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Hormonal and Metabolic Profile of Sellar and Suprasellar Masses

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Abstract

Introduction: The sellar and parasellar region, which surrounds the pituitary, is an anatomically complex area that serves as a vital crossroads for essential surrounding structures. While the sellar region has distinct anatomical characteristics, the parasellar region encompasses all of the structures that surround the sella turcica. The pituitary gland, the sella turcica, and the parasellar region can be affected by a variety of lesions, including benign and malignant neoplasms like pituitary tumours, parasellar tumours like craniopharyngiomas (3–5% of all intracranial expanding lesions in adults, 6% in children), as well as non-neoplastic tumor-like lesions and dysembryogenetic lesions like Rathke's Non-functioning pituitary adenomas (NFPA) are the most frequent type of adenohypophysis tumour, accounting for up to 54 percent of all pituitary adenomas. Except for modest hyperprolactinemia in a few cases, NFPA are usually benign and slow-growing neoplasms with no clinical or biochemical indications of hormone overproduction. The present study is intended to understand hormonal and metabolic profile in patients with Sellar and Suprasellar masses.

Aim

- To study the hormonal & metabolic profile in patients with sellar and suprasellar masses
- To analyse the changes in the hormone levels and metabolic parameters of patients with sellar and suprasellar masses.

Methodology

The study is a non-randomized cross-sectional study including 30 patients of all ages with sellar and

suprasellar masses in Sri Ramakrishna Hospital, Coimbatore. The study was conducted for a period of 18 months from December 2020 to May 2022. The vitals such as BP and Pulse Rate were recorded for all the patients in the study. Metabolic paramters like Haemoglobin, Serum Creatinine,, RBS, HbA1C, Sodium, Potassium and Calcium levels were tested and noted. Hormones such as freeT3, freeT4, TSH, Cortisol, Prolactin, LH, FSH, Testosterone level in Male and Estradiol in female patients were done and taken for the study. The collected data was coded in MS-Excel and analysed using SPSS 22.0. Statistical tools such as mean, Standard deviation, Cross Tabulation and ANOVA was applied appropriately.

Results: Among the patients studied, 60% of the patients have pituitary Macroadenoma, 10% have pituitary Microadenoma and 10% have Rathke cleft cyst. Granulomatous Hypophysitis, Tuberculum Sella Meningioma and Suprasellar Craniopharyngeoma are seen in one patient each. Only 36% people had mild anemia. Creatinine level is normal in all the patients. One third of the patients found to have raised LDL level and found to be dyslipidemic. 40% are prediabetic and 27% are diabetic. Among the electrolytes imbalance studied, around 66% had hyponatremia, 26% had hypokalemia, 26% had mild hypocalcemia.

Conclusion: In this study of sellar and suprasellar masses, Non Functioning Pituitary Adenomas are the commonest presentation followed by prolactinoma and other tumors. Out of 30 patients studied, only 3 patients has hyper secreting prolactinoma, whereas majority of other tumors has hypo secretion of hormones. Among the patients studied, around 60% had central hypothyroidism and 63% had hypo cortisolism. Hypogonadism is noted in 50%male patients and 16% in female patients. Panhypopituitarism is noted in 33% of the patients studied, out of which 80% belongs to NF pituitary macroadenoma and the rest is seen in sella meningioma and suprasellar craniopharyngioma.

Keywords: Pituitary Microadenoma, Rathke cleft cyst, Granulomatous Hypophysitis, hormonal profile, metabolic profile, hypogonadism, panhypopituitarism

Introduction

The sellar and parasellar region, which surrounds the pituitary, is an anatomically complex area that serves as a vital crossroads for essential surrounding structures. While the sellar region has distinct anatomical characteristics, the parasellar region encompasses all of the structures that surround the sella turcica.

Brain parenchyma, meninges, visual pathways and other cranial nerves, major blood arteries, the hypothalamopituitary system (HPS), and bone compartments could all be affected. Because of the location, size, and growth potential of the lesions, as well as the subsequent damage to specific adjacent vital structures, a variety of clinical symptoms and signs can arise from a variety of neoplastic, inflammatory, infectious, developmental, and vascular diseases that occupy the parasellar area.

Neoplasms, developmental pathologies, vascular pathologies, inflammation, and infection are among the pathologic processes that can occur in this area, with neoplasms being the most common.

