Abstract

Background: Post-nephrectomy arteriovenous fistula is rare in relation to the number of nephrectomies performed worldwide and they are more frequent on the right side, as was true for the case presented herein.

Case report: A 66-year-old woman underwent right radical nephrectomy in January 2005. In May 2015 she came to a cardiology consultation presenting with anasarca and an abdominal murmur. An abdominal tomography scan was done and an arteriovenous fistula involving the right renal artery and the vena cava was diagnosed. The hemodynamics specialist ruled out endovascular treatment and the patient was referred to our urology service.

Through laparoscopy performed with the patient in the right lateral decubitus position, 2 liters of ascites were extracted and the origin of the right renal artery was dissected. Two 10 mm Hem-o-Lok staples were applied. On the first postoperative day the patient had minimal abdominal pain, tolerated a liquid diet, passed gases, and had normal vital signs, but the abdominal murmur continued to be heard. At 30 h after the procedure, an abdominal tomography scan was carried out that revealed no change in the arteriovenous fistula. The double Hem-o-Lok staples were observed in the superior mesenteric artery, but there was flow despite the 2 staples (partial obstruction). Emergency laparoscopy was performed, removing the staples from the SMA. The right renal artery was located and 2 Hem-o-lok staples were placed. The murmur ceased. The patient had excellent postoperative progression. The control tomography scan showed there was no arteriovenous fistula and the superior mesenteric artery was normal with no staples.

Conclusions: This was an unusual and complex case that was resolved through laparoscopy. Perhaps an atheroma prevented complete superior mesenteric artery obstruction. The position of the patient was an important factor in locating the right renal artery.

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Introduction

Renal arteriovenous fistulas (AVFs) are a rare pathology in everyday urologic practice. Varela described the first case in 1923 in a 28-year-old man with cardiac insufficiency and high blood pressure. Since then, more than 350 cases have been published in the international literature, and an increase in the incidence of this pathology has been observed over the past decades that is basically related to 2 factors: the increase in the percutaneous renal approach for therapeutic or diagnostic purposes. However, the exact incidence of this pathology cannot be calculated given that the majority of cases have no clinical repercussions and usually go unnoticed. There are 3 types of renal AVFs: congenital, idiopathic, and acquired. The most frequent type is the acquired, making up 75% of AVFs. Among the acquired type, the most common are those that are secondary to percutaneous renal biopsy, those produced by trauma (whether penetrating or blunt), and those secondary to percutaneous renal surgery. It is rare for fistulas to appear after a nephrectomy.13 We present herein the case of a patient diagnosed with a fistula between the right renal artery and the vena cava, 10 years after right radical nephrectomy.

Case presentation

A 66-year-old woman underwent an open right radical nephrectomy in January 2005 due to clear cell renal adenocarcinoma with tumor thrombus (figs. 1 and 2), but it was not until April 2007 that she had tumor thrombectomy of the vena cava. Her postoperative period was complicated by abundant bleeding, but she recovered at the end of the period. Oncologic follow-up showed only large dilation of the vena cava, but no sign of tumor activity (figs. 3 and 4). In 2010, the patient was seen due to congestive heart failure data and was managed accordingly, but her physical activity continued to deteriorate. In March 2015 she saw a cardiologist specializing in hemodynamics. Upon physical examination that physician discovered an abdominal murmur. Echocardiogram study revealed a normal left ventricle and increased pulmonary resistance, leading the physician to doubt the previous cardiologic diagnosis and instead suspect AVF. Aortic arteriography corroborated his suspicion. Due to the size of the fistula and the high flow to the vena cava, the cardiologist was reluctant to apply an embolic agent to plug the AVF (for fear that the agent would migrate). To complete the evaluation, a new abdominal angiotomography study was done that reported a very dilated vena cava due to a fistula between the right renal artery (RRA) and the vena cava, with important ascites (figs. 5 and 6). The patient was now presenting with anasarca, respiratory difficulty, and inability to walk. She was given medical treatment and the cardiologist presented her case to us to see if we could resolve it laparoscopically. We reviewed the case and decided to employ the laparoscopic approach from the left side of the abdomen, to dissect the aorta and the origin of the RRA. We would place two 10 mm Hem-o-Lok staples to the RRA to close the AVF, thus avoiding the right side that had undergone 2 previous surgeries. In addition, the extremely dilated vena cava and the pseudoaneurism formed between the stump of the RRA and the vena cava could otherwise be injured, leading to profuse and difficult-to-control bleeding with potentially catastrophic results.

