Trattamento delle emorragie renali

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Renal artery embolization (RAE) refers to the occlusion of the renal artery, or some of its branches, by injection of an embolic agent through an endovascular catheter.

- Temporary occlusion
- Permanent occlusion

- PROXIMAL EMBOLIZATION: embolic agents occlude large vessels
- DISTAL EMBOLIZATION: embolic agents induce an occlusion at the arteriolar or capillary level
Background

Since its development in the 1970s, RAE has become a useful minimally invasive therapeutic option for various clinical situations.

RAE may be used as an adjunct or as an alternative to surgery, and has the potential to improve patient management and reduce hospital stay.

The increase in the use of RAE as a therapeutic strategy reflects continuous improvements in endovascular techniques and embolization materials and the increasing experience of interventional radiologists.
Specific Scenarios

• Non Traumatic
  - Tumors
  - Chronic Diseases
  - AVM

• Traumatic
  - Blunt/Penetrating Trauma
  - Iatrogenic Lesions
## TRATTAMENTO DELLE EMORRAGIE RENALI

### Specific Scenarios

**Catheter Renal Artery Stimulation: Clinical Applications and Techniques**

Sinat, MD, MS, Wael E.A. Saad, MBCh, and Uliko C. Turba, MD

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<table>
<thead>
<tr>
<th>Pathology</th>
<th>Indication</th>
<th>Clinical Endpoint</th>
<th>Technical Endpoint</th>
<th>Embolic Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tumor</strong></td>
<td>Palliation/pain</td>
<td>Reduce intraoperative bleeding</td>
<td>End artery embolization</td>
<td>ETOH, PVA</td>
</tr>
<tr>
<td></td>
<td>Control hematuria</td>
<td></td>
<td>Or</td>
<td>MCoils, GFOAM</td>
</tr>
<tr>
<td></td>
<td>Prenephrectomy</td>
<td></td>
<td>Devascularizing the arterial bed (tumor)</td>
<td>NBCA</td>
</tr>
<tr>
<td></td>
<td>Pre-RFA</td>
<td>Devascularize tumor</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AML</strong></td>
<td>Control retroperitoneal bleeding</td>
<td>Reduce risk of rupture/bleeding</td>
<td></td>
<td>ETOH, PVA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AVM</strong></td>
<td>Hematuria</td>
<td></td>
<td></td>
<td>ETOH, NBCA</td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Renal dysfunction</td>
<td></td>
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<tr>
<td><strong>Degenerative</strong></td>
<td>Reduce risk of bleeding</td>
<td></td>
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<tr>
<td><strong>Global Parenchymal disease</strong></td>
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<td></td>
<td>Hydronephrosis</td>
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<tr>
<td></td>
<td></td>
<td>Hematuria</td>
<td></td>
<td>ETOH, PVA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension</td>
<td></td>
<td>MCoils, GFOAM</td>
</tr>
<tr>
<td><strong>Hematuria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trauma</strong></td>
<td>Bleeding/truncation</td>
<td>Retroperitoneal bleeding</td>
<td>Obliteration of branch arterial flow</td>
<td>MCoils, GFOAM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hematuria</td>
<td></td>
<td>MCoils</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renal dysfunction (transplant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AVF</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hematuria</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PaA</strong></td>
<td>Retroperitoneal bleeding</td>
<td>Hematuria</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MCoils, Stents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduce risk of bleeding</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- TRATTAMENTO DELLE EMORRAGIE RENALI

Specific Scenarios

- Non Traumatic
  - Tumors
  - Chronic Diseases
  - AVM

- Traumatic
  - Blunt/Penetrating Trauma
  - Iatrogenic Lesions

The Dark side of the Guidelines – 1st Interventional Radiologist Under 40 Meeting
The vast majority of renal tumours are treated by surgery alone, using either radical nephrectomy or nephron-sparing surgery (e.g. radiofrequency ablation (RFA) or cryosurgery). During the last decade, minimally invasive alternatives have been proposed to treat small tumours.

Seldom used but may function in two situations: to facilitate subsequent surgery in large tumours, or to relieve symptoms in patients under palliative care.

