



## IMAGING OF ANASTOMOTIC PSEUDOANEURYSM IN RENAL ALLOGRAFT : OUR CENTRE EXPERIENCE

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### ABSTRACT

**INTRODUCTION:** Renal arterial pseudoaneurysm is a rare complication of renal transplantation that often causes a graft loss. The existence of very small series of patients with anastomotic pseudoaneurysm after renal transplantation and isolated case reports published in current literature indicates it is rare. Controversies persist in eliciting the etiology, occurrence, indications for repair, treatment options and prognosis. Imaging plays a major role and so that inspire us to present our experience with pseudoaneurysm after renal transplant.

**AIM:** To determine the incidence of anastomotic pseudoaneurysm in renal allograft in our centre and to discuss role of different imaging modalities in detection of aneurysms and treatment options.

**MATERIAL AND METHOD:** This is retrospective observational study. The data were retrieved prospectively from imaging reports. Academic council permission was taken to review the data. Between June 2010 to June 2018, total 2720 renal transplantation were performed in our institute. Out of these, 513 were deceased donor transplantation and 2207 were live related transplantation. All patients underwent color and duplex Doppler ultrasound examination on the 1st postoperative day, then as and when needed clinically or biochemically. CT angiography was performed in all cases for detailed evaluation.

**RESULTS:** We found 6 renal transplant recipients with anastomotic pseudoaneurysm; out of these 4 were live related transplantation (0.22%) 1 was cadaveric transplantation (0.34%) and 1 was autotransplantation. Incidence of graft loss in our study was 83 % and mortality rate was 16.6%

**CONCLUSION:** Though rare, the development of an extra renal pseudoaneurysm at anastomosis of transplant renal artery can carry a potentially devastating loss of allograft. Early diagnosis and timely management is the most important factors in the survival of patients.

**KEYWORDS :** Pseudoaneurysm, anastomosis, allograft, nephrectomy

### INTRODUCTION:

Renal arterial pseudoaneurysm is a rare complication of renal transplantation that often causes a graft loss. Approximately 10% of patients undergoing renal transplantation may suffer a medical, urological or vascular complication.[1] The existence of very small series of patients with pseudoaneurysm after renal transplantation and isolated case reports published in current literature indicates it is rare. Controversy persist in eliciting the etiology, occurrence, indications for repair, treatment options and prognosis. Imaging plays a major role and so that inspire us to present our modest experience with pseudoaneurysm after renal transplant.

### AIM:

To determine the incidence of anastomotic pseudoaneurysm in renal allograft in our centre and to discuss role of different imaging modalities in detection of aneurysms and treatment options.

### MATERIAL AND METHOD:

This is retrospective observational study. The data were retrieved prospectively from imaging reports. Academic council permission was taken to review the data. Between June 2010 to June 2018, total 2720 renal transplantation were performed in our institute. Out of these, 513 were deceased donor transplantation and 2207 were live related transplantation. Renal transplant vessels were anastomosed in end to side fashion to external iliac vessels of recipient in virtually all patients.

All patients underwent color and duplex Doppler ultrasound examination on the 1st postoperative day, then always in condition of decreased or absent urine output, graft dysfunction and other symptoms like pain or swelling at local site. Colour Doppler was performed on Accuson 500 from Siemens or Cx50 machine from Philips. Multislice CT scan with CT angiography was performed on Somatom sensation 64 CT scan for detailed evaluation. Post biopsy complications are excluded from the study.

### RESULTS

We found 6 renal transplant recipients with anastomotic

pseudoaneurysm; out of these 4 were live related transplantation(0.22%) 1 was cadaveric transplantation(0.34%) and 1 was autotransplantation. The age of patients ranged from 13 years to 43 years. Male to female ratio is 5:1. One patient was pediatric.

Out of 6 patients, one patient had also right external iliac artery thrombosis along with pseudoaneurysm and one patient developed left external iliac artery stenosis after transplant nephrectomy. Clinical features, size of pseudoaneurysm and treatment offered were mentioned in [Table 1]. Four patients underwent transplant nephrectomy, because they had symptomatic nature and size of pseudoaneurysm was more than 3 cm. One patient underwent transplant nephrectomy with thrombectomy from external iliac artery and ligation of pseudoaneurysm. One patient underwent the covered stenting of graft renal artery to bypass the pseudoaneurysm which was failed and pseudoaneurysm reappear after 25 days post operatively and subsequently renal graft failure was observed. Due to small size and asymptomatic nature one patient was managed conservatively. In our experience transplant kidney patients with anastomotic pseudoaneurysm showed a high morbidity rate with a high percentage of losing transplant organ. Incidence of graft loss in our study was 83 %. Mortality rate in our study was 16.6%.

