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The Diagnostic Significance of the Various Radiological Examinations in Adrenal Disease

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副腎疾患の放射線的検査法とその臨床的意義

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副腎疾患の放射線医学的検査は1965年から始まり、現在に至るが、これを1965年から1972年までの前期と1973年から1976年の後期との2期に分けて述べる。前期には後腹膜腔充气法、腹部大動脈造影、腎動脈造影、副腎動脈造影が主として行われた。後期には副腎静脈造影と副腎シンチグラフィが主に用いられた。

対象となつた症例は前期にはクッシング症候群16例、原発性アルドステロン症10例、褐色細胞腫6例であり、後期にはクッシング症候群10例、原発性アルドステロン症14例、褐色細胞腫6例である。

各種副腎検査法に対する評価を試みたが、後腹膜腔充气撮影法ではクッシング症候群、褐色細胞

腫において、一定の大きさ以上の腫瘍の場合にのみ診断的意義がある。腹部大動脈造影では褐色細胞腫の診断に意義がある。腎動脈造影は副腎動脈がこれより分枝している場合、原発性アルドステロン症、褐色細胞腫の診断に有用である。

副腎静脈造影は各種副腎疾患の診断に対する意義は最も大きく、最も患者に対して安全に容易に行いうる検査法である。

副腎シンチグラフィもまた安全な検査法であり、副腎静脈造影と同程度の診断的価値がある。従つて最近では副腎静脈造影、副腎シンチグラフィが主として行われており、時として腹部大動脈造影を行つている。

The radiological studies of the adrenal disease has been performed since 1965 and up to date.

This period can be divided in two parts: in the former period (1965-1972) the retroperitoneal air study, abdominal aortography, renal arteriography and adrenal arteriography are mainly performed, and in the latter period (1973-1976) the adrenal venography and adrenal scintigraphy are chiefly performed.

The cases studied are cushing syndrome 16 cases, primary aldosteronism 10 cases, and pheochromocytoma 6 cases in the former period.

In the latter period 10 cases of cushing syndrome, 14 cases of primary aldosteronism and 6 cases of pheochromocytoma are subjected to study (Table 1).

The evaluation of various radiological methods is done for each adrenal diseases.

The retroperitoneal air study is evaluated to diagnose only for a mass over a certain size especially in cushing syndrome and pheochromocytoma.

The abdominal aortography shows a special value for diagnosing pheochromocytoma.

The renal arteriography is useful occasionally diagnosing the primary aldosteronism and pheochromocytoma, when the adrenal artery branched off the renal artery.

The adrenal venography is much more highly evaluated recently because of patient's safety and technical easiness. The diagnostic value is higher than any other radiological method.

The adrenal scintigraphy is also highly evaluated because of patient's safety. The diagnostic value is almost the same as the adrenal venography.

We radiologists are going to examine the patients suspected to be suffering from the lesions of the adrenal gland, when the patients complain of the various symptoms, such as high blood pressure, weakness of the extremities, elevation of 17-KS in urine and cortisol in blood, and hypopotasemia. In such conditions in order to determine, the location of adrenal mass lesion, and its laterality, the following radiological examinations such as radiography of the abdomen, pneumo-adrenography, abdominal aortography, renal arteriography, adrenal arteriography, adrenal venography, and adrenal scan have been performed.

In this paper, these methods of radiological examinations are described, and their application and evaluation are discussed.

Materials and Methods

Radiological examinations for the adrenal disease has begun in 1965 in my department, and continued up to date. This period can be divided into two parts: in the former period (1965-1972) the retroperitoneal air study accompanied by tomography, abdominal aortography, renal arteriography and adrenal arteriography are mainly performed; and in the latter period (1973-1976) the adrenal venography and adrenal scan are chiefly performed.

The cases subjected to study are 16 cases of cushing syndrome (CS), 10 cases of primary aldosteronism (PA) and 6 cases of pheochromocytoma (Pheo) in the former period.

In the latter period 10 cases of cushing syndrome, 14 cases of primary aldosteronism and 5 cases of pheochromocytoma are studied (Table 1).

