International Journal of Radiology Research
www.radiologyjournal.in
Online ISSN: 2663-4562
Received: 10-03-2026, Accepted: 10-04-2026, Published: 25-04-2026
Volume 8, Issue 2, 2026, Page No. 8-13

Endovascular transarterial embolization of giant renal angiomyolipoma – is it a definite curative option

Dr. Rajesh Venunath Nair[1,2], Dr Ahmad Shawky[1]
[1] Department of Interventional Radiology, Jaber Al Ahamd Hospital, Kuwait
[2] "Sagar" TRRA-159 Sagar Thamarassery Road Poonithura P.O, Kochi, Kerala, India
Corresponding Author: Dr. Rajesh Venunath Nair

Abstract
Renal angiomyolipomas (AML) are benign lesions usually left alone. However, lesions larger than 4 cm carry the risk of spontaneous haemorrhage and need urgent treatment. Angiography and embolization are the current standard of care particularly in patients with high operative risks. Angio-embolization is a safe, minimally invasive procedure preserving maximum renal parenchyma, with the added advantage of preventing peri-procedural morbidity. Transarterial embolization of angiomyolipoma demonstrates low rates of mortality and serious complications. However is transarterial embolization a definite curative option in cases of large lesions or has it only a role in management of bleeding tumours to arrest hemorrhage.
Here we present a case of young 25 year old female with sporadic non tuberous sclerosis related left lower pole renal angiomyolipoma. The patient was diagnosed with the same following spontaneous unprovoked retroperitoneal hemorrhage and underwent emergency angioembolization using gelform and pushable microcoils. Subsequent follow up after 4 months with contrast enhanced CT scan showed reduction the vascularity with no significant reduction in size of the tumour. Later following a multidisciplinary team discussion it was decided to repeat angioembolization as the patient refused to undergo surgery. Repeat Angiography showed new vessels recrutited from the inferior braches of the left lower pole renal artery. The patient underwent a second session of embolization with embospheres 100-300 microns until complete stasis was obtained with absent tumour blush. Follow up after 6 months showed more than 30% reduction in size of the tumour.

Keywords: Kidney, angiomyolipoma, embolization

Introduction

Angiomyolipomas are benign renal tumors accounting for 0.3% to 3% of all renal masses [1, 2]. They are benign mesenchymal hamartomatous tumours composed of blood vessels, fat and smooth muscle in varying quantities [3, 4, 5]. Angiomyolipoma has a prevalence of 0.02% to 0.1% in males and 0.22% to 0.29% in females [6, 7, 8].The mean age of presentation is about 38.8 to 48.5 years. Of all the patients with angiomyolipoma, 20% have Tuberous Sclerosis, an autosomal dominant, multi-organ disorder predisposing to benign tumor formation. Angiomyolipoma develops in 50% of all patients with Tuberous Sclerosis during their lifetime [9]. The remaining 80% of cases of angiomyolipoma are sporadic [6, 8].

Angiomyolipomas are easily diagnosed in Ultrasound, CT and MRI and lesions containing macroscopic fat with multiple variable sizes intralesional aneurysms with 99% specificity.

The main clinical manifestation of AML is pain caused by spontaneous perinephric hemorrhage (Wunderlich Syndrome) positively related to the size of the neoplasm [2, 3]. Among AMLs 4 cm or larger, 52%-94% are symptomatic and due to tortuous aneurysmatic arteries, is prone to rupture spontaneously and cause pain, hematuria, retroperitoneal hemorrhage, or even death. Although benign in nature, AML is a concern in pregnancy as well as if lesions are >4 cm where propylactic treatment is preferred due to the risk of rupture [4, 5, 6]. In patients with TSC, AML can be treated with a mammalian target of rapamycin (mTOR) inhibitor (Everolimus) [7].

Traditional surgical options include open or laparoscopic removal of the tumor using nephron-sparing surgery or total nephrectomy, the latter in large, complicated tumors. Minimal invasive treatments include thermal ablation or selective endovascular trans-arterial embolization (TAE). Prophylactic surgery reduces the risk of rupture but must carry limited side effects due to the benign nature of the disease. The most frequent treatment of AML is abdominal surgery with its inherent risk of postoperative complications [8].

Selective TAE of renal AML is a minimally invasive treatment with few complications and a tempting option because it is a more nephron-sparing option than surgery [9]. Studies are still limited with short follow-up [9, 12].

