Operative Management of Hilar Renal Artery Aneurysm in a Pregnant Patient

Wibke Schulte, MD,1 Manuel Rodriguez-Davalos, MD, FACS,1 Marko Lujic, MD,1 Felix Schlosser, MD, PhD, RPVI,2 and Bauer Sumpio, MD, PhD, FACS2

Complications of renal artery aneurysms (RAAs) can be life threatening and include the spontaneous rupture which may lead to severe retroperitoneal hemorrhage, loss of the kidney, or death. As the incidence and diagnosis of RAAs is expected to rise, it is becoming increasingly important to enhance our awareness and knowledge of this rare clinical entity. Here, we present the case of a hilar right RAA and the surgical approach for primary repair during the postpartum period. Additionally, we discuss current pathophysiologic mechanisms, associated symptoms as well as current treatment modalities for RAAs.

Keywords: renal artery aneurysm (RAA), pregnancy, primary repair

Introduction

A renal artery aneurysm (RAA) is a rare clinical entity with an incidence of <0.1%, and is typically an incidental finding on imaging studies performed for other medical ailments.1 In recent years, the incidental diagnosis of RAAs has increased due to the more widely use of CT, MRI and angiographic imaging studies. Predisposing factors for the development of RAAs include congenital vascular and connective tissue diseases, degenerative atherosclerotic processes of the arterial wall, inflammatory lesions, and vascular trauma.2 In contrast, in pregnant patients, the formation of RAAs is likely caused by changes in the vascular wall integrity secondary to hormonal and hemodynamic changes.3 While pregnant patients are not reported to have a higher incidence of RAAs, the cardiovascular changes associated with pregnancy increase the risk of rupture and subsequent fetal and/or maternal death. For this reason, the repair of RAAs with a maximum diameter of >2 cm is usually recommended in pregnant women and women of reproductive age.1

Case Report

A 29-year-old woman, gravida 4 para 3, at 26 weeks and two days of gestation presented to the obstetric/gynecology clinic with worsening right flank pain. She had a history of a right RAA, which was diagnosed in her third pregnancy three years ago during the diagnostic workup for flank pain. At that time, Doppler ultrasound had shown a RAA in the right renal hilum with a diameter of 1.7 cm. Her family history was positive for a cousin with a ruptured RAA.

Diagnostic studies were initiated at her current presentation. A MRI angiogram examination without intravenous contrast demonstrated a right RAA measuring 2.4 cm × 1.6 cm (Fig. 1). It was located at the bifurcation of the right main renal artery approximately 2.5 cm from the right lateral edge of the aorta. A segmental branch arising from the superior aspect of the aneurysm was noted. A Doppler ultrasound examination confirmed the above measurements and showed no evidence of active bleeding. Therefore, the patient’s flank pain was controlled with minimal narcotics. In light of the increased risk of rupture of the aneurysm during pregnancy, especially during the imminent third trimester, the patient had close obstetric monitoring. The Maternal-Fetal Medicine team, together with our group, decided to plan the surgical repair of the right RAA for the postpartum period. At 37 weeks of gestation, the patient underwent a scheduled cesarean section without complications and delivered a healthy child.

Fifty days postpartum the patient was admitted to the hospital for the elective surgical repair of a right RAA. A surgical repair was chosen over an endovascular approach due to the hilar location of the RAA, which would not
permit an optimal placement of a stent without compromising a segmental branch of the renal artery. A repeat Duplex ultrasound examination demonstrated a patent right hilar RAA measuring 2.2 cm × 2.1 cm × 2.4 cm with a calcified wall (Fig. 2). Through a right subcostal incision, a right medial visceral rotation was performed, followed by a Kocher maneuver mobilizing the duodenum to expose the IVC and the hilum of the kidney. The right kidney was completely dissected anteriorly and posteriorly, the renal vein and artery were isolated, and the ureter was identified at the level of the renal hilum (Fig. 3A and 3B). The RAA was saccular and upon performing an arteriotomy the distance between the proximal inflow and the proximal outflow of the aneurysm was only 1 cm (Fig. 3C). It was decided to perform a primary repair of the RAA instead of a vein interposition graft. The aneurysm wall was excised while the arterial side branch of the aneurysm was carefully preserved. The aneurysm wall was closed primarily with a running 6-0 polypropylene suture (Fig. 3D). After the anastomosis was completed, adequate Doppler signals were heard over the proximal and distal renal artery as well as over the right kidney parenchyma. The total clamp time was 40 min and the kidney was adequately re-perfused. The abdominal wall incision was closed and the patient was transferred to the post-anesthesia care unit in stable condition.

The patient’s postoperative course was uneventful. Her blood pressure was well controlled; serum blood urea nitrogen and creatinine levels remained stable within the reference range. The patient was able to void spontaneously and the urine output was adequate. On postoperative day five she was discharged home. She was doing well and without any complaints at her one-month post surgery follow-up visit and on telephone surveillance five months later.

