Section: Radiodiagnosis

Case Series

ENDOVASCULAR EMBOLIZATION AS THE KEYSTONE THERAPEUTIC STRATEGY IN MANAGEMENT OF RENAL ARTERY PSEUDOANEURYSMS AND AV-FISTULA: A CASE SERIES

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Abstract

Renal vascular anomalies, encompassing pseudoaneurysm and arteriovenous fistula, emerge infrequently but significantly following renal trauma or procedural interventions. This study outlines three post-renal biopsy pseudoaneurysms and a singular renal arteriovenous fistula arising from minor trauma. Pseudoaneurysms, often sub clinically presented, entail a latent risk of sudden hemorrhage, necessitating meticulous diagnostic scrutiny for precise radiological intervention. Arteriovenous fistulas, whether congenital or acquired, manifest with a nuanced clinical spectrum. Diagnostic precision is enhanced through computed tomography angiography, offering intricate visualization of vascular dynamics. The keystone of therapeutic strategy lies in selective endovascular angioembolization, notable for efficacy with success rates exceeding 90%. This underscores radiological prowess in orchestrating comprehensive management of renal vascular intricacies, ensuring favorable patient outcomes.

INTRODUCTION

Renal vascular anomalies, exemplified by pseudoaneurysm and arteriovenous fistula, constitute infrequent complications arising in the aftermath of renal trauma or procedural interventions, including but not limited to renal biopsy, percutaneous nephrostomy and surgical nephrolithotomy.[1]

In this investigation, we delineate three instances of pseudoaneurysm stemming from post-renal biopsy and one case of renal arteriovenous fistula arising from minor trauma.

CASE 1

A 66-year-old male, post right percutaneous nephrolithotomy (PCNL), presented with hematuria and urinary retention. Contrast-enhanced computed tomography (CT) [Figure 1] revealed a well-defined, rounded, intensely enhancing lesion arising from the interlobar branch of the inferior segmental artery within the lower pole of the right kidney, proximal to the post-intervention site, indicative of a pseudoaneurysm. Subsequent digital subtraction angiography (DSA) [Figure 2] confirmed the presence of a right renal inferior segmental artery arteriovenous (AV) fistula and pseudoaneurysm. Employing right femoral artery access, SIM catheter, and microcatheter, two coils were successfully deployed for embolization, addressing the identified vascular abnormalities. The patient was discharged successfully with no active complaints, signifying the efficacy of the radiologically-guided intervention in achieving resolution of symptoms and optimal post-procedural recovery.

CASE 2

A 36-year-old male, post bilateral percutaneous nephrolithotomy (PCNL) and DJ stent insertion, presented with a persistent 15-day history of hematuria. Serial monitoring revealed a gradual decline in hemoglobin levels, prompting a diagnosis of anemia through laboratory investigations. Contrast-enhanced computed tomography (CECT) [Figure 3] demonstrated a well-defined saccular

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outpouching in the lower pole of the left kidney, manifesting intense contrast opacification during the arterial phase. Notably, there was no progressive increase in enhancement or evidence of contrast extravasation. Subsequent digital subtraction angiography (DSA) [Figure 4] via right common femoral artery (CFA) access, utilizing a 5F sheath and left renal artery cannulation, unveiled a pseudoaneurysm in the left lower segmental artery branch. Successful embolization with a combination of coils and gel foam was accomplished, achieving a cutoff of the pseudoaneurysm from circulation on the check run. The patientwas discharged in a hemodynamically stable condition following the interventional procedure.

