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Middle Aortic Syndrome Revealed by Resistant Hypertension in Young Women from Sub-Saharan Africa: A Case Series of Three Patients

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Abstract

Background: Middle aortic syndrome and renovascular disorders are rare but serious causes of secondary hypertension in young adults. Their diagnosis may be delayed, particularly in young women, when hypertension is initially attributed to pregnancy, the postpartum period, or essential hypertension. This three-case series reports three distinct patterns of severe arterial disease in young women from sub-Saharan Africa presenting with resistant hypertension: a probable inflammatory form consistent with Takayasu arteritis, a form compatible with middle aortic syndrome revealed in the postpartum period, and significant left renal artery stenosis complicated by major renal functional impairment. The main interest of this case series was to show that focused clinical examination and vascular imaging can reveal rare anatomical lesions responsible for severe hypertension and high cardiorenal risk in a resource-limited setting. **Case 1:** involved a 38-year-old woman with long-standing severe hypertension complicated by a pregnancy-related stroke with fetal loss in the second trimester, associated with an inflammatory syndrome, fever, a systolic murmur, and diminished femoral pulses. Computed tomography angiography concluded to middle aortic syndrome of probable inflammatory

origin, consistent with Takayasu arteritis, with diffuse aortic involvement and severe bilateral renal artery disease. **Case 2:** involved a 27-year-old primigravida who had previously been normotensive and developed hypertension at 32 weeks of gestation, which persisted postpartum despite quadruple antihypertensive therapy. Examination revealed a blood pressure difference between the upper and lower limbs, a dorsal systolic murmur, and diminished femoral pulses. Imaging investigations supported the diagnosis of middle aortic syndrome with severe stenosis of the aortic isthmus associated with tight ostial stenosis of the left renal artery. **Case 3:** involved a 27-year-old woman with resistant hypertension evolving over one year, associated with an abdominal bruit suggestive of renovascular disease. Dynamic renal scintigraphy showed marked functional asymmetry, with left kidney function limited to 15%, consistent with renovascular hypertension secondary to significant stenosis of the left renal artery. **Conclusion:** This case series shows that any resistant hypertension in a young woman, particularly in the setting of pregnancy or the postpartum period, should prompt investigation for a secondary vascular cause, especially middle aortic syndrome or renovascular disease. The key message is that the combination of simple clinical clues (blood pressure difference between limbs, absent or diminished femoral pulses, vascular bruit) and targeted imaging examinations, particularly Doppler ultrasound, computed tomography angiography, and renal scintigraphy when indicated, can establish the diagnosis, assess functional impact, and guide therapeutic strategy. In our setting, however, limited access to revascularization remains a major obstacle to optimal management of these patients.

Keywords

Middle Aortic Syndrome, Resistant Hypertension, Takayasu Arteritis, Renal Artery Stenosis, Postpartum

1. Introduction

In young adults, particularly women, early-onset, severe, or resistant hypertension should prompt investigation for a potentially curable secondary cause. Among these etiologies, renovascular disorders and aortic abnormalities occupy an important place, especially when suggestive clinical signs are present, such as a vascular bruit, blood pressure asymmetry, or diminished peripheral pulses [1] [2].

Middle aortic syndrome refers to a segmental or diffuse narrowing of the distal thoracic or abdominal aorta, often associated with involvement of the renal and visceral branches. It is a rare vascular disorder of congenital or acquired origin, with acquired causes including Takayasu arteritis. Clinically, it presents with severe hypertension, relative hypotension of the lower limbs, claudication, or signs of renal artery stenosis, making it an important but often underrecognized cause of secondary hypertension in young women [3] [4].

Takayasu arteritis is likewise a rare vasculopathy that predominantly affects

young women and involves the aorta and its major branches. In a series of 272 cases, the mean age at diagnosis was 25 years, 75% of patients were women, and hypertension was the most frequent presenting manifestation, most often related to renal artery stenosis or aortic coarctation. Therefore, in the presence of resistant hypertension in a young woman, the possibility of inflammatory aorto-renal disease should be considered early, particularly when systemic features or diffuse vascular abnormalities are present [5].

Pregnancy and the postpartum period may further complicate the diagnosis by masking or revealing underlying vascular disease. In patients with Takayasu arteritis and renal involvement, maternal and fetal complications are more frequent in the absence of prior intervention, and clinical observations have shown that persistent postpartum hypertension may lead to the diagnosis of previously unrecognized middle aortic syndrome [6] [7].

