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A Five-Year Panorama: Unraveling the Clinicopathological Spectrum of Pituitary Tumors in a Tertiary Hospital

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Abstract

Background: Nowadays, pituitary gland tumors are increasingly recognized as common disorders, accounting for up to 25% of intracranial neoplasms. Mentioned repeatedly there are not many studies investigating the updated and larger epidemiology of pituitary gland tumors studies are needed.

Methods: This study employed a descriptive observational study design with a retrospective approach using secondary data from medical records of patients diagnosed with pituitary gland tumors at Dr. Soetomo General Hospital Surabaya from January 2019 – December 2023.

Results: A total of 193 patients met the inclusion criteria. Variables studied included age, gender, demographic origin, clinical manifestations, blood hormone levels, radiological imaging, histopathology, immunohistochemistry, and patient management.

Conclusions: Among the patients, 56.5% are females, with the largest age group being 51–60 years (24.9%), and most patients resided in East Java Province outside Surabaya City (61.1%). Most common clinical manifestations were visual disturbances (66.3%), headache (58.3%), and nausea–vomiting (16%). About 31,1% of patients presented with hormone-related manifestations. Laboratory examination of blood hormone levels showed the following results: non-functioning pituitary adenoma (51.8%), prolactinoma (39.4%), gonadotroph adenoma (2.1%), somatotroph adenoma (2.1%), TSH-producing tumor (1%), and cortisol-producing tumor (6.6%). examination of pituitary tumors was most commonly performed using MRI, showing lesions with a diameter ≥10 mm, well-defined margins, regular borders, solid components, and no calcification. Histopathological findings revealed that most of the samples were pituitary adenomas (94.3%), with only one case of pituitary carcinoma identified. The most commonly used pharmacological treatments were CRIPSA (22.8%), dexamethasone (21.2%), and euthyroxine (10.6%), Most frequent surgical management was Endoscopic Transsphenoidal Surgery (70.4%).

Keywords: Clinicopathology; Pituitary Adenoma; PitNET

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1. Introduction

The pituitary gland represents the center of the endocrine system and plays a role in various important physiological processes of the body [1]. Pituitary tumors were considered rare in the past but are now increasingly recognized as common disorders, comprising 10 to 25% of intracranial neoplasms [2]. According to the National Cancer Control Committee's estimates, the annual incidence of functional pituitary tumors in Indonesia is 1-2 cases per 100,000 people. This number is likely lower than the actual number of cases due to the tendency for these tumors to go undiagnosed.

It is repeatedly mentioned that there are not many studies investigating the epidemiology of pituitary adenomas (PA), and updated, larger studies on PA epidemiology are needed [3]. Therefore, researchers are interested in studying the clinicopathological profile of pituitary tumors at RSDS Dr. Soetomo Surabaya during the period of January 2019 to December 2023. The results of this study are expected to increase knowledge about pituitary tumors at RSDS Dr. Soetomo Surabaya, serve as reference data for education to the public, especially for high-risk groups of pituitary tumors, be used as secondary data for further research, and assist in the management of patients with pituitary tumors.

2. Material and methods

This type of research is a descriptive observational study with a retrospective study design. This research describes the profile of pituitary gland tumors using medical records with sampling taken by total sampling technique in patients who have been diagnosed with pituitary gland tumors and treated at Dr. Soetomo General Hospital Surabaya during the period of January 2019 to December 2023, supported by radiology/histopathology/blood hormone laboratory data to support the diagnosis. This study has been approved by the Research Ethics Committee at Dr. Soetomo General Hospital Surabaya with the ethics approval code (1831/LOE/301.4/XI/2024). The identities of the respondents are not disclosed in this study to ensure their privacy. All respondent data will be kept confidential by the author, and any information obtained will be used solely for research purposes.

3. Result and discussion

Table 1 General characteristics of pituitary gland tumors patients

Variable		**Total (n=193)**	
Sex, n (%)			
	Female	109	(56.5%)
	Male	84	(43.5%)
Age (years), n (%)			
	≤ 10	7	(3.6%)
	11 – 20	15	(7.8%)
	21 – 30	31	(16.1%)
	31 – 40	33	(17.1%)
	41 – 50	36	(18.7%)
	51 – 60	48	(24.9%)
	>60	23	(11.9%)
	Average	42	
Original place of residence, n (%)			
	Surabaya City	53	(27.5%)
	East Java Province outside Surabaya City	118	(61.1%)
	Java Island outside Java Island	5	(2.6%)
	Outside Java Island	17	(8.8%)

The number of subjects meeting the inclusion criteria for the study was 193 people. Based on Table 1, the mean age of patients in this study was 42 years, with female subjects (56.5%) outnumbering males (43.5%), with the majority of patient's domicile origin coming from East Java Province outside Surabaya City. The age group of 51-60 years represented the largest proportion (24.9%). This indicates a characteristic high risk associated with advancing age [4]. This study findings show that the incidence of pituitary adenoma progressively increases, peaking at ages 60 years before declining. In elderly patients, endocrine dysfunction symptoms tend to be milder. The presence of multiple age-related comorbidities also delays diagnosis and treatment [5]. The youngest patient identified in this study was 6 years old, an earlier onset of pituitary gland tumors at diagnosis is associated with a strong family history of cancer [6].

Disorders of the pituitary gland can present with varied clinical manifestations, depending on the type, size, and progression of the tumor [7]. Clinical manifestations in this study were recorded in 163 patients (84.5%).

Table 2 The distribution of pituitary gland tumor patients clinical manifestations

Clinical Manifestations	**n (patients)**	**(%)**
Related to hormones only	9	(5.5%)
Due to tumor mass effect only	108	(66.3%)
Both	42	(25.8%)
Unrelated	4	(2.5%)
Total	163	(100%)

Based on Table 2, patients who had clinical manifestations related to hormones numbered 51 people (31.1%) and patients with complaints due to tumor mass effect numbered 150 people (92%). Unrelated manifestations to hormones or tumor enlargement, such as uterine prolapse, leg swelling, fever, cold cough, jaundice, scoliosis, red or watery eyes found in 4 people (2.5%). The majority of pituitary gland tumors found were non-functional. Identified in 112 individuals (68.7%). These tumors are characterized by the absence of clinically significant hormone-related symptoms [8].