The method of each radiological examination is described as follows: The radiography of the abdomen and intravenous urography are necessarily described little. Pneumoadrenography consists of retroperitoneal air insufflation and tomography. Abdominal aortography, renal arteriography and adrenal arteriography are performed according to Seldinger's technique. The green catheter (KIFA) is introduced through the femoral

Table 1. The adrenal cases subjected to study

	The former period 1965 - 1972	The latter period 1973 - 1976	Total
Cushing Syndrome	16	10	26
Primary Aldosteronism	10	14	24
Pheochromocytoma	6	5	11

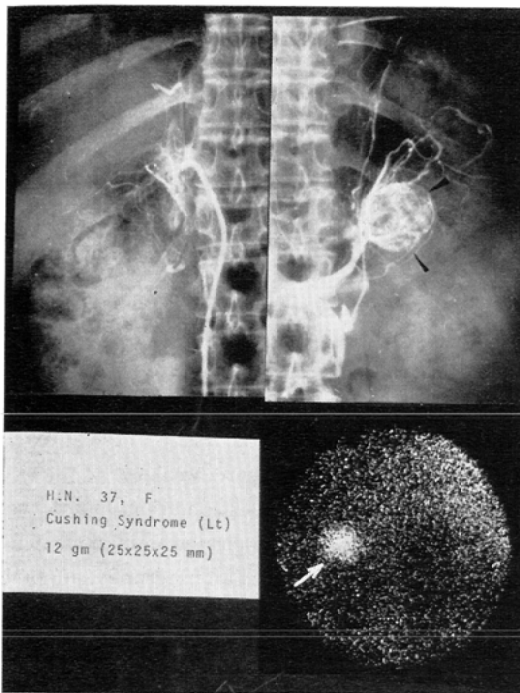


Fig. 2. Cushing syndrome

- A) Adrenal venography demonstrates the right adrenal vein to be normal in its size and shape. The left adrenal venography demonstrates the peripheral branches to be well circumscribed the mass and pooling of the contrast medium.
- B) Adrenal scan with ^{131}I -adosterol demonstrates higher uptake in the left adrenal gland indicating abnormality. The right adrenal gland is not visualized indicating to be normal.

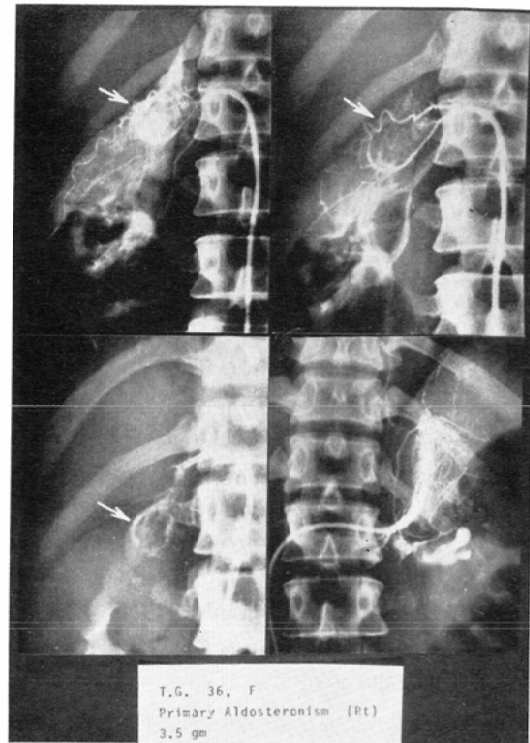


Fig. 3. Primary aldosteronism

- A) Right adrenal arteriography demonstrates two arterial branches displaced by the mass lesion associated slight tumor staining.
- B) Right adrenal venography demonstrates the adrenal vein to be displaced bilaterally and well circumscribed the adrenal mass. The left adrenal venography is normal.

3) Pheochromocytoma

In the former period, pneumoadrenography is performed in 5 cases and discloses the mass lesion. Aortography is performed in a case and demonstrates increase in vascularity in aberrant location (Fig. 5).

Adrenal arteriography is performed in two cases and shows increase in vascularity and tumor stain.

Adrenal venography is performed in two cases and demonstrates displacement of the adrenal vein.

In the latter period, adrenal venography is performed in 5 cases and demonstrates displacement of the adrenal vein. Adrenal scan is performed in two cases and demonstrates high uptake of radioisotopes in the abnormal adrenal gland (Fig. 6).

Discussion

The radiogram of the abdomen is taken routinely in order to see some calcific densities in the region of the adrenal gland. Intravenous urography is performed routinely and occasionally demonstrates pressure effects into the renal pelvis and calyceal system.

artery. The adrenal venography is also performed according to Seldinger's technique; the red catheter (KIFA) is introduced through the femoral vein⁸⁾. The films are taken serially with the automatic film changer.

