Case #1

This 35-year-old patient presented with elevated blood pressure (BP) levels during the 4th month of her 2nd pregnancy (the 1st proceeded uneventfully 5 years earlier). Due to elevated office BP levels, but not home BP levels, her hypertension was diagnosed as white-coat hypertension. Her pregnancy proceeded uneventfully until delivery. As she presented with herpes genitalis, she delivered at term (gestational week 40) by Caesarean section [female; 3.690 g (50-90th centile of normal birthweight)][1]. Three months post-delivery, she repeatedly found elevated BP levels during home BP monitoring, which was confirmed by a cardiologist. Betablocker treatment was initiated but did not lead to BP decrease. Laboratory evaluation showed profound hypokalemia (2.6 mmol/l). Endocrinological investigation revealed suppressed plasma renin levels, elevated serum aldosterone levels, and a right adrenal adenoma (13 mm). Investigation in our ward confirmed elevated BP levels [24-hour ambulatory BP monitoring (24h-ABPM) 149/104 mmHg despite the verapamil treatment], hypokalemia (3.1 mmol/l), elevated serum aldosterone (48.9 ng/dl), and suppressed plasma renin levels (0.58 pg/ml). Due to her young age (35 years) and the finding of an adrenal nodule on CT (13 cm), she was referred to surgery without adrenal venous sampling. Pre-surgery, spironolactone treatment led to a small decrease in BP. After laparoscopic adrenalectomy, her BP levels dropped to systolic BP values of about 100-110 mmHg, which were temporarily associated with fatigue. Hormonal examination revealed low aldosterone values and serum potassium normalized. Histopathological examination confirmed the diagnosis of a cortical adrenal adenoma (13 mm). Molecular genetic analysis of the tumor revealed a somatic mutation in the *KCJN5* gene c.451 G>A.

Case #2

This 39-year-old patient was referred to our ward due to suspicion of secondary hypertension because of profound hypokalemia and hypertension. She was treated for recurrent sinusitis and bronchial asthma according to her medical history. Her hypertension was diagnosed one year before her 1st pregnancy, which proceeded uneventfully [vaginal delivery at gestational week 41 was complicated by placenta adherent which required manual lysis of placenta, male; 3.650 g (50-90th centile of normal birthweight)][1]. Her hypertension persisted post-delivery. Her 2nd pregnancy was complicated two years later by BP elevation at the end of pregnancy and by mild intrauterine growth restriction. Vaginal delivery was induced by prostaglandins at gestational week 40 [female; 2.710 g (5-10th centile of normal birthweight)][1]. One year before admission to our ward, she had developed muscle cramps, fatigue, polyuria with nocturia and polydipsia (5 liters of fluid per day). Laboratory examination found profound hypokalemia (2.4 mmol/l). Her symptoms persisted despite potassium supplementation. Treatment with amlodipine did not lead to BP normalization (24h-ABPM 139/84 mmHg). CT revealed an adenoma in the right adrenal gland (23 x 13 x 18 mm). Examination in our ward found elevated serum aldosterone levels (38.6 ng/dl) and suppressed plasma renin levels (3.3 ng/dl), which confirmed the diagnosis of primary aldosteronism (PA). Laparoscopic adrenalectomy was performed without adrenal venous sampling (AVS) after spironolactone treatment. In the postoperative course, serum potassium levels normalized, and systolic BP decreased to levels of about 100 mmHg associated with temporary fatigue. Histopathology revealed a cortical adrenal adenoma (20 x 18 x 14 mm). She underwent knee arthroscopy without any complications one year after tumor removal. Genetic examination of the tumor found a somatic mutation in the *KCJN5* gene c.503 T>G.