Diagnosis relies on the correlation between clinical findings and vascular imaging, particularly Doppler ultrasound, computed tomography angiography, magnetic resonance angiography, and, in some cases, conventional angiography. In symptomatic patients, treatment is not limited to medical blood pressure control: surgical or endovascular revascularization may be required depending on the etiology, the extent of the lesions, and the degree of renal or visceral involvement. Available evidence suggests a blood pressure benefit after interventional management, with good long-term durability of aortic bypass grafts in operated series, although anatomical and financial constraints often limit access to these treatments in resource-limited settings [8]-[11].

In this context, we report a series of three cases of young women from sub-Saharan Africa in whom resistant hypertension revealed rare arterial disorders, mainly middle aortic syndrome and renovascular lesions. Through these observations, we highlight the importance of systematic vascular examination and early imaging in any severe or unusual hypertension in a young woman, particularly during the postpartum period.

2. Case Presentation

2.1. Case 1: Middle Aortic Syndrome of Probable Inflammatory Origin Consistent with Takayasu Arteritis

2.1.1. Patient Information

This was a 38-year-old Cameroonian woman referred to our cardiology department for evaluation of resistant hypertension that had been evolving for more than ten years, in a context of chronic clinical and biological inflammatory syndrome.

Her medical history included a stroke that had occurred during pregnancy and was complicated by fetal loss in the second trimester. The patient was being followed up as part of the etiological work-up for secondary hypertension.

2.1.2. Clinical Findings

At admission, the patient was febrile, with a temperature of 38˚C, a regular heart

rate of 104 beats per minute, and a body mass index of 22 kg/m^2. Blood pressure measured after 5 minutes of rest in the sitting position was 160/110 mmHg in the right arm and 174/102 mmHg in the left arm. In the lower limbs, blood pressure was lower, at 132/90 mmHg in the right leg and 130/81 mmHg in the left leg, indicating a pressure gradient between the upper and lower limbs.

Cardiovascular examination revealed a grade 3/6 systolic murmur at the aortic area, radiating to the back, as well as bilateral diminution of the femoral pulses compared with the radial pulses. There was neither carotid bruit nor clinical signs of heart failure.

Abdominal examination revealed a soft, non-tender abdomen, with no palpable mass and no audible abdominal bruit. Fundoscopy showed grade II hypertensive retinopathy according to the Keith-Wagener-Barker classification, with arteriovenous nicking and a "copper wiring" appearance. Neurological examination was unremarkable, and there was no peripheral edema. No dysmorphic features suggestive of a syndromic cause were observed.

2.1.3. Diagnostic Assessment

Thoraco-abdomino-pelvic computed tomography angiography with three-dimensional reconstruction was performed after injection of 80 mL of iodinated contrast medium (iohexol 350 mg I/mL) at 4 mL/s, with acquisition during the arterial phase (**Figure 1(A)**).

On unenhanced axial images, the examination showed intimal calcifications associated with aortic wall thickening, as well as a small right kidney. Curvilinear reconstructions demonstrated saccular aneurysms of the descending thoracic aorta and a fusiform aneurysm of the suprarenal abdominal aorta (**Figure 1(B)**). Three-dimensional reconstructions (**Figure 1(C)**) showed non-visualization of the right renal artery and distal occlusion of the left renal artery.

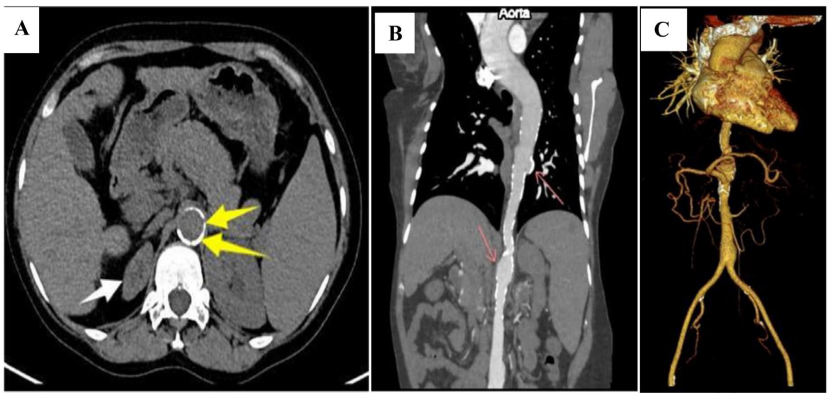

Figure 1. Takayashu arteritis in thoracoabdomal angio CT scan.

