A 45-year-old woman presented with a 10-year history of arterial hypertension. After initially successful conservative therapy with two antihypertensive drugs, arterial blood pressure was not controlled well during the last months. To exclude a renovascular origin of hypertension, an angiography was performed, which showed fibrodysplastic disease of the right renal artery with several stenotic segments and aneurysms (Fig. 8.1).

**Question 1**

Which of the following statements regarding renal artery aneurysm (RAA) is correct?

A. It has a marked female preponderance.
B. It is usually diagnosed during examination for flank pain.
C. It may cause arterial hypertension.
D. It typically leads to proteinuria by compression of the renal vein.
E. It can cause haematuria in rare cases.

**Question 2**

Which statements about the aetiology of the RAA are true?

A. The most frequent underlying diseases of RAA are aortic coarctation with concomitant disease of the renal artery and renal artery dissection.
B. Fibromuscular dysplasia of the renal artery may present with renal artery stenosis (RAS), RAA or both.
C. Arteriosclerosis is a frequent cause of RAA.
D. Some RAA present with inflammation of the arterial wall.

E. The incidence of RAAs is increased in Ehlers–Danlos syndrome and Marfan’s syndrome

**Question 3**

Which risks of the spontaneous course of the RAA should you explain to your patient?

A. The RAA may rupture and lead to a life-threatening bleeding.

B. The risk of rupture decreases during pregnancy and childbirth.

C. Hypertension in RAA may be caused by concomitant stenosis of the renal artery or its branches.

D. In cases of RAA and hypertension the angiography of the renal artery always shows an additional RAS.

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**Fig. 8.1.** Selective intra-arterial renal artery angiography revealed RAA combined with renal artery stenosis due to fibromuscular dysplasia.
E. The RAA may be a source of embolisation leading to a loss of renal function.

**Question 4**

Which of the following statements regarding the indication of renal artery repair (RAR) for RAA is correct?

A. There is an indication for RAR only in cases of symptoms other than hypertension.

B. There is no reason to perform RAR in women of childbearing age if there is no arterial hypertension.

C. There is a good indication for RAR if a concomitant RAS is found.

D. There is a good indication for RAR only if the RAA is larger than 5.5 cm.

E. There is an indication for RAR in patients presenting with RAA and hypertension even if an additional RAS is not detectable.

For RAR, a midline abdominal incision was performed for direct access to the infrarenal aorta, where an end-to-side anastomosis was performed with a segment of the patient's greater saphenous vein. After Kocher's manoeuvre, the distal renal artery was transected and anastomosed to the saphenous vein, which had been placed on the renal hilus dorsal to the inferior vena cava. Good results were shown by postoperative angiography (Fig. 8.2). At re-examination 3 years after the operation, the patient had a normal blood pressure without antihypertensive medication.

**Question 5**

Which of the following statements regarding the management of RAA is correct?

A. Replacement of the diseased renal artery by prosthetic graft is the RAR of first choice.

B. Protection of the kidney against ischaemic injury is performed only during ex situ reconstruction of the renal artery.

C. RAA exclusion and aortorenal vein graft interposition, or RAA resection and end-to-end anastomosis or aneurysmmorrhaphy, are valuable methods for RAR.

D. Ex situ repair of the renal artery may be needed in cases presenting with lesions of the distal branch arteries.

E. Tailoring of RAA often leads to recurrent aneurysmatic dilation of the renal artery.

**Commentary**

RAAs do not usually cause symptoms, and generally they are diagnosed accidentally during work-up for hypertension, as in our patient. In rare cases, flank pain has
been described as the initial symptom, which may be due either to the size of the RAA or to a renal artery dissection. Rupture of the aneurysm into the urinary tract will lead to haematuria. [Q1: A, C, E] The underlying disease is most frequently dysplasia of the arterial wall followed by arteriosclerosis. In our case, fibromuscular dysplasia was found to be the aetiology of the RAA. Rare causes of RAA may be atypical aortic coarctation with concomitant disease of the renal arteries, inflammation of the arterial wall, dissection or trauma, or disorders of the elastic and collagen fibres (i.e. Ehlers–Danlos syndrome or Marfan’s syndrome). [Q2: B, C, D, E]

RAA is found about twice as often in the right renal artery as in the left. Selective angiography often reveals concomitant RAS of mainstem and segmental arteries, and segmental arteries may also be aneurysmal. Concomitant renal artery dissection is rare.

Rupture of RAA, development or deterioration of arterial hypertension, and loss of renal function by thrombosis or embolisation, are impending spontaneous consequences of RAA.
As with all arterial aneurysms, rupture is a possible complication of RAA. While Tham et al. [1] experienced no rupture of RAA in 69 patients who had been treated conservatively during a mean observation time of 4.3 years, Henriksson et al. [2] observed RAA rupture in four cases (10.2 percent), and at the time of rupture only a nephrectomy could be performed. There are several case reports about RAA rupture in pregnancy and childbirth [3–5], and one author found the probability of RAA rupture during pregnancy to be as high as 80 percent [6].

As high arterial blood pressure is in itself a risk factor for rupture of arterial aneurysms of any localisation, one can argue that hypertension per se is an indication to remove an RAA. Hypertension was found in 90 percent of all patients with ruptured RAA [7].

The larger the diameter of the RAA, the more likely the danger of rupture seems to be, which can be explained by Laplace’s law. However, RAAs of any diameter can rupture. In one patient cohort [8], the smallest (1 cm) and the largest (16.5 cm) RAAs ruptured.

About eighty percent of patients with RAA have arterial hypertension [9, 10]. If RAA is accompanied by RAS on the same or the contralateral side, as in our patient, then it is reasonable to remove both, with the intention to improve hypertension and eliminate the risk of rupture. However, an ipsilateral stenosis may be missed by angiography due to overprojection of the aneurysm. Furthermore, aneurysmal disease includes not only dilation of vessels but also elongation, which might cause kinking with a relevant stenosis [11]. [Q3: A, C, E]

There is an absolute indication to remove RAAs in all patients with arterial hypertension with and without concomitant RAS and in women of childbearing age. [Q2: C] RAAs with a diameter greater than 2 cm should be removed, even if there is no hypertension. There are good long-term results for autologous RAR; therefore, there is a relative indication for operation in younger patients without hypertension and concomitant RAS with RAA of diameter of 1 cm or more. [Q4: C, E]

The most promising method of RAR is by autogenous reconstruction. Methods of RAR are replacement of the renal artery by the greater saphenous vein, resection of diseased sections and reanastomosis. The autoplastic reconstruction by tailoring (synonym: aneurysmorrhaphy) is another appropriate technique. Although the aneurysmatic wall is only resected partially, recurrent RAAs have not been observed. The in situ reconstruction is less traumatic, but ex situ repair of the renal artery may be necessary in cases in which not only the distal mainstem artery but also the segmental arteries are involved. [Q5: C, D]

If arterial repair is restricted to renal arteries only, and if concomitant repair of the aorta is not necessary, then a postoperative mortality of less than 1 percent can be expected. Postoperative morbidity is due to temporary kidney insufficiency, graft thrombosis, bleeding, thrombosis and pancreatitis. Affected kidneys can be preserved in more than 85 percent of cases. The number of patients who benefit from surgical therapy in terms of improvement of arterial hypertension varies considerably between authors, ranging from 5 to 50 percent and from 25 to 62 percent, respectively [12].

References