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ORIGINAL ARTICLE

T1W HYPERINTENSE SIGNAL ON MRI OF POSTERIOR PITUITARY GLAND – NORMAL DIMENSIONS IN OUR POPULATION

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ABSTRACT

Background: Pituitary gland is one of the most important gland of the body. The posterior part of pituitary gland depicts a bright spot, seen on T1W sequence. Studies show that the presence of vasopressin and T1 shortening effect, bright spot is depicted in posterior pituitary. Less commonly but absent or ectopic pituitary can also be observed. The aim of this study was to assess normal craniocaudal and anteroposterior dimensions of the posterior pituitary bright spot on magnetic resonance imaging (MRI).

Materials & Methods: It was retrospective study conducted in Radiology Department of Fauji Foundation Hospital, Rawalpindi. Duration is from January, 2022 to September, 2022. Total 499 patients with normal pituitary MRI studies were selected for the study. The dimensions of posterior pituitary bright spot were assessed on non-contrast sagittal T1WI. Anteroposterior and craniocaudal dimensions were noted.

Results: Posterior pituitary bright spot (PBBS) was identified in 98.4 % of the patients with normal pituitary glands. In 1.6 % of patients (n=8) there was absence of posterior pituitary bright spot. Mean (±SD) dimensions of PBS size in craniocaudal dimension were 5.17 ±1.20 mm (range 1.7 – 8.4 mm). Mean (±SD) dimensions in anteroposterior dimension were 2.21±0.59 mm (range 0.5 – 4.4 mm). There is a direct relation in craniocaudal dimension and anterior posterior dimension of posterior pituitary bright spot.

Concluson: Pituitary bright spot is a normal finding in brain MRI. By identifying the normal range, it is hoped that pathology of the pituitary gland can be more easily recognized. In case of its absence, ectopic or pathological pituitary gland must be identified.

KEYWORDS: Bright spot; Dimensions; Magnetic resonance imaging; Pituitary gland; Vasopressin.

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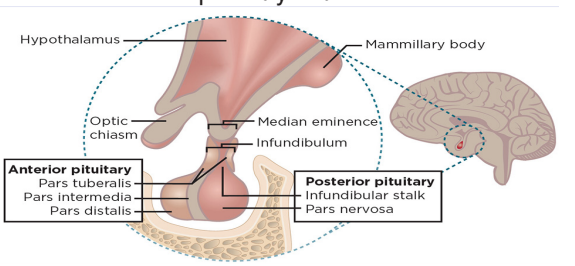
INTRODUCTION

Among the different glands of the body, hypophysis or the pituitary gland is one of the most important one. This gland performs essential functions for the sustenance of life. Hence, due to its such importance it is also termed as the "master gland".[1] It has two major parts i.e. the anterior lobe and posterior lobe. In between the anterior and posterior pituitary portions lies the intermediate lobe. The gland is seated within the pituitary hypophyseal fossa at the base of brain.[2] The hypophyseal fossa is an indentation in the roof of the body of the sphenoid bone within the middle cranial fossa. Pituitary gland it is bounded anteriorly, posteriorly and inferiorly by the sella turcica of the sphenoid bone. Laterally and superiorly the fossa is limited by reflections of the dura matter.[3] The gland is connected to the brain by a thin stalk called the tuber cinereum or pituitary stalk.



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Both lobes secrete various types of hormones. However, the anterior lobe secretes the majority of hormones.[4] Six important peptide hormones plus several hormones of less importance are secreted by the anterior pituitary. The hormones of anterior pituitary play crucial role in control of various metabolic functions throughout the body.[5] Hypothalamic hormones regulates the release of anterior pituitary hormones. These can be either of releasing type or inhibitory type. Anterior pituitary gland contains several different cell types that synthesize and secrete hormones. Usually there is one cell type for each major hormone formed in the anterior pituitary gland. These five cell types are somatotropes, corticotropes, thyrotopes, gonadotropes, lactotropes. In response to neural activity, the hypothalamic hormones are released from the nerve endings into the hypophyseal portal blood which are then taken down to the anterior pituitary. The posterior pituitary is neural in origin and is also called neurohypophysis. It is a combination of pars nervosa and the infundibular stalk. The posterior pituitary is a direct extension from the hypothalamus, connected to it through the infundibular stalk. It produces two hormones i.e. the anti-diuretic (ADH) and oxytocin.[6] The bodies of the cells that secrete the posterior pituitary hormones are not located in the pituitary gland itself but are large neurons, called magnocellular neurons which are located in the supra-optic and periventricular nuclei of the hypothalamus. The hormones are then transported in the axoplasm of the neurons nerve fiber passing from the hypothalamus to the posterior pituitary gland.