CASE 3:

In the case of a 37-year-old male with a history of right-sided double-J (DJ) stenting for renal calculi presenting with right loin pain and hematuria, contrast-enhanced CT [Figure – 5] delineated a 6.4 x 3.8 mm intensely enhancing nodular focus during the arterial phase, emerging from the posterior segmental branch in the interpolar region of the right kidney, indicative of a pseudoaneurysm. Furthermore, a well-defined non-enhancing hyperdense area measuring 2x1.5 cm was observed in the interpolar region of the right renal pelvis, suggestive of a hematoma. Mild renal enlargement with heterogeneous parenchymal enhancement, attributed to post-DJ stenting procedural edematous changes, was noted. Following the contrast-enhanced CT, digital subtraction angiography (DSA) [Figure - 6] was pursued, revealing the pseudoaneurysm in the posterior segmental branch. Intervention involved right common femoral artery access using a 6 French (F) sheath, with subsequent microcatheter-guided cannulation of segmental branches, specifically targeting the posterior segmental artery. Embolization with a combination of glue and Lipiodol (25%) successfully achieved hemostasis, leading to the cessation of the pseudoaneurysm's circulation, as confirmed by a subsequent check run displaying restored flow in the remaining branches. Post-intervention, the patient was discharged without active complaints, emphasizing the efficacy of interventional radiology in managing post-DJ stenting complications. Regular follow-up was recommended to monitor recovery and detect any potential complications, ensuring the patient's sustained clinical well-being.

CASE 4

A 46-year-old male, with a convoluted medical history involving a road traffic accident eight years prior, presented with a compelling clinical scenario. His recent complaints included a one-week history of insidious-onset, intermittent left flank pain, partially alleviated with medication. The diagnostic journey unfolded through meticulous examinations, employing both Ultrasound and Contrast-Enhanced Computed Tomography (CECT) [Figure 7], revealing an enlarged left kidney hosting a heterogeneous lesion in the lower pole, along with grossly dilated intra-renal vessels and a sizable clot. CECT further delineated a formidable picture—a bulky left kidney featuring a well-defined, hyperdense oval structure exhibiting heterogeneous post-contrast enhancement with areas suggestive of thrombus. This intricate tapestry hinted at the presence of an arteriovenous (AV) fistula in the interpolar region, coupled with a substantial, partially thrombosed pseudoaneurysm—presumably post-traumatic in nature. Despite the judicious advice for Digital Subtraction Angiography (DSA) and the subsequent recommended treatment plan, the patient, regrettably, did not proceed with the proposed investigations or interventions. Owing to unanticipated conditions, the patient was regrettably lost to follow-up.

Figure 1: Coronal section of CECT abdomen showing Pseudoaneurysm (yellow ring) in the lower pole of the right kidney, arising from the interlobar branch of the inferior segmental artery, adjacent to the post-intervention site

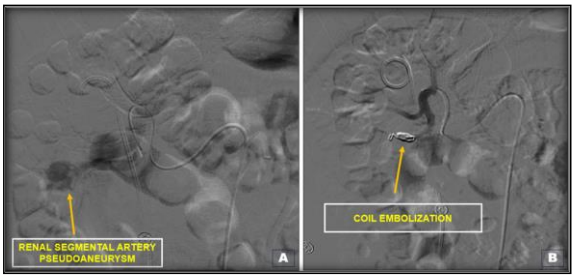

Figure 2: (A) Pre embolization DSA - Pseudoaneurysm in the lower pole of the kidney, arising from the interlobar branch of the inferior segmental artery. (B) Post embolization DSA – Post embolization angiographic images reveal no filling of the pseudoaneurysm following the placement of coils.

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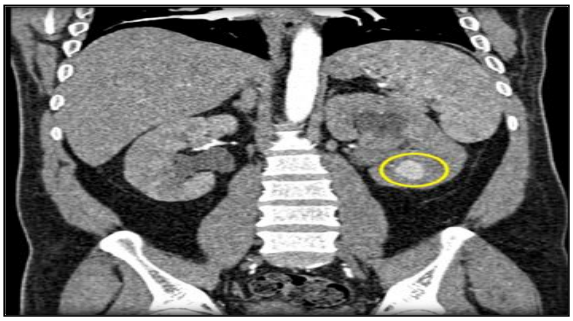