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Major Category</th>
<th>Subclassification</th>
<th>Indication</th>
<th>Clinical Endpoint</th>
<th>Technical Endpoint</th>
<th>Embolic Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumor</td>
<td>RCC</td>
<td></td>
<td>Palliation (pain)</td>
<td>Reduce intraoperative bleeding</td>
<td>End artery (arteriolar) or devascularizing the arterial bed (tumor)</td>
<td>ETOH, PVA, MCoils, GFOam, NBCA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Control hematuria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Prenephrectomy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pre-RFA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ginat et al. Tech Vasc Interventional Rad 2009, 12:224
Preoperative RAE of locally advanced tumours has been proposed to facilitate subsequent nephrectomy. Although there is no clear evidence that preoperative RAE reduces blood loss during nephrectomy, it allows the ligation of the renal vein before the artery. This approach is particularly useful for patients with hilar tumours or large adenopathies.

A longer delay between RAE and surgery might improve the reduction in the size of the tumour thrombus, but imposes a longer PES and increases the risk of development of collateral vessels. The recommended delay between RAE and surgery is 24–72 hours.

Various embolic agents have been used for preoperative RAE of locally advanced tumours, but microparticles and coils seem particularly well-suited for this indication9 (Figure 5). Proximal vascular plugs are also a common treatment choice, but attention must be paid to ensure a residual stump of the proximal artery remains to allow for surgical clamping.

Renal cancers: Adjuvant treatment
Preoperative Embolization

Comparison of preoperative embolization followed by radical nephrectomy with radical nephrectomy alone for renal cell carcinoma.

Zielinski H¹, Szmigielski S, Petrovich Z.

Abstract
A series of 474 patients with renal cell carcinoma (RCC), who had radical nephrectomy during a period of 15 years, was studied to assess the prognostic significance of various pathologic parameters (tumor stage [pT], lymph node status, metastasis, tumor grade, venous involvement) and value of preoperative embolization of renal artery. There were: 20 (4%) pT1, 204 (43%) pT2, 245 (52%) pT3, and 5 (1%) pT4 patients. All 474 patients underwent nephrectomy including a group of 118 (25%) patients (24 pT2, 90 pT3, and 4 pT4) who underwent preoperative embolization of the renal artery. To compare treatment outcomes in embolized patients with RCC, a group of 116 (24%) nonembolized patients with RCC was selected. This group was matched for sex, age, stage, tumor size, and tumor grade, with the embolized patients (p<0.01). All important prognostic factors were studied as to their influence on survival by the treatment group. The overall 5- and 10-year survival was 62% and 47%, respectively. The 5- and 10-year survival rates were significantly better (p<0.01) for patients with pT2 than for those with pT3 tumors (79% vs. 50% and 59% vs. 35%, respectively). Involvement of regional lymph nodes (N+) was an important prognostic factor for survival in patients with pT3 tumors. The 5-year survival for pT3 N+ was 39%, compared with 66% in those with pT3N0 (p<0.01). Preoperative embolization was also an important factor influencing survival. The overall 5- and 10-year survival for 118 patients embolized before nephrectomy was 62% and 47%, respectively, and it was 35% and 23%, respectively, for the matched group of 116 patients treated with surgery alone (p = 0.01). The most important finding of this study was an apparent importance of preoperative embolization in improving patients' survival. This finding needs to be interpreted with caution and confirmed in a prospective randomized trial.

a significant increase in 5-year survival among patients who underwent pre-nephrectomy RAE, but no prospective data have been published to confirm this finding
Renal cancers: Adjuvant treatment
Preoperative Embolization

Superselective RAE of small tumours before surgery or RFA has also been proposed to allow zero-ischaemia laparoscopic partial nephrectomy, to reduce local blood flow, and to increase the ablated volume.

However, the vast majority of patients treated by RFA or cryotherapy do not undergo preoperative RAE.

Renal cancers: Palliative treatment

- RAE can be used in non-operable cases to alleviate severe local pain or recurrent haematuria.
- Paraneoplastic hypocalcaemia might also regress following RAE.
- The advantages and drawbacks to palliative RAE must therefore be considered with caution.

Renal cancers: Complications

Post Embolization Syndrome (PES) occurs following RAE of the whole kidney, in the majority of patients, regardless of the embolization technique.

The severity of PES depends on the volume of necrosis, and must be treated with corticosteroids and analgesics that can be initiated 24 h before the procedure.

PES can have dramatic consequences in these fragile patients, and can cause tubular necrosis, renal abscesses, and even death.

Neo-adjuvant anti-angiogenic treatments also decrease the size of locally advanced renal tumours to allow for their surgical resection; therefore, the use of RAE must always be balanced with that of neoangiogenic drugs.