All clinical, biological, and morphological findings were strongly suggestive of middle aortic syndrome of probable inflammatory origin, consistent with Takayasu arteritis, with diffuse aortic involvement and severe bilateral renal artery disease (**Table 1**).

Table 1. Laboratory investigations (case 1).

Parameter	Result	Reference Range	Interpretation
Hematology			
Hemoglobin	11 g/dL	12 - 16 g/dL	Mild anemia
White blood cells	9800/mm^3	4000 - 11,000/mm^3	Normal
Platelets	334,000/mm^3	150,000 - 400,000/mm^3	Normal
ESR	18 mm/h	<20 mm/h	Normal
CRP	27 mg/L	<5 mg/L	Elevated
Renal function			
Serum creatinine	100 µmol/L (1.11 mg/dL)	45 - 84 µmol/L	Mildly elevated
eGFR (CKD-EPI)	73 mL/min/1.73m^2	>90 mL/min/1.73m^2	Mild renal impairment
Blood urea nitrogen	9 mmol/L	2.5 - 7.1 mmol/L	Slightly elevated
Serum potassium	3.9 mmol/L	3.5 - 5.0 mmol/L	Normal
Serum sodium	141 mmol/L	135 - 145 mmol/L	Normal
Urinalysis			
Proteinuria (24 h)	0.29 g/24 h	<0.15 g/24 h	Mild proteinuria
Microalbuminuria	192 mg/24 h	<30 mg/24 h	Elevated
Urinary sediment	Normal	Normal	No active sediment
Lipid profile			
Total cholesterol	4.2 mmol/L	<5.2 mmol/L	Normal
LDL-cholesterol	2.4 mmol/L	<2.6 mmol/L	Normal
HDL-cholesterol	1.7 mmol/L	>1.2 mmol/L	Normal
Triglycerides	1.2 mmol/L	<1.7 mmol/L	Normal
Glucose metabolism			
Fasting glucose	5.1 mmol/L	3.9 - 5.6 mmol/L	Normal
HbA1c	4.8%	<5.7%	Normal

2.1.4. Therapeutic Intervention

The case was discussed in a multidisciplinary meeting involving the cardiology, vascular medicine, vascular surgery, and interventional radiology teams. At the end of this discussion, a medical management strategy was retained.

The treatment initiated combined:

1) Methotrexate: 2.5 mg, 8 tablets per day, *i.e.*, 20 mg/day;

2) Methyldopa: 500 mg in the morning, 500 mg at midday, and 1000 mg in the evening, *i.e.*, 2000 mg/day;

3) Metoprolol: 100 mg/day;

4) Amlodipine: 10 mg/day;

5) Indapamide: 1.5 mg/day.

Corticosteroid therapy was also recommended as maintenance treatment for the inflammatory component.

2.2. Case 2: Middle Aortic Syndrome Revealed by Resistant Postpartum Hypertension

2.2.1. Patient Information

This was a 27-year-old Cameroonian woman, primigravida, with no known significant past medical history and previously normotensive, referred to our cardiology department for evaluation of persistent resistant hypertension at six weeks postpartum.

2.2.2. Obstetric History and Clinical Course

The pregnancy had been achieved spontaneously, and the first two trimesters were uneventful. At 32 weeks of gestation, an elevated blood pressure of 160/105 mmHg, without proteinuria, led to the diagnosis of gestational hypertension. Treatment with methyldopa 500 mg three times daily was initiated. Despite this management, blood pressure values remained elevated, ranging between 150 - 170/95 - 110 mmHg.

At 38 weeks of gestation, the patient had a spontaneous vaginal delivery of a stillborn male infant weighing 2800 g. No eclamptic seizure or sign of severe preeclampsia had been reported during pregnancy.