Pituitary tumours cause issues because of the hormones they secrete or because of the impact of an increasing sellar mass. The vast majority of pituitary lesions are benign; pituitary carcinomas are so uncommon that they only arise in isolated case reports. Pituitary tumours, on the other hand, can be invasive without being cancerous.

Prevalence of sellar and suprsellar masses ranges from 1 in 865 adults to 1 in 2688 adults. The incidence in children vary from 2.5 -4 per 100000 children. The recent prognostic clinicopathological classification include tumor size (macro>10mm/micro≤10mm/giant), type(prolactin, GH, FSH/LH, ACTH and TSH) and grade(grade 1a,non invasive; 2a,invasive; 2b invasive and proliferative; 3 metastatic).57 Out of which, prolactinoma constitute the most common type, followed by GH secreting tumor(acromegaly), ACTH secreting tumors(cushing's syndrome), TSH/FSH/LH secreting tumors are rare and nonfunctional tumors constitute only 15%. 52 Over the decades, numerous studies have sought to decipher the optimal evaluation of patients, though the radiological diagnosis is found to be confirmatory, still the metabolic and hormonal profile has not been studied clearly in our demographic area. By this thesis, we like to study about hormonal and metabolic profile of sellar and suprasellar masses in our centre.

Aim and Objectives

- To study the hormonal & metabolic profile in patients with sellar and suprasellar masses
- To analyse the changes in the hormone levels and metabolic parameters of patients with sellar and suprasellar masses.

Materials and Methods

Study Area: Sri Ramakrishna Hospital, Coimbatore

Study Population: Patients with sellar and suprasellar masses in Sri Ramakrishna hospital

Study Design: Cross Sectional Observational Study

Study Duration: 18 months (Dec 2020- May 2022)

Sample Size: 30

The following formula is used to estimate the sample size (n).

$$n = \frac{N \times X}{(X + N - 1)}$$

$$X = \frac{Z_{\alpha/2}^2 \times p \times (1 - p)}{MOE^2}$$

Zα/2 is the critical value of the Normal distribution at α/2 (e.g. for a confidence level of 99%, α is 0.01 and the critical value is 2.56), MOE is the margin of error, p is the sample proportion, and N is the population size. The values given to compute the sample size is as follows; MOE=1% (0.01), confidence level=99%, population = 2786600, sample proportion = 0.04% (4 per 10,000). Therefore, minimum of 30 samples is required for this study.

Inclusion Criteria

Patients diagnosed with sellar or suprasellar masses

Exclusion Criteria

Individuals with physiological pituitary hyperplasia

Method of Collection of Data

After obtaining informed written consent from the patients fulfilling the inclusion criteria, patient information along with laboratory values and imaging reports will be collected and documented. The study will be explained in a simple way to the patient.

Result

The data collected were subjected to Statistical Analysis using SPSS version 22. Descriptive Statistics, Frequency analysis, Chi-Square test and ANOVA were performed for appropriate variables. The probability value, p was defined as 0.05 to be significant and a p value below 0.01 was considered highly significant for all the significance tests. The results of the Statistical analysis are presented in subsequent tables.

Table 1: Distribution of Patients based on type of Sellar and Suprasellar masses

Type of masses	Frequency	Percent	Cumulative Percent
Pituitary Microadenoma (NFPA)	3	10.0	10.0
Pituitary Macroadenoma (NFPA)	18	60.0	70.0
Rathke cleft cyst	3	10.0	80.0
Granulomatous Hypophysitis	1	3.3	83.3
Tuberculum Sella Meningioma	1	3.3	86.7
Suprasellar Craniopharyngeoma	1	3.3	90.0
Prolactinoma	3	10.0	100.0
Total	30	100.0	

Table 1 presents the frequency of patients with different Sellar and Suprasellar masses. 60% of the patients have pituitary Macroadenoma, 10% have pituitary Microadenoma and 10% have Rathke cleft cyst. Granulomatous Hypophysitis, Tuberculum Sella Meningioma and Suprasellar Craniopharyngeoma are seen in one patient each. 10% of the patients have Prolactinoma.

