THE PLANET

Original Article

Association Between Pituitary MRI Characteristics and Serum Prolactin Levels in Adult Female Patients with Hyperprolactinemia

Sumi Datta[1*], Subrata Shakhar Kar[2]

ARTICLE INFO

Received: 9 June 2026
Accepted: 15 June 2026
Published Online: 19 June 2026

DOI: 10.5281/zenodo.20760766

Volume: 9, Number: 4, Page: 148-151

e-ISSN: 2789-5912
ISSN: 2617-0817

*Corresponding author

ABSTRACT

Background: Hyperprolactinemia is marked by increased serum prolactin levels, primarily caused by prolactinomas, resulting in reproductive issues in women. Pituitary adenomas differ in size, with larger tumors usually exhibiting elevated prolactin levels. MRI is crucial for identifying pituitary lesions, although the link with prolactin levels is unreliable. This research assesses the relationship between pituitary MRI results and serum prolactin concentrations in adult women. **Methods & Materials:** This cross-sectional research took place at BIRDEM General Hospital in Dhaka from July 2024 to June 2025 involving 130 adult female patients diagnosed with hyperprolactinemia. Serum prolactin concentrations and pituitary MRI results were assessed, and information was processed using SPSS version 26.0, with statistical significance defined at $p<0.05$. Ethical consent and informed approval were acquired. **Results:** Out of 130 female patients suffering from hyperprolactinemia, the most frequent MRI finding was microadenoma (47.7%). The average serum prolactin level was 86.5 ± 57.8 ng/mL, with the highest levels observed in macroadenoma cases (182.4 ± 58.7 ng/mL). A significant positive correlation was found between adenoma size and prolactin levels ($r = 0.721$, $p < 0.001$), with severe hyperprolactinemia (>100 ng/mL) being notably linked to macroadenomas, suggesting that larger pituitary tumors correlate with elevated prolactin levels. **Conclusion:** The size of pituitary adenomas is significantly positively linked to serum prolactin levels, with elevated levels observed in macroadenomas, underscoring the need for MRI along with biochemical evaluation in cases of hyperprolactinemia.

Keywords: *Serum Prolactin, Adult Female, Hyperprolactinemia, Pituitary MRI.*

1. *Assistant Professor, Department. of Radiology and Imaging, BIRDEM, Dhaka, Bangladesh (ORCID: 0009-0005-9919-3344)*
2. *Consultant, Department of Plastic and Reconstructive Surgery, KPJ specialized Hospital, Gazipur, Dhaka,Bangladesh (ORCID: 0009-0004-3959-5678)*

INTRODUCTION

Hyperprolactinemia refers to increased serum prolactin levels resulting from decreased dopaminergic inhibition or enhanced secretion from pituitary lactotrophs. It often results in reproductive issues and unsuitable milk production [1,2]. It can be physiological, pathological, or induced by medication. Pathological factors are primarily pituitary conditions, particularly prolactinomas, which are the most prevalent cause [3].

The symptoms of hyperprolactinemia differ based on the level of prolactin and the underlying cause. In women, it often manifests as menstrual irregularities, amenorrhea, galactorrhea, infertility, and reduced libido. Extended cases can result in hypogonadism and decreased bone density from a lack of estrogen. Timely detection and recognition of the root cause are crucial [4,5].

Pituitary adenomas are noncancerous tumors of adenohypophyseal cells, categorized as microadenomas (<10 mm) and macroadenomas (≥10 mm). Prolactinomas make up roughly 40% of pituitary adenomas and represent the most prevalent hormonally active tumors. Bigger tumors typically generate elevated prolactin levels [2]. Pituitary MRI is the definitive method for assessing structural reasons for hyperprolactinemia, facilitating thorough examination of the sella and identification of microadenomas, macroadenomas, and various other irregularities. Nonetheless, serum prolactin levels do not consistently align with MRI results, as there is considerable overlap even among patients with normal imaging [6]. The "hook effect" is a laboratory artifact in immunoassays that can inaccurately decrease prolactin levels in extremely large pituitary adenomas, possibly postponing diagnosis. Consequently, biochemical outcomes must always be analyzed in conjunction with imaging results [7].

