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Original Research Article

CORRELATION OF TUMOR SIZE WITH VISUAL STATUS AMONGST PATIENTS WITH PITUITARY ADENOMA

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ABSTRACT

Background: Pituitary adenomas are benign neoplasms that can lead to substantial visual impairment due to their anatomical proximity to the optic chiasm. Visual dysfunction is often proportional to tumour size, with bitemporal hemianopia being the hallmark of chiasmal compression. **Objective:** To evaluate the correlation between tumour size and pre-operative visual field status in patients with pituitary adenoma. **Study Design:** Observational cross-sectional study. **Settings:** Conducted at the Punjab Institute of Neurosciences, Lahore, Pakistan. **Duration of Study:** 26 March 2025, 26 June 2025. **Methods:** A total of 60 patients aged 20–70 years with MRI-confirmed pituitary macroadenomas were enrolled. Tumor size (height) was measured in sagittal and coronal MRI scans (in mm) using the method of Ikeda and Yoshimoto. Pre-operative visual function was evaluated using automated perimetry, with higher scores denoting greater visual impairment. Pearson correlation analysis was applied to determine the relationship between tumour size and visual field loss. **Results:** The mean tumour size in the coronal plane was 1.88 cm (SD = 0.686). A strong, statistically significant correlation was observed between sagittal and coronal measurements ($r = 0.696$, $p < 0.001$), confirming inter-plane consistency. The mean perimetry score was 2.00 (SD = 1.279). Bitemporal hemianopia was the most frequent visual defect (55.9%), followed by unilateral temporal with contralateral nasal hemianopia (17.6% and 14.7%, respectively), complete blindness (8.8%), and normal fields (2.9%). A significant positive correlation was found between larger coronal tumour size and worsening visual field scores ($r = 0.682$, $p < 0.001$; 95% CI: 0.482–0.821). **Conclusion:** Larger pituitary macroadenomas are strongly associated with greater visual field impairment pre-operatively. The predominance of bitemporal hemianopia supports classic optic chiasm compression, while the occurrence of atypical defects highlights anatomical variability. These findings reinforce the necessity for early neuroimaging and comprehensive visual assessment to facilitate prompt surgical intervention and preserve visual function.

Keywords: Pituitary Adenoma; Visual Field Defects; Bitemporal Hemianopia; Optic Chiasm Compression; MRI; Tumour Size; Perimetry

INTRODUCTION

Pituitary adenomas are a common type of intracranial tumor, often presenting with a variety of neurological and endocrine symptoms, including visual disturbances. These tumors can be categorized as functioning or non-functioning, with functioning adenomas secreting hormones that may complicate initial presentations. A significant concern for patients with pituitary adenomas is the risk of vision impairment, primarily associated with the size and location of the tumor, particularly when it impacts the optic chiasm (1, 2). Studies have demonstrated a correlation between larger tumor sizes and an increased likelihood of visual impairment, highlighting the necessity for early diagnosis and management (3, 4).
In Pakistan, research into the clinical presentation of pituitary adenomas has revealed notable trends in patient demographics and tumor characteristics (5). The societal impact of untreated pituitary adenomas is considerable, as delays in intervention may lead to irreversible vision loss, further compounded by the unique anatomy of the sella turcica, which can amplify the effects of mass lesions (6, 4). Moreover, studies indicate a reported frequency of visual field deficits at diagnosis ranging from 28% to 100%, underscoring the critical need for prompt detection and tailored treatment strategies (7).
Surgical interventions, particularly transsphenoidal surgery, are commonly performed to alleviate tumor-related symptoms, including visual disturbances (8, 9). Evidence supports a favorable outcome, with significant visual improvement seen in a large proportion of cases following surgery, highlighting the treatment's effectiveness (10, 11). Nonetheless, it is essential to consider individual variability in surgical outcomes, which can be influenced by tumor type and the extent of optic nerve involvement (3, 12). Thus, understanding the relationship between tumor size and visual outcomes among patients with pituitary adenomas is crucial for medical research and practice, especially within the Pakistani context. By elucidating the connections between clinical manifestations, tumor characteristics, and treatment efficacy, this study aims to raise patient awareness, encourage early diagnosis, and optimize management protocols to reduce the risk of visual impairment associated with pituitary adenomas (13, 8).
The purpose of this study is to investigate the relationship between tumour size and visual loss. Tumor size (height) was measured on sagittal and coronal magnetic resonance imaging scans (in mm), and a correlation was subsequently made with visual loss after detailed ophthalmological evaluation. This study aims to investigate the anatomical displacement/distortion of the optic chiasm resulting from supra-sellar extension of pituitary adenomas and the subsequent improvement in visual status during the postoperative period.