Graph 1: Distribution of Patients based on type of Sellar, Suprasellar masses

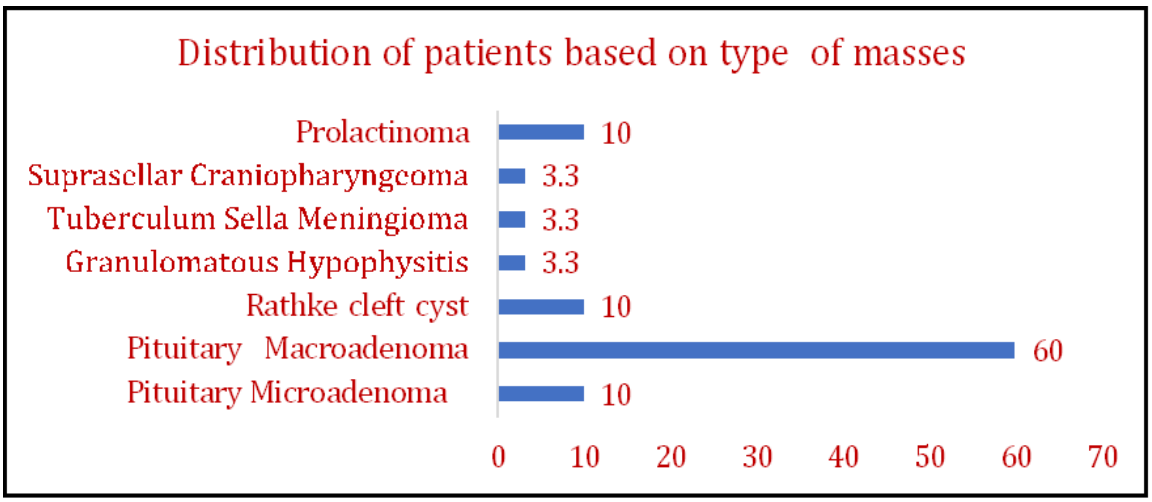
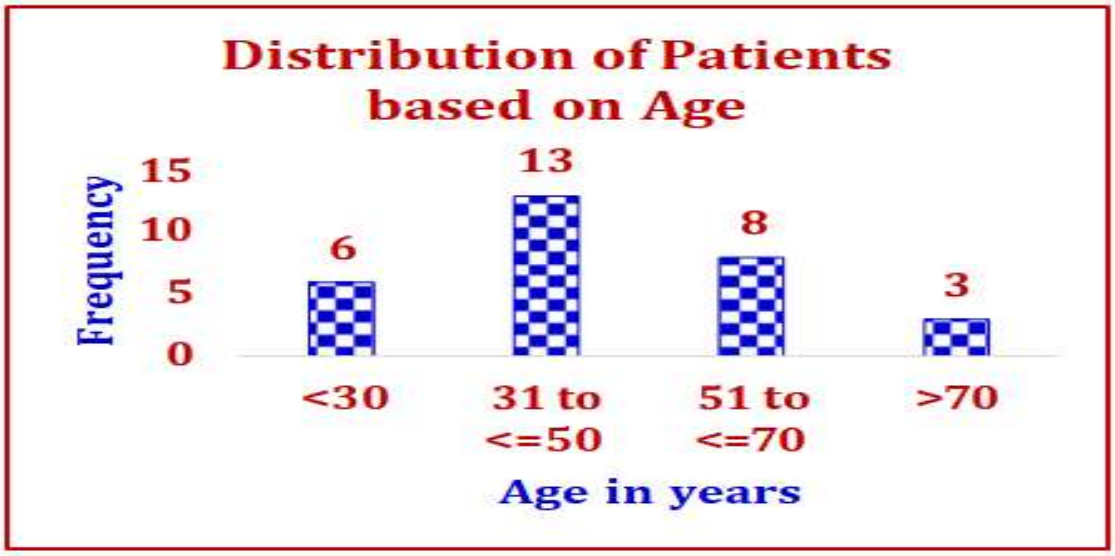


Table 2: Distribution of Patients based on age

Age in years	Frequency	Percent	Cumulative Percent
<30	6	20.0	20.0
31 to <=50	13	43.3	63.3
51 to <=70	8	26.7	90.0
>70	3	10.0	100.0
Total	30	100.0	

Table 2 portrays the distribution of patients based on age in the study group. It is clear from the Table that majority of the patients (43.3%) are of the age group 31 to 50 years, followed by 26.7% of them between 51 and 70 years, 20% belonging to less than 30 years and the remaining 10% above 70 years of age.