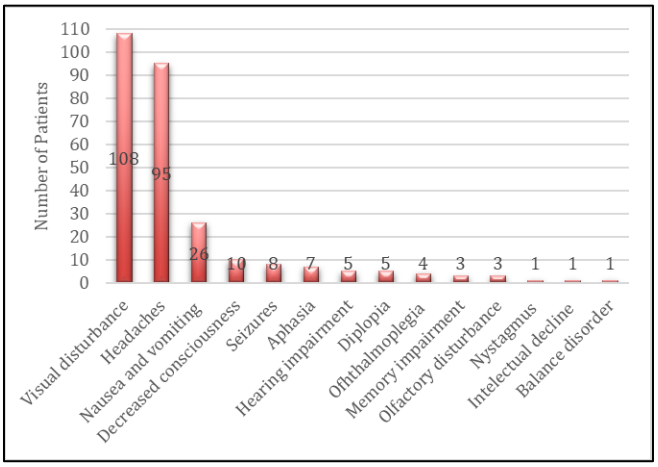

Figure 1 The distribution of clinical manifestations due to pituitary gland tumor mass effect

Based on Figure 1, the most common clinical manifestations Due to tumor mass effect, as reported, were visual disturbances in 108 patients (66.3%), headaches in 95 patients (58.3%), and nausea vomiting in 26 patients (16%). The variety of visual disturbances that arise depends on the structures compressed by the tumor mass. Compression of the optic chiasm can cause a decrease in visual acuity [9]. Caudal compression of the chiasm results in bitemporal hemianopsia [10]. Compression of other structures, such as the cavernous sinus, leads to ptosis, diplopia, or facial pain. Tumor invasion into the optic chiasm or nerves can cause a common and serious complication of pituitary gland tumors, namely partial or complete blindness [9]. Displacement due to mass effect, increased intracranial pressure caused by edema, expansion, and brain tumor hemorrhage results in traction on pain-sensitive intracranial structures, causing headache [11].

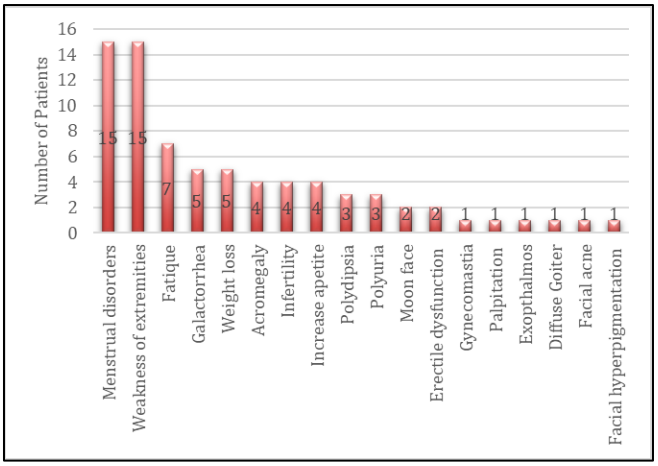

Figure 2 The distribution of clinical manifestations related to hormones

Pituitary adenomas often present disturbances caused by either deficiency or excess of hormones produced by the anterior pituitary, which acts as a regulator [7]. Figure 2 show 22 patients (13.5%) had complaints related to ACTH deficiency; 22 patients (13.5%) had complaints related to prolactin excess; six patients (3.7%) presented with symptoms of increased ACTH, marked by increased appetite and moon face with or without acne and facial hyperpigmentation; 5 patients (3.1%) reported symptoms related to ADH deficiency, characterized by polyuria and polydipsia; 4 patients (2.5%) had complaints related to increased growth hormone, presenting with acromegaly; and 2 patients (1.2%) displayed thyroid hormone-related complaints, including palpitations and exophthalmos.

The increase in hormones is caused by the adenoma's hormone secretion pattern, which exhibits increased "spikiness" and irregularity in hormone release, differing from normal hormone secretion that is more regular and tightly regulated by the body's hormonal feedback [12]. Different hypersecretion syndromes depend on the tumor's cell of origin: corticotropic adenomas secreting corticotropin cause Cushing's disease, somatotropic adenomas secreting growth hormone cause acromegaly, lactotropic adenomas secreting prolactin cause hyperprolactinemia, and thyrotropic adenomas secreting thyrotropin cause hyperthyroidism. Gonadotropic adenomas typically do not secrete hormones, causing hypogonadism and often manifesting incidentally as a sellar mass [13]. Hormone deficiency symptoms are not considered due to their nonspecific nature [14].

Variations of clinical manifestations related to ACTH hormone deficiency and prolactin hormone excess detailed below.

Table 3 The Distribution of complaints related to prolactine hormone excess in 22 pituitary tumor patients

Menstrual disorders	**Infertility**	**Galactorrhea**	**Gynecomastia**	**Erectile dysfunction**	**n (patients)**	**(%)**
V	-	-	-	-	10	(45.5%)
V	v	-	-	-	3	(13.6%)
-	-	v	-	-	3	(13.6%)
V	-	v	-	-	2	(9.1%)
-	-	-	-	v	2	(9.1%)
-	-	-	v	-	1	(4.5%)
-	v	-	-	-	1	(4.5%)
Total					22	(100%)

Table 4 The distribution of complaints related to ACTH hormone deficiency in 22 pituitary tumor patients

Weakness of extremities	Fatique	Weight loss	n (patients)	(%)
v	-	-	13	(59.1%)
-	v	-	5	(22.7%)
-	-	v	3	(13.6%)
v	-	v	1	(4.5%)
Total			22	(100%)

Blood laboratory tests were recorded for 175 patients (90.7%) taken from the earliest laboratory results performed, normal ranges follow those listed in each hormone's laboratory report. Consist of growth hormone (GH) tests for 58 patients (30.1%), prolactin hormone tests for 136 patients (70.5%), gonadotropin hormone tests for 47 patients (24.4%), ACTH hormone tests for 2 patients (1%), cortisol hormone tests for 136 patients (70.5%), and thyroid hormone tests for 148 patients (76.7%).

