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Magnitude, Clinical Presentation and Outcome of Patients with Pituitary Lesions: An Experience from Tikur Anbessa Specialized Hospital, Ethiopia

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Abstract

Background: Pituitary tumors are frequently encountered intracranial neoplasms. The prevalence of these tumors in autopsy series is reported to be significant in many studies. However, there are no adequate studies on magnitude, clinical presentation and outcome of pituitary lesions in our country.

Patients and methods: A retrospective study, data collected using chart review was conducted at national endocrine referral clinics of the hospital. A five years data from June 2010 to June 2015 was collected. The patients' clinico-demographic and radiologic features were documented using a prestructured data collection tool. Data was entered into SPSS version 20 and analyzed. Frequencies and means were computed for description of the various variables. Individuals aged 14 years and above from both sexes who started follow-up in the study years at Tikur Anbessa Specialized Hospital Endocrinology Clinics were included in the study.

Results: Out of the total of 1124 patients seen at endocrine clinics 51 (4.54%) were diagnosed to have pituitary lesions. A total of 42 patients with confirmed pituitary lesions were included in the analysis out of which 30 (71.4%) were females and 12 (28.6%) were males. The age range was 14 to 60 years old (mean age was 32.5 years). Among the 42 patients 20 (47.6%) had prolactinoma, 9 (21.43%) Cushing's disease, 7 (16.67%) acromegaly, 2 (4.76%) features of both prolactinoma and acromegaly, 2 (4.76%) panhypopituitarism, 1 (2.38%) hypogonadism and 1 (2.38%) nonfunctional pituitary adenoma. The most common presenting symptoms were headache in 33(78.6%) and visual disturbances in 20(47.6%) of patients. Among the 42 patients 26 (61.9%) had pituitary macroadenoma, 5 (11.9%) pituitary microadenoma, 7 (16.7%) normal Magnetic Resonance Imaging (MRI) and 4 (9.5%) of patients had no MRI. Of all patients included in the analysis 24 (57.1%) were treated medically only to control hormone secretion, 11(26.2%) patients were referred for surgical intervention and the rest were treated with both medical and surgical approaches or with regular follow-up only. Most of the patients with prolactinoma (80%) had improvement with medical treatment only.

Conclusion: Pituitary lesions accounted 4.54% of endocrine patients and Prolactinomas were the most common followed by Cushing's disease and Acromegaly. The patients with Prolactinomas had a good outcome with medical treatment only.

Keywords: Pituitary adenoma; Prolactinoma; Acromegaly; Cushing's disease; Hypopituitarism

Background

Pituitary adenomas account for 10 to 15% of all intracranial tumors [1,2]. The prevalence of these tumors in autopsy series is reported to be 5-20%, with most series estimating the prevalence to be approximately 10% [3]. Another meta-analysis found an overall estimated prevalence of pituitary adenomas of 16.7% (14.4% in autopsy studies and 22.5% in radiologic studies) [4]. In a cross-sectional study done in England the prevalence of clinically apparent adenomas was 78.87 cases/100 000 inhabitants [5]. The pituitary adenomas are either clinically functioning adenomas or non-functioning adenomas [6].

In a study done in Romania there was no significant difference between sexes, 65% of patients had pituitary macroadenomas, 51.3% were non secreting pituitary adenomas and 65.2% were operable [7]. In a large demographic study in US they observed that incidence rates increased with age and were higher in males in later life and in females in early life [8]. In a study done in Belgium among the group 67.6% were females and had a mean age at diagnosis of 40.3 years and 42.6% had macro adenomas [9]. In the English study the series comprised prolactinomas (56%), acromegaly (11%), non-functional pituitary adenomas (NFPA) (17%), Cushing's disease (1.6%) and pituitary masses of unknown functional status (14%) [5]. In the study stated above Prolactinomas comprised 66% of the group, with the rest having nonsecreting tumors (14.7%), somatotropinomas (13.2%), or Cushing's disease (5.9%); 20.6% had hypopituitarism [9].

