Fever
- Nausea
- Vomiting
- Paralytic ileus
- Leucocytosis

1 to 3 days after RAE
Complications: post-embolization syndrome

Supportive treatment:

analgesics
antipyretics
antiemetics
Thank you
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