Table 5 The Distribution of blood hormone Levels in Pituitary Gland Tumors Patients

Horomone		n	(%)
Growth Hormone		n = 58	
	Decrease	3	(5.2%)
	Normal	51	(87.9%)
	Increase	4	(6.9%)
	Average	5.23 ng/mL	
Prolactine		n = 136	
	Decrease	12	(8.8%)
	Normal	48	(35.5%)
	Moderately increase	28	(20.6%)
	Severely increase (>200 ng/mL)	48	(35.3%)
	Average	1051.33 ng/mL	
Gonadotrophine		n = 47	
	Decrease	20	(42.6%)
	Normal	23	(48.9%)
	Increase	4	(8.5%)
Cortisol		n = 136	
	Decreased	54	(39.7%)
	Normal	69	(50.7%)
	Increase	13	(9.6%)
	Average	26 µg/dL	
Thyroid		n = 114	
	Secondary hypothyroidism	34	(29.8%)
	Subclinical hypothyroidism	1	(0.9%)
	Subclinical hyperthyroidism	20	(17.5%)

	Primary hyperthyroidism	1	(0.9%)
	Euthyroid	58	(50.9%)

Table 5 shows there were 93 patients (48.2%) with functioning pituitary gland tumors out of a total of 193 pituitary tumor patients at Dr. Soetomo General Hospital during the period from January 2019 to December 2023, including 76 patients (39.4%) prolactin-producing tumors (prolactinomas), 4 patients (2.1%) FSH/LH-producing tumors (gonadotroph adenomas), 4 patients (2.1%) GH-producing tumors (somatotroph adenomas), 2 patients (1%) TSH-producing tumors, and 13 patients (6.6%) with tumors cortisol-producing tumors with one of them also producing the ACTH horomone.

Secondary hypothyroidism, also known as central hypothyroidism, is caused by dysfunction in the hypothalamic-pituitary axis or the hypothalamus itself, despite a normal thyroid gland [16], and found in 34 individuals (29.8%) in this study. It is assessed with FT4 levels below the reference range accompanied by low, normal, or slightly elevated TSH in the setting of pituitary disease, which typically confirms the diagnosis [17]. This can occur due to mechanical pressure from pituitary tumors causing increased intrasellar pressure, compression of portal blood vessels, and subsequent disruption of hypothalamic hormone delivery, including TRH, to the anterior pituitary [18]. Secondary hyperthyroidism may present with hyperthyroid symptoms such as sweating, heat intolerance, diarrhea, and weight loss [9]. Abnormal thyroid hormone levels due to thyroid gland damage were also found in this study. Primary hyperthyroidism is defined as low TSH hormone levels with high T3 or T4 levels [19] was found in 1 patient (0.9%) in this study Patients with subclinical hyperthyroidism (SCH) were found in 20 individuals (17.5%). Defined biochemically as a condition with normal serum FT4) levels and TSH serum levels below the reference range [20]. Repeating serum TSH, T3, and T4 concentrations in 3 to 6 months is recommended before confirming the diagnosis of SCHyper for considering treatment [21]. Subclinical hypothyroidism was found in 1 individual (0.9%).

The Indonesian Endocrinology Association (PERKENI) Consensus on Pituitary Adenoma Diagnosis outlines criteria for prolactinoma investigation, stating that patients with measured blood prolactin levels >200 ng/mL and confirmed by MRI can be classified as having prolactinoma, there were 48 patients (35.3%) with blood prolactin hormone levels >200 ng/mL in this study. Females predominated with a 3:1 ratio, one reason for the higher prevalence among females is that estrogen, for example during menopausal hormone therapy, potently induces hyperprolactinemia. Additionally, primary hypothyroidism, intracranial hypotension, and stress can elevate serum prolactin [15]. Radiological examinations, including MRI and CT scans, at RSUD Dr. Soetomo during the study period performed in 46 patients. All CT scan results showed macroadenomas, while MRI examinations in 42 patients revealed macroadenomas in 32 patients and microadenomas in 10 patients. Incomplete clinical manifestations were noted in 11 patients. Prolactine-related complaints such as menstrual disorders, infertility, gynecomastia, galactorrhea, and erectile dysfunction were found in 12 patients. Non-prolactin hormone-related clinical manifestations, acromegaly and heart palpitations, were each found in 1 patient. Tumor compression-related clinical manifestations were present in all patients, with the most common being headache in 28 patients and visual disturbances in 27 patients. Adenomas with moderately increased prolactin levels should be considered as prolactinoma stalk effect, as parasellar or intrasellar masses, including non-secreting pituitary adenomas, can compress the pituitary stalk and inhibit dopamine flow, thereby increasing prolactin levels [15].

Patients with moderately increased blood prolactin hormone levels. Findings from this study showed that CT scan examinations performed on 3 patients, all indicated macroadenomas. While MRI examinations revealed macroadenomas in 18 patients and microadenomas in 2 patients. Incomplete clinical manifestations were noted in 4 patients. Prolactin-related clinical manifestations included menstrual disorders in 4 patients with or without infertility and erectile dysfunction in 1 patient, while non-prolactin hormone-related manifestations, moon face was found in 1 patient. Tumor compression complaints were present in 32 patients, with the most common being visual disturbances in 23 patients and headaches in 16 patients. Patients with macroadenomas, especially those >3 cm with normal or mildly elevated prolactin, require serum prolactin dilution to rule out the hook effect, which occurs when hormone levels are too high, interfering with sandwich antibody-antigen-antibody complex formation. Prolactinomas with hook effect can be misdiagnosed as non-secreting pituitary adenomas or NFPA [17]. Samples should be remeasured after 1:100 dilution to exclude high-dose hook effect [15]. Measurements to confirm hook effect using immunoassay were not tested in this study.

The distribution of hormone-secreting pituitary gland tumors, relationship with clinical manifestations, and tumor size can be seen in Table 6.

