

# Hormonal Characteristics of Patients with Arterial Hypertension with Various Tumors of the Adrenal Glands

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## ANNOTATION

**Purpose of the Study:** To study the hormonal characteristics of patients with arterial hypertension with various tumors of the adrenal glands.

**Material and Research Methods:** The material for the study was the analysis of 89 cases of hypertension of adrenal origin according to retrospective data for 2 years (from 2021 to 2024) in the clinic of the Russian Scientific and Medical Center of Endocrinology of the Ministry of Health of the Republic of Uzbekistan in various departments: neuroendocrinology, endocrine surgery. The following groups of patients were formed: 1 gr. – patients with corticosteroma (13 patients), 2 g. – patients with aldosteroma (8 patients), 3 gr. – patients with pheochromocytoma (21 patients), 4 gr. – adrenal incidentaloma (17 patients), 5 gr. – patients with adrenal hyperplasia (comparison group - 30 patients).

**Research Results:** In patients with corticosteroma, there was a significant increase in the average values of cortisol and prolactin ( $P < 0.05$ ), while the basal levels of ACTH, renin and aldosterone were not significantly changed. In the group of patients with aldosteroma, there was a significant increase in the average values of plasma renin and aldosterone ( $P < 0.05$ ), while the basal levels of ACTH, cortisol, and testosterone were not significantly changed. It was typical for patients with pheochromocytoma that the basal levels of ACTH, cortisol, prolactin, testosterone, and cortisol were not significantly changed ( $P > 0.05$ ), since for these patients the most informative determination of catecholamines in 24-hour urine. In patients with adrenal incidentaloma, basal levels of ACTH, cortisol, prolactin, testosterone, and cortisol were not significantly changed ( $P > 0.05$ ). In patients with adrenal hyperplasia, basal levels of ACTH, cortisol, prolactin, testosterone, and cortisol were not significantly changed ( $P > 0.05$ ).

**Conclusion:** According to the analysis of retrospective data on hormonal parameters of blood plasma (basal levels taken in the morning on an empty stomach) and urine, the most significantly significant differences in their content were found in patients with corticosteroma, aldosteroma and pheochromocytoma ( $P < 0.05$ ).

**Keywords:** Adrenal Tumors; Arterial Hypertension Complications

## Relevance

Adrenal tumors occur in approximately 4–10% of the general population, and their incidence increases with age [1-4] as a result because of spread use of imaging techniques. They are most often discovered incidentally during imaging performed as part of the diagnosis of unrelated conditions. The peak incidence occurs in the seventh decade of life [4,5]. All patients found to have an adrenal tumor should undergo a detailed clinical, biochemical, and radiological examination to select those who require surgical treatment [1-4]. Many adrenal tumors (about 80%) are adrenal adenomas, hypertrophy, or nodular adrenal hyperplasia. Other lesions include pheochromocytomas (PHEC) (3–6%), adrenocortical carcinomas (ACC) (2–5%), adrenal metastases (1–2%), mesenchymal tumors (myelolipomas, lipomas, hemangiomas, sarcomas), lymphomas, cysts, ganglioneuromas [6-14], other rare tumors [15] or collision tumors consisting of at least two different histopathological types [7,16]. Purpose of the study– to study the hormonal characteristics of patients with arterial hypertension with various tumors of the adrenal glands.

## Material and Research Methods

The material for the study was the analysis of 89 cases of hypertension of adrenal origin according to retrospective data for 2 years (from 2021 to 2024) in the clinic of the Russian National Research Medical Center of Endocrinology of the Ministry of Health of the Republic of Uzbekistan in various departments: neuroendocrinology, endocrine surgery. The following groups of patients were formed: 1 gr.–patients with corticosteroma (13patients), 2 g.–patients with aldosteroma (8patients), 3gr.–patients with pheochromocytoma (21 patients), 4 gr. – adrenal incidentaloma (17 patients), 5 gr.–patients with adrenal hyperplasia (comparison group-30 patients).

## Research Methods Included

1. General clinical (examination of endocrine and ocular status)

2. Instrumental - ECG, CT/MRI of the Sella turcica and adrenal glands
3. Ultrasound of internal and genital organs, etc.)
4. Hormonal blood tests (STH, IGF-1, LH, FSH, PRL, TSH, ACTH, prolactin, testosterone, estradiol, progesterone, cortisol (IKLA method) and others. In addition, the postoperative material was subjected to histological diagnosis at the Republican Specialized Medical Center of the Ministry of Health of Uzbekistan named after Academician Y. Kh. Turakulova (Histology Department, candidate of medical sciences Issaeva S.S.).