Prolactinomas are the most common secretory pituitary tumor with a prevalence of 45-50 per million [5]. Serum levels of prolactin correlate with tumor size, with levels above 250 ng/Ml consistent with a macro adenoma [10]. Clinical symptoms and signs include oligo or amenorrhea in women and hypogonadism in men, infertility, and galactorrhea. In one series of patients with prolactinomas the mean age

was 29.7 year and 49.2% had a microadenoma, and 50.8% had a macroadenoma, of which 20% were intrasellar and 30.8% were extrasellar adenoma [11]. Acromegaly is a disease of disproportionate skeletal, tissue, and organ growth. The incidence of acromegaly is only 3 cases per million per year with an overall standardized mortality ratio of patients with acromegaly being 1.48 [12]. In one study of acromegalic patients there was no significant difference of proportion of men and women and 74.7% had a macro adenoma with a mean tumor diameter of 1.86 cm (0.2–4.6) [13]. Corticotroph adenomas represent approximately 10–12% of all pituitary adenomas and are seen predominantly in women, with a female to male ratio of 8:1 and with a peak incidence in the third to fourth decades of life [3].

In a retrospective study done in North West Italy to determine the clinical presentation of patients with NFPA the main presenting symptoms were visual defect (67.8%) and headache (41.4%) and the most frequent clinical symptom was hypogonadism (43.3%) and almost all tumors were macro adenomas (96.5%) [14]. Hypopituitarism is the inability of the pituitary gland to provide sufficient amount of one or more of the hormones (adapted to the needs of the organism). Incidence and prevalence of hypopituitarism was estimated to be 4.2 per 100 000 per year and 45.5 per 100 000, respectively [15].

In a study done here in Ethiopia, Pituitary adenomas constituted 14.6% of all studied intracranial masses and the mean size of the lesions was 4.1cm (2.9-5 cm) [16]. In another study on pituitary adenomas, the authors reported that 53.3% patients were males and 46.7% were females; the most common presentations being headache in 93.3% and visual disturbances in 86.7% [17].

In a meta-analysis on pituitary adenomas the authors concluded that given the high frequency of pituitary adenomas and their potential for serious consequences, early diagnosis and treatment will have significant benefits [4].

All the above studies show that pituitary lesions are common endocrine disorders and are associated with significant morbidity and mortality. To date, baseline data regarding the magnitude of pituitary lesions and patterns of common clinical presentations, laboratory and imaging features and treatment outcomes in Ethiopia are not adequately studied.

The aim of the study was to assess the magnitude, clinical presentation and outcome of pituitary lesions seen at Tikur Anbessa Specialized Hospital (TASH) National Endocrinology Referral Clinics, Addis Ababa (AA), and Ethiopia.

Materials and Methods

A retrospective study was conducted at National Endocrine Referral Clinics of TASH from June 15 to August 15, 2015.

The hospital is a university teaching and the national Endocrine referral center, where the endocrine clinics are active throughout the week managing diabetic patients and other endocrine diseases. The endocrine clinics are separate from diabetic clinics. An average of 100-120 patients per week have follow up in the endocrine referral clinics, the rotation of follow up period varies from 1 week to 16 weeks. The Endocrine clinics are run by five consultant endocrinologists, a fellow, and senior residents. The final diagnosis of patients is usually set by the endocrine consultants. Individuals with pituitary lesions visiting national referral endocrinology clinics of Tikur Anbessa Specialized Hospital diagnosed by clinical evaluation and biochemical tests whose diagnosis was set by the consultant Endocrinologists were included in the study. All consecutive patients coming to the endocrine referral clinics with pituitary lesions who fulfilled the inclusion criteria were included in the study.

Individuals aged 14 years and above from both sexes who started follow up in the study years at Tikur Anbessa Specialized Hospital Endocrinology Clinics were included in the study. Patients younger than fourteen years old were not included because they have follow-up in pediatric clinics. Charts with inadequate information were excluded from the study.