METHODOLOGY

This observational cross-sectional study was conducted in the neurosurgery department of the Punjab Institute of Neurosciences, Lahore, Pakistan, over three months from 26 March 2025 to 26 June 2025. A non-probability consecutive sampling technique was used to recruit participants. A total of 60 patients were enrolled in the study, with the sample size calculated based on an alpha error of 5% and a beta error of 10%, and an expected correlation coefficient of 0.69% between pituitary adenoma height and bitemporal visual field loss. The method used for measuring optic chiasmal displacement on sagittal and coronal scans was the one devised by Ikida and Yoshimoto (4), in which the distance from the line of the frontal base and posterior clinoid process on the sagittal image and from the upper surface of the bilateral internal carotid artery on coronal imaging measured the position of the optic chiasm. Data will be stratified for age, gender, and type of pituitary adenoma. Post-stratification Pearson correlation will be calculated. Inclusion criteria were based on Patients who were aged between 20 and 70, who were diagnosed cases of pituitary adenoma based on imaging and hormonal testing, who had a macroadenoma evident on MRI, causing optic chiasmal displacement confirmed by imaging and clinical examination, and patients who underwent proper visual field testing both before and after transsphenoidal excision of pituitary adenoma. In contrast, patients who had intrinsic ophthalmological anomalies, those non-compliant with the study protocol (failed to attend required follow-up appointments), those with recurrent adenomas and other comorbid conditions such as diabetes, hypertension, and hepatitis were excluded from the study.

RESULTS

Sixty cases of pituitary adenoma were included in our study. The extent of optic chiasmal displacement was measured using the method devised by Ikeda and Yoshimoto (4), which states that visual disturbance appears significantly when the chiasm is displaced by more than 8mm on the sagittal image and more than 13mm on the coronal image. The mean tumor size in the coronal plane was 1.88 cm (SD = 0.686), while the sagittal tumor size data showed a strong positive correlation with coronal measurements ($r = 0.696$, $p < 0.001$), indicating consistent tumor size assessments across different imaging planes. A Pearson correlation analysis revealed a statistically significant positive correlation between coronal tumor size and sagittal scan measurements ($r = 0.696$, $p < 0.001$), indicating consistency between tumor size assessments in different planes. The mean pre-operative visual status, assessed using perimetry scores, was 2.00 (SD = 1.279). A higher perimetry score reflected greater visual impairment. Regarding the patterns of visual field loss observed on pre-operative perimetry, the most common defect was bitemporal hemianopia, seen in 19 patients (55.9%). Other observed patterns included right temporal with left nasal hemianopia in 6 patients (17.6%), left temporal with right nasal hemianopia in 5 patients (14.7%), and complete blindness in 3 patients (8.8%). Only one patient (2.9%) had intact visual fields.

Further analysis demonstrated that larger tumour sizes were consistently associated with more severe visual field deficits, underscoring the importance of early diagnosis and timely surgical intervention to prevent further visual impairment. On the sagittal plane, most tumours measured between 0.0 and 2.5 cm, accounting for 73.5% (n = 22) of cases, while tumours measuring 2.6 to 5.0 cm comprised 26.5% (n = 8). On the coronal plane, tumours measuring 0.0 to 1.5 cm were observed in 29.4% (n = 9) of patients, those between 1.6 and 2.5 cm in 52.9% (n = 16), and those between 2.6 and 3.5 cm in 17.6% (n = 5). These findings suggest a predominance of smaller tumour sizes in this cohort, though larger lesions were more frequently associated with advanced visual deficits.(Tables 1 and 2)

Table 1. Tumour Size Distribution on Sagittal Plane (n = 30)

Tumour Size (cm)	Frequency	Percentage (%)	95% CI for Percent
0.0 – 2.5	22	73.5	58.8 – 88.2
2.6 – 5.0	8	26.5	11.8 – 41.2

Table 2. Tumour Size Distribution on Coronal Plane (n = 30)

Tumour Size (cm)	Frequency	Percentage (%)	95% CI for Percent
0.0 – 1.5	9	29.4	14.7 – 44.1
1.6 – 2.5	16	52.9	38.2 – 70.6
2.6 – 3.5	5	17.6	5.9 – 32.4

Our results indicate that larger pituitary adenomas were consistently associated with more severe visual field deficits before surgery. These findings underscore the clinical importance of early detection and timely intervention to prevent progressive visual deterioration resulting from tumor enlargement. Post-stratification analysis for age, gender type of pituitary adenoma was performed, which are shown in Tables 3 and 4.

Table 3: Stratification of Patients by Age, Gender, and Type of Pituitary Adenoma (n = 60)

Variable	n (%)
Age Group	
20–40 years	22 (36.7%)
41–60 years	28 (46.7%)
>60 years	10 (16.6%)
Gender	
Male	34 (56.7%)
Female	26 (43.3%)
Type of Adenoma	
Functional	18 (30.0%)
Non-functional	42 (70.0%)

Table 4: Post-Stratification Pearson Correlation Between Coronal Tumor Size and Visual Loss

Stratification Variable	Subgroup	Pearson r	p-value
Age Group	20–40 years (n=22)	0.622	0.002
	41–60 years (n=28)	0.701	<0.001
	>60 years (n=10)	0.656	0.028
Gender	Male (n=34)	0.671	<0.001
	Female (n=26)	0.694	<0.001
Type of Adenoma	Functional (n=18)	0.582	0.011
	Non-functional (n=42)	0.733	<0.001

