The study presented three cases of patients diagnosed with adrenal tumors subject to surgical intervention during the past 6 months in our Department. The patients presented with radiological diagnostic difficulties, as to the character and location of the primary tumor. The aim of the study was to demonstrate differences between radiological examination results and the factual situation observed during the adrenalectomy. In all the presented cases patients were subject to laparoscopic intervention. In two cases conversion to open surgery was necessary. The histopathological results of the surgically removed samples were as follows: leiomyoma, myopericytoma and pheochromocytoma. In selected cases imaging examinations might be of limited value, especially when determining the character and location of the primary lesion of the adrenal gland.

Key words: laparoscopic adrenalectomy, adrenalectomy, adrenal tumor, computer tomography, magnetic resonance, retroperitoneal space tumor, laparoscopic surgery

Since the beginning of the development of endocrine surgery, especially of the adrenal glands, there was a need to optimize the diagnostic methods. Due to the location and topography of the adrenal glands, one encountered both visualization and lateralization diagnostic difficulties, especially in case of hormonally active tumors. Different diagnostic methods were used in the diagnosis of adrenal gland tumors, such as angiography, retrograde venography, scintigraphy, classical radiodiagnostic with retropneumoperitoneum, as well as others. Often, due to the insufficient amount of information bilateral surgical preparation of the adrenal glands was performed combining diagnostics with treatment. The technical progress of visualization diagnostic methods, such as ultrasound, computer tomography, and magnetic resonance significantly improved imaging diagnostics of many adrenal gland diseases, although in selected cases final diagnosis remains to be established.

The examination of patients with adrenal gland tumors, prior to qualification for surgery is aimed at determining the character of the tumor (adenoma, pheochromocytoma, cancer, metastasis, lymphoma, and cyst), its eventual hormonal activity, location, size, and relationship to large blood vessels (1).

Diagnostics of a patient with an adrenal gland tumor consists in the clinical examination, laboratory tests, and imaging examinations. Tumors
Adrenal tumors – diagnostics and the factual situation

Detected by abdominal ultrasonography are verified by means of computer tomography (CT) or magnetic resonance (MR) (2).

In case of tumors diagnosed by means of CT with a density of $\leq -50$ Hounsfield units (H) myelolipomas are diagnosed, while a density of $\leq +10$ H. units corresponds to an adenoma containing intracellular lipids. Lesions with a density of $> +10$ H. units correspond to lipid-poor adenomas (20-30% of all adenomas), pheochromocytoma, primary carcinoma or metastatic tumors. The diagnosis of the above-mentioned tumor requires further diagnostics, such as contrast enhanced CT with washout characteristics (evaluation after 1 and 10-15 minutes) or magnetic resonance imaging with the chemical shift (3-6). Considering CT, rapid contrast washout is characteristic of adenomas.

Magnetic resonance is usually performed in case the CT result is not unambiguous. The chemical shift method determining the lipid content may distinguish adenomas, however, as in case of CT results the differentiation of carcinomas, metastases, and pheochromocytomas is not possible (2, 5).

The specificity of ultrasonography considering adrenal gland evaluation is estimated at 92%. The sensitivity of the examination is estimated at 76%, lower in case of left-sided tumors, those < 2 cm in diameter, and in obese patients (6).

The specificity of CT and MR examinations in the detection of adrenal gland tumors is high (>90%), while their specificity is diverse: moderate for single-phase CT without contrast enhancement (70-75%), and high in case of washout contrast-enhanced CT, and MR by means of the chemical shift method (>95%) (5, 7).

CASE REPORTS

1. A 50-year old male patient was admitted to the Department for planned laparoscopic adrenalectomy, due to a left adrenal gland tumor. Additionally, the patient had hypertension; type 2 diabetes mellitus treated by means of oral drugs, and was obese.

Three months prior to the hospitalization the patient had an abdominal ultrasound, due to recurrent abdominal pain. The radiologist observed a normal pancreas with a cystic lesion near the upper pole of the kidney, 32x47x51 mm in size. Suspecting a pancreatic cyst he suggested CT verification. No other pathologies were observed.