Research indicates a positive relationship between serum prolactin levels and the size of pituitary adenomas, particularly in prolactinomas, where larger tumors exhibit increased secretory activity and diminished dopaminergic inhibition. Nonetheless, variability arises from differences in assays and the heterogeneity of tumors. A slight increase in prolactin might indicate stalk compression, whereas a significant rise leans towards prolactinoma, although the overlap restricts diagnostic precision [8,9].

A retrospective study from Bangladesh indicated that extremely elevated serum prolactin levels are frequently linked to pituitary macroadenomas, making MRI crucial for evaluating tumor size and spread. It highlighted the importance of performing serial dilution in prolactin tests to prevent the hook effect and to avoid misestimation of prolactin amounts [10].

In Bangladesh, there is scarce evidence regarding the specific relationship between pituitary MRI results and serum prolactin concentrations. This study intends to assess the relationship between MRI features and prolactin levels, including the correlation with adenoma size, in adult women experiencing hyperprolactinemia.

METHODS & MATERIALS

Study Design and Setting

This cross-sectional analytical study was conducted in the Department of Radiology and Imaging, BIRDEM General Hospital, Dhaka, Bangladesh, over a one-year period from July 2024 to June 2025. The study was designed to evaluate the association between magnetic resonance imaging (MRI) findings of the pituitary gland and serum prolactin levels among adult female patients presenting with hyperprolactinemia.

Study Population and Sampling

Adult female patients aged 18 years and above who were diagnosed with hyperprolactinemia and referred for pituitary MRI during the study period were considered eligible for inclusion. A total of 130 consecutive patients fulfilling the selection criteria were enrolled using a purposive sampling technique.

Inclusion Criteria

- Female patients aged ≥18 years.
- Biochemically confirmed hyperprolactinemia based on serum prolactin assay.
- Patients who underwent MRI examination of the pituitary gland during the study period.
- Patients who provided informed consent for participation.

Exclusion Criteria

- Previous pituitary surgery or radiotherapy.
- Known pituitary malignancy.
- Pregnancy or lactation.
- Patients receiving medications known to significantly alter serum prolactin levels (unless evaluation was specifically requested for suspected drug-induced hyperprolactinemia).
- Incomplete clinical, laboratory, or imaging data.

Data Collection Procedure

Relevant demographic and clinical information, including age and indication for MRI, were collected from patient records and structured data collection forms. Serum prolactin levels measured within two weeks before or after MRI examination were recorded from laboratory reports.

MRI examinations were performed using a dedicated pituitary protocol. Imaging sequences included sagittal and coronal T1-weighted images, T2-weighted images, and contrast-enhanced T1-weighted images following intravenous gadolinium administration. MRI findings were interpreted independently by experienced radiologists. Pituitary gland abnormalities were categorized as normal pituitary gland, microadenoma (<10 mm), macroadenoma (≥10 mm), empty sella syndrome, or pituitary hyperplasia. For patients with adenoma, the maximum lesion diameter was measured in millimeters.

Study Variables

The primary outcome variable was serum prolactin level (ng/mL). The principal explanatory variables included MRI findings of the pituitary gland and adenoma size. Additional variables included patient age and prolactin level categories, classified as mild elevation (20–50 ng/mL), moderate elevation (51–100 ng/mL), and severe elevation (>100 ng/mL).

Statistical Analysis

Data were entered, cleaned, and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Differences in serum prolactin levels among various MRI categories were evaluated descriptively. The association between MRI findings and prolactin level categories was assessed using the Chi-square test. Pearson's correlation coefficient was used to determine the relationship between pituitary adenoma size and serum prolactin concentration. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of BIRDEM General Hospital before commencement of the study. Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of participants were maintained throughout the study, and all procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

RESULTS

The present study evaluated the relationship between pituitary MRI findings and serum prolactin levels among 130 adult female patients with hyperprolactinemia. Demographic characteristics, radiological findings, prolactin level distributions, and the association between pituitary lesion size and serum prolactin concentration are summarized in *Tables I-VI*.

