

EMPTY SELLA: IT IS WORTH MENTIONING IN ROUTINE MR BRAIN IMAGING: A REVIEW OF 200 CASES FROM A TERTIARY CARE HOSPITAL

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ABSTRACT

BACKGROUND: Primary empty sella (PES) is regarded as an incidental finding but there are several studies documenting the association of PES with clinical, hormonal and imaging abnormalities. The primary empty sella (PES) or arachnoidocele is the herniation of subarachnoid space within the sella turcica in patients having no history of pituitary tumor, surgery, or radiotherapy. **MATERIAL AND METHODS:** This study is designed to retrospectively evaluate the selected variables including clinical features, biochemical endocrine functions and radiological imaging findings from the medical records of 200 patients with a diagnosis of PES on MR brain imaging. **RESULTS:** Out of 200 patients 41 (20.50%) were male and 159 (79.50%) were female. The mean age at the time of diagnosis was 56.87 years. In all the patients the diagnosis of PES was made by magnetic resonance imaging (MRI). In both the genders headache is the most prevalent symptom in our study seen in 67.5%. The second commonest association in male group is vertigo seen in 7.5% and obesity in female group seen in 28.5%. The third commonest association observed in male group found to be obesity in 6.5% and hypertension in female group seen in 26.5%. The least common association are ataxia and raised intracranial tension (ICT) seen only in 3% of cases. **CONCLUSION:** Primary empty sella is a condition ranging from asymptomatic population to patients with multiple clinical, neuroophthalmological and hormonal disorders. This wide range of variability reflect the diversity of its pathogenesis. Patients having severe intracranial tension (ICT), disabling headaches and severe visual disturbances should be evaluated for a potential neuro-surgical treatment. As our study is retrospective so no follow up data could be obtained. However due to risk of disease progression a regular radiological, endocrine and neuroophthalmological reassessment is recommended.

Keywords: Primary empty sella (PES), Empty sella (ES), Magnetic resonance imaging, brain, arachnoidocele, headache.

Introduction

The empty sella or arachnoidocele has been defined as the herniation of subarachnoid space within the sella turcica and it is associated with elongated pituitary stalk and flattening of pituitary gland.^{1-3,31} In earlier days an enlarge sella on plain radiography was considered with presence of an intra sellar or para sellar neoplasm.

An incomplete sellar diaphragm is an essential pre requisite for the development of primary empty sella. It may congenital or due to other acquired causes.¹⁶⁻¹⁷ It is either with or without enlargement of sella. Initially this condition is diagnosed in post mortem studies and on plain radiography however it is increasingly

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recognized in routine radiology practice due to advent of CT scans and MR Imaging. Multiple endocrine and non-endocrine abnormalities are described in association with empty sella.⁴⁻⁹ Now it has been a routine practice in most imaging centers worldwide including ours to comment on sella as a part of routine brain reporting protocol. Two types of empty sella should be distinguished. The first one is called Primary empty sella (unrelated to any previously known pathology) and secondary empty sella when a pituitary gland shrinks after surgery, radiotherapy, drug treatment, postpartum necrosis or lymphocytic hypophysitis.^{2,5,10}

PES may be seen in asymptomatic patients or it is associated with various clinical and neurological features and endocrine dysfunctions.¹¹

The aim of this retrospective study is to report the incidences of selected variables in patients with PES.

Material and Methods

We retrospectively evaluate the clinical data for our selected variable in 200 patients from both genders. All the patients had PES diagnosed by MRI. The mean age at the time of diagnosis was 56.87 years. Clinical data was obtained from the hospital medical records with approval from ethics committee.

SETTINGS:

Study was conducted at the department of radiology, Liaquat National Hospital, a tertiary care hospital and teaching institute in Karachi.

STUDY GROUP:

The study group consisted of patients from both genders who were diagnosed to have PES on routine MRI imaging at our institute from July 2015 to June 2018.