Figure 3: Coronal section of CECT abdomen showing saccular out pouching in the lower pole of the left kidney, displaying marked contrast opacification in the arterial phase suggestive of pseudoaneurysm

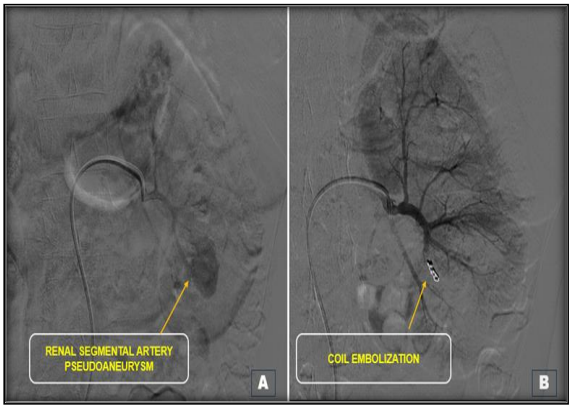

Figure 4: (A)- Pre embolization DSA: Pseudoaneurysm of left lower segmental artery branch. (B)Post embolization DSA: Post embolization angiographic images reveal no filling of the pseudoaneurysm following the placement of coils.

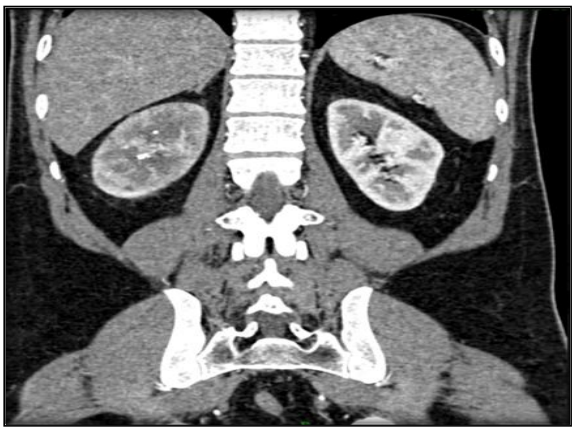

Figure 5: Nodular focus noted in coronal section of CECT abdomen, measuring 6.4 x 3.8 mm, displaying pronounced enhancement during the arterial phase, is visualized emanating from the posterior segmental branch in the interpolar region of the right kidney, indicative of a pseudoaneurysm

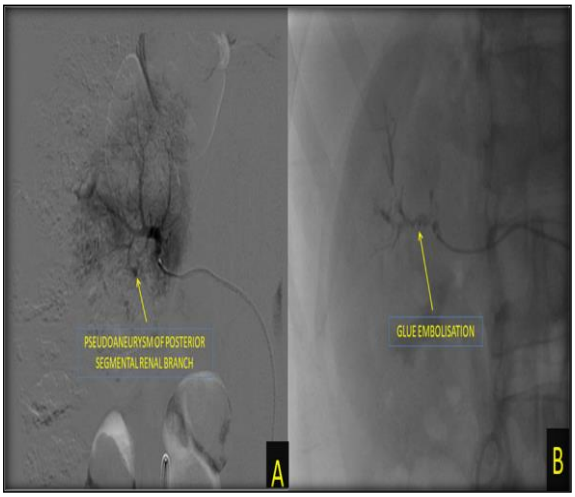

Figure 6: (A) - Digital Subtraction Angiography (DSA) was undertaken, uncovering the presence of the pseudoaneurysm within the posterior segmental branch of renal artery. (B) - Post-embolization angiogram reveals a well-defined glue cast without any residual pseudoaneurysm, indicating successful and complete occlusion of the aneurysmal sac.

