

CASE REPORT

Renal artery aneurysm rupture in the immediate puerperium: an uncommon cause of hypovolemic shock after cesarean section

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ABSTRACT

Renal artery aneurysm (RAA) is a rare vascular condition, with a prevalence of less than 1%; however, it becomes particularly relevant during pregnancy because of the increased risk of rupture, with maternal mortality exceeding 50% and fetal mortality greater than 70%. Most RAAs remain asymptomatic, which delays diagnosis until acute events occur. This report describes the case of a 33-year-old woman at 36.4 weeks of gestation who developed severe abdominal pain, acute anemia, and hypovolemic shock after an emergency cesarean section. Computed tomography angiography revealed rupture of a saccular aneurysm in a segmental branch of the right renal artery, with active bleeding and an extensive retroperitoneal hematoma. Given the patient's hemodynamic instability and the lack of immediate availability of endovascular treatment, emergency right nephrectomy was performed, followed by intensive care management under a massive transfusion protocol, with a favorable clinical course. This case highlights the importance of early recognition, a multidisciplinary approach, and timely surgical intervention as decisive measures for maternal survival.

Ruptura de aneurisma de arteria renal en el puerperio inmediato: causa infrecuente de choque hipovolémico tras cesárea

Palabras clave:

aneurismas renales; choque hipovolémico; embarazo; hemorragia retroperitoneal; nefrectomía (fuente: DeCs-BIREME).

RESUMEN

El aneurisma de la arteria renal (AAR) es una entidad vascular poco frecuente, con una prevalencia menor al 1 %, pero adquiere especial relevancia durante el embarazo debido al mayor riesgo de ruptura, con mortalidad materna superior al 50 % y fetal mayor al 70 %. La mayoría de los AAR permanecen asintomáticos, lo que retrasa su diagnóstico hasta la aparición de eventos agudos. Se presenta el caso de una mujer de 33 años, con 36,4 semanas de gestación, que, tras una cesárea de urgencia, desarrolló dolor abdominal severo, anemia aguda y choque hipovolémico. La angiotomografía evidenció la ruptura de un aneurisma sacular de una rama segmentaria de la arteria renal derecha con sangrado activo y extenso hematoma retroperitoneal. Ante la inestabilidad hemodinámica y la falta de disponibilidad inmediata de tratamiento endovascular, se realizó nefrectomía derecha de emergencia, seguida de manejo en terapia intensiva bajo protocolo de transfusión masiva, con evolución favorable. Este caso resalta la importancia del reconocimiento temprano, el abordaje multidisciplinario y la intervención quirúrgica oportuna como medidas determinantes para la supervivencia materna.

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INTRODUCTION

Renal artery aneurysms (RAAs) are uncommon visceral artery aneurysms. Their prevalence in the general population is low, estimated at 0.01% to 0.09% in angiographic studies and slightly higher in contemporary computed tomography-based series, which explains why most cases remain clinically silent and are diagnosed incidentally or after acute events⁽¹⁻³⁾. Despite their rarity, RAAs are of particular clinical relevance during pregnancy, a period in which the risk of rupture increases substantially.

Pregnancy is the main predisposing factor for RAA rupture because of the combination of hemodynamic and hormonal changes. Increased plasma volume, cardiac output, and pressure within the retroperitoneal space, together with the effects of estrogen and progesterone on the arterial wall, promote aneurysmal dilation and reduced arterial wall strength, particularly during the third trimester and the immediate puerperium^(1,4-6). In this context, RAA rupture, although extraordinarily uncommon, is associated with high maternal mortality, reported at 40% to 60%, and fetal mortality that may exceed 70%, mainly as a consequence of sudden hemodynamic collapse and delayed diagnosis^(1,6-8).

More than 80% of ruptures described in the literature occur during the third trimester or the immediate puerperium, when circulatory demands reach their highest level^(4,6,9). Clinically, the condition usually presents with sudden abdominal or lumbar pain, acute anemia, hypotension, and signs of hypovolemic shock. However, the clinical presentation is nonspecific and is frequently confused with more prevalent obstetric conditions, such as placental abruption, uterine rupture, or postpartum hemorrhage, delaying identification of the vascular source of bleeding^(6,10,11).

Early diagnosis is based on computed tomography angiography (CTA), considered the imaging modality of choice because of its high sensitivity for detecting active contrast extravasation, retroperitoneal hematoma, and the precise location of the aneurysm^(9,12). Under ideal conditions, the treatment of choice for ruptured RAAs is endovascular exclusion by coil embolization or stent-graft placement, given its lower physiological impact and the favorable outcomes reported^(8,13). However, this alternative depends on the immediate availability of interventional radiology and relative hemodynamic stability, conditions that are not always present, particularly in hospitals in developing

countries or in patients with severe shock^(6,13,14). Under such circumstances, open surgery and, particularly, emergency nephrectomy remain lifesaving strategies when there is a massive retroperitoneal hematoma and irreversible compromise of renal viability^(8,14,15).

