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Research Article

A Descriptive Study to Find Possible Correlation Between Pituitary Magnetic Resonance Image Findings and Abnormal Pituitary Hormones: A Retrospective Single Centre Study in Saudi Community Based Hospital

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Abstract

Background: Data on pituitary Magnetic Resonance Imaging (MRI) in patients with abnormal pituitary hormones in Saudi Arabia are very scarce. We conducted a retrospective analysis of radiological and hormonal data of 459 patients with pituitary MRI between January 2008 and December 2015 to define the frequency of normal pituitary MRI in patients with abnormal pituitary hormones in a well-defined population.

Results: Over the 7-year period, out of 459 patients; 129 (28.1%) were males and 330 (71.9%) were females with mean age of 35.4 ± 13.7. Positive MRI compared to normal MRI were seen in 268 (58.4%) and 191 (41.6%) subjects respectively. Subjects with Positive MRI were significantly older, 36.8 ± 14.1 vs. 33.5 ± 12.9, p value = 0.01. Hyperfunctioning pituitary hormones were significantly associated with positive MRI, 259 (63.2%) vs. 151 (36.8) whereas hypofunctioning pituitary hormones were associate with normal MRI, 40 (81.6%) vs. 9 (18.4%), p value < 0.001. Three types of hyperfunctioning pituitary gland were seen such as hyperprolactinemia, somatotroph adenoma, and corticotroph adenoma were associated with more frequent positive MRI as to Five types of hypofunctioning pituitary gland were seen such as panhypopituitarism, secondary hypogonadism, growth hormone deficiency, central hypothyroidism and central adrenal insufficiency which were associated with more frequent normal MRI.

Conclusion: The current study indicates hyperfunctioning pituitary gland was significantly associated with positive MR whereas hypofunctioning pituitary gland was associate with normal MRI. In the absence of registry data, larger cooperative studies involving diverse population samples from multiple centers could help to provide further information on the true frequency nationally.

Keywords: *Magnetic Resonance Image; Pituitary Hormones; Saudi Arabia*

Introduction

The procedure of choice in the evaluation of sellar masses is MR imaging using (3 mm) sagittal and coronal T1-weighted images with optional T2-weighted or fat-suppressed sequences [1,2]. Histological analysis of autopsy specimens and radiologic (computed tomography [CT] and MRI) data from patients being treated or studied for conditions related and unrelated to pituitary disease are the two principal methods that have been used to estimate the population prevalence of PA. Many studies have been performed using this approach to estimate the prevalence of Pituitary adenoma (PA). Both methods have generated estimates ranging from 1% to 30% [3-9]. In addition, intracranial tumors constitute 10 - 15% of PA in surgical specimen.

Typical hypersecretory syndromes constitute 65% of PA (48% prolactin, 10% growth hormone, 6% corticotropin, and 1% thyrotropin) [10,11]. Nonfunctioning (or non-secreting) PA constitute the remaining 35%.

The objective of this study, therefore, is to investigate a possible relationship between the frequency of normal MRI findings and different hormones abnormalities in a tightly defined geographical area in Jeddah, Saudi Arabia.

Methods

All MRI pituitary records were collected from the radiology department data base between January 2008 and December 2015 at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia. MRI and clinical Records of patients were thoroughly analyzed. Out of the initial screening of 630 subjects, 93 subjects were excluded from the study as they were either incomplete clinical records or MRI was repeated for the same patients. In addition, 78 subjects were excluded as the diagnosis was nonfunctioning PA. The remaining 459 subjects constitute the subject material for the study. Information was collected from two resources such as clinical case records of subjects seen at the endocrinology or other services and the data on hormonal analysis including neurodynamic tests of the subjects. Records were thoroughly reviewed for clinical data and hormonal assays. Subjects were further sub-classified into: Hyperprolactinemia, panhypopituitarism, somatotroph adenoma, secondary hypogonadism, growth hormone deficiency, corticotroph adenoma, secondary adrenal insufficiency and central hypothyroidism.

Statistical Analysis

Continuous variables were described using means and Standard Deviations. Univariate analysis of baseline demography both between groups, were accomplished using unpaired t-test and Chi square test were used for categorical data comparison. P value < 0.05 indicates significance. The statistical analysis was conducted with SPSS version 22.0 for Windows.