Table I shows total of 130 adult female patients with hyperprolactinemia were included in the study. The mean age of the participants was 32.8 ± 8.6 years, with ages ranging from 18 to 52 years. The majority of the patients belonged to the 26–35 years age group (43.1%), followed by the 18–25 years age group (24.6%).

Table I

Distribution of Participants by Age Group (*n*=130).

Age Group (Years)	Frequency	Percentage (%)
18–25	32	24.6
26–35	56	43.1
36–45	30	23.1
>45	12	9.2
Total	130	100.0

Table II presents the mean serum prolactin level among the study participants was 86.5 ± 57.8 ng/mL, with values ranging from 28.4 to 320.7 ng/mL. MRI evaluation of the pituitary gland revealed that microadenoma was the most common finding, detected in 62 patients (47.7%), followed by normal pituitary appearance in 38 patients (29.2%) and macroadenoma in 22 patients (16.9%). Empty sella syndrome and pituitary hyperplasia were less frequently observed.

Table II

MRI Findings of the Pituitary Gland (*n*=130).

MRI Finding	Frequency	Percentage (%)
Normal Pituitary Gland	38	29.2
Microadenoma (<10 mm)	62	47.7
Macroadenoma (≥10 mm)	22	16.9
Empty Sella Syndrome	5	3.8
Pituitary Hyperplasia	3	2.4
Total	130	100.0

Table III shows analysis of serum prolactin levels according to MRI findings demonstrated marked variation among the different diagnostic categories. Patients with macroadenoma exhibited the highest mean prolactin level (182.4 ± 58.7 ng/mL), followed by those with pituitary hyperplasia (95.6 ± 22.1 ng/mL) and microadenoma (76.5 ± 28.4 ng/mL). Participants with normal MRI findings had comparatively lower prolactin concentrations (42.8 ± 12.6 ng/mL).

Table III
Serum Prolactin Levels According to MRI Findings.

MRI Finding	Mean Prolactin Level (ng/mL)	SD
Normal Pituitary Gland	42.8	12.6
Microadenoma	76.5	28.4
Macroadenoma	182.4	58.7
Empty Sella Syndrome	51.3	14.8
Pituitary Hyperplasia	95.6	22.1

Table IV shows among the 84 patients diagnosed with pituitary adenoma, lesions measuring 5–9.9 mm were the most prevalent (45.2%), followed by adenomas smaller than 5 mm (28.6%). Larger adenomas measuring 10–19.9 mm and ≥20 mm accounted for 17.9% and 8.3% of cases, respectively.

Table IV
Distribution of Pituitary Adenoma Size Among Patients with Adenoma (*n*=84).

Adenoma Size	Frequency	Percentage (%)
<5 mm	24	28.6
5–9.9 mm	38	45.2
10–19.9 mm	15	17.9
≥20 mm	7	8.3
Total	84	100.0

Table V presents correlation analysis demonstrated a strong positive relationship between pituitary adenoma size and serum prolactin level ($r = 0.721$, $p < 0.001$), indicating that increasing adenoma size was associated with progressively higher prolactin concentrations.

Table V
Correlation Between Adenoma Size and Serum Prolactin Level (*n*=84).

Variable	Correlation Coefficient (r)	p-value
Adenoma Size (mm) vs Serum Prolactin Level	0.721	<0.001

Table VI shows when serum prolactin levels were categorized according to severity, severe hyperprolactinemia (>100 ng/mL) was predominantly observed among patients with macroadenoma, whereas mild elevations were more common in patients with normal MRI findings. A statistically significant association was found between MRI findings and prolactin level categories ($\chi^2 = 48.6$, $p < 0.001$).