**Discussion**

A RAA is a localized dilation of the renal artery or of one of its segmental branches. To date, many underlying diseases and causative factors have been identified to contribute to
the development of RAAs. These include atherosclerotic lesions in the arterial wall, fibromuscular dysplastic changes, collagen disorders, inflammatory diseases or blunt or penetrating trauma. \(^4\) Additionally, iatrogen trauma or infection secondary to surgical, endoscopic or radiologic procedures has been reported to contribute to the formation of RAAs. During pregnancy, the increased blood flow and augmented intraabdominal pressure as well as the changes in the vessel wall formation associated with the hormonal and metabolic changes of gestation are thought to be contributory. \(^3\)

Most RAAs are asymptomatic and are diagnosed incidentally during imaging studies for unrelated medical conditions. However, approximately 40% of patients develop symptoms such as uncontrolled intractable hypertension, hemorrhagic shock, or less frequently, flank pain, thrombosis or hematuria. \(^5\) Hypertension is the most common symptom in patients with RAAs but it is still unclear whether hypertension is a consequence of RAAs or whether it is a causative factor for the development of RAAs. The spontaneous dissection or rupture of a RAA is an acute and possibly deleterious complication. Patients present with flank pain or, if more severe, hemorrhagic shock. Reports have suggested that asymptomatic RAAs with a size of <1.5 cm and circumferential calcifications possess a low risk for rupture. \(^4\) In contrast, non-calcified saccular aneurysms that are accompanied with hypertension have a high risk for rupture (>20%). Likewise, the risk for rupture is high in pregnant patients, especially during the third trimester, and is associated with a maternal mortality of approximately 50% and a fetal mortality of approximately 80%. \(^6\) Moreover, RAAs can thrombose or release emboli which subsequently obstruct smaller renal arteries causing multiple renal infarctions. Hematuria, another less frequent symptom, develops when small intraparenchymal RAAs rupture into the collecting system. Because of these severe and potentially life-threatening complications, it is important to immediately diagnose and appropriately treat RAAs. Commonly, the diagnosis of RAAs is made through imaging studies involving duplex ultrasound, spiral CT, magnetic resonance angiography (MRA) or digital subtraction arteriography (DSA).

RAAs can be classified into four main categories (saccular, fusiform, dissecting, or intrarenal) based on their morphology and anatomic location. In addition, Rundback et al. proposed a classification of RAAs into three main types with important therapeutic implications. \(^7\) Type I constitutes saccular aneurysms arising from the main renal artery or a large side branch, type II includes fusiform aneurysms and type III comprises intralobar artery aneurysms.

Currently, there are no guidelines for the treatment of RAAs and the specific indications remain controversial. However, general indications for therapeutic intervention include the presentation with a rupture, high risk of rupture, presence of associated symptoms, or a large diameter of >2 cm. If none of these factors exist, an expectant management is chosen and RAAs should be closely monitored with regular follow-up ultrasound or CT studies. Otherwise, depending on the circumstances, RAAs are managed in an emergency or elective setting.

In the case of an acute RAA rupture, emergency surgical repair is required to limit blood loss and prevent subsequent complications such as hemorrhagic shock and renal ischemia. Renal artery reconstruction should be attempted if the patient is hemodynamically stable. However, nephrectomy may be necessary in a hemodynamically instable patient to control blood loss.

The elective management of RAAs can be achieved by surgical or endovascular approaches, which both aim at excluding the RAA from high intra-arterial pressure to prevent expansion and rupture of the RAA. \(^8\) Elective treatments are usually tailored to the patient’s individual presentation and vary with respect to the presence of symptoms, the relative risk of rupture, the anatomic location and the size of the particular lesion.

Saccular RAA that arise from the main renal artery or a large side branch (Rundback Type I) can be treated surgically or endovascularly. The surgical procedure of choice for these RAAs is tangential excision with primary repair or patch angioplasty using autologous (i.e., saphenous vein) or prosthetic material. \(^9\) More complicated cases of RAAs may require a splenorenal, hepatorenal or iliac-to-renal bypass. Moreover, a partial nephrectomy may be indicated in case of an associated renal lesion (i.e., neoplastic disease) or a complete nephrectomy may be performed if the kidney is non-functioning (i.e., end-stage renal disease). In contrast, endovascular therapies such as endovascular coil occlusion may be employed if the saccular RAA presents with a narrow neck, which constrains the coil within the aneurysm sac, and an adequate collateral blood flow, which allows for adequate kidney perfusion during the procedure. Alternatively, stent grafts may be used. \(^10\)

For fusiform RAAs (Rundback Type II), the preferred surgical treatment is to create an aortorenal bypass using the autologous saphenous or gonadal vein after the segmental excision of the RAA. Alternatively, these RAAs can be treated with covered stent grafts or coils, which are placed proximally and distally to the RAA, thereby excluding the RAA from the circulation. Of note, the latter requires collateral blood flow for end organ perfusion whereas covered stents usually exhibit good patency rates and allow for the simultaneous treatment of RAA and renal artery stenosis.

Intralobar RAAs (Rundback Type III) can best be managed with endovascular techniques such as embolization...
with large particles followed by coil placement. However, this procedure results in the thrombosis of end arteries and subsequent infarction. Alternatively, complex intralobar or hilar RAAs can be treated with ex vivo surgery. For this procedure, the kidney is removed, preserved with cold preservative solution, the RAA is reconstructed extracorporally, and the kidney is subsequently autotransplanted into the renal or iliac fossa.

The mortality rates after an elective treatment of a RAA is low and was reported to be <5%. Nevertheless, a careful selection of patients is mandatory as complications such as the intraoperative rupture of the RAA may result in the loss of the kidney or even the death of the patient.

In this article, we present the case of a 29-year-old female patient with a saccular RAA located at the right renal hilum. Due to its size of >2 cm, the occurrence of flank pain, and the patient currently being in childbearing age we decided to treat this RAA. The patient was managed pre-partum with careful maternal and fetal monitoring. An elective post-partum surgical approach was chosen and, following its intraoperative presentation, the RAA was treated with primary repair.

Conclusion

A RAA is a rare clinical entity and is frequently diagnosed as a result of an incidental finding on imaging studies. Nevertheless, RAAs possess the potential for life threatening complications and, therefore, demand appropriate observation or endovascular versus surgical treatment. Here, we report on the successful surgical primary repair of a hilar RAA to raise awareness for this clinical entity and to provide assistance to treating physicians when deciding on the appropriate treatment modality.

Disclosure Statement

All authors have no conflict of interest.

References