A structured data collection tool (data extraction format) which has four parts (demographic data, clinical manifestations, laboratory and imaging results and outcome) was used. Data was collected by two internal medicine residents after being well trained. Patient's charts were retrieved during follow-up clinics and from appointment and follow up registration books at endocrinology clinics. A five years data from June 2010 to June 2015 was collected. The patient's clinico-demographic and radiologic features were documented. The completed data collection tool was checked for completeness, consistency and was coded. Data was entered into statistical soft wares (SPSS version 20) and analyzed. Descriptive statistics was performed for the prevalence of clinical presentations, laboratory and imaging results and outcomes using simple frequencies.

Ethical approval

Ethical clearance was obtained from research ethics committee of Department of Internal Medicine, School of Medicine and Institution Review Board of College of Health Sciences of Addis Ababa University. The data collected was anonymous and was coded in numbers. No personal identifiers were collected and confidentiality was well maintained.

Results

Out of the 1124 patients seen at national endocrine referral clinics of TASH during the study period, 51 (4.54%) patients were diagnosed to have pituitary lesions. Nine patients were excluded from analysis because of inadequate information on the chart. A total of 42 patients with confirmed pituitary lesions were included in the analysis out of which 30 (71.4%) were females and 12 (28.6%) males. The age range was from 14 to 60 years old (median age was 29.5 years and mean age was 32.5 years (SD 10.7) (Table 1).

Characteristics		Numbers.	Percentage (%)
Sex	Female	30	71.4
	Male	12	28.6
Address	Urban	19	45.2
	Rural	23	54.8
Age group (years)	14-20	5	11.90
	21-30	20	47.62
	31-40	7	16.67
	4-50	7	16.67
	51-60	3	7.14

Table 1: Sociodemographic characteristics of patients with pituitary lesions at National Endocrine Referral clinics, TASH, June 2010 to June 2015.

Twenty (47.6%) had prolactinoma, 9 (21.43%) Cushing disease, 7 (16.67%) acromegaly, 2 (4.76%) patients had features of both prolactinoma and acromegaly, 2 (4.76%) presented with panhypopituitarism, 1 (2.38%) presented with hypogonadism and 1 (2.38%) had nonfunctioning pituitary adenoma (Table 2). The most common presenting symptoms were headache and visual disturbances in 33(78.6%) and 20(47.6%) of patients respectively (Table 3).

	Female	Male	Total	
			Numbers.	Percentage (%)
Prolactinoma	16	4	20	47.62
Acromegaly	5	2	7	16.67
Cushings disease	8	1	9	21.43
Hypogonadism	0	1	1	2.38
Panhypopituitarism	0	2	2	4.76
Acromegaly plus Prolactinoma	1	1	2	4.76
Nonfunctioning adenoma	0	1	1	2.38
Total	30	12	42	100.00

Table 2: Types of Pituitary lesions by sex of patients at National Endocrine Referral clinics, TASH, June 2010 to June 2015

	Numbers.	Percentage %
	For all patients (n=42)	
Headache	33	78.57
Blurred or double vision	20	47.62
High blood sugar or Diabetes	14	33.33
High blood pressure	14	33.33
	For patients with Prolactinoma (n=20 n=16(females) n=4(males)	
Headache	20	100
Blurred or double vision	10	50
Changes in menstrual cycle in women (n=16)	16	100
	For patients with Acromegaly (n=7)	
Headache	6	85.71
Blurred or double vision	7	100
Growth of skull, hands and feet	7	100
High blood sugar or Diabetes	4	57.14
	For patients with Cushings disease (n=9)	
Headache	4	44.44
Blurred or double vision	3	33.33
Unexplained weight gain	9	100
High blood sugar or diabetes	5	55.56
High blood pressure	8	88.89

Table 3: Frequency of common clinical manifestations in patients with Pituitary lesions at National Endocrine referral clinics, TASH, June 2010 to June 2015

In 40 (95.2%) of patients Pituitary adenoma was the cause of Pituitary lesions. Of all patients 26 (61.9%) had pituitary macroadenoma, 5 (11.9%) had pituitary microadenoma, 7 (16.7%) had normal MRI and 4 (9.5%) of patients had no MRI (Figures 1 and 2).