Result

1) Cushing syndrome

In the former period pneumo-adrenography is performed in 11 cases and disclosed mass lesion in the region of the adrenal gland. Adrenal arteriography is performed in 4 cases of adenomatous lesions and disclosed increase in vascularity and tumor stain. Adrenal venography is performed in 5 cases of hyperplasia and disclosed increase in size with normal vascular pattern. Two cases of adenoma demonstrate circumscribed mass with vein (Fig. 1).

In the latter period most of cases are examined by adrenal venography and adrenal scan.

Adrenal venography is performed in 2 cases of hyperplasia and 8 cases of adenoma. In adrenal hyperplasia increase in size of the adrenal gland is seen and in adrenal adenoma displacement of vein is noted. Adrenal scan is performed in 5 cases and demonstrates moderate uptake in the abnormal gland (Fig. 2).

2) Primary aldosteronism

In the former period pneumo-adrenography is performed in 6 cases and demonstrates increase in size.

Adrenal arteriography is performed in 7 cases and demonstrates tumor stain.

Adrenal venography is performed in 3 cases and demonstrates displacement of vein (Fig. 3).

In the latter period, adrenal venography demonstrates slight to moderate displacement of adrenal vein in 13 cases except for a single case of the right side. Adrenal scan demonstrates high uptake in the abnormal side of the adrenal gland in 12 cases except for two cases (Fig. 4).

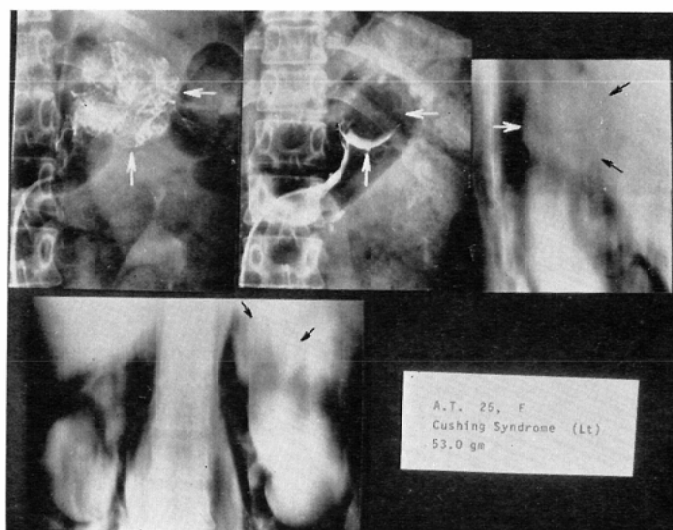


Fig. 1. Cushing syndrome

- A) Left adrenal arteriography demonstrates moderate increase in vascularity in the tumor and staining.
- B) Left adrenal venography demonstrates smooth of adrenal vein displacement by the adrenal mass.
- C) Retroperitoneal air study shows a soft tissue density just above the left renal shadow due to adrenal tumor.

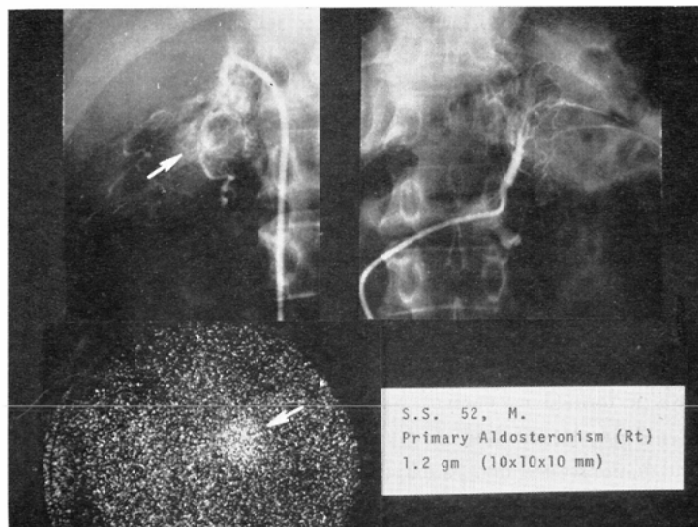


Fig. 4. Primary aldosteronism

- A) Adrenal venography demonstrates the left adrenal gland to be normal. The right adrenal venography shows a mass lesion to be well circumscribed by the peripheral vein.
- B) Adrenal scan shows higher accumulation of radioisotope into the right adrenal gland indicating to be abnormal. The left adrenal gland is not visualized.