**Table 1 : Clinical data of patients with pseudoaneurysm following transplantation**

No.	Age/Sex	Size of pseudoaneurysm	Clinical presentation	Treatment	Graft loss	outcome
1	39 Y M	22x13mm	Asymptomatic	conservative	no	Normally functionally graft
2	43 Y M	46x40mm	Pain, heaviness in LIF, hypotension	Auto transplant nephrectomy	yes	Normally functionally contralateral kidney

3	38Y M	21x15mm	Asymptomatic	Treated with balloon expandable covered stent insertion	yes	Contralateral second transplantation
4	39Y M	32x30mm	pain, fever, hypotension and tender mass in RIF	Graft nephrectomy with drainage of frank pus	yes	Patient loss
5	27Y M	30x27mm	Pain and swelling of right lower limb	Graft nephrectomy	yes	On Maintenance Hemodialysis
6	13Y F	45x31mm	Local site pain and swelling	Graft nephrectomy	yes	On Maintenance Hemodialysis

### DISCUSSION :

Renal Transplantation is the treatment of choice for patients with end-stage kidney disease. Vascular complications represent an important cause of morbidity and mortality after renal transplantation. Different studies have shown a range of 3 to 15% occurrence [2,3]. They include transplant renal artery stenosis, transplant renal artery thrombosis, transplant renal vein thrombosis, hematomas, extra-renal false aneurysms and biopsy-induced arteriovenous fistulas and intra-renal false aneurysms.

Extra-renal pseudo aneurysms are rare vascular complications accounting for less than 1%, but are potentially devastating and can lead to allograft loss due to the risk of rupture [2,4,5]. It may affect the anastomotic site between iliac and renal arteries and their etiology is attributable to various factors like poor surgical technique, perivascular infection, defective suture technique, suture rupture, anastomotic leakage, vessel wall ischemia and arterial dehiscence caused by local infection [6,7]. No experimental or clinical data to suggest an immunological cause for extra renal pseudo aneurysm in transplant patients, while there are few reported cases of intra renal small pseudo aneurysm in association with immunologic factors such as acute or chronic rejection [8]. Extra renal pseudo aneurysms mostly occur in the early weeks after transplantation and are rarely observed as a late complication [9].

In our case series, two patient developed pseudoaneurysm in early weeks (9 & 23 days) and four patients developed in later weeks (45, 57 days, 75 days and 6 months later) Most late pseudoaneurysms are the consequence of mycotic infection; other causes are suture rupture, anastomotic leakage, or vessels wall ischemia [10]. Histopathology of our four operated pseudoaneurysm cases neither showed infective etiology nor immune injury.

Patients with pseudoaneurysm after their renal transplant are usually asymptomatic and they are diagnosed incidentally. Few are reported to present with fever anemia of unknown origin, compression of adjacent structures in iliac fossa, discomfort, renal dysfunction or deterioration of renal graft function, signs of ischemia, thrombosis in the ipsilateral limb, abdominal pain, graft loss and lethal hemorrhage due to acute rupture [11].

Physical examination should identify any existing tenderness, pulsatile masses, thrill or bruit. There is no documented existing size for developing symptoms. One can expect that the size of the false aneurysm is a direct factor to predict risk of rupture as well as other factors such as the rate of expansion or growth, the presence of active blood flow in the false aneurysm, weakness of the wall and existence of trauma, or radial force on the lesion. From the review of literature, there is no identified diameter to predict the risk of rupture of these rare lesions [12].

Occurrence of vascular complication are more frequent in recipients of deceased donor renal transplantation as compared to recipients of living donor renal transplantations and more frequent with renal allograft with multiple renal blood vessels (more than one artery or one vein) compared to allograft with a single artery and vein [13]. Our all renal transplantation patients had one renal artery and one renal vein. In our case series, only one patient had deceased donor transplantation while others are living related transplantation

Multiple imaging modalities have been used to identify pseudo aneurysms of transplanted renal artery. Ultrasonography is routinely used; a pseudoaneurysm can be easily detected. On B mode ultrasound pseudo aneurysm appears as a simple or complex cyst adjacent to supplying artery. Concentric layers of hematoma are occasionally seen within the pseudoaneurysm. Color Doppler shows intracystic blood flow. Colour doppler allows a differential diagnosis from hematoma, urinoma and lymphocele.