A common finding in MRI scan of the sellar region is the presence of a bright or hyperintense T1 signal intensity.[7] Normal T1 hyperintensity observed at the posterior aspect of sella turcica (neurohypophysis) is due to vasopressin storage. Hence it's a normal physiological signal. It is also known as the posterior pituitary bright spot (PPBS). It occurs due to the effect of T1-shortening because of stored vasopressin in the posterior lobe of pituitary gland.[8,9] This normal signal intensity is observed in 95.9 – 99.7 % of the population.[10,15,16] Other normal and variant causes of hyperintense signal can also be related to the presence of bone marrow in normal anatomic structures, lactating women, neonates, magnetic susceptibility effects and flow artifacts. [8,12]

An abnormal pituitary can be seen in various disease processes. When a T1 hyperintense signal in the sellar region is seen without the typical location, features, dimensions and morphology of the posterior pituitary bright spot, other pathological causes should be considered. A large area of T1 hyperintensity is seen in a number of pathologies. Pathologic variations in T1 signal hyperintensity can occur due to pituitary apoplexy, craniopharyngioma, Rathke cleft cyst, mucocele, fat containing lesions, chordoma or paramagnetic substance (such as melanin).[11,12] An absence of posterior pituitary bright spot can be observed in few of the patients. In case of absence there is often presence of an ectopic bright spot due to storage of vasopressin granules in another anatomical location.[17]

Plain radiography has limited role in assessment of pituitary based pathologies. Its role is limited only to observe the osseous integrity of the sella turcica and to assess bone widening. Pituitary related abnormalities are often discovered incidentally on CT scan. CT imaging can be useful for assessment of osseous structure and degree of calcification. It complements MRI and is helpful in preoperative planning for surgical resection of masses. For assessment of pituitary lesions, the diagnostic imaging and gold standard modality is pituitary protocol MRI pre- and post-intravenous contrast. Multi-planar and multi-sequential images are obtained on MRI.[13] Pituitary bright spot is a normal finding in brain MRI. In our study we will assess the normal dimension of the posterior pituitary bright spot in healthy subjects presenting to our hospital. By identifying the normal range, it is hoped that pathology of the pituitary gland can be more easily recognized. In case of its absence, ectopic or pathological pituitary gland must be identified

MATERIAL AND METHODS:

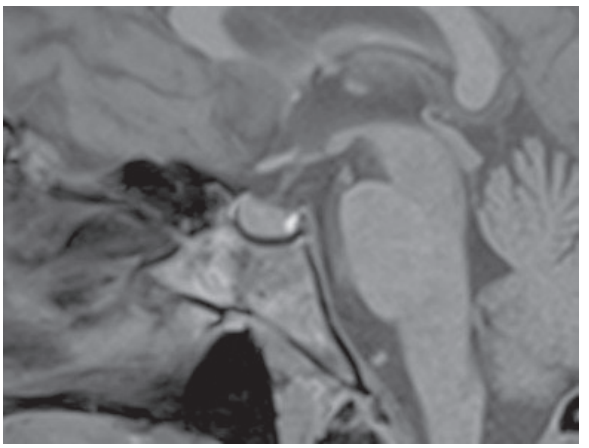
After receiving institutional review board and ethical committee approval, we reviewed all the MRI brain scans done from Jan, 2022 to Sept, 2022. It was retrospective study conducted in Radiology Department of Fauji Foundation Hospital, Rawalpindi. MRI was done on 1.5 Tesla Toshiba Vintage Titan machine. In imaging protocol high resolution Axial T1, T2, FLAIR, Coronal and saggital T1, T2 weighted sequences of the brain & pituitary were done. In case of contrast studies, post-contrast enhanced images were obtained as well. All these studies were reported by consultant radiologist. In all these patients, the pituitary gland had no abnormality. In our study, we excluded pregnant women as well as patients who had previous sellar or anterior skull base surgery. Patient having malignancy of pituitary were also excluded. Those scans which had motion related artifacts were not included in the study.