Graph 2: Distribution of Patients based on age



It is clear from below Table 3 that 50% of the patients with Pituitary Microadenoma are below 30 years of age and the remaining 50% are between 31 and 50 years of age. But, 50% of the Patients with Pituitary Microadenoma are between 31 and 50 years of age, 27.8% are between 51 and 70 years, 16.7% are above 70 years and only 5.6% are below 30 years of age. Rathke cleft is also seen in patients below 50 years of age. Granulomatous Hypophysitis, Tuberculum Sella Meningioma and Suprasellar Craniopharyngeoma are seen in Patients between 51 and 70 years.100% of the prolactinoma patients are below 20 years of age.

Table.3: Distribution of Patients based on type of Sellar, Suprasellar masses and Age

Type of Sellar masses and Suprasellar masses	Age in years			
	<30	31-<=50	51 - <=70	>70
Pituitary Microadenoma (NFPA)	0 (0%)	3 (100%)	0 (0%)	0 (0%)
Pituitary Macroadenoma(NFPA)	1 (5.6%)	9 (50%)	5 (27.8%)	3 (16.7%)
Rathke cleft cyst	2 (66.7%)	1 (33.3%)	0 (0%)	0 (0%)
Granulomatous Hypophysitis	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Tuberculum Sella Meningioma	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Suprasellar Craniopharyngeoma	0 (0%)	0 (0%)	1(100%)	0 (0%)
Prolactinoma	3 (100%)	0 (0%)	0(0%)	0(0%)
Total	6 (20%)	13(43.3%)	8(26.7%)	3 (10%)

Graph 3: Distribution of Patients based on type of masses and age

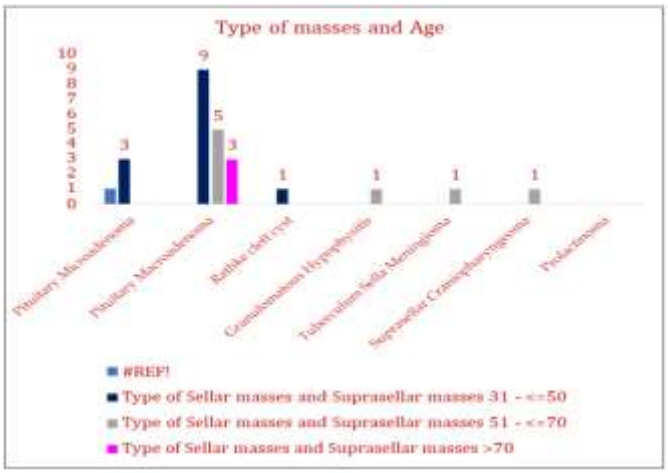


Table 4: Distribution of Patients based on gender

Gender	Frequency	Percent	Cumulative Percent
Male	19	63.3	63.3
Female	11	36.7	100.0
Total	30	100.0	

Table 4 presents the distribution of Patients based on gender. It can be inferred from the Table that 63.3% of the patients in the study group are Male and the remaining 36.7% are female.

Graph 4: Distribution of Patients based on gender

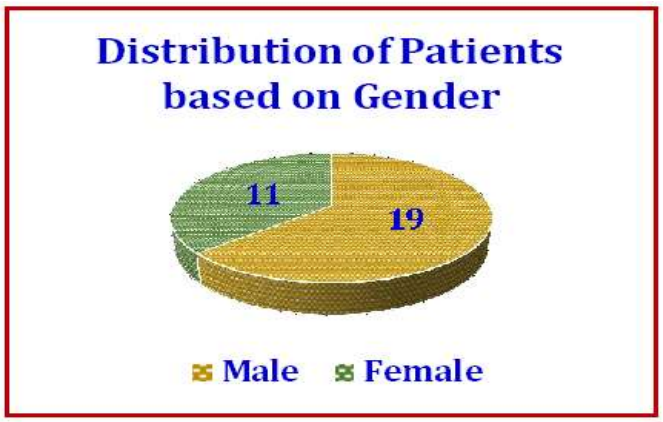


Table 5: Descriptive statistics on metabolic parameters

Parameters (N=30)	Minimum	Maximum	Mean	Std. Deviation
Haemoglobin (g/dL)	8.3	14.8	12.257	1.4957
Creatinine(mg/dL)	0.4	1.0	0.647	0.1570
LDL (mg/dL)	84	201	143.83	31.890
Random Blood Sugar(mg/dL)	82	212	114.47	30.022
HbA1C (%)	4.9	9.3	6.167	1.1021
Na2+(mEq/L)	116	141	130.73	7.296
K+ (mmol/L)	2.7	4.6	3.763	0.5586
Calcium (mg/dL)	8.0	10.1	8.890	0.5904