Case #3

This 38-year-old patient had been diagnosed with hypertension during her pregnancy 12 years before examination in our ward. Significantly elevated BP levels were measured at the end of pregnancy. Due to leg edemas, and elevated BP levels despite alpha-methyldopa and magnesium sulphate treatment, Caesarean section was performed at gestational week 36 [female; 3.550 g (˃ 95th centile of normal birthweight)][1]. Following the delivery, BP levels were normalized for 6 months. Thereafter, therapy with betablockers was initiated due to elevated BP levels, and palpitations. Due to unsatisfactory BP control, therapy with ACE inhibitors and indapamide were added. After 6 years of hypertension treatment, the patient developed profound fatigue, muscle weakness and cramps. She was admitted to the local hospital due to rhabdomyolysis because of severe hypokalemia (1.75 mmol/l). Spironolactone therapy was instituted, but not tolerated due to dysmenorrhea. She was admitted again to the local hospital 6 years later with clinical signs of heart failure – dyspnea and leg edemas, and markedly elevated BP levels (225/125 mmHg). Despite the therapy with a low dose of spironolactone (25 mg), the patient tended to hypokalemia. A right adrenal adenoma (17 mm) was found on CT. Investigation in our ward confirmed the suspicion of PA [significantly elevated serum aldosterone (63.8 ng/dl) and suppressed renin levels (4.8 pg/ml)] despite the treatment with 100 mg spironolactone. ABPM confirmed good BP control (124/74 mmHg). Echocardiography showed normal left ventricular systolic function without hypertrophy. Right laparoscopic adrenalectomy was performed without complications. Histopathological examination found a typical cortical adrenal adenoma (17 x15 x11 mm). Therapy with betablockers was started due to palpitations, and with diuretics due to leg edemas in the later postoperative course. This therapy was associated with fatigue due to lower BP levels (home systolic BP < 110 mmHg). ABPM confirmed very good BP control with a white-coat phenomenon (124/75 mmHg). Potassium levels were repeatedly close to the upper range of normal (5.1 mmol/l) and serum aldosterone and plasma renin levels normalized.

Case #4

This patient was diagnosed with hypertension 6 years before the diagnosis of PA was made during her 1st uneventful pregnancy with spontaneous delivery [female; 3.710 g (50-90th centile of normal birthweight)][1]. Hypertension persisted after puerperium. In her 2nd pregnancy 3 years later, BP levels decreased during the first trimester, which allowed for cessation of antihypertensive medication. However, BP levels increased during the third trimester and remained elevated despite the alpha-methyldopa treatment. She was admitted to hospital with suspicion of preeclampsia, which was not confirmed. She spontaneously delivered a healthy boy [3.220 g (10-50th centile of normal birthweight)][1] at gestational week 40, ten days after admission to hospital. Her hypertension persisted post-delivery and she started to complain of nocturia, fatigue, leg swellings, and paresthesia. Almost three years later, profound hypokalemia was found (2.3 mmol/l) and she was referred to our ward for suspected PA. High serum aldosterone (99.2 ng/dl) and suppressed plasma renin (2.8 ng/dl) levels confirmed the diagnosis of PA, and CT scan showed a left adrenal adenoma (18 mm). ABPM confirmed elevated BP levels (137/95 mmHg) during amlodipine treatment. Her symptoms disappeared after initiation of spironolactone treatment. Laparoscopic adrenalectomy was performed without previous AVS due to her young age at the time of the diagnosis (33 years) and adenoma on CT (18 mm). Postoperatively (histopathology confirmed the diagnosis of adenoma – 17 x 20 x10 mm), her BP levels normalized, and her exercise tolerance significantly improved.

Case #5

This 33-year-old patient was diagnosed with hypokalemia for the first time 7 years before admission to our ward. Hypokalemia was treated by KCl supplementation. Three years later, hypertension was diagnosed at the time of pregnancy diagnosis. Her BP levels had been increasing continuously despite the treatment. She was admitted to the local hospital at gestational week 27 because of her permanent markedly increased BP levels, progressive leg edemas, and significant proteinuria. She was transferred to the tertiary Obstetrical Center due to severe preeclampsia. As her BP did not decrease on therapy with natrium nitroprusside, and fetal hypoxia was detected on cardiotocography, an urgent Caesarean section was performed (male; 860 g, 15-20th centile of normal birthweight)[1]. Her hypertension persisted post-delivery, and therapy with spironolactone was instituted due to the inability to undergo examinations to confirm the suspicion of secondary hypertension, as she was breastfeeding. Later, hormonal examination confirmed the PA diagnosis with markedly elevated serum aldosterone levels (82.9 ng/dl) and suppressed plasma renin levels (2.1 ng/dl). CT examination revealed an adenoma in the left adrenal gland (15 x 15 x 17 mm). Laparoscopic adrenalectomy (adenoma 21 mm confirmed on histopathology) led not only to normalization of potassium levels, but also to normalization of the parameters of the renin-angiotensin-aldosterone axis and BP levels.