Patient Selection

Patients were referred to an interventional radiologist for embolization after clinical evaluation by a urologist. Indications for TAE were an AML size threshold of greater than 40 mm maximal diameter, an aneurysm of 5 mm or greater or acute hemorrhage from an AML of any size. Patients who had contraindication for anesthesia or high risk for surgery were also candidates for transarterial embolization.

Diagnosis and Measurements

AML were diagnosed on the basis of presence of macroscopic fat content and the absence of calcification or necrosis at computed tomography with CT Hounsfield values less than -20HU. MRI was used for diagnosis in patient who were pregnant or had allergy reactions to

contrast media and renal impairement. MRI demonstrated heterogeneous high signal intensity on T1 and T2 sequences with loss of signal in fat supressed sequences. Gadolinium contrast injection was seldom required if macroscopic fat could be demonstrated within the lesion in chemical shift imaging. DWI sequences and ADC mapping did not provide any added advantage to the diagnosis. Percutaneous biopsy was performed only in doubtful cases for histopathological confirmation. The volume of the lesion was determined using the three largest orthogonal diameters (d1, d2, d3) measurements recorded using electronic calipers. The volume was calculated using the elipsoid formula - $d1 \times d2 \times d3 \times \pi/6$ which provided the baseline for post procedure follow ups. Aneurysms were diagnosed and measured on contrast enhanced CT studies performed 30 seconds after contrast material injection.

Preprocedural evaluation

Preoperative laboratory data including serum urea nitrogen and creatinine levels, complete blood count, and activated partial thromboplastin time and prothrombin time were obtained. Pre procedural broad spectrum IV antibiotics was administered to prevent infection of renal infarction. Patients were kept 6-8 hours fasting in elective cases. Elective procedures were mostly carried out under conscious sedation after through pre anaesthetic evaluation.

Technique.

The embolizations were performed under conscious sedation with use of fentanyl citrate and midazolam based on the practice guidelines outlined by the American Society of Anaesthesiologists. Right common femoral access was mostly used with 6Fr femoral sheath.

An abdominal aortogram was obtained to determine the possible presence of accessory renal arteries and to determine the number of vessels feeding the tumor. After aortography, selective renal catheterization was performed with use of a 5-F Cobra 2 catheter or Sim 1 reverse curve catheter. Selective 2.7Fr microcatheter was then advanced into the vessel feeding the tumor distal to the branches supplying normal renal parenchyma using coaxial technique. Digital subtraction angiography was performed to delineate the tumour vessels and aneurysms. Embolization was mostly performed using 500-700 unsieved PVA particles. Combination of gelform and PVA particles can also be used. Coils were used only in selective cases.

Postembolization control angiograms were obtained from the mother catheter after removal of microcatheter to determine the degree of embolization. The endpoint was determined by angiographic criteria including occlusion of the arterial branches supplying the tumor and lack of opacification of the tumor itself. If residual tumor vascularity was visualized, embolic agent was injected in the manner described earlier until satisfactory stasis was achieved. Additional branches supplying the mass were selectively catheterized and the process was repeated until the entire tumor was embolized. Technically satisfactory result was defined as 98% tumour devascularisation. Small peripheral feeding branches of less than 1mm diameter may be difficult to target. Sheath was removed and puncture site occluded with plug based vascular closure device.

Postprocedure Management

Patients were monitored in the interventional unit for the first 2 hours and hospitalized for a day. After 24 hrs, before discharging patients, a Doppler ultrasound of the punctured femoral artery was performed to verify the absence of pseudoaneurysm. A CT scan was also realized to assess the extent of renal infarction associated with embolization within 3 days. Depending on the extent of renal infarction, a prescription was systematically made for 3 days to 1 week of a nonsteroidal anti-inflammatory drug combined with a proton-pump inhibitor and an analgesic to reduce the clinical manifestations of post-embolization syndrome. Renal function was tested pre-procedure and post-procedure by measuring serum creatinine and estimating the glomerular filtration rate according to local laboratory methods.

Mortality and Complications

Post embolization syndrome, a self-limiting constellation of symptoms including fever, nausea, vomiting and pain within the first 72 hours, occur in 40% of cases. Further post-procedural morbidity includes nontarget embolization in 2.3%, respiratory complications in 2.0%, abscess formation in 1.6%, active retroperitoneal hemorrhage in 1.0%, allergic reactions in 0.6%, urinary retention in 0.6%, urinary tract infections in 0.3%, femoral artery damage requiring repair in 0.3% and renal artery spasm in 0.3%.

Follow up.