Table 5 shows the minimum, maximum, mean and Standard deviation of clinical parameters such as Haemoglobin, Creatinine, LDL, Random Blood Sugar and HBA1C. The average Hb level was 12.257 g/dL with a Standard deviation of 1.4957 g/dL. The Creatinine levels was within the normal range with a mean of 0.647 mg/dL and standard deviation of 0.1570 mg/dL. The mean LDL levels was 143.83 mg/dL which is little higher than the normal range of less than 100 mg/dL. In the same way average RBS was 114.46 mg/dL which is well within the normal range of less than 140 mg/dL. However, HbA1C was 6.167% which corresponds to prediabetic stage. The average Sodium levels was 130.73 mEq/L which is within the normal range of 136 -145 mEq/L. Similarly, Potassium levels (3.763 ± 0.5586) were also within the normal range of 3.6 to 5.2 mmol/L. In the same way the average Calcium levels was 8.890 mg/dL which is within in the normal range of 8.6 to 10.3 mg/dL.

Table 6: Prolactin levels in patients with different Sellar and Suprasellar masses

Type of Sellar and Suprasellar masses	N	Prolactin levels in ng/ml		ANOVA „F" („p" value)
		Range	Mean ± Std. Deviation	
Pituitary Microadenoma (NFPA)	3	12.0 – 62.0	30.133±27.6849	0.333 p=0.913 (p>0.05 Not Significant)
Pituitary Macroadenoma (NFPA)	18	5.1 – 4624.0	597.800±1251.5225	
Rathke cleft cyst	3	12.1 – 29.4	22.067±8.9456	
Granulomatous Hypophysitis	1	24.0	24.000±0.0	
Tuberculum Sella	1	21.4	21.400±0.0	
Suprasellar Craniopharyngeoma	1	16.8	16.800±0.0	
Prolactinoma	3	41.9-69.3	53.600±14.1312	
Total	30	5.1 –4624.0	371.333±998.9541	

Table 6 displays the prolactin level in patients with different types of Sellar and Suprasellar masses. The Mean Prolactin level in Patients with Pituitary Microadenoma is 30.133 ± 27.6849 ng/ml with a minimum of 12.0 ng/ml and maximum of 62.0 ng/ml. Similarly, the Prolactin level in Patients with Pituitary Macroadenoma is 597.800 ±1251.5225 ng/ml with a minimum of 12.1 ng/ml and maximum of 29.4 ng/ml. The mean Prolactin level in Patients with Rathke Cleft Cyst is 22.067 ± 8.9456 ng/ml with a minimum of 12.1 ng/ml and a maximum of29.4 ng/ml. The prolactin level in Patients with Granulomatous Hypophysitis, Tuberculum Sella Meningioma and Suprasellar Craniopharyngeoma are 24 ng/ml,21.4 ng/ml and 16.8 respectively. The Mean Prolactin level in Patients with prolactinoma is 53.600 ± 14.1312 ng/ml with a minimum of 41.9 ng/ml and maximum of 69.3 ng/ml. However, there is no significant difference in the Prolactin levels in the Patients with different types of Sellar and Suprasellar masses as the ANOVA „F' value (0.333; p>0.05) is insignificant at 5% level.