Reparación laparoscópica de fistula de arteria renal derecha a vena cava, posnefrectomia radical derecha

Resumen

Antecedentes: La fistula arteriovenosa posnefrectomia es poco frecuente a pesar del número de nefrectomías que se realizan en el mundo, y ocurren más a menudo en el lado derecho, como el caso que presentamos.

Presentación del caso: Mujer de 66 años de edad. En enero 2005 se realizó nefrectomía radical derecha. En mayo 2015 se presenta a la consulta de cardiólogia en anasarca y con un soplo abdominal, se realiza tomografía de abdomen, se diagnostica fistula de arteria renal derecha a cava. Hemodinamista descarta tratamiento endovascular, es enviada a nuestro servicio de urología. Por laparoscopia, en decúbito lateral derecho se extraen 2 l de ascitis y se disea el nacimiento de la arteria renal derecha y se aplican 2 grapas de Hem-o-lok de 10mm. El primer día de postoperatorio: mínimo dolor abdominal, toleró vía oral, canalizó gases y signos vitales normales, sin embargo, se sigue escuchando soplo abdominal (30 h de postoperatorio); se hace tomografía de abdomen. La fistula arteriovenosa sin cambio y doble grapa Hem-o-lok en la arteria mesentérica superior, pero con flujo a pesar de las 2 grapas (obstrucción parcial). Hicimos laparoscopía de urgencia, se retiran grapas de la arteria mesentérica superior, se localiza la arteria renal derecha, doble grapa Hem-o-lok, desaparece el soplo. Postoperatorio excelente. Tomografía de control, sin fistula arteriovenosa y arteria mesentérica superior normal sin grapas.

Conclusiones: Caso complejo, poco común, que se resolvió con técnica laparoscópica. Quizá una placa de ateroma evitó la obstrucción completa de la arteria mesentérica superior. La posición del paciente fue un factor importante para encontrar la arteria renal derecha.

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Surgical technique

With the patient in the right lateral decubitus position at an almost 80-degree inclination angle, 4 trocars were placed; 2 of 5mm and 2 of 10-12 mm in the left hemiabdomen. The left paracolic sulcus was opened for access to the retroperitoneum. The left ureter was dissected together with the left ovarian vein. Its dissection was continued to the cephalad portion up to the left renal hilum, stapling the lumbar vein with 5 mm Hem-o-Lok to free the left renal vein and be able to dissect the aorta and the origin of the left renal artery. The inferior surface of the left renal vein was lifted in an attempt to find the RRA. It was not found, so the left adrenal vein was dissected and stapled with 5 mm Hem-o-Lok. The left renal vein was caudally displaced, the RRA was identified and stapled with 10 mm Hem-o-Lok at its origin at the aorta, ruling out that it was the superior mesenteric artery (SMA). The small bowel was observed for no less than 10 min, and when no sign of intestinal ischemia was seen, a second staple was placed. The small bowel was checked once more, corroborating that there was no intestinal ischemia. A closed drain was left in the abdominal cavity, the 10-12 mm ports were closed with a Carter-Tomason needle with 0 Vicryl and the skin was closed with 3-0 Nylon. There were no complications.