Renal angiomyolipomas

Angiomyolipomas are either sporadic or associated with tuberous sclerosis complex (TSC) or pulmonary lymphangioleiomyomatosis (LAM).

Blood vessels within angiomyolipomas are thought to possess poor elastic layers with predisposition to the formation of aneurysm and spontaneous haemorrhage. Consequently, angiomyolipomas account for 17–20% of all patients who present with spontaneous perinephric haemorrhage.

In the setting of acute bleeding, conservative surgery is difficult and can lead to haemostasis nephrectomy. Therefore, consensus exists to recommend RAE as a first-line treatment in cases of acute bleeding.

Low failure rate and requirement for a subsequent nephrectomy (<7%) has been reported when RAE is used as a first-line treatment.

Steiner et al. J. Urol. 150, 1782–1786
Specific Scenarios

Renal angiomyolipomas

Clear consensus exists as to how asymptomatic angiomyolipomas should be treated, and whether preventative treatment should be employed.

The risk of bleeding increases with tumour size and in angiomyolipomas associated with TSC or LAM.

There is general consensus that angiomyolipomas >80 mm require preventive treatment.

A threshold of 35 mm was proposed for initiating preventive treatment in patients with TSC or LAM.


## Renal angiomyolipomas

### Review of the Tuberous Sclerosis Renal Guidelines from the 2012 Consensus Conference: Current Data and Future Study

<table>
<thead>
<tr>
<th>Early diagnosed or suspected TSC</th>
<th>Diagnosed with definite or possible TSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance of kidneys</td>
<td>Obtain MRI of the abdomen to assess angiomyolipoma progression and renal cystic disease (every 1–3 years for life)</td>
</tr>
<tr>
<td>Main MRI of the abdomen to assess for the presence of angiomyolipoma and renal cysts</td>
<td>Assess renal function (GFR and blood pressure) at least annually</td>
</tr>
<tr>
<td>Renal function by determining GFR</td>
<td></td>
</tr>
</tbody>
</table>

### Clinical presentation

**Management recommendations for renal angiomyolipoma**

- **Embolization** (followed by corticosteroids for 7 days to mitigate post-embolization syndrome) [3]. Embolization should be as selective as technically feasible to preserve renal parenchyma...
- Avoid nephrectomy

- Asymptomatic, growing angiomyolipoma >3 cm in diameter
  - **First-line:** mTOR inhibitor
  - **Second-line:** selective embolization or kidney-sparing resection
Renal angiomyolipomas

RAE should predominantly target areas of microaneurysms.

A proximal (upstream of microaneurysms) and distal (tumour bed) embolization, using microparticles and coils, is advised for the treatment of microaneurysms.

RAE causes shrinkage of treated AMLs (to 20–70% of the initial volume).

The importance of this shrinkage depends on the relative proportion of vascular and fatty components.

Major complications are rare (4.8% of 311 aggregated cases from 13 series) and include complications owing to endovascular manoeuvres (such as dissections and thrombosis), unintended renal infarction and abscesses of the necrotic AMLs.

Bleeding can occur following embolization (0–5.3% of all embolized AMLs), but it is usually successfully treated by a second embolization.

Some AMLs may also re-grow following embolization, leading to the need for a repeat preventive procedure.
Renal angiomyolipomas
Renal angiomyolipomas
Renal angiomyolipomas
Specific Scenarios

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Polycystic kidney disease

Patients with autosomal dominant polycystic kidney disease (ADPKD) suffer from a nephromegaly that is inversely proportional to renal function. This complication can induce pain, abdominal distension, dysphagia, constipation and dyspnoea, and hinders further transplantation owing to the lack of space in the pelvis.

Surgical techniques, including nephrectomy or cyst fenestration, have been proposed to alleviate the symptoms of ADPKD and to facilitate graft implantation in the pelvis.

However, these techniques carry a 28–66% risk of complication among patients with ESRD.

Percutaneous techniques, such as needle aspiration or cyst ethanol scleropathy are of limited use given the large number of cysts present.

RAE is a potential alternative to surgery. It has been indeed hypothesized that, as renal failure progresses, the function of the renal arteries shifts from supporting renal function to supplying fluid to the renal cysts.

RAE has proven to be efficient in alleviating symptoms among patients and inducing a reduction in kidney volume of ~50% at 1 year, with a shorter hospitalization period as compared with surgery.