## Research Results

Thus, out of 89 patients, 22 (24.7%) were patients aged 13 to 29 years. There were 26 patients (29.2%) aged 30 to 44 years. From 45 to 59 years old–33 (37.0%), and over 60–only 8 patients (8.9%). So, among the tumors of the adrenal glands (H) with hypertension, the most common was pheochromocytoma-21 patients (23.6%), in 2nd place were patients with incidentaloma H-17 cases (19.0%), in 3rd place in frequency were patients with corticosteroma-13 (14.6%) and in last place were patients with aldosteroma-8 cases (8.9%). Patients with hyperplasia made up the control group, although their number was dominant-30 patients (33.7%). According to the analysis of retrospective data from hormonal studies (basal levels taken in the morning on an empty stomach), the following data were obtained for the groups. In the Table 1 shows the average hormone values in 1 group of patients. As can be seen from Table 1, in patients with corticosteroma there was a significant increase in the average values of cortisol and prolactin ( $P<0.05$ ), while the basal levels of ACTH, renin and aldosterone were not significantly changed. Table 2 shows the average value of blood plasma hormones in patients of group 2 ( $n=8$ ). As can be seen from Table 2, in patients with aldosteroma there was a significant increase in the average values of plasma renin and aldosterone ( $P<0.05$ ), while the basal levels of ACTH, cortisol, and testosterone were not significantly changed. Table 3 shows the average value of blood plasma hormones in patients of group 3 ( $n=21$ ).

**Table 1:** Average value of blood plasma hormones in patients of group 1 ( $n=13$ ).

| Hormones          | Average value | R      | Control      | Norm                            |
|-------------------|---------------|--------|--------------|---------------------------------|
| ACTH              | 34.18 ± 9.4   | > 0.05 | 22.3 ± 2.1   | Up to 50 pg/ml                  |
| Prolactin         | 6.98 ± 0.3    | > 0.05 | 5.2 ± 0.3    | 5.7 ng/ml                       |
| Free testosterone | 17.2 ± 5.2    | <0.05  | 25.3 ± 5.5   | 8.69-54.69 ng/ml                |
| Cortisol          | 917.3 ± 26.2  | <0.05  | 342.2 ± 29.5 | In the morning 260-720 nmol/l   |
| Renin             | 1.2 ± 0.01    | > 0.05 | 0.8 ± 0.04   | Resting rate 0.5-1.9 ng/ml/hour |
| Aldosterone       | 10.3 ± 0.05   | > 0.05 | 12.9 ± 2.3   | From 8.0 - 172.0 pg/ml          |

Note: P - Significance of differences compared to the control group.

**Table 2:** Average value of blood plasma hormones in patients of group 2 (n=8).

| Hormones          | Average value | R      | Control      | Norm                            |
|-------------------|---------------|--------|--------------|---------------------------------|
| ACTH              | 27.3 ± 7.8    | > 0.05 | 22.3 ± 2.1   | Up to 50 pg/ml                  |
| Prolactin         | 5.4 ± 0.5     | > 0.05 | 5.2 ± 0.3    | 5.7 ng/ml                       |
| Free testosterone | 19.7 ± 6.2    | > 0.05 | 25.3 ± 5.5   | 8.69-54.69 ng/ml                |
| Cortisol          | 371.3 ± 26.2  | > 0.05 | 342.2 ± 29.5 | 260-720 nmol/l                  |
| Renin             | 11.4 ± 0.6    | <0.05  | 0.8 ± 0.04   | Resting rate 0.5-1.9 ng/ml/hour |
| Aldosterone       | 342.3 ± 9.5   | <0.05  | 12.9 ± 2.3   | From 8.0 – 172.0 pg/ml          |

Note: P - significance of differences compared to the control group.

**Table 3:** Average value of blood plasma hormones in patients of group 3 (n=21).

| Hormones          | Average value | R      | Control      | Norm                            |
|-------------------|---------------|--------|--------------|---------------------------------|
| ACTH              | 23.8 ± 6.4    | > 0.05 | 22.3 ± 2.1   | Up to 50 pg/ml                  |
| Prolactin         | 4.8 ± 0.3     | > 0.05 | 5.2 ± 0.3    | 5.7 ng/ml                       |
| Free testosterone | 16.9 ± 3.5    | > 0.05 | 25.3 ± 5.5   | 8.69-54.69 ng/ml                |
| Cortisol          | 324.3 ± 16.9  | > 0.05 | 342.2 ± 29.5 | In the morning 260-720 nmol/l   |
| Renin             | 1.7 ± 0.01    | > 0.05 | 0.8 ± 0.04   | Resting rate 0.5-1.9 ng/ml/hour |
| Aldosterone       | 1.4 ± 0.05    | > 0.05 | 12.9 ± 2.3   | From 8.0 – 172.0 pg/ml          |

Note: P - significance of differences compared to the control group.