Characteristic "yin-yang" sign (typical swirling motion) with bidirectional flow at the neck of pseudo aneurysm is seen in doppler study. Spectral waveform demonstrates the classic to and fro flow at neck. Advantages of colour doppler study are: portable, readily available, inexpensive, fast, involves no ionizing radiation or renal toxic contrast material and non-invasive. However there are few disadvantage are also like: evaluation of deep (visceral) arteries is difficult and it is operator dependent.

Multi slice Computed tomography angiography, Magnetic resonance angiography or catheter directed conventional angiography can be used to confirm the findings of ultrasound before embarking on treatment modality.

Contrast enhanced Multislice CTA demonstrate a contrast material-filled sac and communication between donor artery and pseudoaneurysm; Wall of the pseudoaneurysm usually smooth and well delineated except in a mycotic pseudoaneurysm, whose wall is thickened, irregular, or ill defined. It also delineates low-attenuation area within the pseudoaneurysm suggestive of partial thrombosis. Intermediate or high attenuation (haemorrhage) can be identified adjacent to the pseudoaneurysm which indicates pseudoaneurysm rupture.

Advantage of CT scan is it allows visualization of the lesion from all angles and provides a global perspective on the entire vasculature, including adjacent vascular beds. Disadvantages of CT scan are it requires more contrast material than for angiography and endovascular therapy cannot be performed at the time of diagnosis. So conventional angiography carries the additional benefit of intervention. Superselective transcatheter embolization can be used to treat small favorable false aneurysms [14]. Intravascular graft stenting can be used for extra-renal false aneurysms with suitable anatomy [15]. However, there are some disadvantages of conventional angiography like its invasive nature, increased risk of procedure-related complications and it does not help to accurately assess the size of a pseudoaneurysm that contains a thrombus.

Indications for repair of anastomotic pseudoaneurysm in renal transplant recipients and therapeutic strategies are at present controversial. Asymptomatic small pseudo aneurysms are managed conservatively with periodic ultrasound monitoring [16]. Fujikata et al. describes a conservative treatment for a mycotic aneurysm with an unaltered size and no complications in his three year follow-up study [17]. They require repair in cases where they are symptomatic, larger than 2.5cm in size, show presence of infection, progressive enlargement and if there are sign of impending rupture [18].

Open surgical repair/graft nephrectomy, endovascular treatment with covered stent placement to exclude aneurysm, and ultrasound-guided percutaneous injection of thrombin into the aneurysmal sac are the current reported treatment options for managing extra-renal false aneurysms complicating renal transplantation. Open surgical repair includes the surgical resection of the false aneurysm and the subsequent arterial reconstruction with patch angioplasty, reanastomosis [19] or an allograft autotransplantation [18].

An interposition graft or an extra anatomic reconstruction following false aneurysm resection has been reported to lead to graft loss [20].

Endovascular repair has become a more attractive treatment option for extra-renal anastomotic pseudo aneurysms and has gained popularity during the last decade [15]. It excludes blood flow into the false aneurysm by Endoluminal stent deployment, therefore reducing the risk of rupture. Certainly it requires anatomic criteria for proximal and distal landing zones. Endovascular stenting of the external iliac artery with renal transplant artery exclusion can be considered in emergency situations of acute rupture with adjunctive percutaneous drainage of the retroperitoneal hematoma [21].

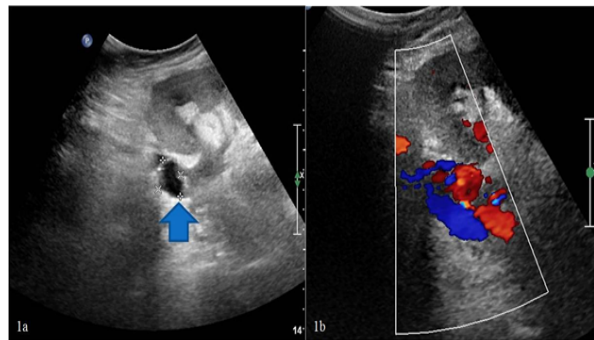
Ultrasound-guided percutaneous thrombin injection (USG-PT) has been reported as an efficient and secure treatment option given the false aneurysm is accessible and not associated with infection[22]. Complications of thrombin injection are reported as rare, they include distal arterial embolization, and anaphylaxis reaction, and generalized urticaria,[23] after using bovine thrombin. Poels et al. reported combined use of a thrombotic agent and covered stent in an end-to-end anastomosis while preserving the transplant kidney [24].