The presentation of this case is justified by the extreme rarity of the event, the severity of the associated hypovolemic shock, and the need for immediate surgical intervention in the absence of endovascular options, with a favorable maternal outcome that contrasts with the high mortality described in the literature. It also provides clinically relevant evidence for the Latin American context, where technological limitations may require rapid decision-making and a timely multidisciplinary approach to preserve maternal life.



CASE PRESENTATION

A 33-year-old multigravida woman with a history of cesarean delivery for fetal distress, at 36.4 weeks of gestation, presented to the obstetric emergency department with sudden-onset, severe, persistent lumbar pain associated with irregular uterine activity. On admission, she was alert, normotensive (118/70 mmHg), and tachycardic (98 bpm), with no signs of advanced labor. Initial obstetric ultrasonography showed a single live fetus with reassuring fetal status.

Because of the persistence of severe lumbar pain and her obstetric history, an emergency cesarean section was performed. The procedure was completed without apparent complications, resulting in the delivery of a healthy newborn. During the first hours of the immediate postoperative period, the patient remained stable.

However, approximately four hours later, she developed abrupt clinical deterioration characterized by worsening abdominal and lumbar pain, marked pallor, cold sweats, progressive tachycardia (145 bpm), and hypotension (80/40 mmHg). At the same time, a sudden decrease in hemoglobin from 10.2 g/dL to 6.1 g/dL was documented, prompting the immediate initiation of hemodynamic resuscitation and transfusion of two units of packed red blood cells.

Despite the initial measures, the patient remained unstable; therefore, urgent surgical exploration was performed with the support of the General Surgery and Cardiovascular Surgery services. This revealed massive hemoperitoneum and an extensive right

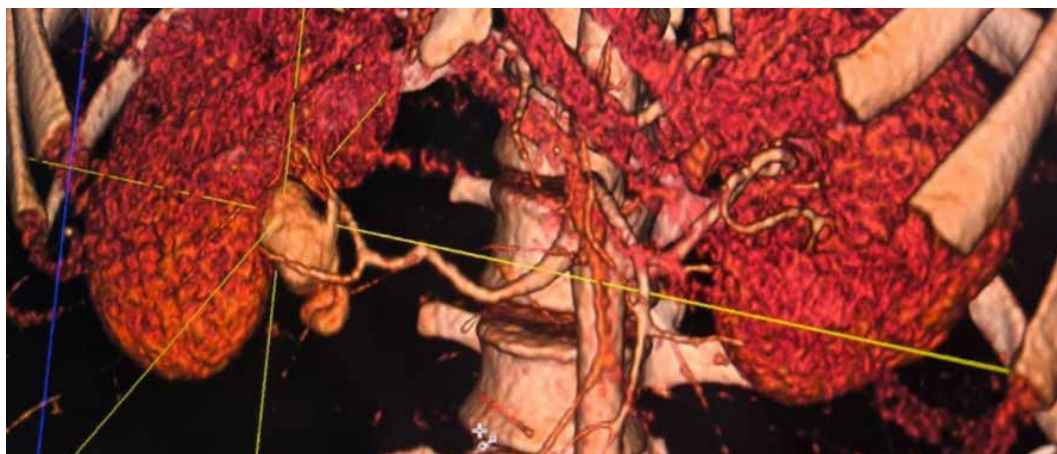


Figure 1. Contrast-enhanced abdominal computed tomography angiography showing a ruptured saccular aneurysm of the superior segmental branch of the right renal artery (23 × 16 mm), with contrast extravasation indicating active bleeding, associated with an extensive predominantly right retroperitoneal hematoma with an approximate volume of 1500 mL. Delayed right renal parenchymal enhancement, consistent with hypoperfusion secondary to compression or ischemia.

retroperitoneal hematoma, with no evidence of uterine or mesenteric bleeding. Given the suspicion of a retroperitoneal vascular injury, and in agreement with the Cardiovascular Surgery team, a contrast-enhanced abdominal computed tomography angiography (CTA) was requested. This showed a ruptured saccular aneurysm in a segmental branch of the right renal artery, with active contrast extravasation and a large hematoma displacing adjacent structures (see Figure 1; see Figures 2a and 2b).

After the diagnosis, the patient was transferred to the Intensive Care Unit (ICU) for comprehensive stabilization and preparation for definitive surgery. She was admitted in severe hypovolemic shock,

with marked metabolic acidosis (pH 7.08, lactate >10 mmol/L), hypothermia, and coagulopathy secondary to massive hemorrhage. Likewise, a massive transfusion protocol was activated, along with vasopressor support (escalating norepinephrine), renal protection, mechanical ventilation, and advanced hemodynamic monitoring.