EXCLUSION CRITERIA:

1. MRI reports not having functional details.
2. MRI reports not mentioning about pituitary gland.
3. Patients having pituitary or parasellar tumors.
4. Patients who undergoing sellar surgery or radiotherapy.
5. Patients having growth hormone or cortisol hyper secretion.

6. Patients having raised serum prolactin level > 100 mg/ml.

DATA ACQUISITION

Study group was identified by searching MRI report data base with the key word "empty sella."

Standard criteria (CSF occupying more than 50% of sella turcica with compressed pituitary against the sellar wall) for MRI diagnosis of empty sella is followed at our institute (Fig. 1, 2)

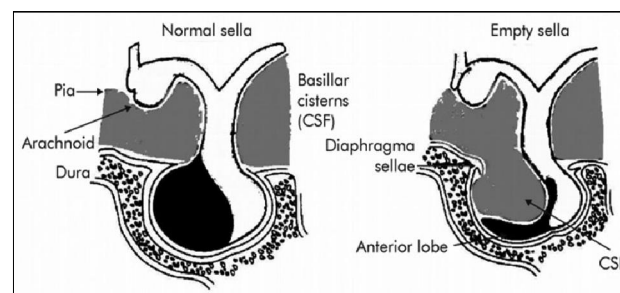


Figure 1: Normal anatomic relationships of sella (left) and arachnoid herniation through an incompetent diaphragm sellae with ballooning of the sella (right).

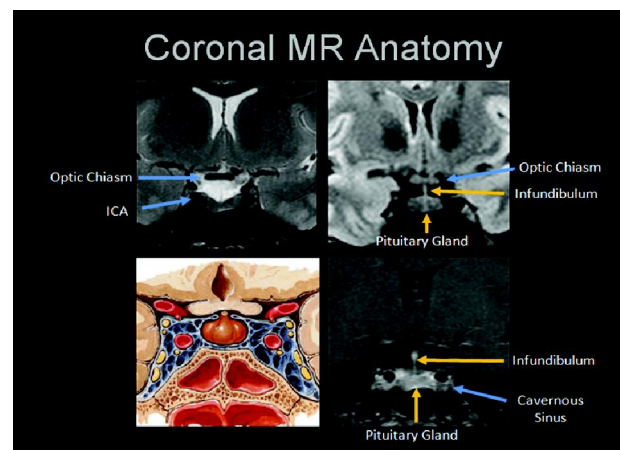
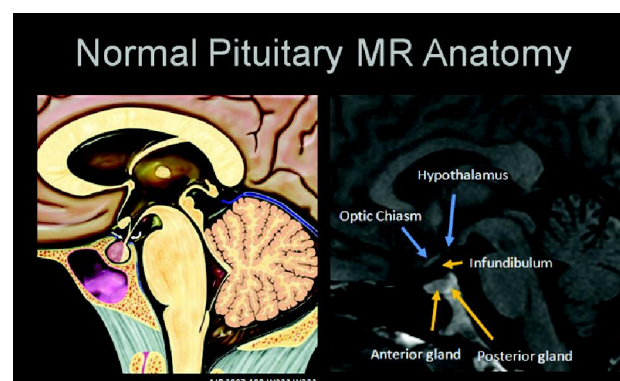


Figure 2a & b: (T1 and T2 sagittal and coronal MRI demonstrating the normal pituitary gland & sella)

Clinical and hormonal disturbances of selected variables was recorded from medical records. There are nine selected variables (headache, fits, ataxia, visual disturbance, hormonal disturbance, raised ICP, Psychiatric illness, Sensorineural hearing loss and vertigo) noted in the study population having PES.

