

Report

Endovascular Coil Occlusion of Right Renal Artery Aneurysm with Embolization of the Right Kidney: A Case Report

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Abstract

Introduction: Renal artery aneurysm is rare and has reported incidence of 0.09% of the general population. The occurrence of a giant renal artery aneurysm from the main renal artery has even been more rarely reported. Endovascular intervention is ideal for the treatment of patients with vascular anomalies of the renal artery especially in cases where surgical morbidity is high. This article reports our experience in the treatment of giant complex renal artery aneurysm by endovascular techniques in a young man with poor performance status. **Case report:** A 25-year-old male with no significant past medical history presented with progressively worsening abdominal pain, generalized body swelling, progressive abdominal distension, low blood pressure and difficulty in breathing. He had poor performance status with suboptimal oxygen saturation probably due to splinting of the diaphragm from the progressive abdominal distension and was immediately transferred to intensive care unit for close monitoring. Ultrasound scan revealed a huge right renal mass with turbulent internal flow paving way for suspicion of a giant renal artery aneurysm. Subsequent CT angiogram confirmed a giant saccular aneurysm emanating from the proximal main right renal artery with evidence of surrounding hematoma signifying recent rupture. There was significant mass effect on adjacent structures including the inferior vena cava which was nearly completely collapsed. Following a multidisciplinary discussion with interventional radiology, he was transferred to a facility equipped with a catheterization laboratory. **Procedure:** Real-time ultrasound was used to gain access into the right radial artery and a 6French sheath placed. A 5 Fr Vertebral curve catheter was advanced successfully from the right radial artery access into the right renal artery over a 0.035 guidewire. Following arteriograms and confirmation of site of aneurysm being the proximal main renal artery, considerations for treatment included stent graft placement or sacrifice of the right renal artery. Due to unavailability of an appropriately sized stent graft, we elected to sacrifice the right renal artery. Through the 5 French catheter, multiple 0.035 detachable and nondetectable coils were deployed proximal to the aneurysm sac and distal to the aneurysm sac to completely occlude the right renal artery. Post embolization arteriogram showed complete exclusion of flow within the aneurysm sac. **Conclusion:** Endovascular embolization as a minimal invasive technique is an ideal treatment option for the treatment of giant complex renal artery aneurysms especially in patients in a poor clinical state.

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Keywords

Renal Artery, Aneurysms, Embolization, Interventional Radiology, Arteriogram

1. Introduction

Renal artery aneurysm (RAA) refers to dilatation of segment of renal artery with diameter more than twice the diameter of a normal renal artery. [1] Renal artery aneurysm is rare with a reported incidence ranging between 0.01%- 0.09% on autopsy series. [2] RAA represents 22%–25% of intraabdominal arterial aneurysms with incidence ranging between 0.3%–2.5% on radiological studies and 0.7% incidentally discovered on computed tomography scan. [3-6] True RAA is characterized by localized dilatation of renal arterial wall involving all the three layers. Predisposing factors includes atherosclerosis, fibromuscular dysplasia and vasculitis including Takayasu disease or Marfan syndrome [7]. Asymptomatic RAAs appears benign but has the potential for serious complications including rupture, fistula formation requiring elective repair. Symptomatic RAAs may result to hematuria, renal infarction, pain and secondary hypertension. [8]

Intervention is indicated in symptomatic RAA. RAA in a female who is pregnant or is contemplating pregnancy, diameter greater than 2 cm, pain, hematuria, hypertension enlarging or ruptured RAA and RAA associated with acute dissection. [9] Currently, there is no consensus regarding the size at which an asymptomatic RAA should be repaired though asymptomatic RAAs less than 2cm are managed conservatively. [10] Asymptomatic RAA less than 2cm in diameter are managed conservatively except for RAA in females who are pregnant or planning to get pregnancy because they have increased risk of rupture due to pregnancy. [11]

Confirmation of diagnosis involves the use of gadolinium-enhanced magnetic resonance angiography (MRA) or computed tomography angiography (CTA) with three-dimensional (3D) reconstruction. Patients on conservative management are followed up with ultrasonography or CT. Spontaneous cure by thrombosis of small aneurysms has also been reported.