Table 7: Distribution of Patients based on type of masses and LH level

Gender	Type of Sellar masses and Suprasellar masses		LH Level		Total
			Normal	Low	
MALE	Pituitary Microadenoma (NFPA)	Frequency	2	0	2
		Percentage	100.0%	0.0%	100.0%
	Pituitary Macroadenoma (NFPA)	Frequency	3	10	13
		Percentage	23.1%	76.9%	100.0%
	Rathke cleft cyst	Frequency	1	1	2
		Percentage	50.0%	50.0%	100.0%
	Granulomatous Hypophysitis	Frequency	0	1	1

		Percentage	0.0%	100.0%	100.0%
	Tuberculum Sella Meningioma	Frequency	0	0	0
		Percentage	0.0%	0.0%	0.0%
	Suprasellar Craniopharyngeoma	Frequency	0	1	1
		Percentage	0.0%	100.0%	100.0%
	Prolactinoma	Frequency	0	0	0
		Percentage	0.0%	0.0%	0.0%
FEMALE	Pituitary Microadenoma	Frequency	1	0	1
		Percentage	100.0%	0.0%	100.0%
	Pituitary Macroadenoma	Frequency	3	2	5
		Percentage	60.0%	40.0%	100.0%
	Rathke cleft cyst	Frequency	1	0	1
		Percentage	100.0%	0.0%	100.0%
	Granulomatous Hypophysitis	Frequency	0	0	0
		Percentage	0.0%	0.0%	0.0%
	Tuberculum Sella Meningioma	Frequency	0	1	1
		Percentage	0.0%	100.0%	100.0%
	Suprasellar Craniopharyngeoma	Frequency	0	0	0
		Percentage	0.0%	0.0%	0.0%
	Prolactinoma	Frequency	1	2	3
		Percentage	33.3%	66.7%	100.0%

Table 7 displays the distribution of patients based on LH level, gender and type of sellar and suprasellar masses. It can be inferred from the table that 100% of the male patients with Pituitary Microadenoma have normal LH. Similarly, 32.1% of the male patients with Pituitary Macroadenoma have normal LH level and 76.9% have low LH level. 50% of the male patients with Rathke cleft cyst, have normal LH level and the remaining 50% have low LH level. All the male patients with Granulomatous Hypophysitis have normal LH level. 100% of the male patients with Suprasellar Craniopharyngeoma have low LH level.100% of the female patients with Pituitary Microadenoma have normal LH. Similarly, 60% of the female patients with Pituitary Macroadenoma have normal LH and 40% have low LH level. 100% of the female patients with Rathke cleft cyst, have normal LH level. All the female patients with Tuberculum Sella Meningioma have low LH level. 33.3% of the female patients with prolactinoma have normal LH and 66.7% have low LH level.

Graph 5: Distribution of Patients based on type of masses and LH level

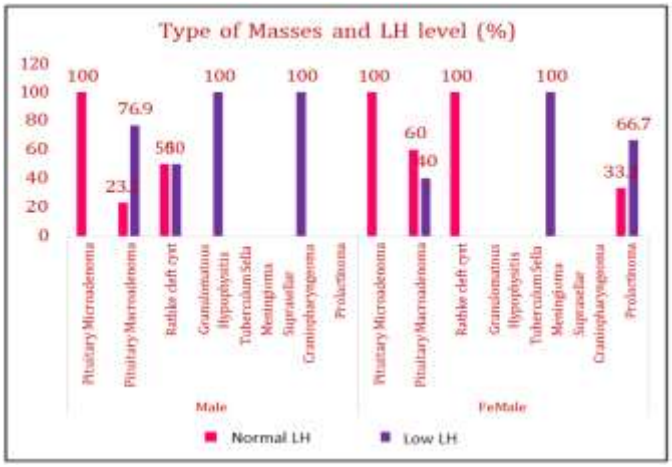


Table 8: Distribution of Patients based on type of masses and Estradiol level in female patients

Type of Sellar masses and Suprasellar masses		Estradiol Level		Total
		Normal	Low	
Pituitary Microadenoma (NFPA)	Frequency	1	0	1
	Percentage	100.0%	0.0%	100.0%
Pituitary Macroadenoma (NFPA)	Frequency	4	1	5
	Percentage	80.0%	20.0%	100.0%
Rathke cleft cyst	Frequency	0	1	1
	Percentage	0.0%	100.0%	100.0%
Granulomatous Hypophysitis	Frequency	0	0	0
	Percentage	0%	0%	0%
Tuberculum Sella Meningioma	Frequency	0	1	1
	Percentage	0.0%	100.0%	100.0%
Suprasellar Craniopharyngeoma	Frequency	0	0	0
	Percentage	0%	0%	0%
Prolactinoma	Frequency	1	2	3
	Percentage	33.3%	66.7%	100.0%

Table 8 displays the distribution of female patients based on estradiol level and type of sellar and suprasellar masses. It can be inferred from the table that 100% of the female patients with Pituitary Microadenoma have normal Estradiol level. Similarly, 80% of the patients with Pituitary Macroadenoma have normal Estradiol level and 20% have low Estradiol.100% of the patients with Rathke cleft cyst, have low Estradiol level. 100% of the patients with Tuberculum Sella Meningioma have low estradiol level. 33.3% of the female patients with prolactinoma have normal estradiol while 66.7% have low levels of estradiol.