Multiphase abdominal CT revealed the presence of a nodular, oval-shaped lesion, 42x54mm in size (lateral and antero-posterior dimension) located in the antero-posterior projection of the left adrenal gland. The anterior density of the nodule amounted to 20 H. units, while in the posterior 37 H. units, being contrast-enhanced in the arterial phase 36 H. and 46 H. units, respectively; and in the parenchymal phase (after one minute)-37 H. and 53 H. units, respectively. After 10 minutes the density ratio amounted to 35 H. units in the antero-superior part, and 56 H. units in the postero-inferior part, demonstrating no washout contrast characteristics. Three lymph nodes were visualized in the vicinity of the inferior caval vein and aorta branching of at the level of the renal arteries, 20, 14 and 9 mm in size. No other pathologies were observed in the abdominal cavity and retroperitoneal space.

The examination was consulted by radiologists who confirmed the diagnosis.

The patient was subject to clinical and laboratory examinations at the Department of Internal Diseases and Endocrinology, in order to determine whether the tumor was hormonally active. The increased DHEA-S (461.6 µg/dl; N: 44.3- 331 µg/dl) and chromogranin A (78.8 U/l; N: 2-18 U/l) levels might be evidence of a hormonal active tumor. No other pathologies were observed. The patient was qualified for laparoscopic adrenalectomy.

The operation was performed by means of the lateral transperitoneal approach using four trocars. The peritoneal cavity was insufflated by means of mini-laparotomy. After preparation of the spleen and posterior peritoneal plaque the adrenal gland was visualized in the predominating adipose tissue, being significantly enlarged. After preparation of the adrenal gland and separation from the pancreas the adrenal vein was visualized and severed after previous clipping. Although the prepared adrenal gland was small in size the surgeons decided on its removal. The adrenal gland was completely excised. The sample was placed in a laparoscopic capsule and removed. Hemostasis was controlled.

After viewing the adrenal gland the described 5 cm tumor was not observed, simply adrenal gland hypertrophy was present.
The decision concerning laparotomy was undertaken. The abdominal cavity was opened by means of an incision under the left costal arch (trocar placement). A tumor was visualized, being located under the smaller curvature of the stomach. The tumor was adhered to the wall of the stomach without infiltration of surrounding tissues. After preparation and ligation of the numerous pathological blood vessels the tumor was completely excised, together with the serous membrane of the stomach. The lumen of the stomach remained untouched. The defect of the serous membrane was sutured. The peritoneal cavity was closed by means of layered sutures, and drainage was maintained. The excised tissues were sent for histopathological verification. The drain was removed on the second day after surgery. The patient was discharged from the hospital on the seventh day after the surgical intervention in good general condition. The wound healed by first intention.

The histopathological result of the 7x3x2 cm adrenal gland showed no pathological lesions. The microscopic examination revealed diffuse adrenal hyperplasia, accompanied by sporadic adrenal nodular hyperplasia. The peritoneal cavity tumor – encapsulated 8 x 6 x 5 cm in size. The microscopic examination- fusiform cancer with the following phenotype: CD117 (-), CD34 (-), HMB45 (-), S100 (-), NSE (-+), Des (+-), Act (+), MIB + in single cells. Mitosis was not observed. Due to the negative CD117 and CD34 reaction stromal tumor (GIST) diagnosis was not possible. Markers characteristic of the muscular origin of the tumor were positive- leiomyoma of deep soft tissue.

2. A 78-year old male patient was admitted to the Department of Internal Diseases and Endocrinology for planned right-sided adrenalectomy, due to the presence of a hormonally inactive adrenal gland tumor. The patient had a history of myocardial infarction (two years before) and CABG (one year ago). Additionally, the patient was diagnosed with a hiatal hernia, gastritis, duodenitis, and intestinal diverticula.

A right adrenal gland tumor was diagnosed three months before during abdominal ultrasound performed because of dyspeptic symptoms lasting for the past 6 months. The abdominal ultrasound revealed the presence of a hypoechogenic lesion 45 x 37 x 36 mm in size. Laboratory tests excluded the presence of a hormonally active tumor.