Although EVR and USG-PT offer a less invasive approach for the exclusion of these pseudoaneurysms, surgery is still indicated in case of infection, failure to identify the origin of pseudoaneurysm, presence of a large neck, when the pseudoaneurysm is not accessible for percutaneous treatment, and in cases of unsuccessful mini-invasive procedures. But there is need for nephrectomy in majority of renal transplant patients with rejection, infection or other ensuing complications arising from a non-functioning graft.. Bracale et al. described their experience in the treatment of six patients with anastomotic pseudoaneurysms [25]. Five of six patients needed a transplant nephrectomy, as a result of irreversible rejection (three patients) or local infection (two patients). In our case series four operated cases had larger size of pseudoaneurysm as compare to other two cases and had symptoms of pain and hypotension. So decision of graft nephrectomy was taken.

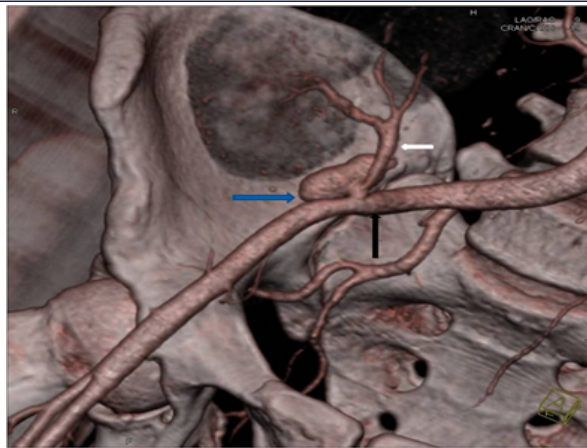
**CONCLUSION**

Pseudoaneurysm can be easily detected by Ultrasonography and colour doppler. The analysis from literature and from our series leads us to formulate some considerations: The anastomotic PA should be identified early, this condition can be fulfilled only with periodic ultrasound monitoring in post-transplant follow up. Conservative procedures should be considered in patients in good condition with preserved graft function and without symptoms or signs of infection. Open surgical repair, endovascular repair and ultrasound guided percutaneous thrombin injection are the current reported treatment options. Pseudoaneurysm can carry a potentially devastating loss of allograft and need for allograft nephrectomy. Early diagnosis and timely operation might be the most important factors in the survival of patients. Clinical, biochemical as well as radiological follow up examination confirmed successful therapeutic management of the patient.

**FIGURES:**



**Figure 1(a)** Grey scale sonography image of graft kidney shows cystic lesion near anastomosis (blue arrow)  
**Figure 1 (b)** Doppler image shows color filled out pouching at anastomosis confirmed non thrombosed pseudo aneurysm



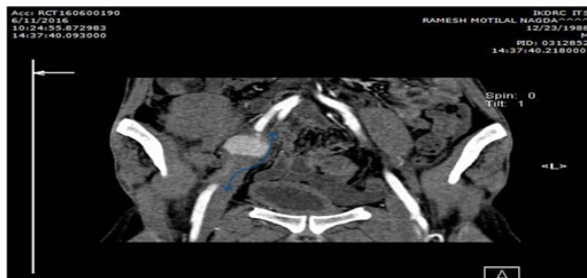
**Figure 3** Volume rendering image of CT scan shows anastomotic pseudoaneurysm(blue arrow), graft renal artery (white arrow) and right external iliac artery(black arrow)



**Figure 2 (a)** Axial image of CT Renal Graft Angiography shows contrast filled pseudoaneurysm at anastomosis, with perigraft hematoma and non visualization of main renal artery  
**Figure 2 (b)** Sagittal Image of CT Renal Graft Angiography arterial phase show pseudoaneurysm at anastomosis with contrast filled main renal artery



**Figure 4** Gray scale Ultrasound image of Renal graft shows two echogenic line structure (Stent) in Main anastomotic renal artery



**Figure 5** Maximum intensity projection (MIP) image of coronal CT scan revealed pseudoaneurysm with non contrast filled right external iliac artery and acute cutoff of proximal and distal end.(blue arrow) Suggest thrombosis

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