During the postpartum period, hypertension remained severe, with values ranging from 165 - 180/100 - 115 mmHg, secondarily associated with proteinuria, despite continuation of methyldopa. Given the persistence of uncontrolled hypertension, treatment was gradually intensified over four weeks by sequential addition of labetalol 200 mg twice daily during the first week, sustained-release nicardipine 50 mg twice daily during the second week, and spironolactone 50 mg/day during the fourth week. An anxiolytic treatment with diazepam 5 mg as needed was also prescribed because of associated anxiety. Despite this quadruple antihypertensive therapy at maximally tolerated doses, blood pressure remained uncontrolled, ranging from 155 - 175/95 - 110 mmHg.

2.2.3. Clinical Findings

On examination at six weeks postpartum, blood pressure measured after 5 minutes of rest in the sitting position was 172/108 mmHg in the right arm and 168/105 mmHg in the left arm. In the lower limbs, it was reduced to 135/80 mmHg in the right leg and 130/78 mmHg in the left leg, indicating a significant pressure gradient between the upper and lower limbs. Heart rate was regular at 88 beats per minute, and body mass index was 24.3 kg/m^2. Cardiovascular examination revealed a grade 3/6 systolic murmur along the left sternal border, radiating to the back, together with bilateral diminution of the femoral pulses compared with the radial pulses. There was neither carotid bruit nor clinical evidence of heart failure.

2.2.4. Diagnostic Assessment

The electrocardiogram showed sinus rhythm at 86 bpm, left ventricular hypertrophy according to voltage criteria, with a high Sokolow-Lyon index (SV1 + RV5 = 42 mm), as well as a strain-type repolarization abnormality in the lateral leads.

Transthoracic echocardiography showed a preserved left ventricular ejection

fraction of 58%, concentric left ventricular hypertrophy with an interventricular septum measuring 13 mm, posterior wall 12 mm, and left ventricular mass index of 128 g/m^2, grade I diastolic dysfunction, mild left atrial enlargement, and a maximal aortic velocity of 2.1 m/s, suggesting moderate acceleration of proximal flow.

Renal Doppler ultrasound showed a right kidney measuring 10.2 cm, with preserved morphology, a patent main renal artery, and normal hemodynamic parameters. On the left side, the kidney measured 9.4 cm, with preserved corticomedullary differentiation, but Doppler demonstrated turbulent high-velocity flow in the main renal artery, with a peak systolic velocity > 300 cm/s, a renal-to-aortic ratio of 4.2, a resistance index of 0.58, and an intrarenal parvus-tardus waveform, consistent with hemodynamically significant stenosis of the left renal artery.

Thoraco-abdomino-pelvic computed tomography angiography with 3D reconstruction was then performed after injection of 80 mL of iohexol 350 mg I/mL at 4 mL/s, with acquisition during the arterial phase. The examination demonstrated severe focal stenosis of the aortic isthmus, located distal to the origin of the left subclavian artery, measuring approximately 3.78 mm in diameter, corresponding to a caliber reduction greater than 85% over a length of 12 mm. There was pre-stenotic dilatation of the ascending aorta and aortic arch, as well as immediate post-stenotic dilatation of the descending thoracic aorta. The abdominal aorta was patent but mildly hypoplastic. No calcification, atherosclerotic plaque, dissection, or intramural hematoma was observed. The narrowing appeared smooth and concentric, suggesting a congenital etiology or, alternatively, an atypical inflammatory origin.

Regarding the renal arteries, the right renal artery was patent, with normal course and caliber. The left renal artery showed tight ostial stenosis, with a caliber reduced to 2 mm at its origin, corresponding to a diameter reduction greater than 70%, associated with post-stenotic dilatation and small collateral vessels arising from the lumbar and inferior phrenic arteries. The left kidney, measuring 9.2 cm, was smaller than the right, with delayed but preserved enhancement. There was neither renal artery aneurysm nor a "string-of-beads" appearance suggestive of fibromuscular dysplasia.

Table 2. Laboratory investigations (case 2).

