

Clinical Case 2

Patient with Essential Hypertension and Aortic Root Dilatation

2.1 Clinical Case Presentation

A 64-year-old, Caucasian male, was admitted to our outpatient clinic for recent uncontrolled hypertension. He reported a more than 12-year-long clinical history of essential hypertension, initially treated with a combination therapy based on ACE (angiotensin-converting enzyme) inhibitors (ramipril 5 mg) and diuretics (hydrochlorothiazide 12.5 mg).

About 5 years before, for suboptimal blood pressure (BP) control, drug therapy was titrated to ramipril 10 mg and hydrochlorothiazide 25 mg, with satisfactory BP control at home and no relevant side effects or adverse reactions.

About 3 years before, he had been reporting uncontrolled BP levels measured at home. For this reason, his referring physician prescribed amlodipine 5 mg daily in addition to the previous prescribed pharmacological therapy, with mild improvement in BP control.

The patient brought to our attention a recent (2 years earlier) echocardiogram that showed aortic root dilatation (47 mm).

In his medical history he also had diabetes and stage II chronic kidney disease.

His current medications included:

- Metformin 1000 mg daily.
- Acetylsalicylic acid (ASA) 100 mg daily.
- Ramipril 10 mg daily.
- Hydrochlorothiazide 25 mg.
- Amlodipine 5 mg.

Family History

Maternal history of hypertension and paternal history of coronary artery disease. He also has one sibling with hypertension.

Clinical History

He was a previous smoker (more than 20 cigarettes daily) for more than 20 years until the age of 60 years. He has two additional modifiable cardiovascular risk factors: sedentary life habits and obesity. There are no further cardiovascular risk factors or non-cardiovascular diseases.

Physical Examination

- Weight: 83 kg.
- Height: 165 cm.
- Body mass index (BMI): 30.4 kg/m².
- Waist circumference: 100 cm.
- Respiration: clear breath sound.
- Heart sounds: early diastolic murmur (II/VI Levine), best heard over the right second intercostal space, radiated towards the apex.

There was no jugular venous distension or hepatojugular reflux.

- Abdomen: his abdomen was soft and non-tender.
- Resting pulse: regular rhythm with heart rate of 95 beats/min.
- Carotid arteries: no murmurs.
- Femoral and foot arteries: symmetrical, absence of oedema.

Haematological Profile

- Haemoglobin: 15 g/dL.
- Haematocrit: 45%.
- Fasting plasma glucose: 147 mg/dL.
- Lipid profile: total cholesterol (TOT-C), 253 mg/dL; low-density lipoprotein cholesterol (LDL-C), 182 mg/dL; high-density lipoprotein cholesterol (HDL-C), 39 mg/dL; triglycerides (TG), 158 mg/dL.
- Electrolytes: sodium 137.9 mEq/L; potassium 4.0 mEq/L.
- Serum uric acid: 6.4 mg/dL.
- Renal function: urea 50 mg/dL, creatinine 1.18 mg/dL; estimated glomerular filtration rate (eGFR) (MDRD): 66.06 mL/min/1.73 m².
- Urine analysis (dipstick): normal.
- Normal liver function tests.
- Normal thyroid function tests.

Blood Pressure Profile

- Home BP (average): 160–165/95 mmHg.
- Sitting BP: 160/90 mmHg (right arm); 155/88 mmHg (left arm).
- Standing BP: 155/95 mmHg at 1 min.



FIGURE 2.1 12-lead ECG at the first available visit

12 Lead ECG

Sinus rhythm with heart rate 90 bpm, normal atrioventricular and intraventricular conduction, ST-segment abnormalities with signs of LVH (Fig. 2.1).

Echocardiogram

Dilatation of ascending aorta with widest diameter at the level of right pulmonary artery, measuring 41 mm. Dilated aortic root, measuring 50 mm. Descending thoracic aorta and pulmonary artery have normal diameters. Left ventricular hypertrophy (LV mass index: 64.5 g/m^2) with eccentric pattern (relative wall thickness [RWT]: 0.36) with left ventricular thickness measured and the left ventricle is not enlarged end diastole (55 mm). There is normal wall motion of 57% and normal diastolic function. Middle aortic regurgitation (Fig. 2.2).