Results

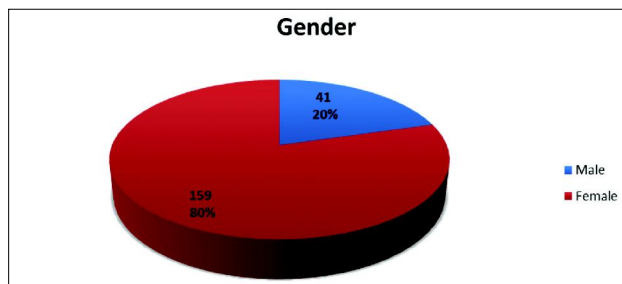
Total 200 patients were included with the diagnosis of primary empty sella (PES) based on MRI reports. Imaging was performed in the department of Radiology, Liaquat National Hospital Karachi over a period of 3 years from 01 July 2015 to 30 June 2018.

STATISTICAL ANALYSIS

Statistical Package for the Social Sciences Software (SPSS) version 21 was used for data analysis. Quantitative variable was presented as Mean \pm SD like age. Frequencies and percentages were computed for qualitative variables like gender, headache, obesity, hypertension, vertigo, hormonal disturbance, visual disturbance, fits, psychiatric illness, sensorineural hearing loss, ataxia and raised CT. Pie charts and bar graphs were plotted for categorical data. Chi-square and Fisher exact test will be used for finding association between categorical variables where appropriate. $P \leq 0.05$ will be considered as significant. Of 200 patients studied 159 (79.5%) were females and 41 (20.5%) were males (Tab. 1). In all the patients empty sella was documented by MR Imaging. Different clinical conditions and associated diseases were

Mean Age:	56.87 \pm 14.16
Gender:	n(%)
Male:	41(20.5)
Female:	159(79.5)

Table 1: Age and Sex distribution



Pie chart for the gender distribution in study population

investigated. In both the groups headache was found to be the most frequent symptom seen in 67.5%. Followed by presence of obesity in 35% cases and hypertension in 33%. Vertigo, hormonal disturbances were also common with incidence of 28.5%, 13.5% and 10.5% respectively. The fits was found to be 9% whereas psychiatric illness was seen in 6% cases.

Association of gender with different factors				
Factors	Total n(%)	Male n(%)	Female n(%)	P-value
Headache				
Yes	135(67.5)	33(16.5)	102(51)	0.046*
No	65(32.5)	8(4)	57(28.5)	
Fits				
Yes	18(9)	1(0.5)	17(8.5)	0.13**
No	182(91)	40(20)	142(71)	
Ataxia				
Yes	6(3)	2(1)	4(2)	0.605**
No	194(97)	39(19.5)	155(77.5)	
Visual Disturbance				
Yes	21(10.5)	9(4.5)	12(6)	0.007*
No	179(89.5)	32(16)	147(73.5)	
Hormonal Disturbance				
Yes	27(13.5)	5(2.5)	22(11)	0.784**
No	173(86.5)	36(18)	137(68.5)	
Raised ICT				
Yes	6(3)	1(0.5)	5(2.5)	1**
No	194(97)	40(20)	154(77)	
Psychiatric Illness				
Yes	12(6)	5(2.5)	7(3.5)	0.061**
No	188(94)	36(18)	152(76)	
Sensorineural Hearing Loss				
Yes	11(5.5)	4(2)	7(3.5)	0.241**
No	189(94.5)	37(18.5)	152(76)	
Vertigo				
Yes	57(28.5)	15(7.5)	42(21)	0.198**
No	143(71.5)	26(13)	117(58.5)	
Obesity				
Yes	70(35%)	13(6.5)	57(28.5)	0.62**
No	130(65)	28(14)	102(51)	
Hypertension				
Yes	66(33)	13(6.5)	53(26.5)	0.843**
No	134(67)	28(14)	106(53)	

Table 2: Association of gender with different selected variables

Sensorineural hearing loss was recorded in 5.5% while ataxia and raised intracranial tension was only seen in 3% cases. In female group obesity is the second commonest association while in male group vertigo is second top most clinical symptom (Tab. 2, 3, 4 & 5). In our study headache and visual disturbances both have significant P-value (0.046 and 0.007 respectively). While in rest of the selected variables the P-value was not found to be statistically significant.