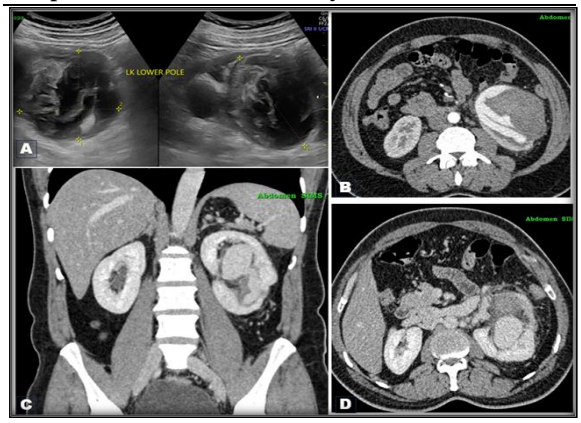

Figure 7: (A) Ultrasonographic image depicting large heterogeneously hypoechoic lesion in the lower pole of left kidney. (B, D)- Axial section & (C) – Coronal section of CECT abdomen showing large pseudoaneurysm with arteriovenous fistula near the interpolar region of left kidney with partial thrombus in pseudoaneurysm and dilated left renal vein

DISCUSSION

A renal pseudoaneurysm is defined as a localized hematoma within the renal parenchyma or the perinephric region, encapsulated by the adventitia of the vessel or renal parenchyma. These pseudoaneurysms typically demonstrate continuity with the arterial lumen. The clinical differentiation from true aneurysms holds significance, as pseudoaneurysms pose the risk of abrupt and substantial hemorrhage. This distinction is crucial for appropriate medical management and intervention.[2]

These pseudoaneurysms often remain asymptomatic, although they may manifest with symptoms such as hematuria, flank pain, and a sudden decline in hematocrit in instances of rupture into the renal collecting system.[3]

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An arteriovenous fistula (AVF) is an anomalous connection between the arterial and venous circulations, lacking an intervening capillary bed. These fistulas may arise either congenitally or as a result of acquired conditions.[1]

Acquired arteriovenous fistula (AVF) is more commonly encountered than its congenital counterpart and is often a consequence of surgical interventions, percutaneous biopsy, penetrating trauma, inflammatory processes, or malignancies. The potential complications associated with acquired AVFs encompass thrombosis, infection, aneurysm development, ischemic steal syndrome, and venous hypertension. The clinical presentation of AVFs is diverse, contingent upon their specific location and size. Patients typically exhibit symptoms such as flank pain and hematuria, although a significant proportion may display only one of these manifestations. The recognition of these varied clinical presentations is crucial for accurate diagnosis and appropriate management.[4-6]

Timely identification and intervention are crucial in managing pseudoaneurysms and arteriovenous fistulas. Computed tomography angiography (CTA) has been a primary tool for diagnosing these conditions. While ultrasonography can be employed for diagnosis, it offers comparatively less detailed information and may result in false-negative outcomes.[2]

Selective endovascular angioembolization stands as the principal treatment modality for pseudoaneurysms, with surgery reserved for cases where persistent bleeding persists despite minimally invasive interventions.[2]

In contrast to the potential risks associated with surgical exploration, endovascular embolization emerges as a safer, more straightforward, and cost-effective option.[3]

Angioembolization has consistently exhibited success rates surpassing 90% in various studies.[2]

The achievement of selective embolization of renal artery branches involves the utilization of microcatheters inserted coaxially over a guidewire. The selection of embolization material is contingent upon the patient's vascular anatomy and the specific clinical indication or pathological process requiring the procedure. Resorbable materials, coils, inert particles, and sclerosants (liquids) are viable options, chosen based on the clinical indication and the vascular structure targeted for occlusion. The overarching objective is to occlude the branch displaying hemorrhagic extravasation while preserving surrounding branches to minimize parenchymal damage.[3,7,8]

CONCLUSION

Renal artery pseudoaneurysm and arteriovenous fistula represent infrequent yet potentially life-threatening complications that can arise following renal trauma or medical procedures. The pivotal role of the radiologist comes to the forefront, not only in the diagnostic phase utilizing CT angiography but also in the subsequent management through minimally invasive angioembolization. This approach characterized by its commendable success rates and reduced complications, underscores the crucial involvement of radiological intervention in ensuring optimal patient outcomes.

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