### Polycystic kidney disease

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample size (n)</th>
<th>Indication for RAE</th>
<th>Primary technical success rate (%)</th>
<th>Technical success rate after repeat RAE (%)</th>
<th>Clinical success rate (%)</th>
<th>Definition of clinical success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ubara et al., 2002</td>
<td>65</td>
<td>Polycystic kidney disease</td>
<td>100</td>
<td>NA</td>
<td>100</td>
<td>Resolution of symptoms</td>
</tr>
<tr>
<td>Cornelis et al., 2010</td>
<td>25</td>
<td>Polycystic kidney disease</td>
<td>100</td>
<td>NA</td>
<td>84</td>
<td>Reduction of kidney volume sufficient to allow renal transplantation</td>
</tr>
</tbody>
</table>
Polycystic kidney disease

American Journal of Transplantation 2010; 10: 2363-2369
Wiley Periodicals Inc.

Brief Communication

Embolization of Polycystic Kidneys as an Alternative to Nephrectomy Before Renal Transplantation: A Pilot Study


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The Dark side of the Guidelines – 1st Interventional Radiologist Under 40 Meeting
Polycystic kidney disease
Polycystic kidney disease
Polycystic kidney disease
Specific Scenarios

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Renal arteriovenous malformations

Renal arteriovenous (AV) shunts are rare pathologic communications between the renal arteries and veins without interconnecting capillaries.

- Renal AVMs can induce gross haematuria, hypertension or high-output cardiac failure.
- Surgical cure of renal AVMs is difficult to achieve and often results in nephrectomy.
- RAE remains the best option for symptomatic renal AVMs and the optimum management focuses on destroying the nidus.
- As a result, proximal RAE is not effective and might even be deleterious, as it can hinder subsequent access to the nidus.
- Ideally, liquid agents that are able to easily reach the nidus should be used.
- RAE of these complex lesions remains difficult and should be performed only by experienced radiologists.
### Renal arteriovenous malformations

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample size (n)</th>
<th>Indication for RAE</th>
<th>Primary Technical success (%)</th>
<th>Technical success rate after repeat RAE (%)</th>
<th>Clinical success rate (%)</th>
<th>Definition Of clinical success</th>
<th>Embolic agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defreyne et al. 2000</td>
<td>1</td>
<td>cirsoid AVM</td>
<td>100%</td>
<td>NA</td>
<td>100%</td>
<td>Resolution of symptoms</td>
<td>n-butyl 2-cyanoacrylate</td>
</tr>
<tr>
<td>Murata et al. 2014</td>
<td>12</td>
<td>renal AVMs</td>
<td>86%</td>
<td>100% (2/14)</td>
<td>100%</td>
<td>Resolution of symptoms</td>
<td>various embolization materials (liquid embolization agents, gelatin sponge, and coils)</td>
</tr>
</tbody>
</table>
Renal arteriovenous malformations

RENAL ARTERIOVENOUS SHUNTS: CLINICAL FEATURES, IMAGING APPEARANCE, AND TRANSCATHETER EMBOLIZATION BASED ON ANGIOARCHITECTURE

**ACHING POINTS**

Because the angioarchitecture of nontraumatic renal AV shunts does not differ from that of peripheral AV malformations, we suggest that the classification by Cho would be more suitable.

To understand the angioarchitecture of a renal AV shunt and consider appropriate treatment strategies, certain features should be evaluated with angiography: (a) feeding arteries: number, size, presence of aneurysms, potential accessibility to the fistulous point, and location of normal renal parenchymal branches from the feeding arteries; (b) fistulous points: number and size; (c) drainage veins: number, presence of saccular dilatation, and accessibility by the transvenous approach; (d) intranidal communication for AV malformations; and (e) shunt flow (circulation time).

- Successful embolization should involve the complete and permanent occlusion of the shunt while preserving the normal renal arterial branches as far as possible. It is therefore important to achieve complete occlusion of the fistulous points distally beyond the normal renal arterial branches. The consideration of the type and angioarchitecture of the shunt is essential for a safe and effective embolization treatment.