As can be seen from Table 3, in patients with pheochromocytoma, the basal levels of ACTH, cortisol, prolactin, testosterone and cortisol were not significantly changed ( $P>0.05$ ), since for these patients the most informative determination of catecholamines in daily urine (see below in subchapter 3.2). Table 4 shows the average value of blood plasma hormones in patients of group 4 (n=17). As can be seen from Table 4, in patients with adrenal incidentaloma, the basal levels of ACTH, cortisol, prolactin, testosterone and cortisol were not significantly changed ( $P>0.05$ ). Table 5 shows the average value of blood plasma hormones in patients of group 5 (n=30). As can be seen from Table 5, in patients with adrenal hyperplasia, the basal levels of ACTH, cortisol, prolactin, testosterone and cortisol were not significantly changed ( $P>0.05$ ). So, according to the analysis of retrospec-

tive hormonal data (basal levels taken in the morning on an empty stomach), the following data were obtained by group. In patients with corticosteroma, there was a significant increase in the average values of cortisol and prolactin ( $P<0.05$ ), while the basal levels of ACTH, renin and aldosterone were not significantly changed. In the group of patients with aldosteroma, there was a significant increase in the average values of plasma renin and aldosterone ( $P<0.05$ ), while the basal levels of ACTH, cortisol, and testosterone were not significantly changed. It was typical for patients with pheochromocytoma that the basal levels of ACTH, cortisol, prolactin, testosterone, and cortisol were not significantly changed ( $P>0.05$ ), since for these patients the most informative determination of catecholamines in 24-hour urine.

**Table 4:** Average value of blood plasma hormones in patients of group 4 (n=17).

| Hormones          | Average value | R      | Control      | Norm                            |
|-------------------|---------------|--------|--------------|---------------------------------|
| ACTH              | 33.6 ± 8.4    | > 0.05 | 22.3 ± 2.1   | Up to 50 pg/ml                  |
| Prolactin         | 4.9 ± 0.7     | > 0.05 | 5.2 ± 0.3    | 5.7 ng/ml                       |
| Free testosterone | 17.2 ± 3.2    | > 0.05 | 25.3 ± 5.5   | 8.69-54.69 ng/ml                |
| Cortisol          | 362.3 ± 23.2  | > 0.05 | 342.2 ± 29.5 | In the morning 260-720 nmol/l   |
| Renin             | 1.6 ± 0.01    | > 0.05 | 0.8 ± 0.04   | Resting rate 0.5-1.9 ng/ml/hour |
| Aldosterone       | 1.3 ± 0.05    | > 0.05 | 12.9 ± 2.3   | From 8.0 – 172.0 pg/ml          |

Note: P - significance of differences compared to the control group

**Table 5:** Average value of blood plasma hormones in patients of group 1 (n=30).

| Hormones          | Average value | R      | Control      | Norm                            |
|-------------------|---------------|--------|--------------|---------------------------------|
| ACTH              | 23.5 ± 3.2    | > 0.05 | 22.3 ± 2.1   | Up to 50 pg/ml                  |
| Prolactin         | 4.2 ± 0.1     | >0.05  | 5.2 ± 0.3    | 5.7 ng/ml                       |
| Free testosterone | 15.3 ± 2.2    | >0.05  | 25.3 ± 5.5   | 8.69-54.69 ng/ml                |
| Cortisol          | 313.3 ± 27.7  | >0.05  | 342.2 ± 29.5 | In the morning 260-720 nmol/l   |
| Renin             | 1.1 ± 0.01    | > 0.05 | 0.8 ± 0.04   | Resting rate 0.5-1.9 ng/ml/hour |
| Aldosterone       | 1.6 ± 0.05    | > 0.05 | 12.9 ± 2.3   | From 8.0 - 172.0 pg/ml          |

Note: P - significance of differences compared to the control group

In patients with adrenal incidentaloma, basal levels of ACTH, cortisol, prolactin, testosterone, and cortisol were not significantly changed ( $P>0.05$ ). In patients with adrenal hyperplasia, basal levels of ACTH, cortisol, prolactin, testosterone, and cortisol were not significantly changed ( $P>0.05$ ). At the same time, patients in group 3 had a significant increase ( $P<0.05$ ) in the level of cortisol in daily urine. In patients of group 3 there was a significant increase ( $P<0.05$ ) in the levels of catecholamines in daily urine (adrenaline, norepinephrine, dopamine). Thus, hormonal blood tests have shown how informative they are in diagnosing adrenal diseases. In the case of hormonally active mass formations of the adrenal glands, assessment of basal hormone levels can be of great diagnostic value in case of corticosteromas, aldosteromas, since these patients have significantly increased values of plasma cortisol and aldosterone, respectively. For patients with adrenal hyperplasia and incidentaloma, these studies turned out to be of little information.

## Conclusion

According to the analysis of retrospective data on hormonal parameters of blood plasma (basal levels taken in the morning on an empty stomach) and urine, the most significantly significant differences in their content were found in patients with corticosteroma, aldosteroma and pheochromocytoma ( $P < 0.05$ ).

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