Pituitary Tumors: What Are They and How Are They Treated?

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The pituitary gland (hypophysis) is a very small, pea-sized gland located inside the skull, specifically beneath the brain and above the back of the nasal cavity. However, if the gland grows beyond its normal size (tumor), it can compress and damage the brain and nerves, leading to hormonal disorders and even blindness. Most pituitary tumors are benign. Their symptoms vary depending on the type of tumor and the areas around the pituitary gland that are affected. Many patients present with visual disturbances or even blindness. Although benign, progressive growth can cause symptoms that significantly affect the patient's quality of life. Management of pituitary tumors may include radiotherapy, medication, and surgery. Surgery is the primary treatment for pituitary tumors. Currently, the Endoscopic Skull Base Surgery (ESBS), Transsphenoidal Approach (TSA), has become one of the techniques that offers advantages such as shorter stays in the ICU and hospital ward, reduced risks and minimal bleeding during surgery, faster recovery, and no facial incisions (better cosmetic outcome).

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1. Introduction

Pituitary tumors (pituitary tumors) originate from the cells of the anterior pituitary gland. Most of them are generally benign tumors and are classified as pituitary adenomas (AP). Only 0.1-0.2% of tumors show craniospinal or systemic metastases, and these tumors are known as pituitary carcinomas.[1]

The pituitary gland, located at the base of the brain and often referred to as the "master gland," is the most important endocrine gland in the body. It regulates the secretion of vital hormones. Pituitary adenomas are slow-growing, benign tumors that originate from the cells of the pituitary gland. They rank third among the most common intracranial tumors after meningiomas and gliomas, representing approximately 15% of all central nervous system tumors.[2] Globally, pituitary adenomas are estimated to impact a patient's quality of life by 2-4 times because clinical symptoms can vary widely depending on mass effect and hormonal dysfunction. In Indonesia, many cases are diagnosed at an advanced stage due to delays in recognizing symptoms and signs. A study at Cipto Mangunkusumo Hospital, a tertiary referral hospital in Jakarta, Indonesia, showed that between 2007 and 2012, 97.8% of cases were macroadenomas of pituitary adenomas, with 44.4% being functional adenomas that could have been diagnosed earlier.[3]

Molecular studies reveal mutations in: GNAS (GH-secreting tumors), USP8 (ACTH-secreting tumors), AIP (familial pituitary adenomas). These mutations activate intracellular signaling pathways such as cAMP and MAPK, leading to uncontrolled cellular proliferation.[20] WHO 2022 classification incorporates transcription factors including PIT1, TPIT, and SF1 for more accurate tumor characterization.[21]

These tumors have several characteristics that distinguish them from typical benign tumors, including a tendency to bleed and necrosis, frequent invasion of nearby structures, a poor patient prognosis, and rare metastasis. These tumors also excrete neuroendocrine proteins such as synaptophysin, chromogranin A, CD56, and insulinoma-like protein 1, which are characteristic of neuroendocrine tumors.[4]

Not all pituitary tumors cause symptoms. Sometimes they are discovered during imaging tests, such as an MRI or CT scan, performed for other reasons. If they don't cause symptoms, pituitary tumors usually don't require treatment. Pituitary tumor symptoms can be caused by the tumor pressing on the brain or other surrounding body parts. Symptoms can also be caused by hormonal imbalances. Hormone levels can increase when a pituitary tumor produces too much of one or more hormones. Large tumors that interfere with the functioning of the pituitary gland can also cause hormone levels to decrease.[5]

The prognosis for pituitary adenomas depends on whether they are functioning or nonfunctioning. Nonfunctioning adenomas and prolactinomas have an excellent prognosis if treated promptly with surgery and/or medical therapy. Functioning adenomas, such as Cushing's disease and acromegaly, are associated with several comorbidities and other complications. Mortality is increased, especially in patients with Cushing's disease who delay medical or surgical treatment.[6]

2. Literature Review and Problem Statement

Pituitary adenomas are among the most frequently occurring intracranial tumors. Large population-based studies report increasing incidence trends, likely due to improved imaging modalities.[14] Prolactinomas represent the most common subtype, followed by non-functioning adenomas.[15] The WHO 2022 classification system provides a more accurate framework for tumor characterization using transcription factors.[21] Despite being predominantly benign, pituitary tumors can cause significant morbidity due to mass effects and hormonal dysfunction. Epidemiologically, although data in Indonesia indicates an incidence of around 1-2 cases per 100,000 people, the actual prevalence is estimated to be higher because some tumors are asymptomatic and therefore go undiagnosed.[10]