Total 499 patients with normal pituitary MRI studies were selected for the study within the specified time period. Most of our patients were female as our hospital caters the families of soldiers and officers who are entitled in our hospital. The dimensions of posterior pituitary bright spot were assessed on non-contrast saggital T1 weighted images. Dimensions were obtained in two planes, i.e. anteroposterior (AP) and craniocaudal (CC) axis.

RESULTS

A total of 499 patients who had MRI brain done were selected for the study. These patients had no

abnormality related to the pituitary gland. There were 311 females (62.3 %) and 188 males (37.7%) and their mean age±SD was 32.4 ±23.4. Out of 499 patients, 8 patients had absence of posterior pituitary bright spot. Hence, the posterior pituitary bright spot was identified in 98.4 % and there was absence of posterior pituitary bright spot in 1.6 % of the sample. No ectopic pituitary bright spot was identified in our study. Mean (±SD) dimensions of PBS size in craniocaudal dimension were 5.17 ±1.20 mm (range 1.7 – 8.4 mm). Mean (±SD) dimensions in anteroposterior dimension were 2.21±0.59 mm (range 0.5 – 4.4 mm). There was a direct relation between the sizes of posterior pituitary bright spot and patient's age.



	CC (mm)	AP (mm)
Mean	5.17	2.21
SD	1.20	0.59
Minimum	1.7	0.5
Maximum	8.4	4.4

DISCUSSION

Posterior pituitary bright spot is a normal and physiological radiological finding. It occurs due to the T1 shortening effect of vasopressin stored in the neurohypophysis. The pituitary bright spot should be measured in its maximum anteroposterior and craniocaudal dimension. In our study, we found that it is present in 98.4 % of population. Study done by Krishna Kiran S, Anston Vernon Braggs showed the presence of PBS in 99.6 % of the population.[14]Similarly, study conducted by Martin Cote et.al. showed the presence of PBC in 99.7% of the patients.[15]

In our study, the range of PBS size in craniocaudal dimension were 1.7 – 8.4 mm and 0.5 – 4.4 mm in anteroposterior dimension. Our study results are consistent with the study done by Martine Cote et.al which showed the dimension of 1.2 and 8.5 mm in its craniocaudal axis and 0.4 and 4.4 mm in its anteroposterior axis.[15]Similar another national study conducted had similar results in which the craniocaudal and anteroposterior dimensions ranged between 1.8-8.6 and 0.8-6.0 mm respectively.[16]

Similarly, we observed that in 1.60% of patients (n=8) there was absence of bright signal. However, in our study we did not found presence of ectopic bright signal. But in case of its absence, ectopic pituitary bright spot should be thoroughly looked for.[17]

CONCLUSION

Posterior pituitary bright spot can be identified in majority of the patients. The age of patient and size of posterior pituitary right spot have direct proportional relation. In case if it is not identified, ectopic pituitary bright should be looked for. Considering the results of our study as reference range the posterior pituitary bright sport measurements in other patients can be correlated and sizes should be within the reference range. When the pituitary bright spot exceeds these dimensions in one or both axes, the radiolo-

		Craniocaudal dimension	Anteroposterior dimension	Age
Craniocaudal dimension	Pearson correlation	1	.461	.251
	Sig. (2-tailed)		.000	.000
	N	491	491	491
Anteroposterior dimension	Pearson correlation	.461	1	.245
	Sig. (2-tailed)	.000		.000
	N	491	491	491
Age	Pearson correlation	.251	.245	1
	Sig. (2-tailed)	.000	.000	
	N	491	491	499

Correlation is significant at the 0.01 level (2-tailed).

gist should consider that the hyperintense signal observed might represent a pathological process. Also when a T1 hyperintensity is seen in the sella without the typical morphology and location of the posterior pituitary bright spot, other causes should be considered.

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CONFLICT OF INTEREST
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	KB, KH
Acquisition, Analysis or Interpretation of Data:	KB, KH, ANZ, FA, KFF
Manuscript Writing & Approval:	KB, KH, ANZ, FA, NHR

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.