Treatment modalities for symptomatic RAAs includes surgical and endovascular therapy. Surgical therapy includes tangential excision with primary repair or patch angioplasty, aneurysm excision with reconstruction using bypass, extracorporeal vascular reconstruction with auto transplantation [13] nephrectomy and minimal invasive surgery including Laparoscopic RAA repair with robotic assistance. [14, 15]

Current trend involves the use of endovascular approaches because of their low morbidity, minimal invasiveness and shorter hospital stay [16, 17]. Endovascular therapies includes coil embolization, liquid/onyx embolization, and stent graft-

ing. Endovascular treatment choice depends on the anatomical characteristics of the aneurysm and the surgeon's experience. The aim is to occlude blood flow into the aneurysm sac thus preventing growth and rupture without affecting normal blood flow to the renal parenchyma. Different techniques with coil embolization, stent grafts, and onyx embolization have been reported although the outcome data following endovascular treatment still remains limited to case series. [9, 16, 18] This article reports our experience in the treatment of giant complex renal artery aneurysms by interventional endovascular techniques in a young man with poor performance status.

2. Case Report

A 25-year-old male with no significant past medical history developed abdominal pain, generalized body swelling, low blood pressure and difficulty in breathing a few weeks prior and presented to a health facility in Kebbi state Nigeria at which time it was thought that he had acute appendicitis and taken to surgery. Two days post appendectomy, he developed significant bleeding from appendectomy wound site for which he had emergency exploratory laparotomy in the same facility.

At the time of exploratory laparotomy, a huge mass in the area of right kidney was discovered and he was referred to Federal Medical Center Abuja (FMCA). He had poor performance status on presentation with suboptimal oxygen saturation probably due to splinting of the diaphragm from the progressive abdominal distension and was immediately transferred to intensive care unit for close monitoring. At FMCA repeat ultrasound scan revealed a turbulent flow within the mass with suspicion of a large renal artery aneurysm for which he was sent for CT angiogram for confirmation. CT angiogram revealed a huge aneurysm emanating from the proximal aspect of the right renal artery with essential leak from the proximal superior aspect of this vessel into and aneurysm sac in the superior pole of the right kidney which measures approximately 13 x 11cm. There was evidence of leakage with hemorrhage around the aneurysm sac with a combination of the hemorrhage and aneurysm sac causing significant mass effect on adjacent structures particularly the inferior vena cava which was nearly completely collapsed. Just distal to the renal vein confluence, there was complete thrombosis of the visual-

ized inferior vena cava and bilateral common iliac veins. There was moderate size bilateral pleural effusion with associated basilar consolidation.

Based on the above findings, the patient was transferred to a facility equipped with a Cath lab. At the Interventional Suite the patient received directed moderate conscious IV sedation.

Under fluoroscopic guidance, a micro-puncture needle was introduced into the right common femoral artery. Over a guidewire an 8french vascular sheath was exchanged for the needle as shown in [figure 1](#).



Figure 1. Introduction of guidewire via the right femoral artery under fluoroscopic guidance.



Figure 2. Arteriogram of the right renal artery.

A 5french cobra catheter was then advanced over a guidewire and multiple unsuccessful attempts made to select the right renal artery. At this time, a reverse curve sos catheter was advanced and again we were not able to select the renal

artery. A 65cm cobra catheter was then advanced and at this time, successful cannulation of the right renal artery was achieved. Arteriogram of the right renal artery was then performed as shown in [figure 2](#).

Following this arteriogram, attempts to advance a 0.035 system into the right renal artery, however was unsuccessful due to the downward projection of the renal artery as a result of the pathology. At this time, a maestro microcatheter and 0.018 guidewire was advanced and successful cannulation of the distal right renal artery was achieved. Arteriogram was then performed but that did not give us a stable access to either coil or placement of a stent graft.

At this time, real-time ultrasound was used to gain access into the right radial artery and a micro-puncture set was advanced. A 6french sheath was then placed over a 0.035 guidewire and advanced successfully from the right radial artery access into the right renal artery. 100cm vert curve catheter was then advanced into the right renal artery and arteriogram performed as shown in [figure 3](#).



Figure 3. Cannulation of right radial artery.