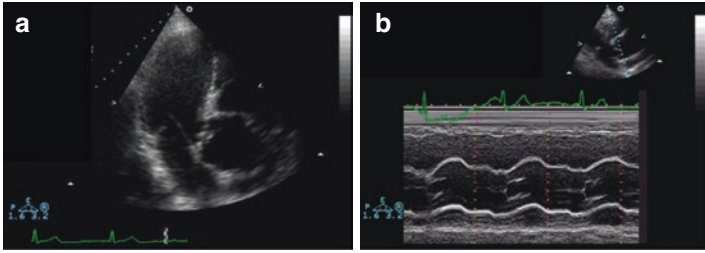


FIGURE 2.2 Echocardiogram at the first visit (Panel a: 5 chamber; panel b: M-mode long axis)

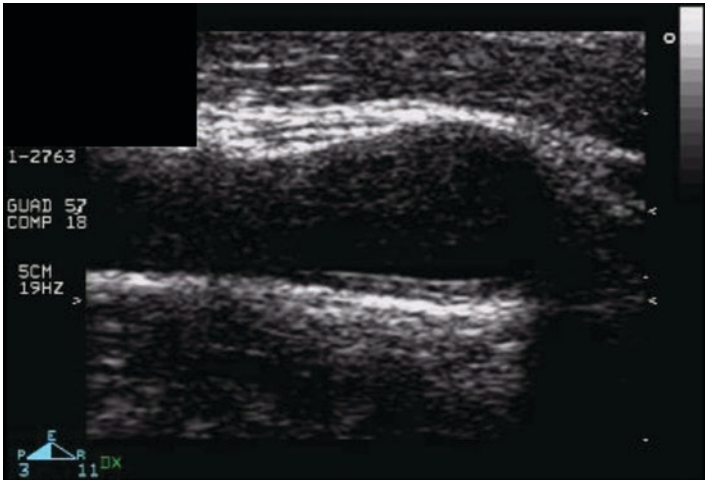


FIGURE 2.3 Carotid ultrasound at the first visit

Vascular Ultrasound

Carotid: intima-media thickness at both carotid levels with evidence of atherosclerotic plaques. At right: atherosclerotic plaque of 2.3 mm extending towards the internal carotid artery (Fig. 2.3).

Diagnosis

Aortic root dilatation in patient with essential hypertension, non-insulin-dependent diabetes and stage II chronic kidney disease, left ventricular hypertrophy, carotid plaque.

Additional modifiable cardiovascular risk factors (sedentary habits and visceral obesity).

Q1: Which is the global cardiovascular risk profile in this patient?

Possible answers are:

1. Low
2. Medium
3. High
4. Very high

Global Cardiovascular Risk Stratification

According to the 2013 European Society of Hypertension (ESH)/European Society of Cardiology (ESC) global cardiovascular risk stratification [1], this patient has very high cardiovascular risk (hypertension + type II diabetes mellitus + stage II chronic kidney disease + left ventricular hypertrophy + carotid plaque).

Treatment Evaluation

- Start bisoprolol 2.5 mg daily.
- Start atorvastatin 20 mg.
- Titrate the dose of amlodipine to 10 mg.

Prescriptions

- Periodical BP evaluation at home according to recommendations from guidelines.
- Low-calorie and low-salt intake.

2.2 Follow-Up (Visit 1) at 6 Weeks

At follow-up visit, the patient is apparently healthy and reports good adherence to prescribed medications, although he experienced drug-related side effects.

Physical Examination

- Weight: 83 kg.
- Waist circumference: 100 cm.
- Resting pulse: regular rhythm with heart rate of 70 beats/min.
- Respiration: normal.
- Heart sounds: early diastolic murmur (II/VI Levine), best heard over the right second intercostal space, radiated towards the apex. There was no jugular venous distension or hepatojugular reflux.
- Femoral and foot arteries: severe oedema of both lower extremities.