Table 6 The Distribution of hormone-secreting pituitary gland tumors, clinical manifestations, and tumor size in 93 pituitary tumor patients

The hormones produces	**Clinical manifestations**	**Tumors size**	**n (patients)**
LH	Galactorrhea and due to tumor mass effect	Microadenoma	1
FSH	Due to tumor mass effect	Macroadenoma	1
FSH	Due to tumor mass effect	No data	1
FSH and LH	No data	Microadenoma	1
Prolactine	No data	No data	1
Prolactine	No data	Microadenoma	4
Prolactine	No data	Macroadenoma	9
Prolactine	Due to tumor mass effect	No data	4
Prolactine	Due to tumor mass effect	Microadenoma	5
Prolactine	Due to tumor mass effect	Macroadenoma	27
Prolactine	*Moon face* and due to tumor mass effect	Macroadenoma	1
Prolactine	Palpitation and due to tumor mass effect	Macroadenoma	1
Prolactine	Erectile dysfunction and due to tumor mass effect	Macroadenoma	1
Prolactine	Galactorrhea and due to tumor mass effect	Macroadenoma	1
Prolactine	Menstrual disorder	Macroadenoma	1
Prolactine	Menstrual disorder and due to tumor mass effect	Microadenoma	1
Prolactine	Menstrual disorder and due to tumor mass effect	Macroadenoma	5
Prolactine	Menstrual disorder and infertility	Microadenoma	1
Prolactine	Menstrual disorder, infertility, and due to tumor mass effect	Macroadenoma	1
Prolactine	Menstrual disorder, galactorrhea, increase apetite, and due to tumor mass effect	No data	1
Prolactine	Menstrual disorder, galactorrhea, and due to tumor mass effect	Microadenoma	1
Prolactine	Menstrual disorder, galactorrhea, and due to tumor mass effect	Macroadenoma	1
Prolactine	Fatique, erectile dysfunction, polyuria, polydipsia, increase apetite, and due to tumor mass effect	Macroadenoma	1
Prolactine	Weakness of extremities and due to tumor mass effect	Macroadenoma	2
Prolactine	Weight loss and due to tumor mass effect	Macroadenoma	1
Prolactine, ACTH, and cortisol	Due to tumor mass effect	No data	1
Prolactine and cortisol	Due to tumor mass effect	Macroadenoma	4
Prolactine and cortisol	Menstrual disorder, infertility, and due to tumor mass effect	Macroadenoma	1
Cortisol	Fatique	Microadenoma	1
Cortisol	Weakness of extremity and due to tumor mass effect	Macroadenoma	1

Cortisol	Exopthalmos and due to tumor mass effect	Macroadenoma	1
Cortisol	Due to tumor mass effect	No data	1
Cortisol	Infertility and due to tumor mass effect	Macroadenoma	1
Cortisol	Menstrual disorder, infertility, *moon face*, acne, facial hyperpigmentation, and due to tumor mass effect	Microadenoma	1
Cortisol	No data	Microadenoma	1
GH	Acromegaly	No data	1
GH	Acromegaly and due to tumor mass effect	Macroadenoma	1
GH	Due to tumor mass effect	Makroadenma	1
GH	Due to tumor mass effect	No data	1
TSH	Due to tumor mass effect	Macroadenoma	1
TSH	Due to tumor mass effect	No data	1
Total patient with hormone-secreting tumors			93

Larger tumor sizes release more growth hormone [18] and can cause excessive growth [4]. The PERKENI Consensus on Pituitary Adenoma Diagnosis states that GH-producing PA diagnosis involves IGF-1 testing followed by an oral glucose tolerance test (OGTT) to assess GH suppression. The body produces GH multiple times per night, but it is rapidly utilized, so single blood levels cannot indicate whether growth hormone production is normal. In contrast, IGF-1 production is controlled by growth hormone and changes more slowly [22].

The PDQ Cancer Information Summaries book states that most tumors producing LH and FSH do not secrete sufficient additional hormones to cause signs and symptoms, thus considered non-functioning tumors. LH and FSH levels fluctuate with the menstrual cycle, making interpretation of their measurements challenging in women. Excessive FSH secretion can cause ovarian hyperstimulation in women of reproductive age, leading to ovarian cysts as well as amenorrhea and galactorrhea [9].

The PERKENI Consensus on Pituitary Adenoma Diagnosis states that ACTH-producing pituitary adenoma is diagnosed in the presence of hypercortisolism. Pituitary adenomas often cause Cushing's disease, an endocrine disorder characterized by excessive ACTH production by the anterior pituitary gland, which stimulates all three layers of the adrenal cortex, resulting in adrenal gland hypertrophy [23] and bilateral adrenal hyperplasia, leading to increased cortisol production [24]. Clinical manifestations such as moon face, or fat accumulation in the cheeks and temporal fossa, occur in female patients with elevated blood cortisol levels above normal due to increased visceral adiposity. These patients also exhibit additional clinical manifestations, including acne across the face. Unlike males, whose primary androgen source is the testes, most circulating androgens in females originate from the adrenal glands [23]. Thus, hyperandrogenism can be diagnosed as an additional symptom. Moon face manifestations in patients with low or normal cortisol levels are likely due to long-term glucocorticoid therapy effects [25].

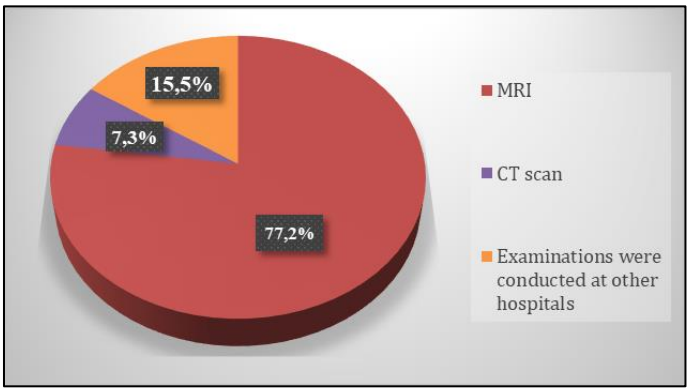

Figure 3 The Distribution of radiological imaging of pituitary gland tumors patients

The number of research subjects who underwent radiological imaging at Dr. Soetomo General Hospital Surabaya was 163 individuals (84.5%) Radiological imaging for 14 subjects (7.3%) was obtained from CT scan results, and for 149 subjects (77.2%) from MRI results. Patients who did not have recorded radiology results at Dr. Soetomo General Hospital during this period but met the inclusion criteria were those who had undergone surgery and had histopathology results supporting a pituitary gland tumor.

