Embolic therapy of renal arteries, distal branches and/or polar arteries: Personal experience

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Learning objectives

Interventional radiology, in renal pathology, beyond the commonly performed revascularization with angioplasty or stent, is gaining increased interest in the field of embolization of arterial vessels. The choice is much favoured as it is minimally invasive and provides a therapeutic option for various indications.

Renal arteries and intraparenchimal branches can be selectively embolized with a variety of different agents.

The aim of this work is to re-evaluate our single centre experience of 10 years in the procedures of renal artery and distal branches embolization (RAE).

Cases will be presented, to underline both the well-established and emerging indications, displaying the technical outcomes.

Background

Indications

Indications to RAE and distal branches are mainly due to embolization of inoperable renal tumors and traumatic or iatrogenic lesion with clinically relevant hematuria.

In addition after the increasingly widespread treatment aortic abdominal aneurysms (AAA) with EndoVascular Aneurysm Repair (EVAR) embolization of polar arteries is often performed. The rationale is to prevent type II endoleak of the aneurysmal sac.

Less frequent, but still performed, is the exclusion of a renal aneurysm with the use of coils or covered stent.

More indications are the treatment, or the prevention, of hematuria or spontaneous hematomas in the setting congenital or acquired A-V fistula, or adult polycystic kidney disease (ADPKD).

Results

Literature displays wide difference in results, with best results for patients recruited in small centers where RAE was performed for palliation of renal tumors, and worse results when RAE was used for treatment of post-traumatic or iatrogenic hematuria.
Technical success varies from 85 to 100%, with a single treatment sufficient in 61 - 100% of the cases, and repeated procedures in 2 - 5 days for post-traumatic lesions while in 2 - 18 months for palliative treatment of renal tumors.

As for agents used, trisacrilc microspheres seem to be more efficient than polyvinyl alcohol particles, and this is attributed to a more distal penetration (considering calibre of particles is matched).

Presence of polar arteris at the neck or in the aneurysmal sac for patients candidate for EVAR may be a contraindication to the procedure itself. Preemptive embolization of the polar vessel has shown in some studies to be effective in avoidance of type II endoleak, favouring reduction in volume of the aneurysmal sac. Nevertheless the results are difficult to compare as different authors use different materials for the EVAR and that aspect also seems to affect the sac reperfusion.

In our experience we observed that patent polar renal arteries arising from the anurysmal sac, not previously embolized before EVAR, are not the feeding artery of type 2 endoleak: but they can sustain inverted flow in lumbar or inferior mesenteric artery.

Short and long-term results of RAE in treatmente of A-V fistulas, renal artery aneurysms, or ADPKD report tecnical success near to 100% with scarce incidence of complivation or the need of a repeated treatment.

Images for this section:
**Fig. 1:** Schematic anatomy of the renal arteries and branching. 1 Main trunk, 2 Adrenal artery, 3 Gonadal artery 4 Segmentary artery, 5 Lobar artery, 6 arcuate artery.
Imaging findings OR Procedure details

This retrospective evaluation considers the time period from June 1999 to July 2009. It consist of 27 patients (19 male, 8 female; mean age 74, range 37 - 93 yo), all underwent the RAE procedure (or distal/polar branches).

Tecnical success was obtained in 26/27 patients (96%), in a single case the operator was not able cannulate a polar artery originating directly form the aneurysmal sac.

In a single case (4%) a patient presenting for macrohematuria from an advanced renal tumor

Agents used

In 17 patients (62,9%) 3 -10 mm metal coils were used Fig.1 - Fig.2; in 11 (41%) cases non-reabsorbables particles, calibre 100 - 1200 µm Fig.3, in 3 (11%) cases fibrine sponge. In 1 case (4%), for the treatment of a patient affected from renal cancer with extended caval thrombosis, acrylic glue was used in association with Lipiodol. Covered stents (6x22 mm and 5x28 mm) were used in 2 patients (7%) affected from main renal artery aneurism and upper polar artery anuerysm Fig.4 both in a setting of fibrodysplasia. The use of vascular plugs with diameter of 6 and 10 mm was limited to 2 patients (7%); one affected from a vast subcapsular hematoma in a setting of metestatic bladder tumor Fig.5, and one presenting with massive macrohematuria with acute anemia in an advanced renal cancer.