Parameter	Result	Reference Range	Interpretation
Hematology			
Hemoglobin	11.8 g/dL	12 - 16 g/dL	Mild anemia
White blood cells	7200/mm^3	4000 - 11,000/mm^3	Normal
Platelets	285,000/mm^3	150,000 - 400,000/mm^3	Normal
ESR	18 mm/h	<20 mm/h	Normal
CRP	4.2 mg/L	<5 mg/L	Normal
Renal function			
Serum creatinine	98 µmol/L (1.11 mg/dL)	45 - 84 µmol/L	Mildly elevated
eGFR (CKD-EPI)	72 mL/min/1.73 m^2	>90 mL/min/1.73 m^2	Mild renal impairment

Continued

Blood urea nitrogen	7.8 mmol/L	2.5 - 7.1 mmol/L	Slightly elevated
Serum potassium	4.1 mmol/L	3.5 - 5.0 mmol/L	Normal
Serum sodium	139 mmol/L	135 - 145 mmol/L	Normal
Urinalysis			
Proteinuria (24 h)	0.28 g/24 h	<0.15 g/24 h	Mild proteinuria
Microalbuminuria	185 mg/24 h	<30 mg/24 h	Elevated
Urinary sediment	Normal	Normal	No active sediment
Lipid profile			
Total cholesterol	5.2 mmol/L	<5.2 mmol/L	Borderline
LDL-cholesterol	3.4 mmol/L	<2.6 mmol/L	Elevated
HDL-cholesterol	1.3 mmol/L	>1.2 mmol/L	Normal
Triglycerides	1.5 mmol/L	<1.7 mmol/L	Normal
Glucose metabolism			
Fasting glucose	5.3 mmol/L	3.9 - 5.6 mmol/L	Normal
HbA1c	5.4%	<5.7%	Normal

Taken together, these findings supported the diagnosis of middle aortic syndrome, combining severe stenosis of the aortic isthmus and significant ostial stenosis of the left renal artery, most likely of congenital origin, although an atypical inflammatory form could not be completely excluded (Table 2).

2.2.5. Therapeutic Intervention

The case was discussed in a multidisciplinary meeting involving cardiologists, vascular physicians, vascular surgeons, and interventional radiologists. Surgical or endovascular revascularization was recommended as definitive treatment.

Pending this intervention, the patient remained on maximal medical therapy, including:

1) Methyldopa 750 mg three times daily (2250 mg/day);
2) Labetalol 200 mg three times daily (600 mg/day);
3) Sustained-release nicardipine 50 mg twice daily (100 mg/day);
4) Spironolactone 50 mg/day;
5) Low-dose aspirin 100 mg/day, introduced after the diagnosis.

2.2.6. Follow-Up and Outcome

Definitive treatment could not be performed because of a major financial barrier. The estimated cost of surgical revascularization ranged from 4,500,000 to 6,000,000 CFA francs (approximately US$7,600 to US$10,200). The patient, who came from a modest socioeconomic background and had no health insurance coverage, was unable to access the procedure despite efforts undertaken through hospital social services, public assistance programs, charitable organ-

izations, and family fundraising initiatives. At the time of writing, she remained on maximal antihypertensive therapy, with persistent uncontrolled hypertension.

2.3. Case 3: Severe Renal Functional Asymmetry Secondary to Left Renal Artery Stenosis

2.3.1. Patient Information

This was a 27-year-old Cameroonian woman with no known significant past medical history, referred for evaluation of resistant hypertension evolving over the previous year.

2.3.2. Clinical Findings

On clinical examination, blood pressure measured after 5 minutes of rest in the sitting position was 182/108 mmHg in the right arm and 178/97 mmHg in the left arm, consistent with severe grade 3 hypertension. Heart rate was regular at 88 beats per minute, and body mass index was 25.1 kg/m^2.

Cardiovascular examination revealed a grade 3/6 periumbilical diastolic bruit, suggestive of abdominal vascular disease, together with bilateral diminution of the femoral pulses compared with the radial pulses. There was neither carotid bruit nor clinical evidence of heart failure.

In view of this clinical presentation, the diagnosis of secondary renovascular hypertension related to probable renal artery stenosis was considered, prompting functional assessment of relative renal contribution.

2.3.3. Diagnostic Assessment

Dynamic renal scintigraphy with 99mTc-DTPA and a furosemide challenge was performed after intravenous injection of 297.6 MBq of 99mTc-DTPA.

The examination showed severe functional impairment of the left kidney, whose contribution to total renal function was only 15%, compared with 85% for the right kidney. This marked asymmetry, in the context of documented left renal artery stenosis associated with resistant hypertension, was highly suggestive of hemodynamically significant renovascular disease.

The perfusion deficit observed in the left kidney corresponded to the anatomically described arterial lesion, confirming the significant functional impact of the stenosis. The delayed **Tmax** on the left side (6 minutes versus 5 minutes on the right) further supported the hypothesis of reduced renal blood flow on the affected side. The right kidney showed a normal nephrogram, indicating preserved function and serving as an internal control. After administration of furosemide, improvement in drainage on the left excluded obstructive uropathy as the cause of the functional decline, thereby confirming the predominantly vascular origin of the left renal impairment.