Follow-up imaging was performed with either CT or gadolinium-enhanced MRI, with the first study being usually performed a minimum of 30 days post-procedure, 6months and then annually for 3 years. Ultrasound had no definite role in follow up as it has low sensitivity to demostrate post embolization tumour vascularity. The efficacy of embolization was determined over a mean follow-up imaging period from embolization of 12-14months. Recurrence was defined as an increase in tumor size more than 2cms on follow-up imaging, rebleeding, or recurrent symptoms requiring repeat embolization. Indications for repeat embolization included pain, hemorrhage, subsequent increase in tumor size, or persistence of intratumoral vascular pedicles.

Case Discussion.

We describe the case of a 25 year old unmarried young female patient with no significant past medical history presenting with acute onset left loin pain following blunt trauma while playing basket ball. During admission contrast enhanced CT scan was performed which showed a large left sided retroperitoneal mass lesion measuring 15 x 11 x 10cms (L x B x H) related to the mid and lower part of kidney showing internal negative density fat components and associated large retroperitoneal hematoma. Prominent arterial feeders were seen from the mid and lower pole subsegmental branches of renal artery.

At the time of admission, patient was vitally stable with HR – 87/minute, SpO2 99% in room air and BP 106/88mm Hg. Hemoglobin was 11gm/dl, Creatinine 58, INR 1.1 and Platelet count 2.8 lakks/$mm^{3.}$

Patient underwent emergency angioembolization and the elective lower pole tumoural vessels were embolized using 300-500 microns microspheres and a 3mm coil placed into the largest feeding brach from the inferior pole renal vessel.

The poste procedure peroid was uneventful and the patient was discharged the following day.

The patient had a follow up contrast CT scan done after a period of 4 months which showed that the lesion had not decreased in size but showed significant reduction in vascularity. The lesion now currently measures 12 x 8 x 6cms (L x B x H). The lower pole of the lesion shows vascularity from peripheral lumbar artery braches supplying the capsule. No obvious intalesional aneurysms were visualised.

After multidisciplinary team discussion with the urologist, oncologist and interventional radiologist, it was decided to performe a repeat trial of angioembolization as the patient was young age and was not consenting to undergo nephrectomy. However given the massive size of the lesion and the predominant fatty component it was advicd that chances of further reduction in size of the lesion was bleek.

The patient underwent a repeat embolization session during which further new tumoral branches were seen recruited from the inferior pole segmental renal artery which was embolized untile near stasis with 100-300 microns embospheres. The capsular feeders from surrounding muscular branches of lumbar vessels could not be tackled owing to the difficult tortous anatomy and narrow caliber vessels.

After a period of one year with no further episodes of retroperitoneal bleed the patient underwent a contrast enhnaced CT scan which showed a 13 x 9 x 6cms (Lx B x H) predominently fatty residual lesion in the lower pole of left kidney showing no significant internal vascularity.

The patient was counselled and underwent left sided nephrectomy one year later with surgical removal of the entire lesion. The patient is now doing very well with stable creatinine and no obvious post procedural complications.

Fig 1: Abdominal radiograph of the 25 year old female patient showing an ill defined soft tissue density mass in the region of the left kidney displacing the pre and properitoneal fat planes. No areas of calcification seen within the lesion.