Progression

On the first postoperative day, abdominal drainage was approximately 600 ml in 24 h. The patient tolerated a liquid diet, passed gases, walked without help, presented with intestinal peristalsis, mild and tolerable abdominal pain, and she stated that she felt better than before the surgery.
However, the abdominal murmur continued to be heard and so a new abdominal angiotomography study was immediately ordered. At 30 h after the surgery, the study showed no change in the AVF and the contrasted SMA was normal, but there were 2 Hem-o-Lok staples at its aortic origin causing partial obstruction (figs. 7 and 8). The patient was immediately taken to the operating room for laparoscopic exploration. She was placed in the right lateral decubitus position, but this time at an approximate 40-degree inclination angle. Laparoscopic access was quickly performed because everything was now dissected. We located the staples in the SMA. The first one was difficult to cut with the conventional laparoscopic scissors (we do not have access to a harmonic scalpel). The second staple was easily cut with parrot-tip laparoscopic scissors. We then continued to look for the RRA and we found it under the left renal vein at the same height as the left arterial artery with no difficulty (thanks to the patient’s new position).

A stethoscope was placed at approximately the L-2 level and the anesthesiologist could hear the murmur produced by the AVF, monitoring to see if there was any change when placing the 10 mm Hem-o-Lok staple at the origin of the RRA. When the staple was placed the murmur immediately ceased. The second staple was placed at the origin of the RRA. The closed abdominal drain was put in place again and the ports were closed as described above. The next day a new abdominal computed axial tomography scan corroborated the absence of the AVF and a normal SMA (with no staples) (figs. 9, 10, and 11). The patient’s postoperative progression was even better, with very little abdominal drainage (less than 50 ml in 24 h). She was released 48 h later, tolerating an oral diet, passing gases, with no drainage, stable vital signs, walking with no assistance,

Figure 5  AVF of the RRA to the vena cava with ascites (06/2015).

Figure 6  AVF of the RRA to the vena cava with ascites (06/2015).

Figure 7  Hem-o-Lok staples in the superior mesenteric artery, still with contrast medium passage.

Figure 8  Staples in the superior mesenteric artery.
Conclusions

Post-nephrectomy AVF is a very infrequent complication. Fewer than 100 cases are reported in the medical literature.\(^6\) Seventy percent of the cases are described on the right side. The vessels are shorter on that side supposing greater difficulty at the time of dissecting the different peduncle components for their separate ligation.\(^1,3,4\)

There are various points in our case to analyze. First, only radical nephrectomy due to renal cancer with tumor thrombus was performed and 2 years and 3 months later tumor thrombectomy was carried out. During a more than 10-year follow-up, there was no tumor activity. Second, diagnostic time was 10 years. Third, was the treatment for its solution. And fourth, was the surgical incident of partial obstruction of the SMA and the laparoscopic reoperation to resolve the incident and the AVF.

1º. According to the literature, clear cell renal adenocarcinoma in clinical stage T3b N0 M0 has a 5-year survival rate of 30-50%. Nevertheless, the present author found no information in relation to tumor thrombectomy delay of more than 2 years with no oncologic repercussion, as occurred in the present case.

2º. Arteriovenous system communication at the level of the fistula produces a left-right short circuit and a consequent increase in cardiac output. All this affects both ventricular cavities, with the appearance of cardiomegaly, and in the long run, congestive heart failure.\(^2,3\) The majority of cases have late diagnosis, many years after the surgery.\(^1,4\) The mean time from surgery to diagnosis is estimated at 15 years.\(^1,3,5\) Clinical manifestations vary in relation to the time between nephrectomy and diagnosis.\(^1,4\) Despite the fact that a continuous murmur at the level of the flank or abdomen is diagnostic, there is often suspicion with the symptom of treatment-refractory high blood pressure or clinical congestive heart failure. The latter is the most important complication of this entity and usually appears in the late stages, as occurred in our patient, plus the history of nephrectomy, and these should alert us to the possibility of this diagnosis.\(^2,7\) Suspicion diagnosis is basically clinical and studies such as Doppler ultrasound, computed axial tomography, and especially, three-dimensional tomography, aid in confirming said diagnosis and in visualizing the morphology of the fistula to decide upon the best therapeutic option.\(^4,7,8\)

