



Original Article

Tuberculum Sellae Meningioma vs Macroadenoma Hypophysis : How to Differentiate Preoperatively?

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Abstract

Background: Sellar region tumors may origin from a various number of structures and each of them have a specific clinical and radiological appearance. Among these pathological processes, one of the most challenging is to distinguish between tuberculum sellae meningioma and macroadenoma hypophysis. Differentiating these two entities preoperatively is very important to decide which approach will be most suitable and beneficial. The purpose of this study is to produce a simple preoperative scoring system to differentiate these two that can be used in specific conditions where MRI is not available or could not be performed.

Methods: This analytical retrospective cohort study contains data obtained from patients treated in Neurosurgery Department of Hasan Sadikin General Hospital-Bandung from 1 January 2008 until 31 December 2010. 34 patients were enrolled in this study, in which 15 of them were diagnosed with macroadenoma hypophysis and remaining 19 patients as tuberculum sellae meningioma which was confirmed with pathology examination.

Results: From clinical presentation we found that the event of endocrinopathy occurs significantly in macroadenoma hypophysis ($p=0.002$). Whereas from radiological evaluation there were 7 parameters that significantly distinguish these two entities including hyperostosis, sellar floor configuration, homogeneity of mass, contrast agent enhancement, waist configuration, peritumoral edema, and dural attachment. From these findings, we propose a simple scoring system to differentiate macroadenoma hypophysis and tuberculum sellae meningioma with a 84.2% sensitivity and 100% specificity.

Conclusion: Although MRI is the modality of choice in differentiating macroadenoma hypophysis and tuberculum sellae meningioma but our scoring system can be used as an aid in choosing best surgical approach.

Keywords: Tuberculum Sellae Meningioma; Macroadenoma hypophysis; CT scan

Introduction

Neurosurgery came to developing countries over a half a century ago, yet the vast majority of population in these countries do not have equity in access to it, owing to the cost of neurosurgical care and geographical isolation of patients. Many biomedical equipments such as CT Scan and MRI are not available to most of the population in these countries.¹

MRI is the examination of choice in pituitary and sellar region tumors because it depicts the complex anatomy around the sellar wall. Almost 30 pathologic entities occur in this region, and most can be distinguished using MRI.² Sellar region tumors are one of the most challenging tumor cases for neuro-surgeons. Two of the most common entities that should be distinguished because of their similarities especially in imaging studies are tuberculum sellae meningioma and macroadenoma hypophysis.³ Preoperative differentiation of these tumors is important for best surgical approach. Tuberculum sellae meningioma is usually operated by craniotomy approach, whereas macroadenoma hypophysis uses transsphenoidal approach.^{4,5}

We propose a simple scoring system based on clinical and radiological evaluation using CT Scan that can be used as an aid for determining surgical strategy in cases where MR imaging could not be performed.

Clinical Materials and Methods

This retrospective cohort study consists of 34 patients with sellar region tumors treated and operated in neurosurgery ward of Hasan Sadikin General Hospital from 1 January 2008 until 31 December 2010. Pathological confirmation showed

15 of these patients diagnosed with macroadenoma hypophysis and 19 patients with tuberculum sellae meningioma. Data collected included clinical presentation and various characteristics based on CT Scan imaging.

Statistical Analysis

Data were processed on a personal computer by using commercially available statistic software. These variables were compared using t test with p value ≤ 0.05 . Only significant variables were then summarized into a scoring system and then tested for its specificity and sensitivity.

Results

From 34 patients in our study, there were 12 male and 22 female patients with average age slightly higher in tuberculum sellae meningioma group. Table 1 shows various clinical presentation of these patients. As shown below, there is significant correlation of endocrine abnormalities ($p=0.002$) in macroadenoma hypophysis. Whereas there is no significant correlation between sex, age, duration of symptoms, tumor size, chief complaint, and visual field defect.

Based on radiological findings shown on CT Scan, there were certain characteristics that we analyzed to differentiate these two entities. According to table 2, there is significant correlation of various radiological presentations such as homogeneity on CT scan ($p=0.017$), contrast enhancement ($p=0.001$), hyperostosis ($p=0.002$), thinning of sellar ($p<0.001$), presence of edema ($p=0.004$), size of the sellar waist ($p=0.007$) and alodural attachment ($p<0.001$) of tumors originating as macroadenoma hypophysis or tuberculum sellae meningioma.