Of the 163 patients who had radiology data at Dr. Soetomo General Hospital during this study period, only 113 patients had complete radiology (MRI) reports and will be detailed as follows.

Table 7 The distribution of radiological imaging in pituitary gland tumors patients at RSUD Dr. Soetomo general hospital

Variable		**n = 113 (%)**	
Diameter			
	Microadenoma (<10mm)	12	(10.6%)
	Macroadenoma (≥10 mm)	101	(89.4%)
	Smallest	0.2 cm	
	Largest	8.4 cm	
	Average	2.97 cm	
Intensity (T1W1 – T2W1)			
	Hypointense – hypointense	4	(3.5%)
	Hypointense – hypoisointense	2	(1.8%)
	Hypointense – isohyperintense	2	(1.8%)
	Hypointense – hyperintense	7	(6.2%)
	Hypoisointense – hypohyperintense	1	(0.9%)
	Hypoisointense – isohyperintense	4	(3.5%)
	Hypoisointense – hyperintense	7	(6.2%)
	Hypohyperintense – hypohyperintense	3	(2.7%)
	Hypohyperintense – isohyperintense	1	(0.9%)
	Hypohyperintense – hyperintense	1	(0.9%)
	Isointense – hypointense	4	(3.5%)
	Isointense – hypoisointense	1	(0.9%)
	Isointense – hypohyperintense	2	(1.8%)
	Isointense – isointense	10	(8.8%)
	Isointense – isohyperintense	12	(10.6%)
	Isointense – hyperintense	36	(31.9%)
	Isohyperintense – hypohyperintense	3	(2.7%)
	Isohyperintense – isohyperintense	2	(1.8%)
	Isohyperintense – hyperintense	1	(0.9%)
	Hyperintense – hypointense	2	(1.8%)
	Hyperintense – isohyperintense	2	(1.8%)
	Hyperintense – hyperintense	4	(2.5%)

	Isohypointense with hyperintense components – isohyperintense	1	(0.9%)
	No hyperintense/hypointense lesions are visible	1	(0.9%)
Margin			
	Well defined – regular	67	(59.3%)
	Well defined – irregular	14	(12.4%)
	Well defined – lobulated	25	(22.1%)
	Partially idefinite – regular	1	(0.9%)
	Partially idefinite – irregular	1	(0.9%)
	Partially idefinite – lobulated	1	(0.9%)
	Identifinate – irregular	4	(2.7%)
	Identifinate – lobulated	1	(0.9%)
Component			
	Solid	59	(52.2%)
	Solid-cystic	35	(31%)
	Cystic	4	(3.5%)
	Lession	15	(13.3%)
Calcification			
	Present	6	(5.3%)
	No calcification present	107	(94.7%)

The radiology result presented in Table 7 were all examined using Magnetic Resonance Imaging (MRI). Dynamic contrast-enhanced MRI has been proven to be the best imaging tool [26] and the most useful in the diagnosis of PitNET/pituitary adenoma [8]. Brain CT scan imaging with contrast offers limited diagnostic value and an additional disadvantage of ionizing radiation compared to MRI when evaluating sellar and suprasellar lesions. Calcifications and bony structures are optimally evaluated [27] and patients with contraindications to MRI, such as those with pacemakers, may opt for CT scan examination [28].

The prevalence of macroadenomas does not always correlate with aggressive behavior, although aggressive pituitary adenomas are typically macroadenomas at diagnosis [2]. MRI signal intensity varies case by case due to inconsistent water content among PitNETs/pituitary adenomas, along with modifications such as degeneration, hemorrhage, and infarction [8]. Well-defined borders and regular margins on tumors generally indicate localized growth and benign tendency. Calcification in pituitary adenomas arises from calcium accumulation in tissues undergoing tumor enlargement, causing ischemic effects, damage, and calcium deposition (dystrophic calcification). Calcification can also result from secondary degenerative changes due to pituitary apoplexy. Calcification may stimulate osteoid metaplasia [29] and, if severe, post surgical challenges due to adherence to surrounding structures, increasing postoperative cerebrospinal fluid leakage risk [22].

Immunohistochemical examination was performed only for prolactin hormone in 3 patients, and all results were positive. Pharmacological management was administered to 151 patients (78.2%), radiation therapy was provided to 1 patient (0.5%), surgical intervention was performed on 71 patients (36.8%), and histopathological examinations were conducted on 70 patients (36.3%).

Table 8 The Distribution of histopathological findings and surgical managements in pituitary gland tumors patients

Variable		**n**	**(%)**
Histopatological findings		n = 70	
	Pituitary adenoma	66	(94.3%)
	Pituitary carcinoma	1	(1.4%)
	Unclassified	3	(4.3%)
Surgical interventions		n = 71	
	Endoscopic Endonasal Transsphenoidal Hypophysectomy (EETH)	50	(70.4%)
	Kraniotomi	7	(9.9%)
	Sublabial Transethmoidal (SLTH)	3	(4.2%)
	The type of surgery was not documented.	11	(15.5%)

Based on Table 8, only 1 patient (1.4%) was diagnosed with pituitary carcinoma based on histopathological results. Pituitary carcinoma (PC) is a very rare clinical entity, with an incidence of only 0.1% to 0.2% of all pituitary gland tumors [30]. The PC case in this study involved a 51-year-old female patient. The diagnosis of PC was established through histopathological findings following endoscopic endonasal transsphenoidal (EETH) surgery. Clinical manifestations included visual disturbances such as blurred vision, headache, and amenorrhea. Hormonal assays showed normal TSH, low LH, normal FSH, and elevated prolactin levels. MRI radiology revealed a tumor measuring 3.1 x 3.4 x 4.3 cm with isointense signal intensity, no calcification, but with evidence of apoplexy. Visual examination indicated blindness in the right eye and 2/60 visual acuity in the left eye. The treatment did not include steroids or hormonal therapy. The underlying pathophysiology of PC remains unknown and is under active investigation, but is believed to be related to genetic mutations [9]. The rarity of this disease limits the design of clinical trials for studying tumorigenesis and its management [31].