3º. All fistulas, and especially the large caliber ones, should be treated, given the risk for heart failure or, on fewer occasions, spontaneous rupture of the aneurism.\(^4,9\) The treatment of choice depends on the fistula size and etiology. Complete exeresis of the fistula, simple ligature of the vein and artery, or percutaneous embolization are therapeutic measures that have been shown to be efficacious for the treatment of this pathology.\(^4,9\) In symptomatic and small-sized fistulas, percutaneous embolization is the treatment of choice, reserving exeresis surgery for large AVFs unresolved by embolization and simple ligature for the cases of large fistulas in which exeresis is difficult due to the surrounding inflammation.\(^4\) Percutaneous embolization, even though much more advantageous than open surgery, is not risk-free. Cases of embolic agent migration into the pulmonary circulatory system (especially large fistulas), cases of intestinal or
contralateral kidney ischemia, and fistula recurrence have been described. The literature reports on different percutaneous embolization techniques using diverse materials in an attempt to reduce the risk for migration.4,9-10 Exeresis surgery consists of individualizing the lesion, ligating the artery and vein separately, after resection of the fistulous tract. In cases of difficult exeresis, simple ligature of the vessels can provide good results, although the risk for recurrence is greater.11,12 The present author searched the literature (PubMed) to no avail for a case similar to the one presented herein that was resolved through laparoscopy or robotic-assisted laparoscopy, making it probably one of the few cases of right post-nephrectomy AVF resolved through laparoscopy.

4º. The patient was referred to our laparoscopic surgical team because of our experience, especially in the field of donor nephrectomy. We considered the procedure feasible through the left side of the abdomen, given that 2 previous surgeries had been performed on the right side and we would possibly find a surgical site with fibrosis and adherences, as well as the great dilation of the vena cava with more pressure due to the AVF, the aneurism of the fistula itself. If any of these structures were to be injured, the bleeding would be difficult to control and the result could be catastrophic.

Thus we decided to approach the case from the left side of the abdomen and carry out one of the basic principles in the repair of any AVF, which is to first control the artery feeding the AVF.12 We placed the patient in the right lateral decubitus position at an inclination angle of 80 degrees. We could not find the origin of the RRA underneath the left renal vein and so we decided to staple and cut the left adrenal vein to displace the vein downward and locate the RRA.

We thought we had found it and we saw that the artery exited laterally to the aorta (because of the position of the patient, which we did not yet take into account). A 10 mm Hem-o-Lok staple was placed at the origin of the artery and we observed the color of the small bowel for at least 10 min to rule out the possibility of having stapled the SMA. Before placing the second staple and even after having placed it, we observed the small bowel irrigation for several minutes before ending the surgical procedure. The patient never had clinical signs of acute abdomen. Only the persistence of the abdominal murmur made us re-evaluate the patient and we then realized that despite having two well-placed Hem-o-Lok staples, the SMA continued to have flow. The only explanation we can think of is that perhaps an atheroma did not allow it. And we could not use a portable fetal Doppler machine because the device had no battery at that time. The re-intervention took less than an hour because almost everything was already dissected. Minimally invasive endoscopic techniques can increasingly substitute those of open surgery, with the advantages of better visualization, less bleeding, and faster recovery.

Ethical responsibilities
Protection of persons and animals. The authors declare that the procedures followed conformed to the ethical standards of the responsible committee on human experimentation and were in accordance with the World Medical Association and the Declaration of Helsinki.

Data confidentiality. The authors declare that they have followed the protocols of their work center in relation to the publication of patient data.

Right to privacy and informed consent. The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the corresponding author.

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Conflict of interest
The authors declare that there is no conflict of interest.

References