Table 1 Clinical presentation of patients diagnosed with Macroadenoma hypophysis and tuberculum sellae meningioma

Variables	MH (n=15)	TSM (n=19)	Total	p value
Sex				0.051*
Male	8 (66.7%)	4 (33.3%)	12 (35.3%)	
Female	7 (31.8%)	15 (68.2%)	22 (64.7%)	
Age (SD) (year)	35.80 (8.02)	39.84 (5.78)		0.097**
Tumor size (SD) (cm)	3.74 (1.53)	3.62 (0.86)		0.777**
Duration of symptoms (SD) (year)	2.24 (2.17)	1.83 (1.64)		0.539**
Clinical symptoms				0.098*
Headache	6 (66.7%)	3 (33.3%)	9 (26.5%)	
Visual Loss				0.009*
Negative	8 (100.0%)	1 (0.0%)	3 (8.8%)	
Unilateral	3 (30.0%)	7 (70.0%)	10 (29.4%)	
Bilateral	4 (26.7%)	11 (73.3%)	15 (44.1%)	
Visual field defect				0.397*
No defect	8 (53.3%)	7 (46.7%)	15 (44.1%)	
Hemianopia Bilateral	4 (33.3%)	8 (66.7%)	12 (35.3%)	
Hemianopia Unilateral	3 (66.7%)	4 (33.3%)	7 (8.8%)	
Endocrine abnormalities				0.002*
Positive	11 (73.3%)	4 (26.7%)	15 (44.1%)	
Negative	4 (21.1%)	15 (78.9%)	19 (55.9%)	

* Chi Square Test ** Mann Whitney test

Discussion

The sellae tursica which resembles a Turkish saddle if viewed from the side, forms a semicircular, central depression within the sphenoid bone. The antero-superior edge of the sella is marked by a horizontal ridge, the tuberculum sellae.⁶ Two of the most frequent pathological process found in this region are macroadenoma hypophysis and tuberculum sellae meningioma.^{3,7} Although according to previous reports the incidence varies according to age, gender, and ethnic group. In our series we found predilection for meningioma higher in female patients with average age of 40 years old.^{7,8,9}

As shown on table 1, there were three most common symptoms in our report; headache, visual disturbance and endocrinopathy. Although almost

70% of our patients complained of visual loss in either of these tumors, there was no significance in this data. In some series, greater than 95% of patients suffer visual acuity and/or field deficits and the pattern of vision loss can vary.^{7,8,9,10} In our series, diabetes insipidus occurrence was the highest endocrine abnormality present in macroadenoma hypophysis. This stalk compression effect was interestingly also present in 4 patients (26%) with tuberculum sellae meningioma.^{9,11}

The gold standard for imaging is MRI as detection rate varies in the literature from 65% to more than 90% for microadenomas but computed tomography and MRI are equivalent in detecting the full extent of a macroadenoma.^{9,11,12} CT scan still has a role in preoperative planning, particularly in

Table 2 Comparison of radiological presentation on CT Scan between macroadenoma hypophysis and tuberculum sellae meningioma