The first-line therapy for pituitary adenoma is transsphenoidal surgery, except for prolactinomas, which pharmacological treatment using dopamine agonists such as bromocriptine or cabergoline is the primary approach [32]. The transsphenoidal approach has several variants, including the perinasal corridor, sublabial, or paraseptal direct approach, with or without the use of nasal speculum or nasal mucosa dissection [33]. The advantage of transsphenoidal surgery is its ability to effectively decompress the delicate optic nerve and rapidly correct hypersecretion [34]. However, one of its drawbacks is the deep and narrow working corridor, which requires specialized instruments and high-level skills [33]. The transcranial approach with craniotomy is employed for very large tumors with predominant extrasellar location [33]. This approach is also used when sphenoid sinusitis is present, which constitutes an absolute contraindication for the transsphenoidal method [35].

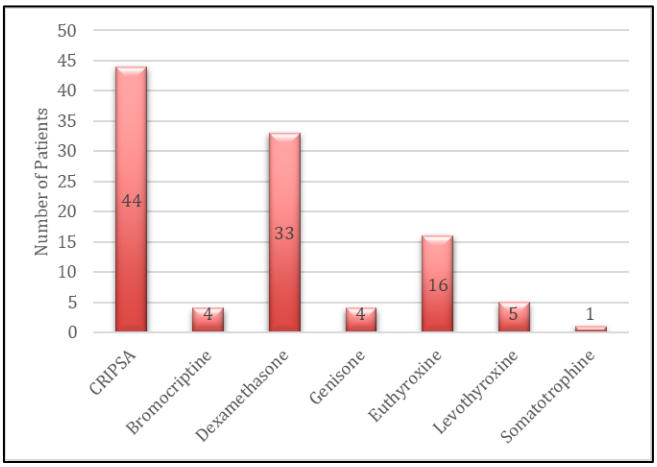

Figure 4 The distribution of pharmacological managements in pituitary gland tumors patients

Based on Figure 4, pharmacological managements for hyperprolactinemia was administered to 44 patients (22.8%), consisting of 40 patients receiving CRIPSA therapy and 4 patients receiving a combination of CRIPSA and bromocriptine therapy. Bromocriptine, belonging to the class of dopamine agonists, is considered highly effective for prolactinomas because it normalizes serum prolactin levels, reduces adenoma mass, and restores gonadal function. Cabergoline is preferred due to its long half-life, high efficacy, and good tolerability. Bromocriptine has a shorter half-life, which can reduce fetal exposure and is safe for pregnant women; however, adenoma fibrosis has been observed in most patients undergoing surgery after preoperative bromocriptine treatment for more than one month [15]. The widespread use of bromocriptine in these findings is likely related to its price and availability.

Pharmacological treatment for hypothyroidism was administered to 18 patients (9.3%), with 13 patients receiving euthyroxin, 2 patients receiving levothyroxine, and 3 patients receiving a combination of levothyroxine and euthyroxin therapy. Levothyroxine is the synthetic version of the body's natural thyroid hormone, thyroxine/T4 [36]. Pharmacological therapy with levothyroxine reduces the size of the pituitary gland, thereby potentially avoiding unnecessary or risky surgery. However, close monitoring is still recommended during long-term use of levothyroxine [37].

Growth hormone (GH) pharmacological therapy was administered to 1 patient (0.4%) in the form of somatotropin and GH injections. Steroid therapy was given to 46 patients (23.8%), with 32 patients receiving dexamethasone, 9 patients receiving methylprednisolone, 2 patients receiving genisone, and 1 patient each receiving combination therapies of dexamethasone - genisone, methylprednisolone - dexamethasone, and methylprednisolone - genisone. Corticosteroids have been widely used in cancer therapy due to their potent effects on tumor-induced edema [38]. Adequate steroid hormone supplementation is essential under stress conditions in pituitary adenoma, including the perioperative period [28]. The steroids reported in this study are dexamethasone, methylprednisolone, and genisone, all belonging to the glucocorticoid subclass. Glucocorticoid corticosteroids have been shown to be beneficial in controlling tumor-related pain, reducing nausea and vomiting, and improving appetite in cancer patients. Dexamethasone is preferred due to its lower sodium and water retention index compared to other corticosteroids [38].

Pharmacological management recorded under "others" included treatments that were neither hormonal nor steroid-based, such as vitamin, gastric acid reducers, antidiabetic agents, antihypertensives, and others, accounting for a total of 64 patients (33.2%).

4. Conclusion

Based on a study conducted on 193 patients with pituitary gland tumors at RSUD Dr. Soetomo during the period from January 2019 to December 2023, the clinicopathological profile obtained is as follows:

Female patients (56.5%) outnumbered males (43.5%). The age group most affected was 51-60 years (24.9%), with the majority of patients belonging to the middle adult age group and an average age of 42 years. Patients residing in cities in East Java, excluding Surabaya, constituted the dominant demographic origin (61.1%).

The most frequently recorded clinical manifestations were visual disturbances (66.3%), headaches (58.3%), and nausea/vomiting (16%). Clinical manifestations related to hormonal complaints were found in 31.1% of patients.

Laboratory hormone blood tests indicated non-functioning pituitary adenomas in 51.8% of cases, prolactinomas in 39.4%, gonadotroph adenomas in 2.1%, somatotroph adenomas in 2.1%, TSH-producing tumors in 1%, and cortisol-producing tumors in 6.6%, with one case also producing ACTH.