Due to the short length of this catheter in 125cm mpa catheter was exchanged over a wire and successful cannulation of the distal right renal artery achieved. Following arteriogram, the decision was made at this time to advance a stent graft into the right renal artery to cover the aneurysm sac. A 7mm x 38mm icaast stent graft was then advanced over the wire to the ostium of the right renal artery. Despite having stable access with amplatiz wire, we were not able to track this stent graft into the right renal artery successfully. Decision was made at this time to remove this stent graft. The retraction of the stent graft through the radial artery re-

sulted to inadvertent deployment of the stent graft in the distal right radial artery. There was however maintained distal right radial artery pulse and post through the region of stent graft. Ultrasound also demonstrated patency of the right radial artery with a stent graft opening up this vessel. At this time, attention was turned again to the right renal artery and through a 5french catheter, multiple 0.035 detachable and non-detectable coils were deployed proximal to the aneurysm sac and distal to the aneurysm sac to completely occlude the right renal artery. Post embolization arteriogram was then performed as shown in [figure 4](#).

Attention was then turned to the right internal jugular vein. A five French sheath was placed through the previous access of the central catheter and an angled catheter wire used to gain access into the inferior vena cava and renal vein. Venogram of the inferior vena cava was performed at this time. Following venogram, the decision was made not to place an IVC filter as the risks are highly outweigh the benefits in this case, see [figure 5](#). At this time, fluoroscopy did reveal there was a coiled extending through the renal artery into the aorta. A snare was then advanced through the femoral artery access and used to capture the coils successfully and retrieved. The sheath in the right radial access and femoral arteries were then removed and hemostasis achieved with manual pressure.

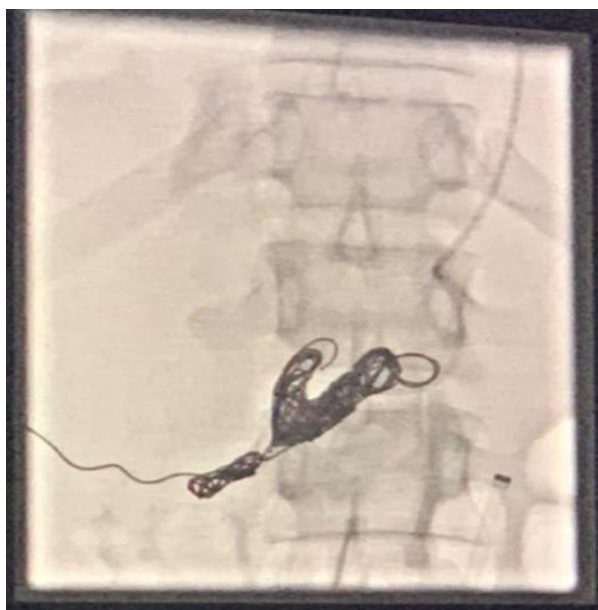


Figure 4. Coils deployed proximal and distal to the aneurysm sac to completely occluded the right renal artery.

Following embolization, there was complete exclusion of flow within the aneurysm sac. This was also confirmed on ultrasound with clot seen within the aneurysm sac. Venogram also demonstrates occlusion of the distal inferior vena cava with patency of the right renal vein. There was severe mass effect on the suprarenal inferior vena cava. See [figure 6](#).



Figure 5. Venogram following deployment of coil occlusion.

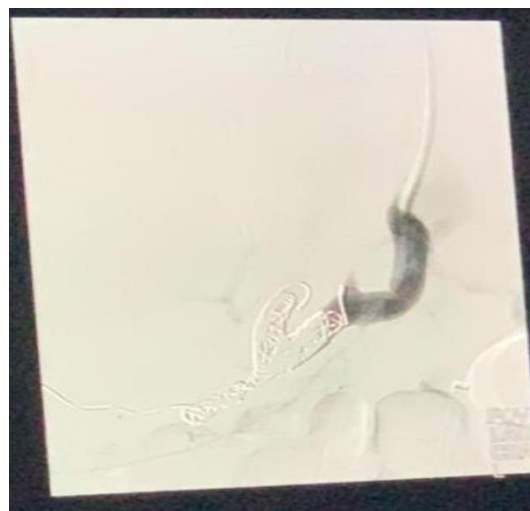


Figure 6. Venogram also demonstrates occlusion of the distal inferior vena cava with patency of the right renal vein.