Results

Over the 7-year period, out of 459 patients; 129 (28.1%) were male and 330 (71.9%) were female with mean age 35.4 ± 13.7. Positive MRI compared to normal MRI were seen in 268 (58.4%) and 191 (41.6%) subjects respectively, table 1. Subjects with Positive MRI were significantly older, 36.8 ± 14.1 vs. 33.5 ± 12.9, p value = 0.01. Hyperfunctioning pituitary gland was significantly associated with positive MRI, 259 (63.2%) vs. 151 (36.8) whereas hypofunctioning pituitary gland was associate with normal MRI, 40 (81.6%) vs. 9 (18.4%), p value < 0.001, table 2. Females with hyperfunctioning pituitary gland were associated with positive MRI whereas males with hypofunctioning pituitary gland were significantly associated with normal MRI, figure. More frequent positive MRI were seen in three types of hyperfunctioning pituitary gland such as hyperprolactinemia, somatotroph adenoma, and corticotroph adenoma. Five types of hypofunctioning pituitary gland were seen such as panhypopituitarism, secondary hypogonadism, growth hormone deficiency, central hypothyroidism and central adrenal insufficiency and were associated with more frequent normal MRI, table 2.

Parameters		Total	MRI findings		P value
			Normal	Positive	
		459	**268 (58.4)**	**191 (41.6)**	
Age (years)		35.4 ± 13.7	36.8 ± 14.1	33.5 ± 12.9	0.01
Gender	Male	129 (28.1)	70 (26.1)	59 (30.9)	0.3
	Female	330 (71.9)	198 (73.9)	132 (69.1)	

Table 1: *Gender and age in correlation to MRI finding.*

Data are number (%) and mean ± standard deviation

Associated pituitary abnormalities	Total	MRI findings	
		Positive	Normal
Hyperfunctioning	410 (89.3)	259 (63.2)	151 (36.8) $
Hypofunctioning	49 (10.7)	9 (18.4)	40 (81.6)
Hyperprolactinemia	399 (86.9)	248 (62.2)	151 (37.8)
Acromegaly	10 (2.2)	10 (100)	0
corticotroph adenoma	1 (0.2)	1 (100)	0
Panhypopituitarism	7 (1.5)	3 (42.9)	4 (57.1)
Secondary hypogonadism	24 (5.2)	2 (8.3)	22 (91.7)
Growth hormone deficiency	16 (3.5)	4 (25.0)	12 (75.0)
Central hypothyroidism	2 (0.4)	0	2 (100)

Table 2: *Pituitary hormones in correlation to MRI finding.*

Data are number (%). $ = p value < 0.0001

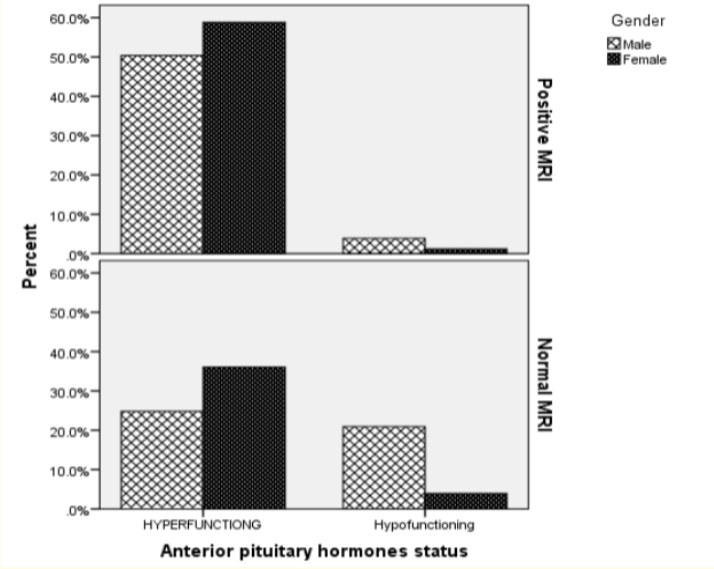

Figure: *The association of gender to pituitary hormone abnormalities in correlation to MRI finding.*

Discussion

The preferred diagnostic imaging modality for evaluation of sellar and parasellar tumors, including adenomas is pituitary MRI. In particular, when functioning adenomas are suspected, a dynamic pituitary MRI, which obtains images within seconds after gadolinium contrast injection, may be more useful because it has higher sensitivity than other imaging modalities for detecting small microadenomas [12]. Finding of small incidental lesions of little or no clinical significance on dynamic pituitary MRI may be misinterpreted as the pathological source of excess hormonal secretion during evaluation of patients for Cushing's disease or acromegaly given lower specificity vs. conventional MRI. Because there are few conditions in which clinicians would obtain pathology results of the pituitary mass when a normal pituitary gland is reported on MRI, he calculation of the specificity of pituitary MRI is likely limited due to underestimation of true negative values.

