Management of kidney-biopsy complications performing renal embolization as a definitive approach with preservation of basal renal function

Poster No.: C-15309
Congress: ECR 2020
Type: Scientific Exhibit
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Keywords: Performed at one institution, Not applicable, Retrospective, Haemorrhage, Embolisation, Arterial access, Ultrasound, Fluoroscopy, Catheter arteriography, Kidney, Interventional vascular, Interventional Radiology
DOI: 10.26044/ecr2020/C-15309

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Purpose

1. To assess renal function and morphologic changes in patients who presented with bleeding after kidney biopsy who were treated with renal embolization as a definitive approach.

2. To demonstrate renal embolization is a safe and reliable technique which can be performed in cases of bleeding after renal biopsy, lowering the risk of needing an urgent nephrectomy.

3. To demonstrate renal embolization performed at early stages can preserve basal renal function.
Methods and materials

Background

Renal biopsy remains a gold standard procedure for the diagnosis of renal disease, which is performed in native and transplanted kidneys and is generally considered a safe procedure. (1)

The use of ultrasound guidance and automated biopsy gun provide a low risk of complications such as pain, bleeding, or a small hematoma. Major complications, including the need for nephrectomy or death, are extremely rare. (2)

Potential risk factors for bleeding complications are the female sex, elevated blood pressure, disturbed hemostasis and low hemoglobin level before intervention. The risk of bleeding appears to be lower for transplant than for native kidney biopsy. (2, 3)

Renal artery embolization is a minimally invasive procedure that is increasingly being used for treatment of a wide range of conditions. It was first introduced in the 1970s. The main indications include: prenephrectomy and preradiofrequency ablation infarction of renal tumors, management of renal angiomyolipomas and renal hemorrhage (life-threatening or chronic debilitating hematuria). It has shown good results in post-biopsy complications. (4)

The rate of major and minor complications has been reported around 10%, the most frequent being renal insufficiency and unintentional embolization of non-target areas. (5)

Study design

A retrospective observational study was performed with biopsied patients from the Hospital Civil of Guadalajara at the Radiology department. Preservation of renal function in patients who required invasive treatment was evaluated by performing renal gammagraphy, ultrasound test (US) and simple phase renal computed tomography (CT). Descriptive statistics, central tendency measures for frequencies and quantitative variables and percentages for qualitative variables were obtained.

Study Population
From January 1st, 2015 to January 1st, 2020, 430 renal biopsies were performed in patients with ages between 7 months and 79 years. 210 were renal graft and 220 were native kidney biopsies. There was a male predominance, 58% of the treated subjects were men and 42% were women. The most common diagnosis for performing the biopsy in renal graft was serum creatinine elevation (25%). The most common diagnosis for native kidney biopsy was proteinuria (56%).

**Inclusion criteria**

Hemoglobin test, platelet count, prothrombin time (PT) and partial thromboplastin time (PTT) in normal ranges were necessary for performing the biopsy.

Antithrombotic drugs were suspended 48 hours before the procedure, systolic blood pressure could not exceed 150 mmHg.

Clinical data was also collected, including gender, age (years), history of hypertension, acute or chronic renal disease and proteinuria.

Body weight and height were collected in order to decide the size of the biopsy needle to be used.

**Biopsy technique**

Procedure was (US) ultrasonography-guided using an automatic tru-cut biopsy gun with a 16-18 Gauge (Ga) needle. (FIG. 1)

For each procedure 1 or 2 samples were obtained. All samples were checked by the same nephropathologist. Ten minutes manual compression was performed after each biopsy. A sonography test and a blood count were performed 4-8 hours later in order to discard complications.

During sonography test four patients (1.1%) showed with renal hematoma and hemoglobin descent (2 or more grams compared to pre-procedure test). Contrast-enhanced CT was performed after US evaluation in these patients to have a better spacial resolution of imagenologic findings. (FIG. 2, 3, 4)

One was controlled by using IV etamsylate (250 mg every 8 hours), IV vitamin K (50 mg every 8 hours) and desmopresin (15 µg single dose).
The other three (0.69%) required endovascular approach performed within the first 12 hours post-procedure.

It drew attention that all four patients who presented with complications were young women with a pre-biopsy diagnosis of systemic lupus erythematosus (SLE). The four biopsies were performed with a 16 Gauge tru-cut needle.

Superselective embolization of the bleeding artery was performed preserving the rest of the circulation. Gel foam was used as the embolic agent in the three cases.