- Proximal embolization of the arterial feeder with coils or vascular plugs should be avoided because recruitment of the blood flow via the collaterals can cause recurrence and complicate the angioarchitecture of type III shunts.
# Renal arteriovenous malformations

## Table 4: Embolic Materials Used for the Occlusion of Renal AV Shunts

<table>
<thead>
<tr>
<th>Embolic Materials</th>
<th>Diameter (mm)</th>
<th>Introducing Catheter (F)</th>
<th>Applicable Type of Renal AV Shunts</th>
<th>Limitation and Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Particles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gelatin sponge</td>
<td>1–10</td>
<td>1.7–4</td>
<td>Type III, traumatic renal AV shunt (combined use with coils or plug)</td>
<td>Low rate of complete occlusion of type III renal AV shunts high rate (&gt;50%) of recurrence, non-target embolization (renal infarction)</td>
</tr>
<tr>
<td>PVA</td>
<td>0.1–1</td>
<td>1.7–4</td>
<td>Type III, traumatic renal AV shunt</td>
<td></td>
</tr>
<tr>
<td><strong>Coils</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pushable coil</td>
<td>2–20</td>
<td>1.9–4</td>
<td>Types I, II, traumatic renal AV shunt (various sizes)</td>
<td>Effective for small and medium-sized AV fistulas, risk of migration for large AV fistulas, effective for AV malformations</td>
</tr>
<tr>
<td>Detachable coil</td>
<td>1–32</td>
<td>1.7–4</td>
<td>Types I (medium fistula size)</td>
<td>Risk of spontaneous deflation migration</td>
</tr>
<tr>
<td>Detachable balloon</td>
<td>7–15</td>
<td>6–10</td>
<td>Types I (medium fistula size)</td>
<td>Large size of guiding catheter, relatively stiff delivery system</td>
</tr>
<tr>
<td>Vascular plug</td>
<td>3–22</td>
<td>4–9</td>
<td>Types I (medium fistula size)</td>
<td></td>
</tr>
<tr>
<td><strong>Liquid materials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absolute ethanol</td>
<td>...</td>
<td>≥1.2</td>
<td>Types I, II, III (medium size)</td>
<td>Toxic effects of alcohol (PH shock), higher risk of overembolization (renal infarction)</td>
</tr>
<tr>
<td>NBCA</td>
<td>...</td>
<td>≥1.2</td>
<td>Types I, II, III, traumatic renal AV shunt (various sizes)</td>
<td>Risk of migration (PE), overembolization (renal infarction)</td>
</tr>
<tr>
<td>Onyx</td>
<td>...</td>
<td>≥1.3, DMSO compatible</td>
<td>Types I, II, III (multiple feeders with small fistula size)</td>
<td>Risk of migration (ARDS), embolization (renal infarction)</td>
</tr>
</tbody>
</table>

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Renal arteriovenous malformations

A 19 yo young woman with haematuria and flank pain (intraparenchimal AVM)
Renal artery aneurysms

Renal artery aneurysms are uncommon, with an estimated prevalence of 0.7% based on computed tomography imaging in the general population.

Predisposing factors include connective tissue disease (Marfan syndrome, Ehlers-Danlos syndrome, Behcet syndrome), neurofibromatosis, atherosclerosis, fibromuscular dysplasia, polyarteritis nodosa, and tuberculosis.

Precise indications for treatment of renal artery aneurysms are not well delineated, although aneurysm diameter 1.5-2 cm, rupture, associated flank pain or hematuria.

Although rare, perhaps the most feared complication of renal artery aneurysm is rupture, as this carries a mortality rate of 80%.

Renal artery aneurysms

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Specific Scenarios

Traumatisms

The kidney is the third most frequent abdominal organ to be injured, with renal trauma occurring in ~1–5% of all trauma cases. In some series, 80–90% of all kidney injuries were secondary to blunt abdominal trauma; yet the rate of penetrating injuries can be up to 20% in urban settings.

*Although general consensus is that patients with critical haemodynamic instability despite active resuscitation should be admitted to surgery to control the bleeding as quickly as possible, RAE is increasingly used as an adjunct or a minimally invasive alternative to surgery*.

- In cases of penetrating or iatrogenic trauma, RAE is mostly used as a first-line alternative to surgery.

- In blunt trauma, the relative role of expectant management, RAE and surgery, mostly depends on the trauma grade of the lesions and on the presence or absence of active bleeding as assessed by CT.

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Specific Scenarios

Blunt traumas are usually caused by motor vehicle accidents or assault.

The consequences of blunt renal trauma range from simple avulsion of the vascular pedicle.