Radiological imaging results showed MRI was more dominant than CT scans. The most common radiological features included tumor diameter ≥ 10 mm/macroadenoma (78.55%), well-defined regular margins (44.2%), solid components (49.15%), MRI intensity showing isointense on T1W1 and hyperintense on T2W1 (27.5%), and no calcification present in the tumor (94.5%). The average tumor diameter in this study was 2.97 cm

Histopathological examination revealed a diagnosis of pituitary adenoma in 94.3% and pituitary carcinoma in 1.4%. Immunohistochemical testing was performed in only 3 patients (1.6%), all of whom tested positive.

The most common pharmacological management was CRIPSA therapy (22.8%), dexamethasone (21.2%), and levothyroxine (10.6%). The most common surgical treatment was Endoscopic Transsphenoidal Surgery (70.4%), while radiation therapy was administered to only one patient (0.5%).

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declared there is no conflict of interest.

References

[1] Laporte E, Vankelecom H. Organoid models of the pituitary gland in health and disease. Front Endocrinol (Lausanne). 2023 Aug 8;14:1233714. doi: 10.3389/fendo.2023.1233714. PMID: 37614709; PMCID: PMC10442803.

[2] Melmed S, Kaiser UB, Lopes MB, Bertherat J, Syro LV, Raverot G, Reincke M, Johannsson G, Beckers A, Fleseriu M, Giustina A, Wass JAH, Ho KKY. Clinical Biology of the Pituitary Adenoma. Endocr Rev. 2022 Nov 25;43(6):1003-1037. doi: 10.1210/endrev/bnac010. PMID: 35395078; PMCID: PMC9695123.

[3] Chin SO. Epidemiology of Functioning Pituitary Adenomas. Endocrinol Metab (Seoul). 2020 Jun;35(2):237-242. doi: 10.3803/EnM.2020.35.2.237. Epub 2020 Jun 24. PMID: 32615708; PMCID: PMC7386114.

[4] Hemminki, K., Försti, A., & Ji, A. (2007). Incidence and familial risks in pituitary adenoma and associated tumors. Endocrine-Related Cancer, 14(1), 103–109. https://doi.org/10.1677/ERC 06-0008

[5] Rosinha, P., Fonseca, L., Amaral, C., Ribeiro, I., & Cardoso, M. H. (2022). Pituitary adenomas in the elderly: Retrospective comparative analysis of clinical/tumor features and surgical data by age group. Medicine (United https://doi.org/10.1097/MD.0000000000030825

[6] Pekic, S., Stojanovic, M., & Popovic, V. (2021). Pituitary tumors and the risk of other malignancies: is the relationship coincidental or causal? Endocrine Oncology, 2(1), R1–R13. https://doi.org/10.1530/eo-21-0033

[7] Hidayat, M. (2015). Adenoma hipofisis. Majalah Kedokteran Andalas, 38(2), 130–138.

[8] Tsukamoto, T., & Miki, Y. (2023). Imaging of pituitary tumors: an update with the 5th WHO Classifications—part 1. Pituitary neuroendocrine tumor (PitNET)/pituitary adenoma. In Japanese Journal of Radiology (Vol. 41, Issue 8, pp. 789–806). Springer. https://doi.org/10.1007/s11604-023-01400-7

[9] Butt WS, Weisbrod LJ, Srinivasan VN. Kanker Hipofisis. [Diperbarui 8 Agustus 2023]. Dalam: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; Januari 2025. Tersedia di: https://www.ncbi.nlm.nih.gov/books/NBK559099/

[10] Astorga-Carballo, A., Serna-Ojeda, J. C., & Camargo-Suarez, M. F. (2017). Chiasmal syndrome: Clinical characteristics in patients attending an ophthalmological center. Saudi Journal of Ophthalmology, 31(4), 229–233. https://doi.org/10.1016/j.sjopt.2017.08.004

[11] Dananjoyo, K., Nalendra Tama, W., Ghazali Malueka, R., Asmedi Staf Departemen Neurologi Fakultas Kedokteran, A., Masyarakat dan Keperawatan, K., & Gadjah Mada, U. (2019). Nyeri kepala tumor otak pada dewasa Brain tumor headache in adult. In Berkala Neurosains (Vol. 18, Issue 2).

[12] Roelfsema F, Pereira AM, Biermasz NR, Veldhuis JD. Hormone secretion by pituitary adenomas is characterized by increased disorderliness and spikiness but more regular pulsing. J Clin Endocrinol Metab. 2014 Oct;99(10):3836-44. doi: 10.1210/jc.2014-2363. Epub 2014 Jul 11. PMID: 25014002; PMCID: PMC4184075.

[13] Melmed S. Pathogenesis and diagnosis of pituitary adenomas. N Engl J Med. 2019 Feb 21;380(8):764-773. doi: 10.1056/NEJMra1810772. PMID: 30763193.

[14] Rosinha, P., Fonseca, L., Amaral, C., Ribeiro, I., & Cardoso, M. H. (2022). Pituitary adenomas in the elderly: Retrospective comparative analysis of clinical/tumor features and surgical data

[15] Petersenn, S., Fleseriu, M., Casanueva, F. F., Giustina, A., Biermasz, N., Biller, B. M. K., Bronstein, M., Chanson, P., Fukuoka, H., Gadelha, M., Greenman, Y., Gurnell, M., Ho, K. K. Y., Honegger, J., Ioachimescu, A. G., Kaiser, U. B., Karavitaki, N., Katznelson, L., Lodish, M., Melmed, S. (2023). Diagnosis and management of prolactin-secreting

pituitary adenomas: a Pituitary Society international Consensus Statement. Nature Reviews Endocrinology, 19(12), 722–740. https://doi.org/10.1038/s41574-023-00886-5

[16] Wenilia, R., & Dokter, P. http://jurnalmedikahutama.com

[17] Drummond JB, Ribeiro-Oliveira A Jr., Soares BS. Adenoma Hipofisis Non-Fungsi. [Diperbarui 12 Oktober 2022]. Dalam: Feingold KR, Ahmed SF, Anawalt B, dkk., editor. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Tersedia di: https://www.ncbi.nlm.nih.gov/books/NBK534880/