Lipid Profile

- TOT-C: 212 mg/dL; LDL-C: 162 mg/dL; HDL-C: 37 mg/dL; TG: 165 mg/dL.

Blood Pressure Profile

- Home BP (average): 140/90 mmHg.
- Sitting BP: 145/92 mmHg (left arm).
- Standing BP: 143/95 mmHg at 1 min.

12 Lead ECG

Sinus rhythm with heart rate 70 bpm, normal atrioventricular and intraventricular conduction, ST-segment abnormalities with signs of LVH (Fig. 2.4).



FIGURE 2.4 12-lead ECG at 6 weeks (follow-up visit 1)

Diagnosis

Aortic root dilatation in patient with essential hypertension, non-insulin-dependent diabetes and stage II chronic kidney disease, left ventricular hypertrophy, carotid plaque.

Additional modifiable cardiovascular risk factors (sedentary habits and visceral obesity).

Treatment Evaluation

- Switch from ramipril 10 mg to telmisartan 80 mg.
- Continue hydrochlorothiazide 12.5 mg.

Prescriptions

- A 24-h ambulatory BP monitoring.
- Periodical BP evaluation at home according to recommendations from guidelines.
- Low-calorie and low-salt intake.

2.3 Follow-Up (Visit 2) at 3 Months

At follow-up visit, the patient is in good clinical condition and asymptomatic.

He also reports good adherence to prescribed medications without adverse reactions or drug-related side effects. No relevant changes of the renal function have been documented.

Physical Examination

- Weight: 83 kg.
- Resting pulse: regular rhythm with heart rate of 66 beats/min.
- Respiration: basal crepitations.
- Heart sounds: early diastolic murmur (II/VI Levine), best heard over the right second intercostal space, radiated towards the apex.

Blood Pressure Profile

- Home BP (average): 130/80 mmHg (early morning).
- Sitting BP: 145/85 mmHg (left arm).
- Standing BP: 135/90 mmHg at 1 min.
- 24-h BP: 123/78 mmHg; HR: 62 bpm.
- Daytime BP: 129/82 mmHg; HR: 66 bpm.
- Night-time BP: 110/69 mmHg; HR: 54 bpm.
- 24-h ambulatory BP profile is illustrated in Fig. [2.5](#).

Lead Electrocardiogram

Sinus rhythm with heart rate 66 bpm, normal atrioventricular and intraventricular conduction, ST-segment abnormalities with signs of LVH.

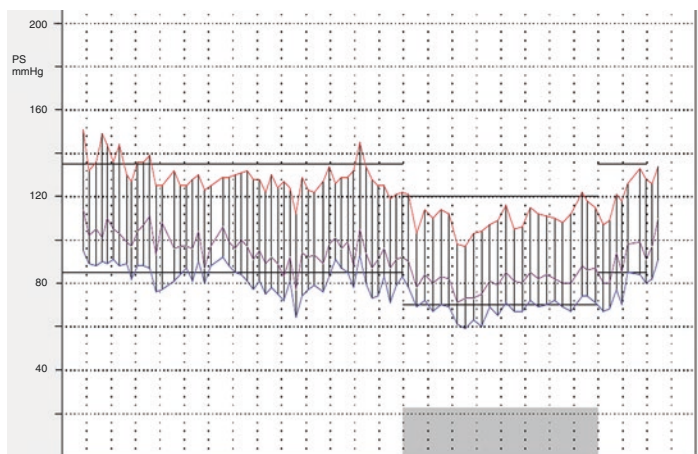


FIGURE 2.5 24-h ambulatory blood pressure profile at 3 months (follow-up visit 2)

Echocardiogram

Dilatation of ascending aorta with widest diameter at level of right pulmonary artery, measuring 44 mm. Dilatation of aortic root, measuring 53 mm. Descending thoracic aorta and pulmonary artery have normal diameters. Left ventricular hypertrophy with eccentric pattern. Left ventricular thickness was measured, and the LV end-diastolic diameter is not enlarged. There is normal wall motion of 59% and normal diastolic function. Middle aortic regurgitation.