Renal injuries are usually graded by CT scan.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Type of Injury</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal contusion</td>
<td>Microscopic or gross hematuria with normal urologic findings</td>
</tr>
<tr>
<td></td>
<td>Hematoma</td>
<td>Nonexpanding subcapsular hematomas with no laceration</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Nonexpanding perinephric (perirenal) hematomas confined to the retroperitoneum</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Superficial cortical lacerations less than 1 cm in depth without collecting system injury</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Renal lacerations greater than 1 cm in depth without collecting system injury</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Renal lacerations extending through the renal cortex, medulla, and collecting system</td>
</tr>
<tr>
<td></td>
<td>Vascular injury†</td>
<td>Injuries involving the main renal artery or vein with contained hematoma, segmental infarctions without associated lacerations</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Shattered kidney, ureteropelvic junction avulsions</td>
</tr>
<tr>
<td></td>
<td>Vascular injury</td>
<td>Complete laceration (avulsion) or thrombosis of the main renal artery or vein that devascularizes the kidney</td>
</tr>
</tbody>
</table>

The Dark side of the Guidelines – 1st Interventional Radiologist Under 40 Meeting
Specific Scenarios

**Traumatisms: Blunt Trauma**

**Grade I–II injuries** are the most frequent and best treated with observation, transfusions, and bed rest.

These traumatisms should not be treated routinely with RAE, despite what might be done in some centres, owing to the risk of inducing unnecessary renal infarctions.

The management of **Grade III–V injuries** is not currently standardized.

- Surgical exploration was originally considered the method of reference; however, this approach led to nephrectomy rather than repair in up to 64% of cases.
- There has, therefore, been a progressive trend to treat high-grade renal traumas with less invasive methods.
- The majority of practitioners support expectant treatment for haemodynamically stable patients without any active bleeding, to avoid surgical exploration at the acute phase where possible.

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Hotaling, *et al.* *J. Urol.* 185, 1316–1320
Breyer, V. A. *J. Urol.* 179, 2248–2252; discussion 2253
TRATTAMENTO DELLE EMORRAGIE RENALI

Specific Scenarios

Intraoperative Urologic Guidelines

TRAUMATISM: Blunt Trauma

American Urological Association (AUA) Guideline

UROTRAUMA: AUA GUIDELINE

Allen F. Morey, MD; Steve Brandes, MD; Daniel David DugI III, MD; John H. Armstrong, MD; Benjamin N. Breyer, MD; Joshua A. Broghammer, MD; Bradley A. Erickson, MD; Jeff Holzbellerlein, MD; Steven J. Hudak, MD; Jeffrey H. Pruitt, MD; James T. Reston, PhD. MPH; Richard A. Santucci, MD; Thomas G. Smith III, MD; Hunter Wessells, MD

7. Clinicians should perform follow-up CT imaging for renal trauma patients having either (a) deep lacerations (AAST Grade IV-V) or (b) clinical signs of complications (e.g., fever, flank pain, ongoing blood loss, abdominal distention). (Recommendation; Evidence Strength: Grade C)

8. Clinicians should perform urinary drainage in the presence of complications such as enlarging urinoma, increasing pain, ileus, fistula or infection. (Recommendation; Evidence Strength: Grade C) Drainage should be achieved via ureteral stent and may be augmented by percutaneous urinoma drain, percutaneous nephrostomy, or both. (Expert Opinion)
Guideline of guidelines: A Review of Urologic Trauma Guidelines

Objective: To review the guidelines released in the last decade by several organizations regarding the optimal evaluation and management of genitourinary injuries (renal, ureteral, bladder, urethral and genital).

Materials and Methods: This is a review of the genitourinary trauma guidelines from the European Association of Urology (EAU) and the American Urological Association (AUA) and renal trauma guidelines from the Societe Internationale D’Urologie (SIU).

Results: Most recommendations are guided by the American Association for the Surgery of Trauma (AAST) organ injury severity system. Grade A evidence is very rare in genitourinary trauma, and most recommendations are based on Grade C evidence. The findings of the most recent urologic trauma guidelines are summarized. All guidelines recommend conservative management for low-grade injuries. The major difference is for high-grade renal trauma, where the SIU and EAU recommended exploratory laparotomy for Grade 5 renal injuries, while the more recent AUA guideline recommends initial conservative management in hemodynamically stable patients.