Table VI
Association Between MRI Findings and Serum Prolactin Categories (*n*=130).

MRI Finding	Mild Elevation (20–50 ng/mL)	Moderate Elevation (51–100 ng/mL)	Severe Elevation (>100 ng/mL)	Total
Normal	24	14	0	38
Microadenoma	10	36	16	62
Macroadenoma	0	4	18	22
Empty Sella	4	1	0	5
Hyperplasia	0	2	1	3
Total	38	57	35	130

Overall, the study findings indicate that pituitary adenomas, particularly macroadenomas, are associated with significantly elevated serum prolactin levels. Furthermore, MRI-determined adenoma size showed a strong positive correlation with prolactin concentration, highlighting the value of pituitary MRI in the diagnostic assessment of hyperprolactinemic female patients.

DISCUSSION

In our study, the age group of 26–35 years had the highest prevalence of hyperprolactinemia. Serum prolactin levels by themselves were not dependable for predicting pituitary lesions because of the overlap between cases with and without MRI abnormalities, though elevated levels were more frequently associated with adenomas. Comparable results in the literature indicate that prolactin offers restricted predictive capabilities, while MRI continues to be crucial for precise diagnosis [7].

In this study, the average serum prolactin concentration was 86.5 ± 57.8 ng/mL, with microadenoma being the predominant MRI observation, followed by normal pituitary and macroadenoma. Comparable evidence indicates that microadenomas are the leading lesion in hyperprolactinemia, although a considerable number of patients may present normal MRI results even with high prolactin levels [12].

In our research, prolactin concentrations were greatest in macroadenomas and least in normal MRI findings, indicating a rise with lesion dimensions. Comparable results in the literature suggest a positive correlation between increased prolactin levels and larger pituitary adenomas, though there is significant overlap among groups. Consequently, serum prolactin by itself is inadequate for precise lesion differentiation, and MRI is crucial [13].

In our research, the majority of pituitary adenomas measured 5–9.9 mm (45.2%),

followed by those <5 mm (28.6%), and there were fewer instances of adenomas ≥10 mm. Comparable evidence indicates that smaller adenomas are more frequently identified, whereas larger tumors are less common but hold greater clinical importance. In general, the size of adenomas plays a crucial role in evaluating and managing the disease [14].

In our study, adenoma size displayed a significant positive correlation with serum prolactin levels, suggesting that larger tumors were linked to increased prolactin levels. Comparable results have shown a strong relationship between prolactinoma size and serum prolactin levels, reinforcing the role of prolactin concentration as a measure of tumor load. This implies that a rise in adenoma size is associated with enhanced hormonal secretion [15].

In our research, pronounced hyperprolactinemia was predominantly linked to macroadenomas, whereas minor increases were more frequent in individuals with normal MRI results, indicating a significant correlation between prolactin levels and MRI diagnosis. Comparable results indicate that elevated prolactin levels are typically associated with larger adenomas and increased tumor load, although MRI is still crucial for a conclusive diagnosis [10].

Overall, Increased serum prolactin levels correlated with larger pituitary adenomas, yet MRI is vital for the precise diagnosis of hyperprolactinemia.

CONCLUSION

The size of pituitary adenomas exhibits a strong positive correlation with serum prolactin levels, where macroadenomas reveal notably elevated prolactin levels. These results indicate that bigger lesions correlate with greater hormonal increases and underscore the significance of MRI combined with biochemical evaluation for precise diagnosis and assessment of hyperprolactinemia.