Taken together, these findings supported the diagnosis of renovascular hypertension secondary to significant stenosis of the left renal artery, complicated by severe renal functional asymmetry and probably partially irreversible parenchymal damage.

2.3.4. Clinical Interpretation and Prognostic Implications

This scintigraphic assessment provided several important pieces of information. First, it showed that the patient was functionally dependent to a large extent on the right kidney, which increased the clinical risk in the event of future involvement of the contralateral kidney (Figure 2(A)). Second, the very low contribution of the left kidney suggested advanced parenchymal damage, likely to limit the functional benefit expected from revascularization (Figure 2(B)). Nevertheless, such an intervention could still be considered with the aim of preserving residual function and improving blood pressure control.

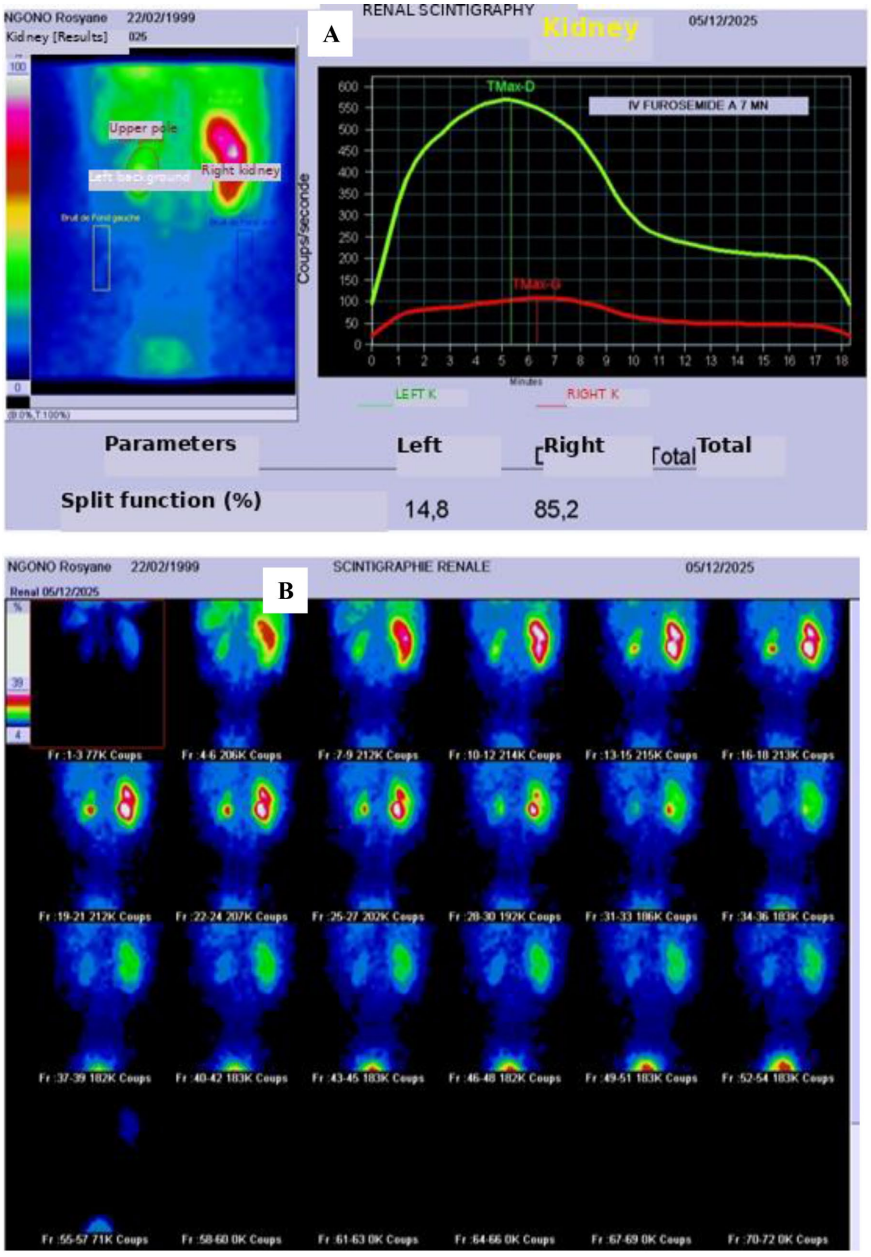

Figure 2. Scintigraphy with significant stenosis of the left renal artery, complicated by severe renal functional asymmetry in a middle aortic syndrom.