Variables	Overall Patients	%
Headache	135	135(67.5)
Obesity	70	70(35)
Hypertension	66	66(33)
Vertigo	57	57(28.5)
Hormonal Disturbance	27	27(13.5)
Visual Disturbance	21	21(10.5)
Fits	18	18(9)
Psychiatric Illness	12	12(6)
Sensorineural Hearing Loss	11	11(5.5)
Ataxia	6	6(3)
Raised ICT	6	6(3)

Table 3: Incidence of variables in study population

Variables	Males	%
Headache	33	16.5
Vertigo	15	7.5
Obesity	13	6.5
Hypertension	13	6.5
Visual Disturbance	9	4.5
Hormonal Disturbance	5	2.5
Psychiatric Illness	5	2.5
Sensorineural Hearing Loss	4	2
Ataxia	2	1
Fits	1	0.5
Raised ICT	1	0.5

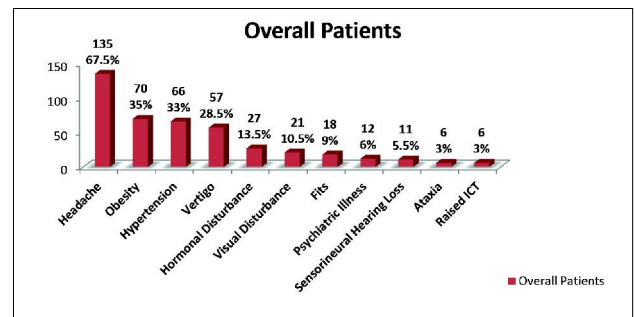
Table 4: Incidence of variables in male group

Discussion

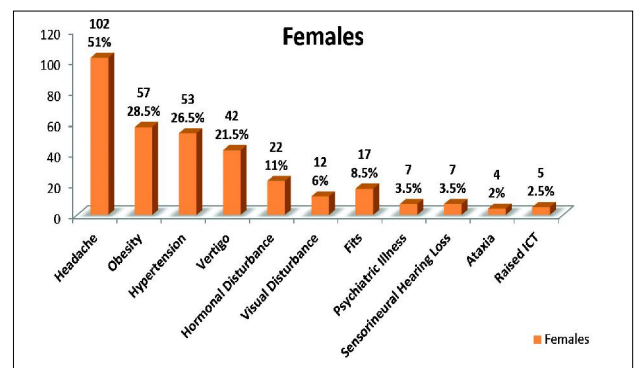
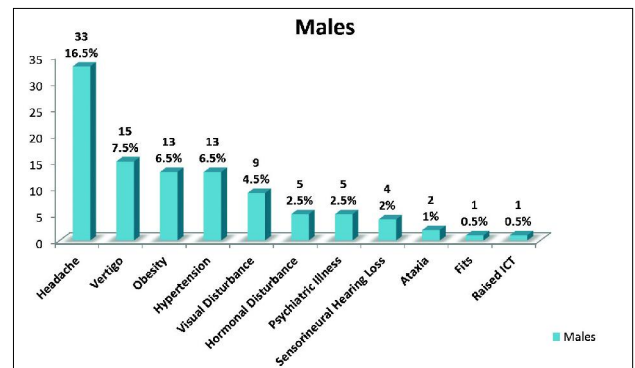
Empty sella is a common incidental finding in imaging studies of brain and it has a varying prevalence between 8-38%.^{2,11,30} It is considered primary when there is no history of any surgery radiation or pharma-

Variables	Females	%
Headache	102	51
Obesity	57	28.5
Hypertension	53	26.5
Vertigo	42	21
Hormonal Disturbance	22	11
Visual Disturbance	12	6
Fits	17	8.5
Psychiatric Illness	7	3.5
Sensorineural Hearing Loss	7	3.5
Ataxia	4	2
Raised ICT	5	2.5