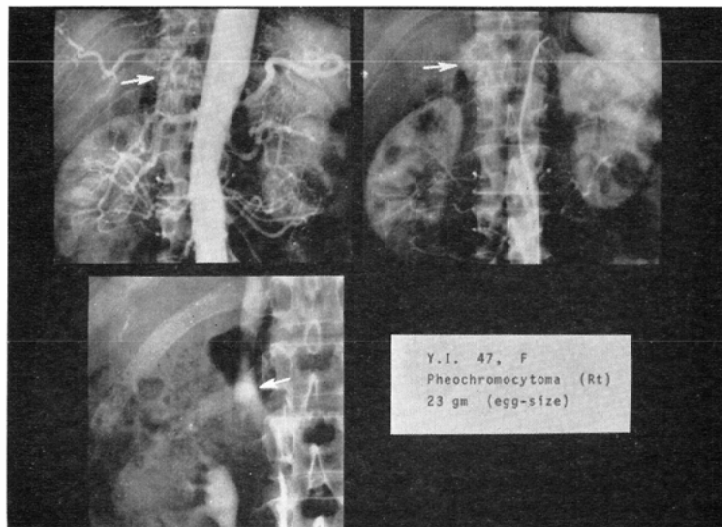


Fig. 5. Pheochromocytoma

- A) Abdominal aortography demonstrates a small round area of slight hypervascularity just above the right renal shadow in the arterial phase and tumor staining in the same area in the capillary phase.
- B) Inferior cavography demonstrates slight concavity on the lateral aspect at the level of the mass described in the aortography.

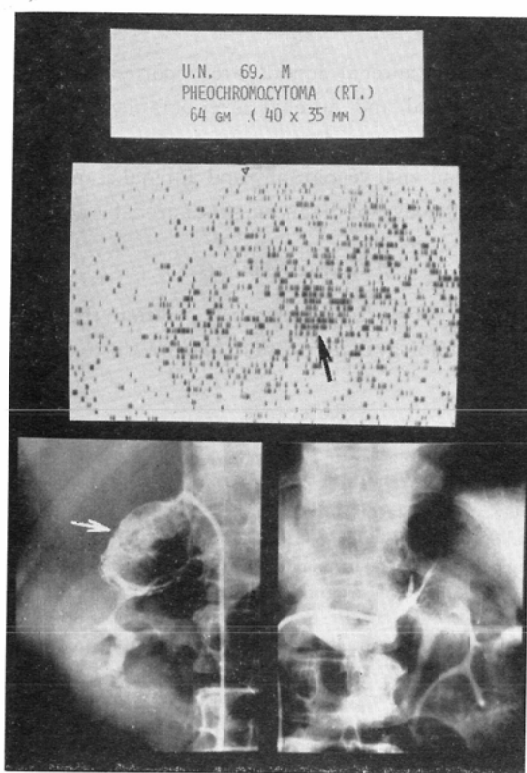


Fig. 6. Pheochromocytoma

- A) Adrenal scan demonstrates slight increase in uptake of radioisotope in the region of right adrenal gland. The left adrenal gland shows minimal uptake.
- B) Adrenal venography demonstrates displacement of the central vein. The mass is well circumscribed by the peripheral vein. The left adrenal venography is normal.

Table 2. Venography/Scintigraphy

	Venography		Scintigraphy	
	Right	Left	Right	Left
Primary Aldosteronism	7/8 (1)	6/6 (2)	7/7 (1)	5/5 (1)
Cushing Syndrome	4/4	8/8	2/2	5/5
Pheochromocytoma	5/5	0	2/2	0

Abdominal aortography, renal and adrenal arteriographies are safely performed by Seldinger's technique at present. There is, however, some caution for shock and bleeding because of hypertension during and after the procedures³⁾⁶⁾¹⁰⁾.

Adrenal venography is much more easily performed than adrenal arteriography and is indispensable for diagnosing the adrenal lesions, and taking blood sample through the catheter¹⁾²⁾⁴⁾⁵⁾⁹⁾¹¹⁾.

Adrenal scan is the safest diagnosing tool for the adrenal lesions¹⁾⁷⁾. (Table 2).

Conclusions

Radiological examinations for the adrenal lesions are reported throughly. In the former period (1965-1972) pneumo-adrenography, renal and adrenal arteriography are mainly performed. But these methods are not so effective for detecting the adrenal lesions.

In the latter period (1973-1976), adrenal venography and adrenal scan are chiefly used. These methods are much more safely performed to be effective for diagnosing the adrenal lesions.

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