Case #6

In this patient, arterial hypertension was diagnosed 10 years before referral to our ward during a routine preventive examination. Her BP levels were well-controlled with monotherapy. Both pregnancies (7 and 9 years after hypertension diagnosis) led initially to improvement of BP levels, but worsened during the third trimester, with subsequent admission to the maternity hospital at gestational week 39 due to preeclampsia (elevated BP values despite the alpha-methyldopa treatment, and proteinuria). Both pregnancies were delivered spontaneously after induction with prostaglandin [female 4.350 g (>95th centile of normal birthweight), male 3.550 g (50-90th centile of normal birthweight)][1]. Unlike after the 1st delivery, BP levels remained elevated after the 2nd delivery. Hypokalemia was found during diuretic treatment. Almost one year after the 2nd delivery, her BP levels increased dramatically, and she was admitted to the Cardiology Department. On admission, profound hypokalemia (2.5 mmol/l) was found. As elevated serum aldosterone (43.3 ng/dl) and suppressed plasma renin (0.5 ng/dl) levels were detected, spironolactone therapy was started. This treatment led not only to normalization of BP levels, but also to the disappearance of nocturia and fatigue. A relatively large cortical adenoma (20 mm) in the the left adrenal was found. Considering her young age (34 years), she was scheduled for laparoscopic adrenalectomy without adrenal venous sampling. Tumor removal was associated not only with normalization of BP levels, but also with normalization of serum aldosterone and plasma renin levels. Histopathological examination confirmed the diagnosis of an adrenal cortical adenoma (15 x 9 x 7 mm). Molecular-genetic analysis found a mutation in the *KCJN5* gene c.503 T>G.

Case #7

This 32-year-old patient was first diagnosed with hypertension during her pregnancy approximately 1.5 years before admission to our ward. She was successfully treated with a low dose of alpha-methyldopa. Apart from the delivery by Caesarean section due to breech presentation [female; 3.100 g (10-50th centile of normal birthweight)][1], her pregnancy proceeded without complications. Her BP levels normalized immediately post-delivery. Almost six months after delivery, significantly elevated BP (180/130 mmHg) was found during routine examination by the allergist. The elevated BP levels prompted examinations to exclude a secondary form of hypertension. Hormonal examination confirmed the diagnosis of PA – low serum potassium (3.4 mmol/l), elevated serum aldosterone (29.9 ng/dl), and suppressed plasma renin levels 0.5 (ng/dl). ABPM showed elevated BP levels (141/98 mmHg) despite the verapamil treatment. As in the previous cases, laparoscopic adrenalectomy was indicated, due to the finding of cortical adenoma in the right adrenal gland on CT (13 mm) and her young age (32 years). Following the operation, her potassium, BP levels, and parameters of the renin–angiotensin–aldosterone axis normalized. A small cortical adenoma (12 x 10 x 8 mm) was found on histopathology.

Case #8

This 33-year-old patient had been treated for hypertension for 10 years. She was pregnant three times (8, 4, and 1 year) before the diagnosis of PA. All pregnancies were without hypertension-related complications and all babies were delivered at term [one by Caesarean section due to breech presentation; female 3.970 g (90-95th centile of normal birthweight), two vaginal deliveries: female 3.490 g (50-90th centile of normal birthweight), male 3.830 g (50-90th centile of normal birthweight)][1]. Despite the known and supplemented hypokalemia for many years (the lowest level 2.7 mmol/l), the search for a secondary cause of hypertension was initiated almost 10 years after diagnosis of hypertension. Hormonal examination showed elevated serum aldosterone levels (40.3 ng/dl) and suppressed plasma renin levels (2.3 ng/dl). Aldosterone secretion was localized to the left adrenal through adrenal venous sampling, which was performed due to the unequivocal CT finding (suspected 12 mm adenoma in the left adrenal). ABPM confirmed the diagnosis of moderate hypertension with average 24-hour levels of 142/90 mmHg under verapamil treatment. Laparoscopic adrenalectomy normalized not only BP levels but also laboratory parameters. A 7 mm cortical adenoma was found on histopathology.