We are also mindful of symptoms from embolization of the right kidney including persistent pain and thrombosis in the near future with persistent bilateral lower extremity edema. However, he was commenced on opioids and anticoagulation with close monitoring. IV heparin as short-term and later transitioned to Xarelto. We plan to assess his lower extremity swelling and symptoms in the next few months and if there is significant lower extremity swelling and persistently ilioacaval thrombosis, he may benefit from the services of vascular surgeons via endovascular ilioacaval reconstruction.

Patient was discharged after 2 weeks to continue follow up as outpatient. He has done remarkably well evidenced by resolution of all symptoms. He resumed his normal activities three months later and subsequent follow up has been uneventful. He got married 2 years after surgery and is currently living his normal life with not deterioration.

3. Discussion

Renal artery aneurysm (RAA) is a rare condition defined as dilated segment of renal artery with a diameter that is more than twice the diameter of a normal renal artery. Renal artery aneurysm has a reported incidence ranging between 0.01%-0.09% on autopsy. [1, 21] Our patient was misdiagnosed initially probably because the physician that treated him earlier had not seen any case of RAA and obviously did not consider RAA as a differential because of its rarity. We were able to diagnosed RAA on careful and multi-disciplinary review of the CT angiography by the urological surgeon and the interventional radiologist.

Endovascular treatment is an effective and safe method with high success rates and low morbidity in the treatment of RAAs and may be superior to surgery as the primary therapy for RAA [3, 9, 17]. Our patient had a poor performance status and unlikely to withstand general anesthesia. Endovascular intervention offered him a viable option and precluded to need for anesthetic challenges that would have being inevitable for this index case. Our current experience emphasizes on the invaluable role of minimal access surgery as gold standard for many surgical interventions.

Currently treatment strategies of RAAs favor endovascular approaches because of their high technical and clinical success rates, minimal invasiveness and shorter hospital stay. [16, 18] Although no intervention is without significant complications, our procedure was significantly uneventful, however he was kept longer on admission because of proximity as he resides outside the city. He had flank pain post -op which was envisaged and was treated with analgesics only with progressive improvement. The general body swelling regressed over time and before discharged we were satisfied with clinical improvement and then referred him to a urological surgeon that resides in the same city with him for close monitoring before his next clinic visit in our center.

Many authors had reported that most clinician will likely encounter RAAs as an incidental finding or while investigating for other diseases using magnetic resonance imaging and computed tomography angiography. [19] Dzsinić C et al reported that the paucity of clinical outlook and controversy continue to surround the surgical decision of RAA especially the size of RAA that should require surgical intervention. [22] Our patient had suspicious features that should give away the diagnosis of RAA but was initially missed. We feel that the initial clinician was not mindful to rule out RAA because it is a rare disease in our environment with paucity of report on RAA in tropical Africa. Higher imaging studies with CT angiography was classical in our patient and this was later confirmed with repeat urologic scan which showed turbulent flow within the aneurysmal sac precluding a solid mass as previously suggested by CT scan.

Henriksson C et al reported that autopsy in significant number of patients did not show rupture of any renal artery aneurysm implying that in a considerable number of patients

the disorder was uncomplicated and compatible with a long life. [5] Our experience was at variance with the findings of Henriksson C et al. Our patient had a poor performance status and we were worried that he may not withstand another general anesthesia which made endovascular minimally invasive intervention under sedation the most viable option. Secondly, our index patient presented with a life threatening huge RAA with significant morbidity which would have been fatal if we did not surgically intervene. The case series reported by Henriksson C et al must have been in patients with small RAA probably discovered incidentally compared to our index case who had a giant RAA with imminent rupture and consequent mortality if managed otherwise.

Sedat J et al in their case series noted that complications of the embolization of renal aneurysms are rare and endovascular treatment should therefore be considered at first for the treatment of renal aneurysms. [7] The index patient had no significant complication and recovery was progressive and satisfactory evidenced by regression of low limb edema and abdominal swelling, stable vital signs and clinical condition. We must also acknowledge that the index patient had severe postoperative with a pain scale of 7/10. This was not unexpected and was managed with opioid analgesics. Down L. A et al reported that for some patients, the RAA is directly related to their hypertension, possibly through a hemodynamic effect on hormonal blood pressure control. He further adduced that the high pressure inside an aneurysm may cause the arterial wall to deform and constrict the artery, creating a "pseudostenosis". [8] The index patient never had hypertension and the cause of the RAA was largely unknown as there was no identifiable risk factor. He is a young boy with no comorbid condition.