2.3.5. Therapeutic Intervention

The case was discussed in a multidisciplinary meeting involving cardiologists, vascular physicians, vascular surgeons, and interventional radiologists. Surgical or endovascular revascularization was recommended as definitive treatment.

Pending this intervention, the patient remained on maximal medical therapy, including:

1) Methyldopa 750 mg three times daily (2250 mg/day);

2) Labetalol 200 mg three times daily (600 mg/day);

3) Sustained-release nicardipine 50 mg twice daily (100 mg/day);

4) Spironolactone 50 mg/day;

5) Aspirin 100 mg/day.

2.3.6. Follow-Up and Outcome

As in the previous case, interventional treatment could not be performed because of a major financial barrier. The estimated cost of revascularization, ranging from 4,500,000 to 6,000,000 CFA francs (approximately US$7600 to US$10,200), exceeded the family's financial capacity, as they had no health insurance coverage. Despite efforts undertaken through hospital social services, government assistance programs, and charitable organizations, no funding solution had yet been secured at the time of writing. The patient therefore remained on maximal antihypertensive therapy, with ongoing clinical and functional follow-up.

3. Discussion

This three-case series highlights a common clinical lesson: in a young woman presenting with severe or resistant hypertension, particularly when associated with a blood pressure gradient between the upper and lower limbs, diminished femoral pulses, or a vascular bruit, a secondary arterial cause should be actively investigated. The etiologies observed here belonged to the spectrum of aorto-renal disorders, with probable inflammatory middle aortic syndrome in the first case, probably congenital middle aortic syndrome revealed in the postpartum period in the second case, and renovascular hypertension secondary to left renal artery stenosis with major functional impairment in the third case. This presentation is consistent with the literature, which emphasizes that renal artery stenosis and aortic abnormalities are important causes of secondary hypertension in young patients, and that middle aortic syndrome is defined by segmental or diffuse stenosis of the distal thoracic and/or abdominal aorta, often associated with involvement of the renal or visceral branches [2]-[4].

From a pathophysiological perspective, the elevated blood pressure observed in our patients may be explained mainly by two complementary mechanisms. First, renal artery stenosis reduces renal perfusion, activates the renin-angiotensin-aldosterone system, and sustains renovascular hypertension that is often severe and difficult to control medically. Second, aortic stenosis increases proximal afterload and promotes hypertension predominating in the upper limbs, with cardiac and

vascular consequences. This dual mechanism explains the severity of the profiles observed in our cases, particularly the persistence of hypertension despite multiple antihypertensive agents and the presence of left ventricular hypertrophy in the patient described in case 2. In Takayasu arteritis, renal artery involvement is in fact a well-recognized cause of resistant renovascular hypertension, whereas in middle aortic syndrome, the fixed anatomical obstruction by definition limits the effectiveness of pharmacological treatment alone [3] [12].

The first case was particularly suggestive of an inflammatory etiology consistent with Takayasu arteritis. The combination of young age, female sex, inflammatory syndrome, fever, diffuse aortic involvement, wall thickening with intimal calcifications, and complex lesions combining stenoses, occlusions, and aneurysms supported this hypothesis. Cross-sectional imaging plays a central role here, as computed tomography and magnetic resonance imaging not only assess the arterial lumen but also the vascular wall, revealing wall thickening, mural inflammation, and aneurysmal or occlusive changes typical of the disease. The literature specifically emphasizes that Takayasu arteritis is a large-vessel vasculitis affecting predominantly young women, and that imaging is essential for characterizing its extent and guiding therapeutic strategy [13] [14].

In contrast, the second and third cases were more suggestive of a congenital or non-inflammatory origin. In case 2, the smooth and concentric nature of the aortic narrowing, the absence of reported signs of active inflammation, the topography of the stenosis, and the lack of arguments in favor of fibromuscular dysplasia were more consistent with non-inflammatory middle aortic syndrome. In case 3, the lesion appeared to be dominated by left renal artery stenosis and its functional consequences, without associated systemic features. It should nevertheless be recalled that, in young patients, the differential diagnosis of renal artery stenosis primarily includes fibromuscular dysplasia and Takayasu arteritis. Fibromuscular dysplasia classically predominates in young women, whereas Takayasu arteritis should be considered when systemic features or associated aortic involvement are present [15].