Case #9

This 32-year-old patient sought an explanation for her BP increase during her first pregnancy, to avoid potential complications during her planned second gravidity. This was the reason for her appointment at our Hypertension Center. Her hypertension had been diagnosed 4 years before examination in our ward during a preventive examination. Her gravidity was complicated by worsened hypertension in the 8th month of pregnancy. She was admitted to the hospital at gestational week 36 due to premature rupture of membranes, and an acute Caesarean section was performed [male; 2.410 g (10-50th centile of normal birthweight)][1]. Laboratory examination in the maternity hospital revealed hypokalemia (3.2 mmol/l), which did not prompt her attending physician to search for a secondary cause of hypertension. Her hypertension was treated with amlodipine, but diastolic BP levels remained above 90 mmHg. Examination in our ward 3 years after the delivery revealed severe hypokalemia (2.8 mmol/l), elevated plasma aldosterone levels (53.4 ng/dl) and suppressed plasma renin activity (0,494 μg/l/h). CT showed a left adrenal adenoma (24 mm). Laparoscopic adrenalectomy led to normalization of potassium, serum aldosterone, plasma renin activity, and BP levels. Histopathological examination confirmed the diagnosis of a cortical adenoma (20 x 25 x15 mm). Four years after tumor removal, her pregnancy proceeded without any complications, apart from herpes genitalis before delivery, which led to a Caesarean section.

Case #10

This patient was diagnosed with hypertension during a preventive examination at the age of 27 years. Two years later, her pregnancy was complicated by worsened hypertension, despite escalating antihypertensive treatment (higher doses of alpha-methyldopa and metoprolol). Laboratory examination showed hypokalemia, which was supplemented with 3 g KCl. She was admitted to hospital at gestational week 40 because of intrauterine growth restriction and hypertension. Caesarean section was indicated due to imminent fetal hypoxia [male; 2.640 g, (<5th centile of normal birthweight)][1]. She was discharged from hospital on treatment with alpha-methyldopa, metoprolol, and KCl supplementation. Due to the pathological finding in the urine, she underwent nephrological examination 9 months post-delivery. Diagnosis of PA was facilitated by a finding of profound hypokalemia (2.9 mmol/l) and was confirmed by elevated levels of plasma aldosterone (35.8 ng/dl) and suppressed plasma renin activity (0.594 μg/l/h). Adrenal CT did not find any pathology and she was switched to treatment with high doses of spironolactone (150 mg). She was referred to our Hypertension Center to establish the final diagnosis of PA. Adrenal venous sampling localized the aldosterone secretion to the left adrenal, which was concordant with a repeated CT (7 mm adenoma on the left side). Despite the verapamil and doxazosine treatment, ABPM showed elevated BP levels (139/91 mmHg). Laparoscopic adrenalectomy led to normalization of potassium, serum aldosterone and plasma renin activity levels. However, mild to moderate hypertension persisted, for which lacidipine and betaxolol treatments were instituted. Histopathology confirmed the diagnosis of a small adrenal adenoma (5 mm).

Case #11

This 28-year-old patient was diagnosed with primary aldosteronism. Hypertension appeared for the first time during her 1st pregnancy 2.5 years before the diagnosis of PA. This pregnancy was complicated by a gradual BP increase, which led to the decision to deliver by Caesarean section at gestational week 39 [female; 3.450 g (50-90th centile of normal birthweight). Her BP levels did not normalize after delivery. Approximately one year post-delivery, her BP levels increased, and she started to feel tired. Hypokalemia was found (3.2 mmol/l) and spironolactone therapy was initiated. The mineralocorticoid receptor antagonist therapy led to normalization of BP levels and fatigue disappearance, but its tolerance was poor due to gastrointestinal intolerance. She was subsequently referred to our ward for further examination. Moderate hypertension was confirmed by ABPM ( 140/93 mmHg while treated with isradipine and doxazosine). We found elevated serum aldosterone levels (37.8 ng/l), suppressed plasma renin activity (0.262 µg/l/h), and a small adrenal nodule on CT (11 x 8 mm). Adrenal venous sampling lateralized aldosterone secretion to the left side. Laparoscopic adrenalectomy was associated with normalization of plasma aldosterone, renin activity, and potassium levels. Her BP returned to normal levels. Histopathology revealed a small cortical adenoma (11 mm). She delivered her second child spontaneously 6 years after adrenalectomy, and the course of this pregnancy was uncomplicated.