Table 5: Incidence of variables in female group



Graph 1: % of Selected variables in overall study population



Graph 2,3: % of selected variables in male & female groups

cological treatment while empty sella discovered after any intervention or procedure is labeled as secondary empty sella. With the increasing no of patients undergoing CT and MRI studies of brain the reported prevalence of primary empty sella is also rising proportionately. The optimum imaging of sella is with MRI. Computed tomography (CT) imaging is complementary to MR Imaging for the detection of underlying bony changes (Fig 1). If MR is contraindicated thin section multi detector imaging of sella is performed with sub millimeter slice thickness followed by reconstruction in all three imaging planes (Fig. 2, 3).³³ The standard MRI criteria for diagnosis of primary empty sella used in our institute is that 50% of the sella



Figure 3a & b: T1WI sagittal post-contrast MRI demonstrating (a) normal pituitary gland and stalk (white arrow), (b) empty sella (white block arrow). Note that most of the sella turcica is occupied by cerebrospinal fluid, which appears hypo intense.

turcica is being occupied by the cerebrospinal fluid (CSF) and it is a standard practice to report all such cases done at our institute. Magnetic resonance imaging (MRI) confirms the diagnosis of an empty sella. On T1 sagittal images there is extension of CSF into the sella and remaining glands is compressed along the sellar floor. Central position of the infundibulum is a useful sign in an empty sella which helps to rule out a supra sellar cystic lesion³² in asymptomatic patients with an incidental finding of an empty sella, secondary causes should be excluded first.²⁹ Primary empty sella is a common finding and it is most commonly reported in females. In our study we found PES in 159 females 18 and 41 male patients. Pregnancy also trigger the onset of PES.¹⁹ Multiple studies suggests that headache is the most commonest symptom in PES population and it is reported in 60-80% of cases^{3,20} similar to our findings (67.5%). The headache in PES patients is hypothesized to be caused by traction on the vascular and

meningeal structures in the sellar cavity still there is no conclusive evidence available to support this hypothesis.²⁵ Several reports in literature suggests that PES has also been associated with obesity,²¹⁻²² Few authors believe that obesity induces hypercapnia which will lead to elevated CSF pressure and induce herniation of suprasellar subarachnoid space.²³⁻²⁴ In our study we found symptoms of vertigo in 28.5% and hormonal disturbances in 13.5%. Visual disturbances were seen in 10.5% of cases. In literature the visual disturbances reported in PES patients is between 1.6-16%.³ Visual disturbances usually consist of reduced vision, visual field defects, bitemporal heminopia and quadrantanopia. Some authors explain the improvement of visual field defects after surgical interventions by the fact that traction of pituitary stalk may cause microscopic anatomical alteration in the visual system or in its vascular supply that is not clearly evident on the imaging studies. Visual defects may occur from compression of optic chiasma.²⁸ Fits and psychiatric illness was seen in 9% and 6% respectively. Sensorineural hearing loss (SNHL) is seen in 5.5% and ataxia and raised ICT both have a low incidence of only 3%. Patients with symptoms of raised ICT, hypertension, disabling headache and visual disturbances should be carefully monitored and evaluated for a potential neurosurgical treatment.²⁶ Due to risk of disease progression various studies suggests regular radiological and neuroophthalmological reassessments.²⁷ Our study has a large patient data base and wide range of variables. The study has limitations of retrospective data collection and analysis based on patients medical record maintained in our institute however precautions were taken to incorporate to collect all the relevant data. As this is a retrospective study no follow up data could be obtained.

Conclusion

Primary empty sella is not always be an incidental finding on MRI imaging. Multiple clinical conditions like headache, hypertension, vertigo, hormonal and visual disturbances, fits and psychiatric illnesses, SNHL, ataxia and raised ICT are often seen in patients with PES. This reflects the diverseness of its pathogenesis. In our study most cases of PES were

seen in female population. We suggests that patients with PES should undergo clinical, endocrine and neuroophthalmological evaluations considering the high incidence of this disorder.

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Conflict of Interest: There are no potential conflicts of interest or any financial or personal relationships with other people or organization that could inappropriately bias conduct and finding of this study.

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