CT with Contrast Medium

Aortic root dilatation (50 mm) and ascending aorta dilatation (42 mm).

Diagnosis

Stable aortic root dilatation in patient with essential hypertension, non-insulin-dependent diabetes and stage II chronic kidney disease, left ventricular hypertrophy, carotid plaque.

Additional modifiable cardiovascular risk factors (sedentary habits and visceral obesity).

Treatment Evaluation

- No changes to prescribed therapy.

Prescriptions

- Periodical BP evaluation at home according to recommendations from current guidelines.
- Periodical control of routine chemistry.
- Low-calorie and low-salt intake.

2.4 Follow-Up (Visit 3) at 6 Months

At follow-up visit, the patient is in good clinical condition. He is asymptomatic and has a good control of home BP values.

Physical Examination

- Weight: 86 kg.
- Resting pulse: regular rhythm with heart rate of 61 beats/min.
- Respiration: normal.
- Early diastolic murmur (III/VI Levine) is heard, particularly over the right second intercostal space, radiated towards the apex.

Blood Pressure Profile

- Home BP (average): 125/70 mmHg (early morning).
- Sitting BP: 130/80 mmHg (left arm).
- Standing BP: 127/83 mmHg at 1 min.

Lipid Profile

- TOT-C, 243 mg/dL; LDL-C, 170 mg/dL; HDL-C, 35 mg/dL; TG, 187 mg/dL.

Lead Electrocardiogram

Sinus rhythm with heart rate 60 bpm, normal atrioventricular and intraventricular conduction, ST-segment abnormalities with signs of LVH.

Echocardiogram

Dilatation of ascending aorta (42 mm) and aortic root (49 mm). Descending thoracic aorta and pulmonary artery have normal diameters. Eccentric left ventricular hypertrophy without end-diastolic dilatation. There is normal wall motion of 58% and normal diastolic function. Middle aortic regurgitation.

Diagnosis

Chronic aortic root dilatation in patient with essential hypertension, non-insulin-dependent diabetes and stage II chronic kidney disease, left ventricular hypertrophy, carotid plaque.

Additional modifiable cardiovascular risk factors (sedentary habits and visceral obesity).

Q2: Which is the best therapeutic option in this patient?

Possible answers are:

1. No changes
2. Add another antihypertensive
3. Increase atorvastatin
4. Change telmisartan

Treatment Evaluation

- Lifestyle changes.
- Titrate the dose of atorvastatin to 40 mg.
- No changes to other drugs.

Prescriptions

- Periodical BP evaluation at home according to recommendations from current guidelines
- Periodical control of routine chemistry
- Low-calorie and low-salt intake

2.5 Follow-Up (Visit 4) at 1 Year

At follow-up visit, the patient is in good clinical condition. He experienced dyspnoea for intense efforts, NYHA (New York Health Association) classification II.

Physical Examination

- Weight: 80 kg.
- Resting pulse: regular rhythm with 60 beats/min.
- Absence of peripheral oedema.
- Respiration: normal.
- Heart sounds: an early diastolic murmur (III/VI Levine).

Haematological Profile

- Haemoglobin: 15.1 g/dL.
- Haematocrit: 47%.
- Fasting plasma glucose: 124 mg/dL.
- HbA1C: 42 mmol/mol (6%).
- Lipid profile: TOT-C, 193 mg/dL; LDL-C, 125 mg/dL; HDL-C, 40 mg/dL; TG, 139 mg/dL.