REFERENCES

1. Majumdar A, Mangal NS. Hyperprolactinemia. Journal of human reproductive sciences. 2013 Jul 1;6(3):168-75.
2. Melmed S, Casanueva FF, Hoffman AR, Kleinberg DL, Montori VM, Schlechte JA, Wass JA. Diagnosis and treatment of hyperprolactinemia: an Endocrine Society clinical practice guideline. The Journal of Clinical Endocrinology & Metabolism. 2011 Feb 1;96(2):273-88.
3. Casanueva FF, Molitch ME, Schlechte JA, Abs R, Bonert V, Bronstein MD, Brue T, Cappabianca P, Colao A, Fahlbusch R, Fideleff H. Guidelines of the Pituitary Society for the diagnosis and management of prolactinomas. Clinical endocrinology. 2006 Aug;65(2):265-73.
4. Capozzi A, Scambia G, Pontecorvi A, Lello S. Hyperprolactinemia: pathophysiology and therapeutic approach. Gynecological Endocrinology. 2015 Jul 3;31(7):506-10.
5. Ajmal A, Joffe H, Nachtigall LB. Psychotropic-induced hyperprolactinemia: a clinical review. Psychosomatics. 2014 Jan 1;55(1):29-36.
6. Bonneville JF. Magnetic resonance imaging of pituitary tumors. Front Horm Res. 2016 Mar 15;45:97-120.
7. Varaldo E, Cuboni D, Prencipe N, Aversa LS, Sibilla M, Bioletto F, Berton AM, Gasco V, Ghigo E, Grottoli S. Are prolactin levels efficient in predicting a pituitary lesion in patients with hyperprolactinemia?. Endocrine. 2024 May;84(2):670-6.
8. Vilar L, Fleseriu M, Bronstein MD. Challenges and pitfalls in the diagnosis of hyperprolactinemia. Arquivos Brasileiros de Endocrinologia & Metabologia. 2014;58:9-22.
9. Osorio RC, Pereira MP, Oh T, Joshi RS, Haddad AF, Pereira KM, Donohue KC, Peeran Z, Carson W, Badani A, Wang EJ. Correlation between tumor volume and serum prolactin and its effect on surgical outcomes in a cohort of 219 prolactinoma patients. Journal of Neurosurgery. 2022 Oct 14;138(6):1669-79.
10. Petersenn S, Fleseriu M, Casanueva FF, Giustina A, Biermasz N, Biller BM, Bronstein M, Chanson P, Fukuoka H, Gadelha M, Greenman Y. Diagnosis and management of prolactin-secreting pituitary adenomas: a Pituitary Society international Consensus Statement. Nature Reviews Endocrinology. 2023 Dec;19(12):722-40.
11. Rahman MA, Hasan M, Islam KA, Ahmed MF, Ratul RH, Chowdhury S, Islam MJ. Underestimation of prolactin in pituitary macroadenoma: Serial dilution may provide diagnostic insights. Journal of Association of Clinical Endocrinologist and Diabetologist of Bangladesh. 2025 Aug 24;4(2):66-71.
12. Alyami N, Alhenaki G, Al Atwah S, Alhenaki N, Smaisem F, Alotaibi A, Risheh JA, Smaisem M, Alhenaki A, Alanazi S, Alshammeri M. Correlation between MRI findings of pituitary gland and prolactin level among hyperprolactinemia adult female Saudi patients in rural areas: A retrospective multicentric study. Medicine. 2025 Jan 10;104(2):e40686.
13. Azeemuddin M, Naqi R, Wasay M. A descriptive study to find possible correlation between MRI findings of pituitary gland and serum prolactin level. Journal of Pakistan Medical Association. 2013;63(6):739.
14. Bhimani AD, Schupper AJ, Arnone GD, Chada D, Chaker AN, Mohammadi N, Hadjipanayis CG, Mehta AI. Size matters: rethinking of the sizing classification of pituitary adenomas based on the rates of surgery: a multi-institutional retrospective study of 29,651 patients. Journal of Neurological Surgery Part B: Skull Base. 2022 Feb;83(01):066-75.
15. Osorio RC, Pereira MP, Oh T, Joshi RS, Haddad AF, Pereira KM, Donohue KC, Peeran Z, Carson W, Badani A, Wang EJ. Correlation between tumor volume and serum prolactin and its effect on surgical outcomes in a cohort of 219 prolactinoma patients. Journal of Neurosurgery. 2022 Oct 14;138(6):1669-79.