[18] Takamizawa, T., Horiguchi, K., Nakajima, Y., Okamura, T., Ishida, E., Matsumoto, S., Yoshino, S., Yamada, E., Saitoh, T., Ozawa, A., Tosaka, M., Yamada, S., & Yamada, M. (2019). Central Hypothyroidism Related to Pituitary Adenomas: Low Incidence of Central Hypothyroidism in Patients with Acromegaly. Journal of Clinical Endocrinology and Metabolism, 104(10), 4879–4888. https://doi.org/10.1210/jc.2019-00466

[19] Mathew, S., Jose Kurikkattayil, G. P., Paruvakkattil, K. B., & Kalarikkal, E. E. (2020). Clinical presentation and hormonal profile of patients with pituitary tumour. International Surgery Journal, 8(1), 73. https://doi.org/10.18203/2349-2902.isj20205446

[20] Koshi Hashimoto , Pembaruan tentang disfungsi tiroid subklinis , Endocrine Journal , 2022 , Volume 69 , Edisi 7 , Halaman 725-738 , Dirilis di J-STAGE 28 Juli 2022 , Publikasi daring lanjutan 22 Juni 2022 , ISSN daring 1348-4540 , ISSN cetak 0918-8959, https://doi.org/10.1507/endocrj.EJ22-0182

[21] Karen Tsai, Angela M. Leung, Subclinical Hyperthyroidism: A Review of the Clinical Literature, Endocrine Practice, Volume 27, Issue 3, 2021, Pages 254-260, ISSN 1530-891X, https://doi.org/10.1016/j.eprac.2021.02.002.

[22] Tavakol, S., Wedemeyer, M. A., Bakhsheshian, J., Zada, G., Hasan, A., Carmichael, J. D., Liu, C. S. J., Shiroishi, M. S., & Mathew, A. (2020). Calcified Prolactinoma of the Pituitary Gland: Illustrative Case Reports Highlighting Medical versus Surgical Intervention. Journal of Neurological Surgery, Part B: Skull Base, 81(1), 22–29. https://doi.org/10.1055/s-0039 1677678

[23] Juszczak A, Morris D, Grossman A. Sindrom Cushing. [Diperbarui 5 September 2024]. Dalam: Feingold KR, Ahmed SF, Anawalt B, dkk., editor. Endotext [Internet]. South Dartmouth (MA) : MDText.com, Inc.; 2000-. Tersedia di: https://www.ncbi.nlm.nih.gov/books/NBK279088/

[24] Kairys N, Anastasopoulou C, Schwell A. Penyakit Cushing. [Diperbarui 27 Februari 2023]. Dalam: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; Januari 2025. Tersedia di: https://www.ncbi.nlm.nih.gov/books/NBK448184/

[25] Tsutsumi, T., Nakagomi, D., Kobayashi, K., Hanai, S., Kobayashi, Y., Ito, R., Ishii, T., Okuma, H., Uchinuma, H., Ichijo, M., & Tsuchiya, K. (2024). Moon-like Facies by Glucocorticoid Is Associated With the Development of Diabetes and Body Image Disturbance. Journal of the Endocrine Society, 8(5). https://doi.org/10.1210/jendso/bvae036

[26] Chaudhary, V., & Bano, S. (2011). Imaging of the pituitary: Recent advances. Indian Journal of Endocrinology and Metabolism, 15(7), 216. https://doi.org/10.4103/2230-8210.84871

[27] Reeves RA, Parekh M. Pituitary Gland Imaging. [Updated 2023 Jan 16]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK555989/

[28] Pedoman Nasional Pelayanan Kedokteran Tumor Otak (2019) oleh KEMENKES

[29] Khan, Y., Malik, N., Awan, S. I., Khalid, S. H., & Laghari, A. A. (2019). Pituitary Adenoma with Calcifications: A Case Report. Cureus. https://doi.org/10.7759/cureus.5542

[30] Du Four, S., Van Der Veken, J., Duerinck, J., Vermeulen, E., Andreescu, C. E., Bruneau, M., Neyns, B., Velthoven, V., & Velkeniers, B. (2022). Pituitary carcinoma - case series and review of the literature. Frontiers in Endocrinology, 13. https://doi.org/10.3389/fendo.2022.968692

[31] Xu L, Khaddour K, Chen J, Rich KM, Perrin RJ, Campian JL. Pituitary carcinoma: Two case reports and review of literature. World J Clin Oncol. 2020 Feb 24;11(2):91-102. doi: 10.5306/wjco.v11.i2.91. PMID: 32133278; PMCID: PMC7046923.

[32] Tritos NA , Miller KK. Diagnosis dan Penatalaksanaan Adenoma Hipofisis : Sebuah Tinjauan . JAMA. 2023;329(16):1386–1398. doi:10.1001/jama.2023.5444

[33] M. Buchfelder, S.M. Schlaffer, Y. Zhao, The optimal surgical techniques for pituitary tumors, Best Practice & Research Clinical Endocrinology & Metabolism, Volume 33, Issue 2, 2019, 101299, ISSN 1521-690X, https://doi.org/10.1016/j.beem.2019.101299.

[34] Edward R. Laws, John A. Jane, Neurosurgical approach to treating pituitary adenomas, Growth Hormone & IGF Research, Volume 15, Supplement, 2005, Pages 36-41, ISSN 1096-6374, https://doi.org/10.1016/j.ghir.2005.06.008.

[35] Hall WA, Das JM. Hipofisektomi Transsphenoidal. [Diperbarui 15 Februari 2025]. Dalam: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; Januari 2025. Tersedia di: https://www.ncbi.nlm.nih.gov/books/NBK556142/

[36] Eghtedari B, Correa R. Levotiroksin. [Diperbarui 28 Agustus 2023]. Dalam: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; https://www.ncbi.nlm.nih.gov/books/NBK539808/

[37] Ciancia, S., & Cesari, S. (2021). Pituitary Macroadenoma and Severe Hypothyroidism: The Link between Brain Imaging and Thyroid Function.

[38] Stokum, J. A., Gerzanich, V., Sheth, K. N., Kimberly, W. T., & Simard, J. M. (2020). Emerging Pharmacological Treatments for Cerebral Edema: Evidence from Clinical Studies. https://doi.org/10.1146/annurev