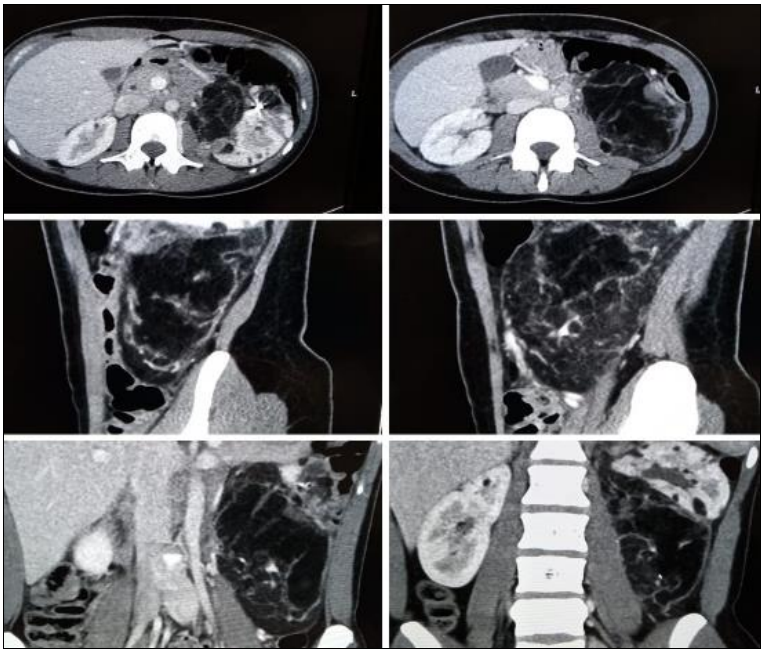

Fig 2: Contrast enhanced CT scan shows an irregular lobulated -10 to -20HU fat density mass lesion arising from the lower pole of left kidney measuring approximately 15 x 11 x 10cms (L x B x H) with internal enhancing vascular components consistent with the diagnosis of large renal angiomyolipoma.

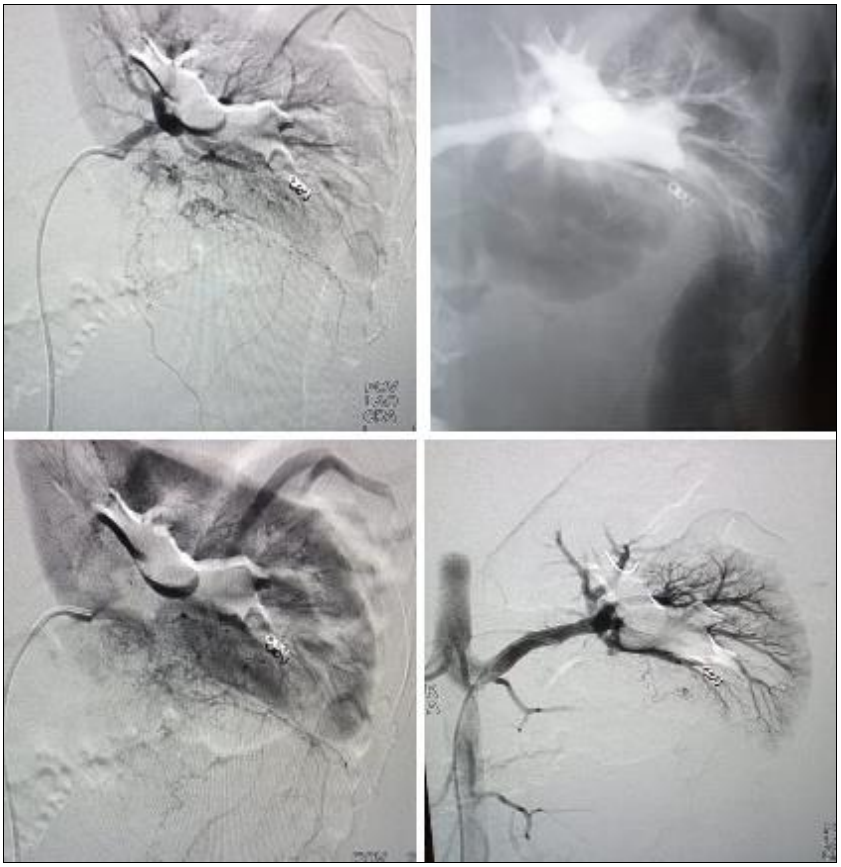

Fig 3: Corresponding Angiographic images shows the tumoral vessels arising from the lower pole segmental branches. Post embolization images shows the helical coil with the main supplying vessel with significant decrease in vascularity.

Discussion

The size of an AML is an important determinant of symptoms and treatment. An AML consists of many thick-walled, often tortuous blood vessels that are frequently in angiomatous arrangements [13, 14, 15]. Lemaitre and colleagues [16] reported that the hemorrhagic risk factors of AML were size, multifocality, and vascular abnormality. From the pathologic aspect, intratumoural and perirenal hemorrhages that figured prominently in the causation of symptoms were frequent gross findings.

More than 50% of tumors 4 cm or larger hemorrhaged, and one third of the patients with acute hemorrhage were in shock. Embolotherapy has been increasingly used during the past two decades in treatment of acutely hemorrhaged AMLs, as these tumors are benign and selective embolization may preserve some renal parenchyma [17, 18, 19]. Given the high risk of hemorrhage in larger AMLs, some authors advocate prophylactic embolization.

With better technology and increasing experience with these tumors, the management approach should be aimed at parenchymal preservation, which can be accomplished by selective embolization or with nephron-sparing surgery Because AML embolization has proven to be a safe and effective procedure in experienced hands, prophylactic embolization of large tumors (>4 cm) is gaining increasing acceptance.