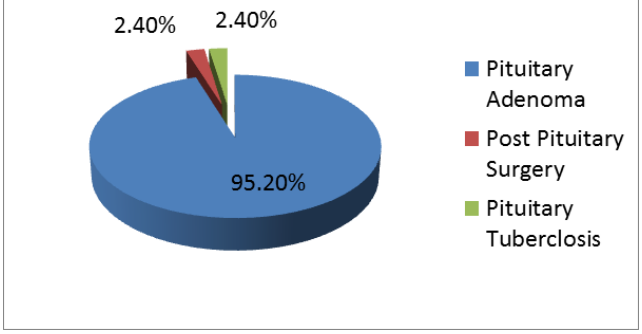

Figure 1: The etiology of pituitary lesions at National Endocrine referral clinics, TASH, June 2010 to June 2015.

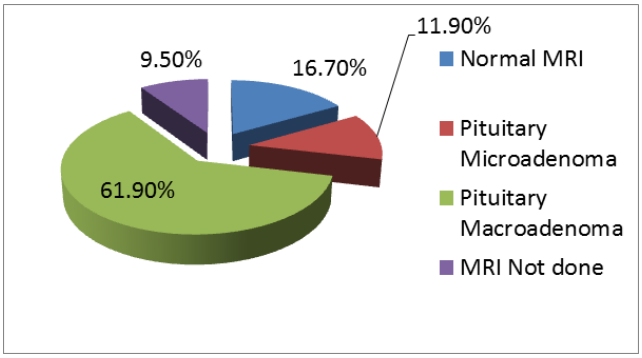

Figure 2: The MRI findings of pituitary lesions at National Endocrine referral clinics, TASH, June 2010 to June 2015.

Among the 20 patents with prolactinoma 16 (80%) were females and 4 (20%) males. The mean age was 32.25 years (SD 9.82). All of the patients had headache at presentation while 10 (50%) had visual

disturbances, all female patients had changes in menstrual cycle and 7 out of 16 women had galactorrhea. Eighteen out of twenty (90%) of the patients had high prolactin level with the mean prolactin level at diagnosis being 714.45 ŋg/ml (normal range 2.5-25 ŋg/ml). Twelve out of them (60%) had pituitary macro adenoma, 5 (25%) had pituitary micro adenoma and 3 patients had no MRI.

Out of the 9 patients with ACTH (Adrenocorticotropic hormone) dependent Cushing syndrome 8 (88.89%) were females. The diagnosis of ACTH dependent Cushing syndrome due to pituitary adenoma was made by consultant Endocrinologists after thorough clinical, biochemical and imaging studies. The mean age of them was 25.55 years (SD 5.10). The presenting complaints of these patients were unexplained weight gain, purple stretch marks over the trunk and abdomen and changes in menstrual cycle in women. Eight of the nine patients (88.89%) were having hypertension, 5 (55.56%) high blood sugar or diabetes, and 3 (33.33%) had compressive symptoms (headache and blurring of vision). Three (33.33%) of the patients had pituitary macro adenoma on MRI.

Seven patients were diagnosed with acromegaly out of which 5 (71.43%) were females. The mean age was 36 years (SD 10.01). Excessive growth of skull, hands and feet, widening of teeth and protruding jaw and headache were the presenting features in all of the patients. Four (57.14%) of the patients had compliant of blurring of vision, or visual loss. Four (57.14%) patients also had high blood sugar or diabetes. Six of the seven (85.71%) patients had MRI which showed pituitary macro adenoma.

Two patients (one male and one female) had clinical and biochemical features of both prolactinoma and acromegaly. They were 45 and 52 years old respectively. Both patients had pituitary macro adenoma on MRI and they were referred for surgical intervention. Two patients (both males) had panhypopituitarism. One of them was after pituitary surgery and the other was following treatment for tuberculous meningitis. One patient was diagnosed with hypogonadism after he presented with complaint of blurred vision and erectile dysfunction and he had pituitary macro adenoma on MRI. Another patient who presented with headache was diagnosed to have nonfunctioning pituitary macro adenoma.