A research gap exists in the clinical management of pituitary tumors in Indonesia, particularly regarding the adoption and outcomes of minimally invasive techniques such as Endoscopic Skull Base Surgery (ESBS) with Transsphenoidal Approach (TSA). Previous studies have documented outcomes in Western centers, but data from Indonesian tertiary hospitals remain limited. This study seeks to address that gap by providing clinical outcome data from Murni Teguh Memorial Hospital, Medan, and by reviewing the current literature on pituitary tumor classification and management.

3. Method

This study is a descriptive study using a literature review and retrospective approach. The literature review was conducted by analyzing relevant national and international scientific journals, textbooks, and clinical guidelines related to pituitary tumors, including their classification, clinical manifestations, and current management strategies, with particular focus on Endoscopic Skull Base Surgery (ESBS) using the Transsphenoidal Approach (TSA). The literature sources were obtained from credible databases and limited to publications from the last ten years.

In addition, a retrospective descriptive study was performed using medical record data of patients with pituitary tumors who underwent surgical treatment using the Transsphenoidal Approach (TSA) at Murni Teguh Memorial Hospital, Medan. The data were collected from patients who underwent surgery between June 2022 and September 2025, with a total of 34 patients included in the study.

The collected data included patient characteristics, type of surgical procedure, length of postoperative hospitalization, and clinical outcomes, particularly improvements in visual function. The data were analyzed descriptively and presented narratively to provide an overview of the management of pituitary tumors using the ESBS-TSA technique and the clinical outcomes achieved.

Data collection from patients who underwent Transsphenoidal Surgery at Murni Teguh Memorial Hospital between June 2022 and September 2025. Literature sources were obtained from peer-reviewed journals published within the last ten years. Data collected included tumor subtype, hormonal profile, surgical outcomes, hospitalization duration, and postoperative visual improvement.

4. Results and Discussion

Large population-based studies report increasing incidence trends, likely due to improved imaging modalities.[14] Prolactinomas represent the most common subtype, followed by non-functioning adenomas.[15] Pituitary adenomas or pituitary tumors are estimated to account for 15% of all intracranial tumors.[7]

Although most are benign, these growths can cause significant clinical impact due to their location at the base of the skull and their role as key regulators of various body hormones.[8]. Tumor growth that presses on the optic nerve or surrounding tissue can cause visual impairment, headaches, and even neurological dysfunction.[9]

Epidemiologically, although data in Indonesia indicates an incidence of around 1-2 cases per 100,000 people, the actual prevalence is estimated to be higher because some tumors are asymptomatic and therefore go undiagnosed. The high rate of incidental findings in autopsies and MRIs also confirms that pituitary tumors can develop symptoms for years before eventually causing serious symptoms.[10]

Clinical symptoms depend on tumor size and hormonal activity. Mass Effect: Bitemporal hemianopsia, Headache, Diplopia, and Hypopituitarism. Macroadenomas frequently compress the optic chiasm, resulting in visual field defects.[16] Hormonal Hypersecretion: Prolactinoma, Amenorrhea, Galactorrhea, Infertility. GH-Secreting Adenoma (Acromegaly): Enlarged hands and feet, Cardiomyopathy, and Diabetes mellitus. Mortality risk increases 2-3 times if IGF-1 remains uncontrolled.[17] ACTH-Secreting Adenoma (Cushing's Disease): Central obesity, Hypertension and Hyperglycemia. Untreated Cushing's disease increases mortality up to fourfold.[18]. Diagnostic Evaluation with hormonal assessment: Serum prolactin, IGF-1, ACTH and cortisol, TSH and Free T4. Imaging: MRI with gadolinium contrast is the gold standard imaging modality.[16]

Table 1. Summary of Key Results and Discussion Aspects

Aspect	Description
Key Findings	Visualization of results (graphs/tables) shows key patterns such as increases, decreases, differences between groups, or relationships between variables.
Comparison with Previous Research	The results show consistency/inconsistency with studies A, B, or other relevant literature, accompanied by methodological reasons or data characteristics.
Phenomena and Explanations	The phenomenon found is consistent/inconsistent with expectations. The contributing factors are explained, such as data assumptions, sample characteristics, or the influence of certain variables.
Preliminary Conclusions	Preliminary conclusions regarding the direction of findings, implications, and potential for further analysis.