Because endovascular techniques were not immediately available and considering the progression of the retroperitoneal hematoma, the Urology Service was also consulted. After multidisciplinary assessment (urology, general surgery, anesthesiology, and intensive care), it was determined that the safest and most feasible therapeutic option would be emergency

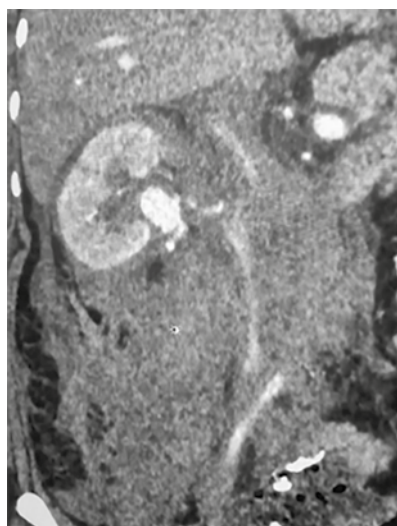


Figure 2a. Contrast extravasation indicating active bleeding.

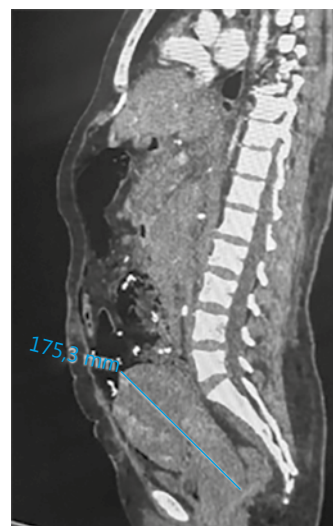


Figure 2b. Extensive predominantly right retroperitoneal hematoma.

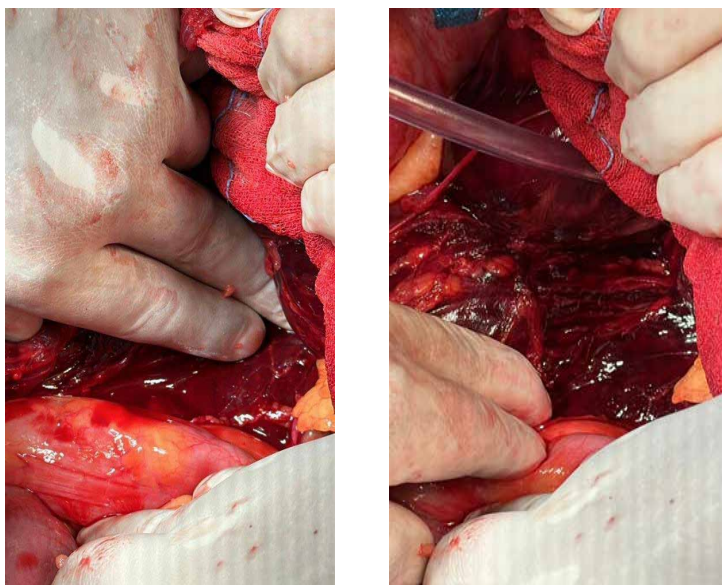


Figure 3. Dissecting retroperitoneal hematoma extending into the abdomen and pelvis.

right nephrectomy, both to control the bleeding and to prevent impending retroperitoneal compartment syndrome.

Once the hemodynamic parameters had been optimized and the metabolic abnormalities partially corrected, the patient was taken back to the operating room. Intraoperatively, a large retroperitoneal hematoma was confirmed, completely distorting the anatomy of the right renal pole and showing ongoing bleeding. A right nephrectomy was performed, achieving adequate hemostatic control. Because of abdominal distention, persistent acidosis, and residual coagulopathy, the abdomen was left temporarily open and managed with a negative-pressure temporary abdominal closure system (see Figure 3).

The patient returned to the ICU, where intensive supportive care was continued. During the first 24 hours, she showed progressive hemodynamic improvement, reduced vasopressor requirements, and correction of acidosis and a decrease in lactate levels. At 48 hours, she underwent reoperation for peritoneal lavage and definitive abdominal wall closure, with no evidence of new bleeding sites. Her clinical course was favorable; she was extubated on day 4 and subsequently transferred to the general ward.

After 10 days of hospitalization, the patient was discharged in good general condition, with adequate contralateral renal function and no complications

during the intermediate puerperium. The newborn remained stable and experienced no adverse events.



DISCUSSION

Rupture of a renal artery aneurysm during pregnancy or the immediate puerperium represents one of the rarest and potentially most lethal vascular emergencies described in the literature. Despite its low incidence, its clinical impact is disproportionately high, with maternal and fetal mortality rates remaining significant even in contemporary series, mainly as a consequence of delayed diagnosis and rapid progression to hypovolemic shock ^(1,6,8).