When we come to the treatment used, it was individualized for each case (Table 4). Of all patients 24 (57.1%) were treated medically just to control hormone secretion and associated manifestations, 11 (26.2%) patients were referred for surgical intervention and the rest were treated with both medical and surgical approaches or with just regular follow up only. Eighty five percent of patients with prolactinoma were treated only medically. One patient with Prolactinoma, 1 with acromegaly and 2 with Cushing's disease who underwent surgery were having follow up at endocrine clinics. Four (57.1%) of the patients with Acromegaly and 3 of the patients with Cushing's disease (33.3%) were referred to surgical side for intervention.

	Medical only		Surgical only		Medical plus surgical		Follow up only		Referred for surgery		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	
Prolactinoma	17	85	0	0	1	5	0	0	2	10	20
Acromegaly	1	14.3	0	0	1	14.3	1	14.3	4	57.1	7
Cushing's disease	4	44.4	2	22.2	0	0	0	0	3	33.3	9
Hypogonadism	1	100	0	0	0	0	0	0	0	0	1
Panhypopituitarism	1	50	0	0	1	50	0	0	0	0	2
Acromegaly plus prolactinoma	0	0	0	0	0	0	0	0	2	100	2
Nonfunctioning Pituitary adenoma	0	0	0	0	0	0	1	100	0	0	1
Total	24	57.1	2	4.8	3	7.1	2	4.8	11	26.2	42

Table 4: Type of treatment used for patients with Pituitary lesions at National Endocrine Referral clinics, TASH, June 2010 to June 2015

The treatment outcome for each of the types of pituitary lesions is shown in Table 5. Most of the patients with prolactinoma (80%) had improvement while the treatment outcome for most (71.4%) with acromegaly was unknown since they were referred to other hospitals or surgical side for surgical intervention. The treatment outcome of 22.2% of patients with Cushing's disease was unknown because of poor documentation and referral for neurosurgical intervention. Improvement of clinical findings was documented for 2 of the patients with Cushing's disease which are the patients who underwent surgical intervention. In 5 (55.6%) of patients with Cushing's disease who were on medical treatment to control associated symptoms and having follow up, improvement was not documented.

	Improved		Same		Unknown		Total
	No.	%	No.	%	No.	%	
Prolactinoma	16	80	2	10	2	10	20
Acromegaly	0	0	2	28.6	5	71.4	7
Cushings disease	2	22.2	5	55.6	2	22.2	9
Hypogonadism	0	0	1	100	0	0	1
Panhypopituitarism	2	100	0	0	0	0	2
Acromegaly plus prolactinoma	0	0	0	0	2	100	2

Nonfunctioning Pituitary adenoma	0	0	1	100	0	0	1
Total	20	47.6	11	26.2	11	26.2	42

Table 5: Treatment outcome of patients with Pituitary lesions at National Endocrine Referral clinics, TASH, June 2010 to June 2015

Discussion

This retrospective analysis has shown some relevant facts about the magnitude and type of Pituitary lesions in the country and common clinical presentations and imaging findings. Although pituitary tumors are said to account for 10 to 15% of all intracranial neoplasms, their true incidence has not been established with certainty [1-4]. In our study pituitary lesions accounted for 4.54% of patients who visited endocrine clinics of TASH. In a study done in Pakistan which reviewed more 3500 Brain MRI reports they found that 9% of patients had pituitary lesions [18]. A study from Cameroon which reported the neuro endoscopy experience stated that 11.8% of the procedures were performed for pituitary macro adenoma [19].

Most (71.4%) of our patients were females, the mean age was 32.5 years and 61.9% had pituitary macro adenomas which is consistent with studies from other countries [9-20]. Overall, headache (in 78.57%) and visual disturbances (in 47.62%) were the most common presentations which is similar to other studies done in Ethiopia and Kenya [17-20] and which is expected since most of our patients (61.9%) had pituitary macro adenoma resulting in compressive symptoms.