Computer tomography revealed the presence of a tumor, 51 x 32 x 40 mm in size, with a density of 50-69 H. units, located in the right adrenal gland- CT image atypical of adenoma. The tumor originated from the dorsal branch of the right adrenal gland, being well-separated from surrounding tissues, adhering to the upper pole of the right kidney, without infiltrating surrounding tissues. There was a cyst in the right kidney – 16 mm in size, and one observed an anatomical variation of the course of the left renal vein, which crosses the aorta from behind. No other pathological lesions were observed.

The patient was operated from the lateral transperitoneal approach using 4 trocars, after prior mini-laparotomy insufflation. After preparation of the liver and posterior peritoneal plaque the adrenal gland and tumor were localized. The adrenal gland was separated from the liver. After visualization of the adrenal vein it was clipped and severed. The lower pole of the adrenal gland adhered to the upper pole of the kidney. The adrenal gland and tumor were completely excised by means of the laparoscopic capsule. After hemostasis the drain was maintained at the site of the removed adrenal gland. The removed tissues were sent for histopathological examination. The drain was removed on the second day after the operation. The patient was discharged from the hospital in good general condition on the fourth day after the operation. The wound healed by first intention. The patient presented with normal blood pressure values, and did not require therapy modification (cardiac).

The histopathological examination revealed the presence of a 5 x 4 x 3.5 cm in size tumor adhering to the adrenal gland. The adrenal glands were histologically normal. The tumor consisted of pleomorphic fusiform and eliptical cells forming solid lesions and fissures, located in the vicinity of the vessels. Significant fibrosis and hyalinization within the tumor was also observed. The immunohistochemical content was as follows: act (+), vim (+), des (+), EMA (-), HMB45 (-), CKAE1+AE3 (-), CD31(-), CD34(-), and S100 positive in selected cells. Amyloid staining proved negative. The morphological picture and immuno-
phenotype speak in favor of myopericytoma diagnosis.

3. A 16-year old male patient was admitted to the Department of Internal Diseases and Endocrinology, due to diagnosis of a right adrenal gland tumor. The patient had an episode of a one-time upsurge of blood pressure, which occurred after physical activity. The patient additionally presented with abdominal obesity. The outpatient abdominal ultrasound revealed the presence of a solid, right-sided adrenal gland tumor, 2x3 cm in size.

Laboratory results showed increased daily metoxicatecholamine urine elimination- 1083 µg/24h (N 100-1000 µg/24 h).

The magnetic resonance demonstrated the presence of a tumor, 39x25 mm in size, located near the medial edge of the upper pole of the right kidney, posterior to the inferior caval vein, and above the right renal artery. The lesion showed an increased signal considering T2 dependent images, and the chemical shift method revealed no lipid presence. The image most likely corresponded to a pheochromocytoma.

After pharmacological preparation the patient underwent surgery. Following minilaparotomy and peritoneal cavity insufflation four trocars were inserted in typical places of the abdominal cavity (lateral approach). The liver and posterior peritoneal plaque, were subject to preparation. The right adrenal gland proved normal without tumor presence. The tumor was located under the renal and inferior caval veins, which were compressed and completely covered the immobile tumor. Due to the localization and lack of possible preparation we decided upon conversion to open surgery. The abdominal cavity was opened by means of Kocher’s incision. Due to the limited mobility and inability to extract the tumor the patient received 20 µg of heparin, followed by renal vein clamping and severing. The tumor was prepared and excised. The renal vein was subject to “end-to-end” anastomosis. The clamping time of the renal vein was 40 minutes, followed by hemostasis. A latex drain was left at the place of the removed tumor and anastomosed vein. The abdominal cavity was closed by means of layered sutures. The excised tissues were sent for histopathological examination.

The drain was removed on the second day after surgery. The patient was discharged from the hospital in good general condition on the fifth day after the operation. The wound healed by first intention. Treatment of hypertension was not necessary.