Conclusion: There is generally consensus among the three guidelines. Recommendations are based on observational or retrospective studies as well as clinical principles and expert opinions. Large-scale prospective studies can improve the quality of evidence, and direct more effective evaluation and management of urologic trauma.
Specific Scenarios

**Traumatisms: Blunt Trauma**

**Guideline of guidelines: A Review of Urologic Trauma Guidelines**

[Bryk, DJ; Darren J. Bryk, BS, Zhao, LC; Lee C. Zhao, MD MS]

doi: 10.111/j.bju.130

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Level of Evidence</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with gross hematuria should undergo abdominal/pelvic CT with IV contrast with immediate and delayed images.</td>
<td>Grade C</td>
<td>SIU, EAU, AUA</td>
</tr>
<tr>
<td><strong>Stable Patient: Conservative management for grades 1, 2 injury.</strong></td>
<td>Grade B</td>
<td>SIU, EAU, AUA</td>
</tr>
<tr>
<td>Initial conservative management for high grade renal injury</td>
<td>Grade B</td>
<td>AUA</td>
</tr>
<tr>
<td>Surgical repair if already undergoing laparotomy for grades 3, 4. Exploratory laparotomy for grade 5.</td>
<td>Grade C</td>
<td>SIU</td>
</tr>
<tr>
<td><strong>Unstable patient: Exploratory laparotomy. Consider angioembolization in experienced centers.</strong></td>
<td>Grade B</td>
<td>SIU, EAU, AUA</td>
</tr>
<tr>
<td>Renovascular injury- Attempt revascularization only in patient with solitary kidney or with bilateral renal injury.</td>
<td>Grade C</td>
<td>SIU</td>
</tr>
<tr>
<td>Follow-up CT for grade 4 or 5 renal injuries 36-72 hours after presentation.</td>
<td>Grade C</td>
<td>SIU, AUA</td>
</tr>
<tr>
<td>Renal trauma patients should have periodic blood pressure monitoring.</td>
<td>Grade C</td>
<td>SIU, EAU, AUA</td>
</tr>
</tbody>
</table>

The Dark side of the Guidelines – 1st Interventional Radiologist Under 40 Meeting
Traumatisms: Blunt Trauma
Traumatisms: Blunt Trauma
Traumatisms: Blunt Trauma
specific Scenarios

• Non Traumatic
  - Tumors
  - Chronic Diseases
  - AVM

• Traumatic
  - Blunt/Penetrating Trauma
  - Iatrogenic Lesions
Penetrating trauma can occur as a result of stab or gunshot wounds.

Penetrating trauma can induce three types of vascular injury: direct bleeding in the subcapsular or perirenal space or in the collecting system (arteriocalyceal fistulas); arterial pseudoaneurysms; and AVFs.

Surgical repair of vascular lesions is difficult and carries a high risk of nephrectomy. Consequently, these lesions are usually managed conservatively by transfusion or RAE.

Traumatism: Penetrating Trauma

Settantenne accoltellato all’addome

Il fatto avvenuto a Luino nella serata di lunedì. L’uomo raggiunto da un fendente: indagano i carabinieri di Redazione redazione@varesenews.it

23 febbraio 2016 - 9:06

Un uomo di 70 anni è stato accoltellato nella serata di ieri a Luino. Un solo fendente avrebbe raggiunto l’uomo all’addome.
Traumatisms: Penetrating Trauma
Traumatisms: Penetrating Trauma
Specific Scenarios

- Non Traumatic
  - Tumors
  - Chronic Diseases
  - AVM

- Traumatic
  - Blunt/Penetrating Trauma
  - Iatrogenic Lesions
Specific Scenarios

**Traumatisms: iatrogenic Injuries**

Iatrogenic injuries following renal biopsy, placement of a nephrostomy tube, or percutaneous, laparoscopic or open surgical procedures.

The incidence of vascular lesions following biopsy of native or transplanted kidneys is 8.0%, with only 0.2–2.0% patients requiring intervention.