Prolactinomas were the most common type of pituitary lesions similar to studies done in other countries followed by Cushing's disease and Acromegaly [3,5,20]. ACTH-dependent Cushing syndrome accounted for 21.43% of all patients with pituitary lesions which is a higher proportion when compared to other studies. We believe that this difference is due to the fact that this group of patients is referred early because of the associated hypertension and diabetes which can be diagnosed easily and which was seen in most of these patients. In a previous study from TASH done by Feleke et al. the authors concluded that Cushing's disease was the most common cause of Cushing's syndrome [21].

Two patients had features of both Prolactinoma and Acromegaly and both of them had Pituitary macro adenomas. Plurihormonal adenomas are rare pituitary tumors that have immune reactivities for more than one pituitary hormone and at the time of diagnosis, these tumors are usually macro adenomas [6] which were the case in our two patients.

Only few patients had complete biochemical and imaging work up due to lack of strong sustainable laboratory and imaging services in the hospital. Most of patients with prolactinoma were treated medically with bromocriptine and had improvement though there were treatment interruptions by most of the patients due to shortage of the medication. The endocrine society clinical practice guideline for diagnosis and management of hyperprolactinomas states that dopamine agonist therapy can lower prolactin levels, decrease tumor size, and restore gonadal function for patients harboring symptomatic prolactin-secreting micro or macro adenomas[10].

Only few patients with acromegaly and Cushing's disease underwent surgery because of the fact that the neurosurgical setup is not strong and sustainable in the hospital. The guidelines recommend transsphenoidal surgery as the primary therapy in patients with acromegaly and Cushing's disease [22,23]. Since most of our patients with acromegaly and Cushing's disease did not undergo surgery despite the guidelines recommendation, the treatment outcome of these groups of patients was either the same or unknown due to referral to other centers. Our patients with hypopituitarism improved with medical treatment. A review article on hypopituitarism recommends individualized doses of hormone replacement with long-term endocrinological follow up [24].

Eleven (26.2%) of patients were referred abroad or to a private Hospital. This shows that there is a limited treatment option at TASH for patients with Pituitary lesions resulting in many referrals of patients for neurosurgical intervention and/or radiotherapy.

Our study has some limitations. First, there was a difficulty of retrieving charts of patients and even some of the patients' charts were lost. Second, there were many charts with incomplete information which we were forced to exclude them from this study. Third, this is a retrospective hospital based study which lacks representativeness when compared to community based studies.

Conclusion

Pituitary lesions accounted 4.54% of endocrine patients and Prolactinomas were the most common followed by Cushing's disease and Acromegaly. The patients with Prolactinoma had a good outcome with medical treatment only.

Recommendations

The hospital should be equipped with strong and sustainable diagnostic facilities like hormonal studies and magnetic resonance imaging and neurosurgical service. We recommend future epidemiological and prospective clinical studies to assess the outcome of treatment of the different pituitary lesions.

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References

1. Fan KJ, Pezeshkpour GH (1992) Ethnic distribution of primary central nervous system tumors in Washington, dc, 1971 to 1985. J Natl Med Assoc 84: 858-863.
2. Counsell CE, Collie DA, Grant R (1996) Incidence of intracranial tumours in the Lothian region of Scotland, 1989-90. J Neurol Neurosurg Psychiatry 61: 143-50.
3. Arafah BM, Nasrallah MP (2001) Pituitary tumors: pathophysiology, clinical manifestations and management. Endocr Relat Cancer 8: 287-305.
4. Ezzat S, Asa SL, Couldwell WT, Barr CE, Dodge WE, et al. (2004) The prevalence of pituitary adenomas: a systematic review. Cancer 101: 613-619.
5. Fernandez A, Karavitaki N, Wass J (2010) Prevalence of pituitary adenomas: a community-based, cross-sectional study in Banbury (Oxfordshire, UK). Clin Endocrinol (Oxf) 72: 377-382.
6. Osamura RY, Kajiya H, Takei M, Egashira N, Tobita M, et al. (2008) Pathology of the human pituitary adenomas. Histochem Cell Biol 130: 495-507.