Several authors agree that most renal artery aneurysm ruptures occur during the third trimester of pregnancy or the immediate puerperium, a period during which hemodynamic demands reach their highest level ^(1,4,6,9). This phenomenon is explained by the combination of renal hyperperfusion, increased plasma volume, and hormonal changes that affect arterial wall integrity, thereby favoring aneurysmal dilation and rupture ⁽⁴⁻⁶⁾. Consistent with these observations, the event in our patient occurred during the immediate puerperium, a stage recognized in the literature as carrying a high risk of rupture ^(1,6,16).

From a clinical standpoint, presentation with sudden abdominal or lumbar pain, acute anemia,

and hemodynamic instability corresponds to the most frequently reported pattern ^(6,10,11,17). However, one of the main challenges described is the difficulty in differentiating this condition from more prevalent obstetric disorders, such as placental abruption, uterine rupture, or postpartum hemorrhage, which helps explain the diagnostic delay and unfavorable outcomes reported in multiple series ^(6,8,10,17).

Computed tomography angiography is currently considered the diagnostic modality of choice when the patient's hemodynamic condition permits, because of its high sensitivity for identifying active contrast extravasation, retroperitoneal hematoma, and the precise location of the aneurysm ^(9,12,18). In this case, CTA was decisive in establishing the etiologic diagnosis and guiding definitive surgical management, as has also been emphasized in other publications ^(9,11).

Regarding treatment, the literature recognizes endovascular exclusion by coil embolization or stent-graft placement as an effective and less invasive alternative, particularly in centers with immediate access to interventional radiology and in patients with relative hemodynamic stability ^(8,13,19). However, this option is not always feasible, especially in the setting of profound shock, massive bleeding, or technological limitations, situations that are common in hospitals in developing countries ^(6,13,14). In such contexts, open surgery continues to play a fundamental role.

Emergency nephrectomy, although radical, has been described as a lifesaving strategy when aneurysmal rupture is associated with an extensive retroperitoneal hematoma and irreversible loss of renal viability ^(8,14,15). Several reports have documented favorable outcomes when the surgical decision is made promptly, prioritizing hemorrhage control and maternal hemodynamic stability over organ preservation ^(8,15). The management performed in this case is consistent with these recommendations and with the findings reported in the international literature.

A key aspect that deserves emphasis is the multidisciplinary coordination among the gynecology, surgery, urology, anesthesiology, and intensive care teams. The literature consistently emphasizes that this comprehensive approach, together with early resuscitation under massive transfusion protocols, is a key factor in improving maternal survival in this type of emergency ^(1,6,14). In this case, coordinated management made it possible to reverse hypovolemic shock and achieve a favorable outcome, in contrast to

the high mortality reported in most publications ^(1,6,8).

Based on this experience and the analysis of the available literature, several clinically relevant recommendations can be drawn. In pregnant women or women in the immediate puerperium who present with sudden abdominal or lumbar pain associated with acute anemia and hemodynamic instability, rupture of a renal artery aneurysm should be considered in the differential diagnosis, even in the absence of known vascular history ^(1,6,10). Likewise, computed tomography angiography should be performed early when the patient's clinical condition permits, because it facilitates an accurate diagnosis and guides definitive treatment ^(9,12). In settings where endovascular treatment is unavailable or contraindicated by the patient's hemodynamic status, open surgery and emergency nephrectomy remain valid and potentially lifesaving therapeutic options ^(8,14,15).

This report has limitations inherent to its design as a single case report, which prevents extrapolation of the findings to broader populations. In addition, the absence of an endovascular strategy limits direct comparison between therapeutic modalities, although it reflects a common situation in hospitals with limited technological resources ^(6,13).

In conclusion, rupture of a renal artery aneurysm during pregnancy or the immediate puerperium is a rare but highly lethal vascular emergency. Delayed diagnosis remains the main determinant of poor maternal and fetal outcomes ^(1,6,8). This case demonstrates that early recognition of the vascular source of bleeding, immediate intensive resuscitation, and timely surgical decision-making, including emergency nephrectomy when necessary, can reverse a potentially fatal condition and preserve maternal life even in resource-limited settings ^(8,14,15,19).



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Authorship contribution

RAO-M: Conceptualization, study design, overall supervision of the study, writing and preparation of the original draft, critical review and editing, and correspondence with the journal.

CLG-H: Conceptualization, acquisition of clinical data, writing and preparation of the original draft, image visualization, and critical review and editing of the manuscript.

CF-S: Acquisition of clinical data, analysis and interpretation of clinical data, critical review and editing of the manuscript, and clinical supervision.

SEN-C: Acquisition of obstetric data, specialized clinical interpretation, critical review and editing of the manuscript, and assistance with the multidisciplinary integration of the data.

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Conflict of interest statement

The authors declare no conflicts of interest.