- Electrolytes: sodium, 140 mEq/L; potassium, 3.9 mEq/L.
- Serum uric acid: 6.3 mg/dL.
- Renal function: urea 48 mg/dL, creatinine, 1.1 mg/dL; estimated glomerular filtration rate (eGFR) (MDRD): 67 mL/min/1.73 m².
- Urine analysis (dipstick): normal.
- Normal liver function tests.
- Normal thyroid function tests.

Blood Pressure Profile

- Home BP (average): 130/70 mmHg.
- Sitting BP: 130/75 mmHg (left arm).
- Standing BP: 125/75 mmHg at 1 min.

Lead Electrocardiogram

Sinus rhythm with heart rate 60 bpm, normal atrioventricular and intraventricular conduction, ST-segment abnormalities with signs of LVH.

Echocardiogram

The echocardiography showed ascending aorta (41 mm) and aortic root (50 mm) dilatation. Eccentric left ventricular hypertrophy (LV mass indexed 57.1 g/m^{2.7}, relative wall thickness 0.38) with normal chamber dimension (LV end-diastolic diameter 52 mm), impaired left ventricular relaxation (E/A ratio < 1) at both conventional and tissue Doppler evaluations and normal ejection fraction (60%). Normal dimension of left atrium. Right ventricle with normal dimension and function. Pericardium without relevant abnormalities.

Mitral (++) , tricuspid (+) and aortic (++) regurgitations at Doppler ultrasound examination.

Diagnosis

Chronic aortic root dilatation in patient with essential hypertension, non-insulin-dependent diabetes and stage II chronic kidney disease, left ventricular hypertrophy, carotid plaque.

Current Treatment

- Telmisartan 80 mg.
- Bisoprolol 2.5 mg.
- Metformin 1000 mg daily.
- Hydrochlorothiazide 12.5 mg.
- Amlodipine 10 mg.
- Atorvastatina 40 mg.

Treatment Evaluation

- No changes to the current therapy.

Prescriptions

- Periodical BP evaluation at home according to recommendations from current guidelines.
- Periodical control of routine chemistry.
- Low-calorie and low-salt intake.
- Strict control of aortic root dimension through periodical echocardiographic assessment (every 6 months).

2.6 Discussion

This clinical case describes a patient with essential hypertension, aortic root dilatation, non-insulin-dependent diabetes, left ventricular hypertrophy and carotid atherosclerotic plaque. The 2013 ESH/ESC guidelines on the clinical management of

hypertension [1] identify this patient as at high cardiovascular risk for the presence of diabetes, left ventricular hypertrophy and carotid plaque, but do not take into account the aortic root dilatation as a risk factor for cardiovascular events.

Aortic root dilatation has been associated with aortic regurgitation, hypertension, arteriosclerosis and hypertension-related end-organ damage, including increased peripheral resistance, carotid intima-media thickness, evidence of plaque [2] and aortic root dimension indexed to height. Also it has been demonstrated to have a predictive value for the incidence of both nonfatal and fatal cardiovascular events [3]. Furthermore, the ratio between the aortic root area and its height provides independent and improved risk stratification for prediction of death [4].

According to the current guidelines, patients with chronic conditions, such as hypertension, should maintain their BP below 140/90 mmHg, by means of lifestyle changes and—if necessary—using antihypertensive drugs [1]. There is no evidence for the efficacy of specific antihypertensive drug classes in preventing the progression of aortic root dilatation, except for patients with Marfan syndrome. Several reports have showed that the prophylactic use of beta blockers, ACE inhibitors and angiotensin receptor blockers (ARBs) seems to be able to reduce either the progression of the aortic dilatation or the occurrence of complications [5–8].

In our patient, we obtained an optimal control of BP and other risk factors (i.e. diabetes and lipid profile), and we suggested to strictly control aortic root dimensions regularly (every 6 months) through echocardiography.

Take-Home Messages

Aortic root dilatation has been associated with other cardiovascular risk factors.

Aortic root dimension indexed to height is predictive of both incident nonfatal and fatal cardiovascular events.

There is no evidence for the efficacy of particular antihypertensive classes of drugs in preventing the progression of aortic root dilatation.

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