PA are the most common intracranial neoplasm comprising approximately 5 - 20% of primary central nervous system tumors, which would translate into a relatively low prevalence [3-9,13-15]. Epidemiologic studies are limited by their dependence on population-specific registries, which subject them to bias from regional influences such as diagnostic practices, reporting patterns, and case definitions. There are limited data on the prevalence of PA in spite of epidemiologic, postmortem, and radiologic studies have been used to estimate their prevalence. In general, the incidence of PA is higher in more recent than in older studies, probably due to improved endocrinological and radiological diagnosis, and increased neurosurgical interest in these lesions [7,10]. In this sample, the mean age of patients was 35 years old. It should be taken into account that PA mostly affect young and economically active individuals in whom diagnostic delay translates into loss of productivity [16].

The clinical features of pituitary adenoma vary depending on the location and size of the tumor and its secretory capability. Pituitary adenomas typically appear during early adulthood, and no sex predilection is known. Approximately 65% of PA secrete a hormone causing typical hypersecretory syndromes [10]. The remaining (35%) PA do not secrete a hormone and are thus referred to as nonfunctioning (or non-secreting) adenomas. Due to compression of pituitary tissue, pituitary stalk and its vascular supply, partial or total hypopituitarism may occur, resulting in deficit of production of some or all pituitary hormones [11,17]. The most common pituitary deficit in these patients is hypogonadism [17]. Hypogonadotropic Hormone deficiencies should also be evaluated because hypopituitarism is present in up to 30% of adenomas, and because of the need to address deficiencies in future treatment regimens. Secretory pituitary adenomas are usually small and generally do not cause neurologic symptoms or hypopituitarism, though they can. The symptoms of functioning tumors are related to the specific hormone the tumor produces. The diagnostic approach to a suspected PA depends on the presenting symptoms and abnormal hormone values. There is no evidence from controlled trials to guide a specific investigative approach, and recommendations are based largely on expert opinion and extrapolation from observational studies [18-23].

Hyperprolactinemia is a common endocrine disorder of the hypothalamic-pituitary axis. It occurs more commonly in women. The prevalence of hyperprolactinemia ranges from 0.4% in an unselected adult population to as high as 9 - 17% in women with reproductive diseases [24]. Of 399 patients in our study with pituitary imaging for hyperprolactinemia, 151 (37.8%) had normal findings and 248 (62.2%) had pituitary tumor. Approximately 16% of patients with idiopathic hyperprolactinemia (negative imaging and no other apparent cause) will develop evidence of microadenomas in follow-up [25-28].

Variability in reported positive MRI results was observed for different clinical indications. Pituitary MRI ordered for the evaluation of patients with suspected acromegaly resulted in a mass reported in 69% of scans, the highest observed among all endocrinopathies which lower than our finding however the number of acromegaly cases in our study was small (10 patients with acromegaly). In contrast, 84% of MRI scans ordered for hypogonadism did not reveal a pituitary lesion which compatible with us. These results highlight that pituitary MRI is likely not helpful as a screening tool for patients with hypogonadism. Positive pituitary MRI scans observed with hypogonadotropic hypogonadism were typically observed in cases of severe testosterone deficiency in which total testosterone was less than 100 (normal 250 - 1000 ng/dl). Given the lack of definitive imaging changes in patients screened for hypogonadism, clinicians should use a higher judgment threshold before ordering pituitary imaging for these patients [29,30]. In the absence of registry data, larger cooperative studies involving diverse population samples from multiple centers could help to provide further information on the true frequency nationally.

We aimed to identify the clinically apparent pituitary masses as screened by MRI scans, and this aim was reflective of the clinical setting because not all pituitary masses are formally diagnosed with histological confirmation. Furthermore, due to the retrospective nature of this study, the observed population reflects a selected yet comprehensive group of patients referred for pituitary MRI, rather than the general population as would be encountered in an autopsy series. Our study could be limited by the question of clustering of cases within the study region and the effect that might have on our estimates, in addition, the current study population may appear limited in size and therefore may underestimate the true prevalence of PA in the general population. In addition, the study shares the limitations of all retrospective studies.

Conclusion

In conclusion, the current study indicates hyperfunctioning pituitary hormones were significantly associated with positive MR whereas hypofunctioning pituitary hormones were associate with normal MRI.

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Conflict of Interests

The authors declare no conflict of interests.

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