Graph 6: Distribution of Patients based on type of masses and Estradiol level

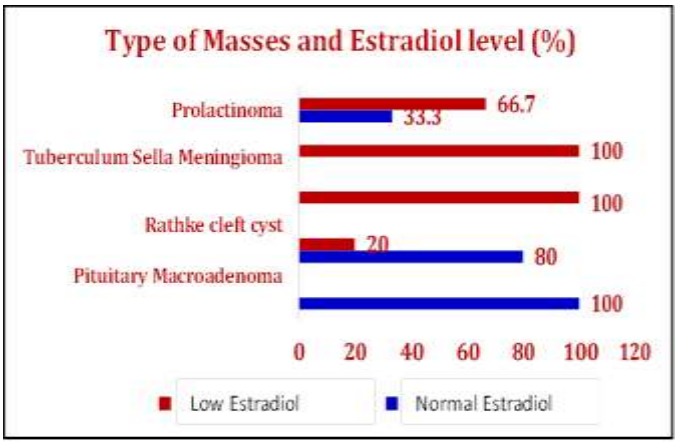
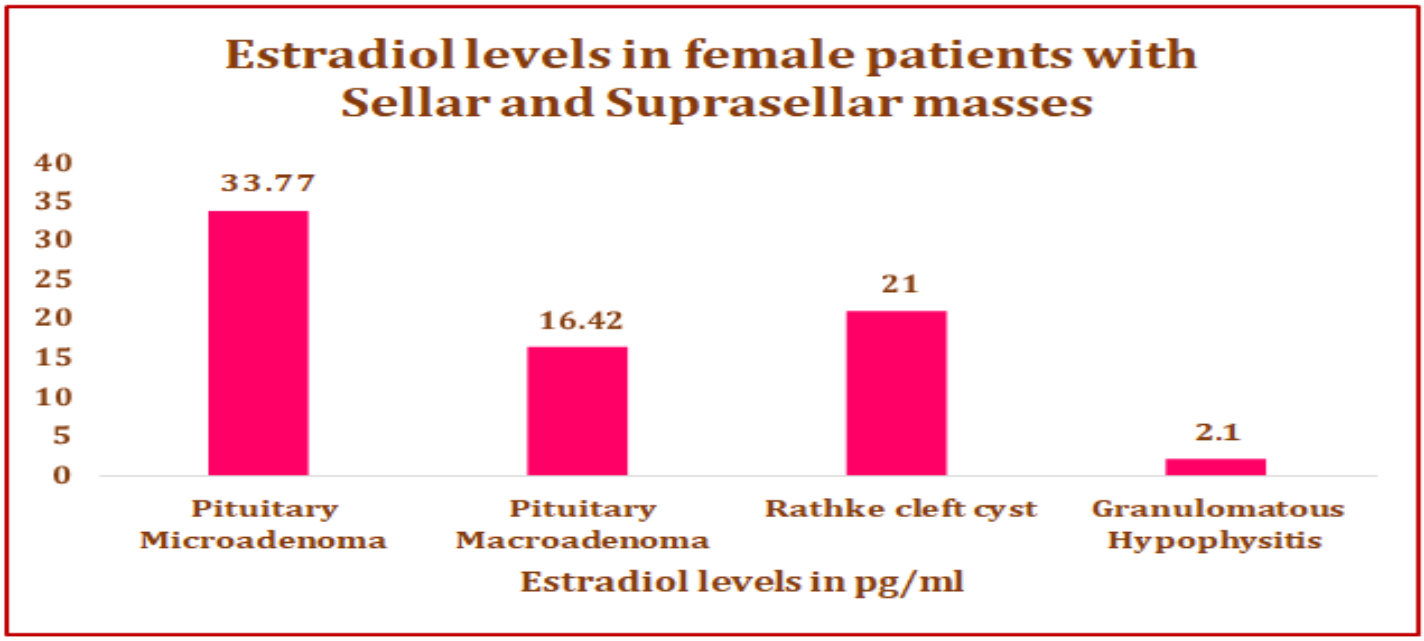