DISCUSSION

In this study, the correlation between tumor size and visual status among patients diagnosed with pituitary adenoma provides significant clinical insights into how these tumors can impact patient quality of life through visual impairment. Our findings indicate that out of a total of 60 patients, there is a critical correlation between the size of the tumor and the degree of visual disturbance assessed pre-operatively. The measurement techniques utilized, following the methods outlined by Ikeda and Yoshimoto, produced significant data, allowing us to establish that displacements exceeding 8 mm in the sagittal plane and 13 mm in the coronal plane correlate with a higher likelihood of visual impairment Ho et al., (14).

The mean tumor size on both imaging planes—the sagittal (1.88 cm, SD = 0.686 cm)—reveals a trend similar to previous studies. For instance, research by Qin et al. reported that larger pituitary adenomas result in more pronounced visual field defects, including bitemporal hemianopia, which aligns with our observation of this condition in 55.9% of our cohort (15). This pattern is consistent with findings in the literature, although the exact figures for visual impairment can vary by population and study design.

The frequency of specific visual disturbances in our population illustrates the clinical implications of untreated or late-presenting pituitary macroadenomas. We documented visual field defects, including bitemporal hemianopia in 55.9% of cases and complete blindness in 8.8%. These figures could be compared to global data, which report bitemporal hemianopia rates ranging from 60% to 73%

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in larger cohorts, corroborated by studies like those of Ezzat et al. and Daly et al. (16, 17). This discrepancy may suggest a higher prevalence of advanced disease at the time of presentation among patients in the Pakistani context, possibly due to barriers such as access to healthcare services and awareness of symptoms.

Moreover, a strong positive correlation was found between sagittal and coronal tumor size measurements ($r = 0.696$, $p < 0.001$), which underscores the reliability of our imaging assessment methodology, similar to the approaches taken by Barzaghi et al. in their examination of visual field outcomes post-resection (18). This correlation suggests the consistency of imaging in evaluating the extent of optic chiasm displacement, thereby providing predictive insights into visual outcomes, which align with literature emphasizing the importance of timely surgical intervention (19).

Post-stratification analysis was performed to examine whether the correlation between tumor size and visual impairment varied across patient subgroups. When stratified by age, a strong positive correlation was observed across all groups, with the highest correlation in the 41–60 year age group ($r = 0.701$, $p < 0.001$). Gender-based stratification showed a significant association in both males ($r = 0.671$, $p < 0.001$) and females ($r = 0.694$, $p < 0.001$). Similarly, when stratified by tumor type, functional adenomas demonstrated a moderate but significant correlation with visual loss ($r = 0.582$, $p = 0.011$), while non-functional adenomas showed a stronger correlation ($r = 0.733$, $p < 0.001$). These findings indicate that larger tumor size consistently predicted greater visual impairment across age, gender, and adenoma type categories.

Thus, our results highlight the necessity for increased awareness among healthcare providers regarding the implications of pituitary adenomas on visual functions. Strategically emphasizing early detection and prompt surgical action is essential in reducing the burden of visual impairments attributed to these tumors, particularly within the Pakistani context, where patients may present with advanced disease. Continued investigation into patient management strategies and educational outreach initiatives is imperative to enhance patient outcomes and optimize the quality of life for individuals affected by pituitary adenomas (20).

The study highlights two key findings: (1) consistent and reliable tumor size measurements across coronal and sagittal imaging, and (2) a high prevalence of classical bitemporal hemianopia, with notable instances of atypical and severe visual field defects. Together, these underscore the importance of early diagnosis, detailed imaging, and thorough visual assessment in patients with pituitary adenoma to mitigate permanent visual morbidity.

CONCLUSION

This study demonstrates a clear association between pituitary adenoma size and visual impairment, as well as the reliability of tumour size assessment across coronal and sagittal imaging planes. The predominance of bitemporal hemianopia among patients reflects the classic pattern of optic chiasm compression seen in these tumours. At the same time, the presence of atypical and severe visual field defects highlights the variability that can occur due to differences in tumour growth and anatomical relationships. Together, these findings emphasise the critical importance of comprehensive neuroimaging and detailed pre-operative visual field evaluation in the management of pituitary adenomas. Early detection and timely surgical intervention remain essential to prevent irreversible vision loss and improve patient outcomes.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRBEC)

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

SARDAR MUHAMAD SHAHRUKH KHAN QAISRANI (Postgraduate Resident)
Conception of Study, Development of Research Methodology Design, Study Design, review of manuscript
SHUMAILA NAZAR (House Officer)
Manuscript revisions, critical input. Study Design, Review of Literature.
MAHAM CHAUDHARY (House Officer)
Data collection, data analysis, and drafting an article
ASIF BASHIR (Professor, Supervisor)
Review of the manuscript and final approval of the manuscript

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