Chung R et al noted in their experience that the use of Onyx in RAA is primarily limited to individual case reports with good success rate. [9] We used multiple 0.035 detachable and non-detectable coils which were deployed proximal and distal to the aneurysm sac to completely occlude the right renal artery when the use of stent graft failed.

Shigehiro Karashima et al reported a case artery fenestration as a congenital vascular malformation causing RAA in a 58 year old patient with hypertension which was confirmed with an enhanced 3-dimensional computed tomography scan showing a 19-mm renal artery aneurysm in a branch of the left renal artery. [10] Renal arteriography showed a fenestration in the aneurysm-forming branch. Coincidentally their patient did well with coil embolization on the central side of the artery forming the aneurysm and fenestration after which all symptoms resolved. Our patient also did well with coil embolization of the huge RAA with resolution of all symptoms. This further emphasizes on the importance of minimal access endovascular coil occlusion and embolization of RAA as an invaluable option and viable alternation to other forms of minimal access endovascular interventions for RAA.

Augustin G et al reported that ruptured renal artery aneurysm should be a differential diagnosis for pregnant or peri-

partum patients with acute and severe flank pain, especially if followed by a drop in blood pressure. [11] The index case presented with similar features and urologic scan confirming turbulent flow within the aneurysmal sac was typical revealing and precludes solid mass earlier reported by conventional CT scan. CT angiography confirmed RAA and we intervened promptly with good outcome. This further emphasizes on the need to consider RAA in patient with severe flank pain, abdominal swelling, sudden drop in blood pressure, progressive lower limb edema and ensure confirmatory radiological investigations before prompt intervention. Surgical intervention for renal artery aneurysms can be achieved with good results and should be indicated for patients with aneurysms greater than 2 cm, aneurysms secondary to renovascular hypertension, significant stenosis, flank pain, hematuria, dissecting, expanding and thrombotic aneurysms and in females expecting pregnancy. [12] Our patient met the indications listed above and surgical intervention was inevitable to avert imminent and obvious mortality. We had fears the index patient may not withstanding another general anesthesia and we were able to perform endovascular coil occlusion of the RAA promptly using sedation with close monitoring in our cath lab. Some authors had reported robotic approach in the management of RAAs as a feasible and safe option that should be considered to open surgical repair when endovascular technique cannot be an option [14, 15]. We do not have facilities and man power for robotic approach and considering the poor performance status of the index patient endovascular intervention offered him a viable alternative.

Renal artery aneurysms are rare but are more often associated with congenital disorders. [13] A complex hilar RAAs is challenging for the vascular surgeon because of their anatomic location as well as when it occurs in a solitary kidney [13]. Our patient was a young man with a high probability that his case may be congenital as it involved the hilar part of renal artery. We did not probe to rule out complex renal vascular anatomy because the patient clinical condition was poor and we were focused on prompt intervention to save his life. Secondly, the aneurysm was quite a huge one occupying the entire hilar region with pressure effect on the surrounding structures including the inferior vena cava which may assessment of unusual anatomy difficult. Since there is no other identifiable risk of RAA in our index patient, we cannot completely rule out congenital etiology.

Etezadi V et al reported that endovascular treatment of RAAs is associated with side effects such as distal embolization and end-organ infarcts which are not clinically significant. [16] In the index case we also performed complete embolization of the right kidney because he had challenges isolating the feeding vessel. We were mindful that the complete occlusion of the right kidney will invariably lead to infarction of the kidney hence the reason we had significant postoperative pain which was successfully managed with opioids. Embolization of the right kidney did not result to any isolated morbidity hence we completely agree with Etezadi V et al.

Surgical procedure for RAAs in properly selected individual provides excellent long-term clinical outcomes. [20] The short and long term outcome in the index patient was satisfactory. We observed exponential improvement evidenced by progressive resolution of both the presenting symptom and postoperative pain with no deterioration.

4. Conclusion

There are emerging prospects in the evaluation and management of renal artery aneurysm. Coil occlusion of renal artery aneurysm and renal artery embolization as a minimal invasive technique remains an effective treatment option for giant complex renal artery aneurysm in patients with poor performance status.

Abbreviations

RAAs	Renal Artery Aneurysms
MRA	Magnetic Resonance Angiography
CT	Computed Tomography

Conflicts of Interest

The authors declare no conflicts of interest.

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