The histopathological examination revealed the presence of a 2.9 cm in diameter, heterogeneous tumor. An adjacent brownish lesion (1cm in diameter) was also observed. Macroscopically, both might be evidence of a pheochromocytoma. The microscopic examination confirmed pheochromocytoma presence. The immunohistochemical result was as follows: chromogranin (+), synaptophysin (+), Melan A (-).

**DISCUSSION**

Laparoscopic treatment of adrenal gland tumors was initiated in 2005. Currently, the team has an experience resulting from more than 200 laparoscopic adrenalectomies. Laparoscopic adrenalectomies are exclusively performed by means of the transperitoneal approach. Due to diagnostic method and location difficulties seven patients required conversion to open surgery, which amounted to 3% of patients with the above-mentioned pathology. Other Authors noted a similar percentage of conversion to open surgery (8). The study presented three patients qualified during the past 6 months for adrenalectomy with diagnostic method and location difficulties.

In all cases the size of the tumor qualified patients for surgery. One patient was diagnosed with a hormonally active tumor. Patients’ were operated by the same team of surgeons, as well as the same pathomorphologist evaluated the histopathological samples.

The histopathological result differed from the expected result, which determined future prognosis and therapy.

Despite the use of advanced radiological diagnostic methods and their interpretation by experienced radiologists, the unambiguous assessment of adrenal gland tumors remains a problem.

Adrenal gland tumors include adenomas, pheochromocytomas, and carcinomas. Metastatic lesions to the adrenal glands are also possible. The diagnosis of an adenoma may mimic that of focal nodular hyperplasia with one dominating nodule (9-12).
Myelolipomas, lymphomas, cysts and neuroblastomas in children are rarely diagnosed (13).

Tumors of both adrenal glands can imitate cysts and upper pole kidney tumors, as well as other retroperitoneal lesions (case 2 and 3). Especially an extra-adrenal pheochromocytoma in a skinny person with a low fat tissue level may be indistinguishable from an adrenal pheochromocytoma.

If the tumor is located on the right side differential diagnosis should consider the following: hepatic lesions, enlarged inferior caval vein, and hepatic flexure of the colon. In case of a pseudo-tumor of the left adrenal gland differential diagnosis should comprise a splenic flap, accessory spleen, tortuous and dilated splenic vessels or splenic artery aneurysm. Differential diagnosis should also consider the tail of the pancreas, gastric diverticulum, and exophytic gastric tumors infiltrating the left adrenal field (case 1) (6, 14).

Adrenal gland tumors may be derived from the adrenal gland or surrounding tissues. In case of skinny patients, devoid of retroperitoneal fat tissue adrenal tumors are difficult to differentiate from extra-adrenal lesions directly adhering to the gland. In case of a tumor comprising fat tissue (myelolipoma, density < −50 H. units) or intracellular lipids (adenoma, density < +10 H. units) CT or MR density measurements (by means of the chemical shift method) usually enable accurate diagnosis. The differentiation of remaining adrenal tumors (pheochromocytoma, carcinoma, metastasis, lymphoma, cyst) from extra-adrenal lesions is often impossible.

The histopathological examination is the final diagnostic method, when determining the type of the lesion.

CONCLUSIONS

1. Increased diagnosis of hormonally inactive adrenal tumors is associated with the growing availability of radiological examinations. The above-mentioned lesions are usually diagnosed by means of abdominal ultrasound and CT performed because of different abdominal complaints or after trauma.

2. Good cooperation between the team of surgeons, radiologists and pathomorphologists seems essential. The combined interpretation of the examination results and evaluation will enable better diagnosis and treatment of patients.

3. When qualifying the patient for laparoscopic adrenalectomy the surgeon should be prepared to modify the procedure in the event of a discrepancy between the interpretation of imaging examinations and the factual intraoperative situation.

4. In selected cases laparoscopy may be diagnostic. Conversion to open surgery is not a complication, merely a change in the strategy of management.

5. The histopathological examination is the final diagnostic method when determining the character of the tumor.

REFERENCES


Received: 2.02.2012 r.
Adress correspondence: 02-097 Warszawa, ul. Banacha 1a