Table 9: Estradiol levels in female patients with different Sellar and Suprasellar Masses

Type of Sellar and Suprasellar masses	N	Estradiol levels in pg/ml		ANOVA "F" (P value)
		Range	Mean ± Std. Deviation	
Pituitary Microadenoma (NFPA)	1	60.00	60.00±0.0	1.239 p=0.387 (p>0.05 Not Significant)
Pituitary Macroadenoma (NFPA)	5	2.30 –55.00	16.4200±21.852	
Rathke cleft cyst	1	21.00	21.000±0.0	
Granulomatous Hypophysitis	1	2.10	2.100±0.0	
Prolactinoma	3	15.10-44.0	25.03±16.43	
Total	11	2.10 –60.00	21.8455±21.15200	

Table 9 displays the Estradiol level in female patients with different types of Sellar and Suprasellar masses. The Mean Estradiol level in Patients with Pituitary Microadenoma is 60.00 ± 0.00 pg/ml. Similarly, the Estradiol level in Patients with Pituitary Macroadenoma is 16.4200±21.852 pg/ml with a minimum of 2.30pg/ml and maximum of 55.00pg/ml. The mean Estradiol level in Patients with Rathke Cleft Cyst is 21.00 pg/ml and Granulomatous Hypophysitis is 2.10 pg/ml. The mean Estradiol level in patients with prolactinoma is 15.10±44.0 with a minimum of 25.03 pg/ml and maximum of 16.43 pg/ml. However, there is no significant difference in the Estradiol levels in the female Patients with different types of Sellar and Suprasellar masses as the ANOVA _F' value (1.239; p>0.05) is insignificant at 5% level.

Graph 7: Estradiol levels based on type of Sellar and Suprasellar masses



Discussion

In the present study various types of sellar and suprasellar masses are studied in different adult age group regarding their hormonal and metabolic profile. 60% of the patients have pituitary Macroadenoma, 10% have pituitary Microadenoma and 10% have Rathke cleft cyst.

Majority of the patients (43.3%) are of the age group 31 to 50 years, followed by 26.7% of them between 51 and 70 years, 20% belonging to less than 30 years and the remaining 10% above 70years of age.63.3% of the patients in the study group are Male and the remaining 36.7% are female in the present study.

Most of them found to have normal hemoglobin. Only 36% people had mild anemia. None of them presented with severe anemia. Anemia is seen in 33% of NF pituitary microadenoma, 39% of pituitary macroadenoma, 100% in suprasellar craniopharyngioma and 66% of prolactinoma patients.

RBS and HbA1C levels are studied in our group of patients to rule out impaired glucose tolerance levels which is mostly associated with pituitary disorders.

LH and FSH levels are low in almost 60% and 67% of patients studied respectively. Hypogonadism is noted in significant number of patients studied. In male patients, low testosterone is observed in 50% patients with NF

pituitary macroadenoma, 85% patients with NF pituitary microadenoma, 50% patients with rathke cleft cyst, 100% in meningioma and prolactinoma patient. However, Low estradiol is observed in 20% of NF pituitary macroadenoma, 100% of rathke cleft cyst and meningioma patients. Two third of patients with prolactinoma had low estradiol.

Conclusion

In this study of sellar and suprasellar masses, Non Functioning Pituitary Adenomas are the commonest presentation followed by prolactinoma and other tumors. Out of 30 patients studied, only 3 patients has hypersecreting prolactinoma, whereas majority of other tumors has hyposecretion of hormones. Among the patients studied, around 60% had central hypothyroidism and 63% had hypocortisolism. Hypogonadism is noted in 50%male patients and 16% in female patients. Panhypopituitarism is noted in 33% of the patients studied, out of which 80% belongs to Non functioning pituitary macroadenoma and the rest is seen in sella meningioma and suprasellar craniopharyngioma.

Limitations of The Study

- The main limitation of the study is the small sample size and the results will be more significant if the sample size is large.
- Children were not included in the study thus neglecting the uniformity in sample selection.
- The severity of adenomas was not assessed in the present study which will be better estimation of the actual influence of metabolism and Hormones in the masses.

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