**Embolization technique**

Procedure was performed under fluoroscopic guidance. Femoral approach was obtained using a 5 French arterial introducer, after that a 0.035 in x 150 cm hydrophilic curved end guidewire was advanced until reaching the main renal artery. A 5 French hydrophilic Cobra catheter was advanced until this position, performing an arteriography to localize the bleeding branches. (FIG. 5)

Once localized the site of bleeding, a superselective canalization of these branches was performed by advancing a 2.9 French microcatheter to the desired position.(FIG. 6)

Contrast medium was injected to corroborate microcatheter's position at the bleeding site. After that, non-ionic contrast medium was mixed with gel foam as embolic agent and injected through the microcatheter. (FIG. 7) Another arteriography was performed to ensure embolization of the desired branches was complete.

A final arteriography at the main renal artery is made in order to corroborate no embolic agent was mistakenly migrated into the rest of the renal circulation. (FIG. 8)

There were no immediate complications.
Fig. 1: 16 Ga automatic tru-cut biopsy gun used to perform renal biopsies

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**Fig. 2:** Presence of posterior renal hematoma located at the inferior pole of the left kidney. Concomitant free fluid in abdominal cavity.

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Fig. 3: Contrast-enhanced axial CT image. Contrast extravasation to the inferior pole of the left kidney is seen, which means active bleeding (white arrow).

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Fig. 4: Coronal contrast-enhanced CT reconstruction. Active contrast extravasation and an adjacent hematoma are seen in the left kidney (white arrow). Bilateral pleural effusion and free fluid in abdominal cavity coexist.

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**Fig. 5:** Digital subtraction renal arteriography. Active contrast extravasation is seen in an inferior pole interlobar artery of the left kidney (white arrow).

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**Fig. 6:** Superselective arteriography using a 2.8 Fr microcatheter at the level of the inferior segmental branch (white arrow). Note that active extravasation of contrast is better characterized using this catheter.

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Fig. 7: Superselective embolization of the inferior interlobar branch with a mix of gel foam and contrast medium. Extravasation and sealing are observed. (white arrow)

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**Fig. 8:** Digital subtraction control arteriography in which the bleeding branch of the inferior renal pole is excluded. White arrow shows the mix of gel foam and contrast medium.

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Results

All three patients showed favorable results and bleeding resolution after superselective embolization. None of them needed an urgent nephrectomy.

Patients were monitored one year after embolization. Renal gammagraphy, ultrasound test and a simple phase renal CT (computed tomography) were performed.

Two of them with no relevant morphologic changes at CT and US, with a renal function >90% seen at renal gammagraphy. (FIG. 9, 10, 11, 12)

The other patient showed a giant hematoma (which was not absorbed after the procedure), Causing compression and displacement of the left kidney seen at CT, kidney could not be seen at US. (FIG. 13, 14, 15)

At renal gammagraphy an 80% renal function was obtained.

Hematoma did not show signs of infection, the patient only referred low back pain at pressure with US transducer.

Patients with normal CT and US studies were diagnosed with post biopsy bleeding within the first 6 hours. The patient with the giant hematoma was not diagnosed until 8 hours after performing the biopsy.

Post biopsy results showed that the two patients with no alterations at CT and US control had a diagnosis of diffuse proliferative lupus nephritis.

The patient with the giant hematoma had a biopsy result of focal segmental glomerulosclerosis.
Fig. 9: US image in which the left kidney is seen normal, with no morphologic changes 1 year after embolization.

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Fig. 10: Doppler color US image showing normal vascularization of the left kidney
**Fig. 13:** CT simple phase coronal reconstruction showing a giant hematoma displacing upwards the left kidney.
**Fig. 14:** Axial CT simple phase image showing a giant hematoma posterior to the left kidney.

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**Fig. 15:** Coronal reconstruction in which the right kidney is seen normal, giant hematoma at the topography of the left kidney.

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Fig. 11: Axial CT simple phase image in which both kidneys appear normal 1 year after left kidney embolization.

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Fig. 12: CT coronal reconstruction showing a normal left kidney one year after embolization.

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Conclusion

It was proved that a close follow-up after performing a renal biopsy helped the early diagnosis of complications, allowing an appropriate management (embolization), leading to preservation of renal function if treated at an early stage. (1)

The rate of complications after performing renal biopsy is very low, showing that only 3 (0.69%) patients required endovascular approach. (2)

It remains controversial but based on this study it is noted that young female patients with SLE diagnosis in which a native kidney biopsy is performed are more likely to suffer complications. Also, the use of a 16 Ga needle instead of an 18 Ga needle in these patients was shown to increase the risk of post-biopsy bleeding. Further studies are necessary to sustain such hypothesis.
Personal information and conflict of interest

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The authors declare that there is no conflict of interest regarding the publication of this article.
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