7. D Rotariu, S Gaivas, Z Faiyad, A Iencean, I Poeată (2011) Pituitary adenoma, therapeutic approach and surgical results. Romanian Neurosurgery 18: 465-447.
8. McDowell BD, Wallace RB, Carnahan RM, Chrischilles EA, Lynch CF, et al. (2011) Demographic differences in incidence for pituitary adenoma. Pituitary 14: 23-30.
9. Daly AF, Rixhon M, Adam C, Dempegioti A, Tichomirowa MA, et al. (2006) High prevalence of pituitary adenomas: a cross-sectional study in the province of liege, Belgium. J Clin Endocr Metab 91: 4769-4775.
10. Melmed S, Casanueva FF, Hoffman AR, Kleinberg DL, Montori VM, et al. (2011) diagnosis and treatment of hyperprolactinemia: an endocrine society clinical practice guideline. J Clin Endocr Metab 96: 273-288.
11. Losa M, Mortini P, Barzaghi R, Gioia L, Giovanelli M (2002) Surgical treatment of prolactin-secreting pituitary adenomas: early results and long-term outcome. J Clin Endocr Metab 87: 3180 -3186.
12. Melmed S (2006) Medical progress: Acromegaly. N Engl J Med 355: 2558-2573.
13. Cheng S, Agha R, Araujo PB, Serri O, Asa SL, et al. (2013) Metabolic Glucose Status and Pituitary Pathology Portend Therapeutic Outcomes in Acromegaly. PLoS One 8: 1-9.
14. Ferrante E, Ferraroni M, Castrignano T, Menicatti L, Anagni M, et al. (2006) Non-functioning pituitary adenoma database: a useful resource to improve the clinical management of pituitary tumors. Eur J Endocrinol 155: 823-829.
15. Schneider HJ, Aimaretti G, Kreitschmann-Andermahr I, Stalla GK, Ghigo E (2007) Hypopituitarism. Lancet 369: 1461-1470.
16. Tesfay M, Hawaz Y, Assefa G, Abebe M (2013) Radiological features and postoperative histopathologic diagnosis of intracranial masses at tikur anbessa specialized hospital and mcm hospital. East Centr Afr J Surg 18: 95-106.
17. Biluts H, Laeke T (2014) Microscopic transphneoidal surgery experence from christian Medical Center Addis Abeba Ethiopia. Ethiop Med J 52: 67-76.
18. Ishtiaq O, Haq M, Rizwan A, Masood M, Mehar S, et al. (2009) Etiology, functional status and short term outcome of patients with pituitary lesions. An experience from a developing country. J Pak Med Assoc 59: 839-843.
19. Ndoumbe A, Simeu C, Jemea B (2016) Eight years of neuroendoscopy practice at the university hospital center of yaounde: indications, procedures and results. Ann SurgInt 1: 1-9.
20. Githinji KJ, Kithikii KP, Kyalo MC, Junius MoN (2012) Clinical experience and outcome of pituitary surgery in Kenyan patients at the Kenyatta national hospital. Afr J Neurol Sci 31: 49-60.
21. Feleke Y, Abdulkadir J (1998) Cushing's syndrome: a ten year experience at Tikur Anbassa Hospital. Ethiop Med J 36: 19-26.
22. Katznelson L, Laws ER, Melmed S, Molitch ME, Murad MH, et al. (2014) Acromegaly: an endocrine society clinical practice guideline. J Clin Endocrinol Metab 99: 3933-3951.
23. Nieman LK, Biller BM, Findling JW, Murad MH, Newell-Price J, et al. (2015) Treatment of cushing's syndrome: an endocrine society clinical practice guideline. J Clin Endocrinol Metab 100: 2807-2831.
24. Kim SY (2015) Diagnosis and Treatment of Hypopituitarism. Endocrinol Metab (Seoul) 30: 443-455.