Treatment for pituitary tumors includes surgery, radiotherapy, medication, or a combination of the three. The primary goals of therapy are to improve neurological function, reduce tumor pressure, and normalize

hormone levels.[11] Surgery is the primary treatment for pituitary tumors. Two surgical approaches are available: craniotomy and transsphenoidal, both of which aim to remove the tumor. Craniotomy is performed for very large tumors that cause damage to surrounding tissue. Transsphenoidal surgery is used for smaller tumors. Transsphenoidal surgery is the first-line treatment for GH-secreting tumors. In the hands of experienced surgeons, IGF-1 normalization is achieved in 80% to 90% of patients with microadenomas and 40% to 60% of patients with macroadenomas.[11],[12] Compared to craniotomy, the TSA technique has been proven to provide more optimal results in terms of shorter hospital stay, minimal risk of bleeding, rapid recovery, and better cosmetic results because it does not involve external incisions.[13]

Medical Therapy: Dopamine agonists (cabergoline, bromocriptine) are first-line therapy for prolactinomas.[15] Somatostatin analogues and GH receptor antagonists are used in acromegaly. Endoscopic Skull Base Surgery (ESBS) & Transsphenoid Approach (TSA) are the latest surgical techniques. The TSA technique is performed by a team involving ENT and Neurosurgery specialists. Murni Teguh Hospital, Medan, North Sumatra, has performed TSA surgery on 34 patients between June 2022 and September 2025. Under endoscope (video camera) guidance, a 0-degree telescope is inserted through the nostrils. Then, the posterior nasal septal mucosa is separated from the posterior nasal septal bone for preparation (Nasoseptal flap - Step 1). Next, the posterior nasal septal bone is removed or cut (Posterior septectomy - Step 2). Then, drilling is performed in the sphenoid rostrum in a clockwise circular motion (Sphenoidotomy - Step 3). The skull base and the shadow of the pituitary tumor are visible. Then, the pituitary tumor is removed piecemeal, bit by bit (Tumor removal - Step 4). The defect after tumor removal is closed with a layer of abdominal fat, nasal septal cartilage and a previously prepared nasoseptal flap (Closure - Step 5).[15]

The surgery is performed using a minimally invasive endoscopic transsphenoidal approach, which usually allows for a quicker recovery compared to an open craniotomy.[15]. Patients are usually hospitalized for 1 to 3 days after surgery for close monitoring of hormone levels, vision, and overall stability. At Murni Teguh Hospital in Medan, after surgery, patients are treated in the ICU for 1-2 days, then treated in the inpatient room for 4-5 days. The total treatment period is 5-7 days, with 80-90% of patients experiencing improvement in visual acuity.[15]

Radiotherapy is indicated for residual, recurrent, or aggressive tumors.[19] Stereotactic radiosurgery offers precise targeting with reduced complication rates. Recurrence rates vary: Non-functioning adenomas: 10-20%, GH adenomas: 10-30% and ACTH adenomas: 15-25%. Long-term hormonal and MRI follow-up is essential.[17]. Quality of Life: Postoperative studies demonstrate significant improvement in quality of life within 12 months after surgery.[17] However, some patients may experience persistent fatigue or mild cognitive impairment.

5. Conclusion

Pituitary tumors are slow-growing, benign tumors that originate from the cells of the pituitary gland. These tumors represent approximately 15% of all central nervous system tumors. The treatment of pituitary tumors has evolved significantly. Surgery is the primary treatment for pituitary tumors. Currently, Endoscopic Skull Base Surgery (ESBS) and Transsphenoid Approach (TSA) are among the techniques that offer advantages such as shorter ICU and inpatient stays, reduced risk and minimal bleeding during surgery, rapid recovery, and no facial scars (better cosmetically).

Pituitary tumors are predominantly benign but clinically significant due to hormonal and compressive effects. Advances in molecular classification and imaging enhance diagnostic precision. Endoscopic Skull Base Surgery with Transsphenoidal Approach provides high remission rates, reduced complications, and

improved recovery time. Early diagnosis and multidisciplinary management are crucial to improving prognosis and long-term outcomes.

6. References

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