After embolization, the decrease in AML size is variable. Because AMLs are composed of varying amounts of adipose smooth muscle and vascular tissue, effects of embolization vary. The adipose tissue, because of its hypovascularity, is probably resistant to embolization, and hence the volume of adipose tissue may not be significantly affected by embolization. In contrast, the angiomyogenic components seem to respond to embolization to a greater extent, as demonstrated by markedly decreased or absent enhancement on follow-up imaging. Therefore, although increasing size may be a prognostic determinant, more importantly, any increase in enhancement or vascularity should be considered suspicious and warrants close follow-up or angiography [20, 25].

Most of the AMLs treated with SAE show a mean reduction in size of about 43% [23]. Nevertheless, in a minority of cases lesions do not shrink and, instead, they increase their size due to an increase in the nonvascular component. In such cases, it is advisable to confirm the initial diagnosis of AML with repeated angiography and, if needed, to re-treat the lesion by SAE [24]. SAE has been associated with less postoperative complications as compared with surgical approaches, and no haemorrhagic complications have been described during a 5-year follow up period.

No deaths have been described in relation to embolization treatment, and kidney function remains nearly unaltered after the intervention. Therefore, SAE is a minimally invasive procedure that is associated with optimal preservation of renal function.

Alternatively, a partial nephrectomy can be performed. This approach has higher complication rates [25], although it is associated with a lower incidence of recurrence as compared with SAE. Due to high morbidity related to the possible occurrence of renal insufficiency, radical nephrectomy is indicated only for the treatment of AMLs >8 cm [26], when suspicion of malignancy is high and when minimally invasive techniques cannot be performed.

In conclusion, patients with AMLs greater than 4 cm who have severe symptoms (bleeding or uncontrollable pain) should undergo selective renal arterial embolization. The

selective arterial embolization is an effective and safe procedure to manage symptomatic AML. Decrement of tumor size is related to the tumor's internal components. The angiomyogenic components of the tumor responded well to the embolic therapy. The angiomyogenic components of tumor nearly all disappeared after embolization, but fatty components were reduced slightly and liquefactive necrosis was observed at follow-up CT. Accordingly, the angiomyomatous components that are crucial for the prevention of bleeding were very sensitive to embolization.

Inference

AMLs are benign mostly asymptomatic renal masses that are largely detected incidentally. Treatment is necessary for symptomatic patients or when the lesion size exceeds 4 cm [4]. The aim is to relieve symptoms and prevent haemorrhage, with the priority of preserving renal function. Treatment options include arterial embolisation or surgical excision. Angio-embolization carries the advantage of being minimally invasive, preservation of renal function and rapid haemodynamic stabilisation in settings of acute intra/peri-lesional haemorrhage [3, 5]. Optimal candidates for embolisation are tumours receiving blood supply by a single arterial branch. In tumours with complex vascular anatomy, embolisation of multiple branches is technically challenging with an increased risk of embolising adjoining normal renal parenchyma with potential functional compromise [6, 7, 8].

Conclusion

Embolisation of renal AML is a safe minimally invasive procedure preserving maximum renal parenchyma, with the added advantage of preventing peri-procedural morbidity. We recommend it as first-line treatment for all AML's requiring treatment.

Among possible treatments, super-selective embolization of segmental arteries that supply the lesion is considered as the most effective minimally invasive approach in preventing haemorrhagic events and symptomatic manifestations. This procedure is advisable for AMLs with a diameter >4 cm. The procedure is well tolerated and is associated with minor complications, although it has been associated with frequent relapses as compared with surgical alternatives. However with tumours larger than 8cms with predominant fatty componets, SAE may note be effective and surgical alternatives may need to be considered.

Abbreviations

AML: Amgiomyolipoma
CT: Computed Tomography
MRI: Magnetic Resonance Imaging
SAE: Selective Arterial Embolization
TAE: Transarterial Embolization
PVA: Polyvinyl Alcohol

