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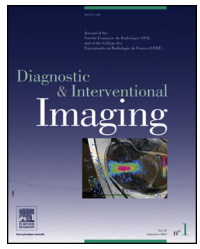

SHORT ORIGINAL ARTICLE / *Cardiovascular imaging*

Selective arterial embolization of life-threatening renal hemorrhage in four patients after partial nephrectomy

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Abstract
Purpose: Partial nephrectomy (PN) is an accepted alternative to radical nephrectomy for nephron sparing surgery to treat renal tumors. Although complications are relatively rare after PN, they may include renal hemorrhage that can be massive and life threatening. Artery embolization can have a major role in the management of these cases and to avoid radical nephrectomy.
Materials and methods: We report four consecutive patients with massive hemorrhage after PN, treated by arterial embolization and review the literature to discuss the clinical presentation, imaging evaluation and clinical outcome. All patients developed arteriovenous fistula and one a pseudoaneurysm.
Results: After selective catheterization and identification of the bleeding site, we used microcoils as embolization material. Immediate technical and clinical success was achieved in all cases.
Conclusion: Superselective artery embolization of renal hemorrhage is a simple, safe and efficient procedure. It has a high clinical success and should be considered as an alternative to nephrectomy, minimizing the morbidity and preserving renal tissue.

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The improvement of imaging techniques has led to the increased discovery of asymptomatic renal tumors [1—3]. Radical nephrectomy has traditionally been the standard treatment for renal cell carcinoma, but some studies showed that PN yields the same cure rates as radical nephrectomy [4,5]. Today the accepted indications for PN have been expanded and include unilateral lesions in patients that have a normal contralateral kidney [4] or tumors that deeply invade the renal parenchyma and might affect the collecting system [5]. The main advantages of PN compared to radical nephrectomy is to reduce the risk of chronic kidney disease insufficiency when controlled for risk factors [6] and with maintained similar oncologic outcomes, associated to a decrease in overall mortality and non-cancerous related death due to the lesser impact in cardiac and renal status [2]. Because of this, PN has become a standard of care as a nephron sparing surgery in some cases [7]. Laparoscopic PN is an alternate option to open surgery and in experienced hands can reduce morbidity for selective patients [7].

However, PN is a more challenging procedure with higher morbidity rate [2]. The most frequent complications are perioperative bleeding and urinary fistula [2]. Pseudoaneurysms and arteriovenous fistula (AVF) are uncommon after minimally invasive partial nephrectomy, but can lead to significant morbidity and are potentially life threatening [8—10]. Other techniques are used in the treatment of renal tumors. Radiofrequency ablation can be an efficient alternative solution, less invasive than surgery. It can also have vascular complications although no life-threatening complications were reported [11].

Embolization has been used in various clinical situations related to renal cancer since 1973, including preoperative aid to the resection of localized renal tumors and a means to palliate the symptoms of metastatic disease [12]. One of the major complications of PN can be life-threatening hemorrhage. The purpose of this paper is to report our experience in emergency embolization of four consecutive patients.

Materials and methods

We retrospectively reviewed our cases of urgent arterial embolization after a life-threatening hemorrhage following partial nephrectomy. No approval from the hospital was needed. We included four patients treated in our department from June 2010 until September 2011. Three men and one woman (age range 38—83 years, median 59.5 years) underwent partial nephrectomy for tumorectomy. The first two were diagnosed as clear cell carcinomas, the third was an angiomyolipoma and the fourth patient had a renin-secreting tumor. This last rare case was diagnosed based in the laboratory values (plasmatic renin 130.5 μU/L; plasmatic aldosterone 1490 pmol/L; urinary aldosterone 81 nmol/24 h an urinary cortisol 593 nmol/24 h) as well as on pathology with cells expressing renin, actine alpha, CD34 and viomentin.

They developed renal hemorrhage postoperatively (range 3—9 days after surgery) with significant hemodynamic perturbations. Macroscopic hematuria was the most common sign, present in three patients and flank pain was also observed in three patients. No one had coagulopathy. Pre-intervention imaging included CT and US with Doppler before the arterial angiogram. Complete blood count, mean systolic and diastolic blood pressure were recorded before embolization. Before embolization, hemoglobin levels were 8 g/dL, 8.5 g/dL, 7.5 g/dL and 11.5 g/dL with need of transfusion of 2 units in the first two cases and 5 units of red blood cells in the third patient.

Using the Seldinger technique, we placed a 4 Fr or 5 Fr sheath in the right common femoral artery after local anesthesia of the groin (Lidocaïne 2%). We performed a global aortogram using a pigtail catheter. This first evaluation allowed the identification of renal arteries anatomy as well as to identify the exact bleeding vessel responsible for the hemorrhage. Catheterization of the homolateral renal artery and superselective access using a Progreat microcatheter 2.7 Fr (Terumo, Tokyo, Japan) was performed. The bleeding site was identified in all cases and we used as embolization material tornado® coils with a size range of 2×3 mm to 2×4 mm (Cook, Bjaeverksov, Denmark) and 2×2 mm and 3×2 mm (Azur, Terumo, Tokyo, Japan). The endpoint for embolization was complete occlusion of the bleeding vessel and most efforts were paid to save as much as possible of normal remaining renal parenchyma. Immediate technical success was defined as the ability to stop the angiographic bleeding with absence of flow in the target bleeding vessels. Immediate clinical success was defined as normalization of BP and pulse rate, interruption of clinical bleeding, absence of need of more blood cell transfusion and absence of need for re-embolization or nephrectomy. Clinical follow-up was obtained in all patients.

Results

In all four patients, immediate angiography showed the site of extravasation of contrast as well as an AVF (Figs. 1—6). One patient had a renal pseudoaneurysm. Immediate technical and clinical results were achieved in all cases. No one has post-embolization syndrome. Patient 1 had a history of bilateral pulmonary embolism that required an IVC filter insertion (Fig. 7). We observed in one patient a transient increase of serum creatinine levels that returned to the pre-embolization level after 48 hours. All patients were discharged with restored normal red blood count and normal renal function. Patient 1 had a urinary tract infection (UTI) that was clinical managed with target antibiotherapy with complete resolution. During the post-embolization period, the remaining renal parenchyma showed normal perfusion and no significant damage was observed immediately after and at follow-up examinations, using CT and with follow-up ranged 2—12 months (Figs. 8—10). No major complications were observed immediately after or during the follow-up period.

Discussion

After selective embolization of all four cases, immediate technical and clinical results were observed. No one had major complications. A life-threatening hemorrhage is considered a significant blood loss in the kidney collecting system or in the perirenal space, causing hemodynamic instability [13]. An AVF that does not represent itself the