The incidence of severe bleeding complications requiring intervention is 0.6–1.4% following percutaneous renal surgery and 0.0–9.5% following open or laparoscopic nephron-sparing surgery.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample size (n)</th>
<th>Indication for RAE</th>
<th>Primary technical success rate (%)</th>
<th>Technical success rate after repeat RAE (%)</th>
<th>Clinical success rate (%)</th>
<th>Definition of clinical success</th>
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<tbody>
<tr>
<td>Srivastava et al., 2005</td>
<td>27</td>
<td>Iatrogenic vascular injuries</td>
<td>81</td>
<td>89</td>
<td>89</td>
<td>Control of bleeding without need for surgery</td>
</tr>
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<td>Sam et al., 2011</td>
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<td>Iatrogenic vascular injuries</td>
<td>98</td>
<td>NA</td>
<td>94</td>
<td>Control of bleeding</td>
</tr>
<tr>
<td>Zeng et al., 2013</td>
<td>117</td>
<td>Iatrogenic vascular injuries</td>
<td>90</td>
<td>99</td>
<td>99</td>
<td>Control of bleeding without need for surgery</td>
</tr>
</tbody>
</table>
Transcatheter embolisation of iatrogenic renal vascular injuries
Anna Maria Ierardi · Chiara Floridi · Federico Fontana · Eijona Duka · Antonio Pinto · Mario Petrillo · Elias Kehagias · Dimitrios Tsetis · Luca Brunese · Gianpaolo Carrafello

Abstract

**Purpose** The aim of our study was to review our experience and long-term follow-up in the treatment of iatrogenic renal vascular injuries using transcatheter embolisation.

**Materials and methods** Our retrospective analysis of cases collected in two interventional centres consists of a total of 21 patients who underwent renal arterial embolisation (RAE) for iatrogenic arterial kidney bleeding. Biopsy (n = 4), percutaneous nephrolithotomy (n = 4), nephron-sparing surgery (n = 4), guidewire-induced arterial perforation during coronary angiography or renal stenting (n = 3), percutaneous nephrostomy (n = 3), renal endopyelotomy/pyeloplasty (n = 2) and surgical nephrectomy were the iatrogenic causes. Seven patients presented with haemodynamic instability requiring blood transfusion (33.3 %), the remaining were haemodynamically stable (66.7 %). Diagnostic renal angiography revealed 9 actively bleeding vessels, 6 pseudoaneurysms, 4 arteriovenous fistulas and 1 arterio-calyceal fistula. In one patient selective renal arteriography was negative probably because the bleeding observed at CT angiography was self-limited. Twenty-one embolisation procedures were performed in 21 patients; one patient required a second embolisation 3 days after the first one. Embolisation was performed with microcoils, polyvinyl alcohol particles, embospheres, spongostan emulsion and vascular plug.

**Results** The technical success rate was 100 %. The overall clinical success rate was 95 %. Apart from a patient who died due to disseminated intravascular coagulation, no major complications requiring intensive care treatment were encountered during or after the procedures. No patient required emergency surgery or subsequent surgical treatment. No statistically significant differences in eGFR or renal function stage appeared after RAE.

**Conclusions** Percutaneous treatment can be proposed as first-line treatment in iatrogenic renal arterial injuries, resulting in a safe and effective procedure.
Specific Scenarios

Traumatisms: iatrogenic Injuries

**Statements**
- IRT is procedure dependent (1.8–15%).
- Significant injury requiring intervention is rare.
- Most common injuries are vascular.
- Renal allografts are more susceptible.
- Injuries occurring during surgery are rectified immediately.
- Symptoms suggestive of significant injury require investigation.

**Recommendations**
- Patients with minor injuries should be treated conservatively.
- Severe or persistent injuries require intervention with embolisation.
- In stable patients, repeat embolisation should be considered for failure.
Traumatismi: lesioni iatrogeniche (1)
Traumatisms: Iatrogenic Injuries (1)
Traumatismi: Infortuni Iatrogenici (2)

The Dark side of the Guidelines – 1st Interventional Radiologist Under 40 Meeting
Traumatisms: Iatrogenic Injuries (2)
can be used to treat various uro-logical and nephrological conditions, as an alternative or complementary approach to surgical procedures.

The indications are consensual:
- RAE is the first-line option in penetrating or iatrogenic trauma when conservative treatment has failed in case of bleeding angiomyolipoma.
- In grade III–IV blunt traumas with active bleeding, RAE is also a well-accepted method that can, in association with conservative management, reduce the need for difficult surgical exploration and avoid unnecessary nephrectomies.

Other indications are more controversial:
- The use of RAE as an adjuvant therapy before surgical or percutaneous treatment of cancers remains debated and its respective role as compared to anti-angiogenic therapies must be clarified.

Regardless of the indication, RAE should always be considered and discussed among a multidisciplinary team of clinical staff.