References

1. Steiner MS, Goldman SM, Fishman EK, Marshall FF. The natural history of renal angiomyolipoma. J Urol,1993:150:1782- 1786.
2. Oesterling JE, Fishman EK, Goldman SM, Marshall FF. The management of renal angiomyolipoma. I Urol,1986:135:1121- 1124.
3. Van Baa! JC, Smits NJ, Keeman JN, Lind- hout D, Verhoef S. The evolution of renal angiomyolipomas in patients with tuberous sclerosis. J Urol,1994:152:35-38.
4. Oesterling JE, Fishman EK, Goldman SM, et al. The management of renal angiomyolipoma. J Urol,1986:135:1121.
5. Fujii Y, Ajima J, Oka K, et al. Benign renal tumors detected among healthy adults by abdominal ultrasonography. Eur Urol,1995:27:124.
6. Hajdu SI, Foote FW Jr. Angiomyolipoma of the kidney: report of 27 cases and review of the literature. J Urol,1969:102:396.
7. Nelson CP CP, Sanda MG. Contemporary diagnosis and management of renal angiomyolipoma. J Urol,2002:168:1315.
8. Ryan JW, Farrelly C, Geoghegan T. What are the indications for prophylactic embolization of renal angiomyolipomas? A review of the current evidence in the literature. Can Assoc Radiol J.,2018:69(3):236–9.
9. Bissler JJ, Kingswood JC, Radzikowska E, et al. Everolimus long-term use in patients with tuberous sclerosis complex: Four-year update of the EXIST-2 study. PLoS ONE.,2017:12(8):1–16.
10. Fernández-Pello S, Hora M, Kuusk T, et al. Management of sporadic renal angiomyolipomas: A systematic review of available evidence to guide recommendations from the European Association of Urology renal cell carcinoma guidelines panel. Eur Urol Oncol.,2020:3(1):57–72.
11. Andersen PE, Thorlund MG, Wennevik GE, Pedersen RL, Lund L. Interventional treatment of renal angiomyolipoma: Immediate results and clinical and radiological follow-up of 4.5 years. Acta Radiol Open.,2015:4(7):205846011559244.
12. Bardin F, Chevallier O, Bertaut A, et al. Selective arterial embolization of symptomatic and asymptomatic renal angiomyolipomas: A retrospective study of safety, outcomes and tumor size reduction. Quant Imaging Med Surg.,2017:7(1):8–23.
13. Wang C, Yang M, Tong X, et al. Transarterial embolization for renal angiomyolipomas: A single centre experience in 79 patients. J Int Med Res.,2017:45(2):706–13.
14. Anis O, Rimon U, Ramon J, et al. Selective arterial embolization for large or symptomatic renal angiomyolipoma: 10 years of follow-up. Urology.,2020:135:82–7.
15. Swärd J, Henrikson O, Lyrdal D, Peeker R, Lundstam S. Renal angiomyolipoma-patient characteristics and treatment with focus on active surveillance. Scand J Urol.,2020:54(2):141–6.
16. Lemaitre L, Robert Y, Dubrulle F, et al. Re- nal angiomyolipoma: growth followed up with CT and/or US. Radiology,1995:197:598-602.
17. Hajdu SI, Foote FW. Angiomyolipoma of the kidney: report of 27 cases and review of the literature. J Urol,1969:102:396-401.
18. Chen SS, Lin AT, Chen KK, et al. Renal angiomyolipoma— experience of 20 years in Taiwan. Eur Urol,1997:32:175–178.
19. Soulen MC, Faykus MH Jr, Shlansky Goldberg RD, et al. Elective embolization for prevention of hemorrhage from renal angiomyolipomas. J Vasc Interv Radiol,1994:5:587–591.
20. Kessler OJ, Gillon G, Neuman M, et al. Management of renal angiomyolipoma: analysis of 15 cases. Eur Urol,1998:33:572–575.

21. Hamlin JA, Smith DC, Taylor FC, et al. Renal angiomyolipomas: long-term follow-up of embolization for acute hemorrhage. Can Assoc Radiol J,1997:48:191–198.
22. Mourikis D, Chatziioannou A, Antoniou A, et al. Selective arterial embolization in the management of symptomatic renal angiomyolipomas. Eur J Radiol,1999:32:153–159.
23. Kennelly MJ, Grossman HB, Cho KJ. Outcome analysis of 42 cases of renal angiomyolipoma. J Urol,1994:152:1988 –1891.
24. Sasaki M, Kawabata M, Asaji A, et al. Long-term effect of transcatheter arterial embolization therapy for renal angiomyolipoma. Nippon Jinzo Gakkai Shi,1996:38:273–277.
25. Park JH, Jeon SC, Kang HS, et al. Transcatheter renal arterial embolization with the mixture of ethanol and iodized oil (Lipiodol). Invest Radiol,1986:21:577–580.
26. Stephenson AJ, Hakimi AA, Snyder ME, Russo P. Complications of radical and partial nephrectomy in a large contemporary cohort. J Urol.,2004:171:130–134.