Mean value of pre-procedural serum creatinine (sCr) was 1.2 mg/dL (range 0.6 - 2.4 md/dL) and postprocedural of 1.4 mg/dL (range 0.6 - 5.3 mg/dL). Pre-procedural mean hemoglobin (Hb) of 9.5 g/dL (range 7.8 - 10.9 g/dL), mean hematocrit Hct 28.6% (range 24.2 - 31.9 %), and postprocedural of mean Hb of 11.5 g/dL (range 9.6-18.6 g/dL), mean Hct 33.9% (range 28.5 - 53 %)

In our series we had not experienced major or minor complications.

In 9/11 cases (82%) an increase in Hb was apparent, while in 6/27 (22%) cases a mild worsening in sCr was observed.

Case Gallery

PATHOLOGY AGENTS
CASE 1 - 69 yo/F
Hematuria with multiple iatrogenic pseudoaneurysms, following nephron sparing nephrectomy for renal tumor.

CASE 2 - 85 yo/F
Acquired A-V fistula

CASE 3 - 82 yo/M
Renal tumor, patient with a single malrotated kidney.

CASE 4 - 65 yo/M
Main renal artery aneurysm, in a patient symptomatic from fibrodysplasia.

CASE 5 - 66 yo /M
Vast subcapsular hematoma in a setting of metastatic bladder tumor.

Images for this section:
Fig. 1: Right kidney, selective angiography: multiple iatrogenic pseudoaneurysms of the distal branches (arrow), secondary to nephron sparing nephrectomy, are present.
**Fig. 2:** Early filling of the caliceal system (arrow), confirms bleeding in direct connection with the urinary system.
Fig. 3: Postprocedural: embolization with metallic coils (arrow) shows there is no more filling of the aneurysmal lesions.
Fig. 4: A CT-angio was done before the catheter angiography, but it was able to show just a single (arrow) pseudoaneurysmal lesion.
Fig. 5: Left kidney, selective angiography shows massive A-V fistula, from the main renal artery.
Fig. 6: The feeding artery has been filled with multiple coils and sponge of fibrin.
Fig. 7: Postprocedural angiogram, the dilated feeding artery has been filled with several coils (arrow) and the A-V fistula is no longer visible.
**Fig. 8:** CT-angio, coronal reformat, shows a renal tumor in a solitary malrotated kidney.
Fig. 9: CT-angio, sagittal reformats, shows a renal tumor in a solitary malrotated kidney.
**Fig. 10:** Aortography shows a main right renal artery (dashed arrow) and a polar artery (arrow).
Fig. 11: Selective catheterism of this polar artery shows an highly vascularized tumor.
Fig. 12: Angiography after embolization with polyvinyl alcohol particles and metallic coils.
Fig. 13: Angiography after embolization with polyvinyl alcohol particles and metallic coils.
Fig. 14: Contrast enhanced MR, shows right renal artery aneurysm (arrow), localized on the main trunk, a polar artery is also present (dashed arrow).

Fig. 15: Selective angiography confirms the diagnosis of right renal artery aneurysm (arrow).
Fig. 16: After covered stent deployment (arrow), angiography shows complete exclusion of the aneurysmal sac.
**Fig. 17:** CT-angio, axial thick slice MIP, showing vast spontaneous subcapsular hematoma, with recent bleeding, associated to local parenchimal interruptions. Renal parenchima is thinned and renal pelvis is dilated from hemorrhagic content.
Fig. 18: CT-angio, sagittal thick slice MIP, showing vast spontaneous subcapsular hematoma, with recent bleeding, associated to local parenchimal interruptions. Renal parenchima is thinned and renal pelvis is dilated from hemorrhagic content.
Fig. 19: CT-angio, coronal thick slice MIP, showing vast spontaneous subcapsular hematoma, with recent bleeding, associated to local parenchimal interruptions. Renal parenchima is thinned and renal pelvis is dilated from hemorrhagic content.
Fig. 20: Selective angiography of right renal artery shows compressed renal vascular bed, compressed and dislocated from the hematoma.
Fig. 21: Postprocedural selective angiography, after embolization with vascular plug and fibrin sponge.
**Fig. 22:** Postprocedural selective angiography (later phase), after embolization with vascular plug and fibrin sponge.
Conclusion

RAE is an effective and minimally invasive therapy which is gradually becoming the treatment of choice in symptomatic macroematuria of neoplastic or iatrogenic origin, and in palliation of inoperable renal tumors. It is also effective in the setting of aneurysms, A-V fistulas affecting the main renal artery or the distal branches, and as well in the preemptive exclusion of the inferior renal polar arteries in patients candidates to the EVAR procedure.

Morbidity is low, hospital stay is brief.

A various array of embolic agents are the requisite as is the experience in their usage.

Personal Information

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