Case #12

This patient was diagnosed with hypertension during home BP monitoring at the age of 19 years. Her hypertension was regarded as inherited. Antihypertensive treatment did not lead to BP normalization. Almost two years after the diagnosis of hypertension, her pregnancy was complicated by unsatisfactorily treated hypertension. In the second trimester, her BP levels gradually increased despite the increasing number and doses of antihypertensives. She delivered at gestational week 31 by urgent Caesarean section (female; 1.310 g, 10-50th centile of normal birthweight)][1]. Following the delivery, her BP further increased to very high levels (190/110 mmHg). She was admitted to the local hospital almost 6 months post-delivery, and severe hypokalemia (2.3 mmol/l) was found. Consequently, she was then transferred to our ward due to suspicion of PA. This diagnosis was confirmed by the finding of significantly elevated plasma aldosterone levels (64.1 ng/dl) and suppressed plasma renin activity levels (0.15 µg/l/h). ABPM showed markedly elevated BP levels (166/109 mmHg on verapamil and doxazosin treatment). CT revealed a cortical adenoma (10 x 18 mm) in the right adrenal gland. Open adrenalectomy was accompanied by the resolution of hypertension, and normalization of potassium, aldosterone, and plasma renin activity levels. Histopathology confirmed the diagnosis of an adrenal adenoma (18 mm).

Case #13

This 29-year-old patient was referred to our Hypertension Center due to severe hypertension associated with spontaneous hypokalemia (3.1 mmol/l). Her General Practitioner had diagnosed hypertension 6 months before, when she had sought help for her headaches, palpitations, and dyspnea. She was pregnant two years before establishing the diagnosis of PA. This pregnancy was complicated by mild gestational hypertension (BP levels not exceeding 150/90 mmHg). She delivered spontaneously at gestational week 40 without any complications [female; 3.620 g (50-90th centile of normal birthweight)]. Her hypertension resolved post-delivery. Her BP was not checked until a visit to her General Practitioner due to her BP-related complaints. Examinations in our ward revealing elevated plasma aldosterone levels (47.1 ng/dl) and suppressed plasma renin activity (0,63 µg/l/h) confirmed the suspected PA diagnosis. Because CT showed only a mild adenoma in the left adrenal gland, adrenal venous sampling was added to confirm aldosterone secretion from the left side. Laparoscopic adrenalectomy normalized aldosterone and potassium levels, but not BP levels, which required treatment with 2 antihypertensive agents. Histopathology revealed a cortical adrenal adenoma (20 x 12 x 8 mm).

Case #14

This 24-year-old patient was examined due her migrainous cephalea. Extremely elevated BP levels were measured (220/130 mmHg) during the examination, and antihypertensive treatment was started with good clinical response. Five years later, a gradual BP increase during the second and third trimester complicated her pregnancy. She was admitted to hospital due to preeclampsia at gestational week 33, and an emergency Caesarean section was performed [male; 1.800 g, 10-50th centile of normal birthweight)][1]. Laboratory examination revealed low potassium levels. The suspicion of primary aldosteronism was confirmed in the further course by elevated plasma aldosterone (73.8 ng/dl) and suppressed plasma renin activity (0.29 µg/l/h). Adrenal CT did not show any pathology. Repeated adrenal venous sampling (difficult sampling of the right adrenal vein) did not lateralize aldosterone secretion, and long-life spironolactone therapy was instituted (decreased spironolactone tolerance due to menstrual abnormalities) with good clinical response. Her 2nd pregnancy, two years after establishing the PA diagnosis, was complicated by preeclampsia again, and an acute Caesarean section was performed at gestational week 36 [male; 2.320 g (10-50th centile of normal birthweight)][1]. Spironolactone treatment was switched to alpha-methyldopa and verapamil during pregnancy.

References:

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