The second case also illustrates the revealing role of pregnancy and the postpartum period. In this patient, hypertension that appeared during the third trimester and persisted after delivery could no longer be attributed to simple transient gestational hypertension. Pregnancy physiologically increases plasma volume, cardiac output, and uteroplacental and renal perfusion requirements; in a patient carrying a previously compensated aorto-renal lesion, these changes may increase the hemodynamic gradient and unmask an underlying disease. This interpretation is consistent with pregnancy series in patients with Takayasu arteritis, which report a high frequency of hypertensive complications, as well as with data showing that uncorrected renovascular disease before conception is associated with higher maternal and fetal risk [6] [16] [17].

From a diagnostic standpoint, this case series underscores the importance of a focused clinical examination. In our three cases, simple warning signs were present: young age, resistant hypertension, vascular bruit, diminished femoral pulses,

and in one case a clear blood pressure gradient between the upper and lower limbs. These findings are classic in aorto-renal forms and should prompt rapid etiological assessment. Imaging then made it possible to prioritize the lesions. Renal Doppler ultrasound was a good screening examination in case 2, demonstrating hemodynamically significant stenosis of the left renal artery. Computed tomography angiography was the key examination for aortic and renal lesion mapping in cases 1 and 2. Dynamic renal scintigraphy, for its part, was not intended to detail anatomy, but rather to confirm the functionally significant nature of the stenosis and to estimate residual renal reserve, as in case 3. This complementarity is well described in the literature: morphological imaging defines anatomy, whereas scintigraphy helps assess hemodynamic significance and, in some cases, the likelihood of response to revascularization [18] [19].

Management raised several therapeutic dilemmas in this series. The first concerned the limitations of medical treatment. In patients with a fixed anatomical obstruction, whether due to aortic stenosis or tight ostial renal artery stenosis, combining multiple antihypertensive agents does not always achieve satisfactory control. This was particularly evident in cases 2 and 3, where maximal quadruple therapy remained insufficient. The second dilemma concerned the indication for revascularization. In middle aortic syndrome, surgical and endovascular treatments can provide durable improvement in blood pressure and distal perfusion, although the optimal strategy depends on age, etiology, lesion extent, and available expertise. In renovascular lesions related to Takayasu arteritis, both angioplasty and surgery are used, with variable results depending on inflammatory activity and lesion type [10] [20] [21].

The third case provided an important prognostic nuance. A relative renal contribution limited to 15% suggests already advanced chronic ischemic damage and raises concern about incomplete parenchymal recovery after revascularization. Nevertheless, such a procedure may still be considered with the aim of preserving residual function and improving blood pressure control. The literature on renal scintigraphy in renal artery stenosis indeed emphasizes that a positive functional examination confirms the hemodynamically significant nature of the lesion, but that the magnitude of benefit after intervention depends on the chronicity of ischemia and the remaining parenchymal integrity [20].

Finally, beyond the strictly medical aspects, this series highlights a major limitation of management in our setting: the gap between diagnosis and access to definitive treatment. In cases 2 and 3, the indication for revascularization had been established, but the procedure could not be performed for financial reasons. This obstacle does not diminish the clinical value of these observations; on the contrary, it underscores that in resource-limited settings, the challenge is not only to recognize the disease early, but also to organize care pathways capable of translating an accurate diagnosis into a real therapeutic benefit. The main limitation of our series is precisely the absence of revascularization and long-term follow-up, which does not allow assessment of long-term blood pressure, renal, and vascular outcomes after definitive treatment.

4. Conclusion

This case series shows that middle aortic syndrome and renovascular disorders should be considered in any young woman with resistant hypertension, especially in the presence of a vascular bruit, a blood pressure gradient, or pulse abnormalities. The first contribution of these observations is to emphasize the value of clinical examination. The second is to show that multimodal imaging makes it possible to integrate anatomical diagnosis with functional assessment. The third, finally, is to underline that prognosis depends not only on the nature of the lesions, but also on actual access to revascularization.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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