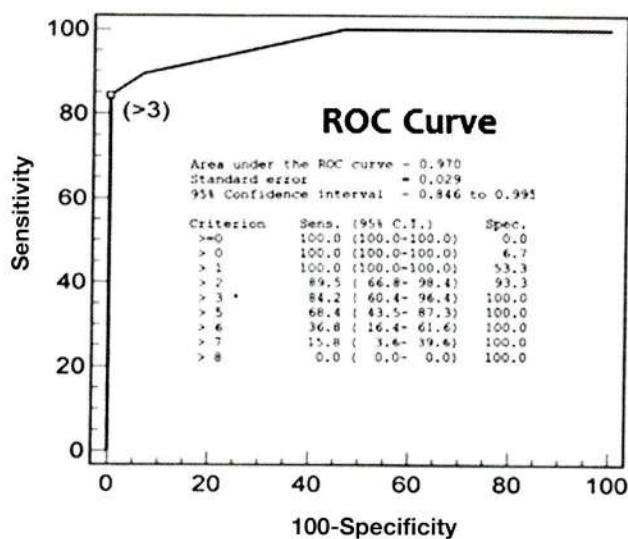
Variable	MH (n=15)	TSM (n=19)	Total	p value	PR(95%CI)
CT appearance				0.001*	2.74 (1.37-5.48)
Homogen	2 (13.3%)	13 (86.7%)	15 (44.1%)		
Inhomogen	13 (68.4%)	6 (31.6%)	19 (55.9%)		
CT Enhancement				0.001**	3.60 (1.75-7.42)
Minimal	9 (83.3%)	1 (16.7%)	10 (29.5%)		
Bright	6 (25.0%)	18 (75.0%)	24 (70.6%)		
Hyperostosis				0.002**	2.50 (1.54-4.04)
Negative	15 (60.0%)	10 (40.0%)	25 (73.5%)		
Positive	0 (0.0%)	9 (100.0%)	9 (26.5%)		
Thinning				<0.001**	5.75 (2.36-14.01)
Negative	4 (17.4%)	19 (82.5%)	23 (67.6%)		
Positive	11 (100.0%)	0 (0.0%)	11 (32.4%)		
Sellar Enlargement				<0.001**	7.53 (1.15-48.84)
Negative	4 (20.0%)	16 (80.0%)	20 (55.8%)		
Positive	11 (78.5%)	3 (21.5%)	14 (44.21%)		
Waist				0.008*	2.63 (1.10-6.24)
Negative	5 (25.0%)	15 (75.0%)	20 (58.8%)		
Positive	10 (71.4%)	4 (28.6%)	14 (41.2%)		
Peritumoral Edema				0.004*	2.36 (1.50-3.70)
Negative	15 (57.7%)	11 (42.3%)	26 (76.5%)		
Positive	0 (0.0%)	8 (100.0%)	8 (23.5%)		
Attachment				<0.001*	-
Negative	15 (100.0%)	0 (0.0%)	15 (44.1%)		
Tuberculum	0 (0.0%)	13 (100.0%)	13 (38.2%)		
Diaphragm	0 (0.0%)	6 (100.0%)	6 (17.6%)		
Mass Shaped				0.442	1.38 (0.56-3.44)
Round	16 (81.25%)	11 (73.3%)	27 (79.4%)		
Lobulated	3 (18.75%)	4 (26.6%)	4 (11.6%)		

* Chi Square Test ** Mann Whitney test

Table 3 Scoring system of various variables to differentiate between macroadenoma hypophysis and tuberculum sella meningioma

Variable	PA (n=15)	TSM (n=19)	Total	p value	Se	Sp	PPV	NPV
Score				<0.001*				
>3	0	16	16		84.2%	100%	100%	83.3%
≤3	15	3	18					

* Chi Square Test



Graph.1 ROC curve showing cut off point of 3 in determining our scoring system.



Tuberculum Sellae Meningioma



Macroadenoma Hypophysis



Fig.1 Tuberculum sellae meningiomas appear distinctively homogeneous and enhance entirely after application of contrast. On the contrary, macroadenoma hypophysis have various CT appearance with minimal contrast enhancement

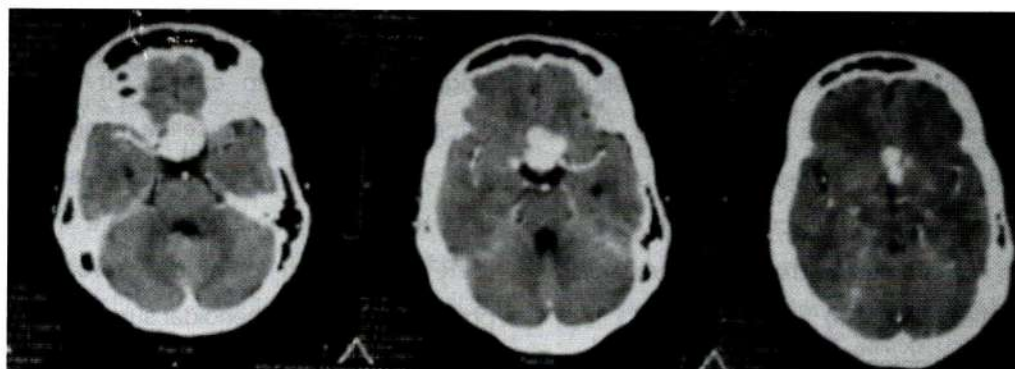


Fig.2 A CT Scan of a 44 year old lady diagnosed with tuberculum selae meningioma. Note the homogenous enhancement and lobulated configuration but no hiperostosis of the bone is present.

regard to pneumatization and the anatomy of the sphenoid sinus as not all neurological centres have MRI facilities.²

In our study, we found seven radiological criterias to help recognize these two entities. Macroadenomas have variable appearances because they tend to have necrosis, cyst formation, and hemorrhage that appear as mixed attenuation. Curiously there were 6 patients (31.6%) with tuberculum sellae meningioma that show inhomogeneity of mass and 1 patient (5%) showing minimal enhancement after contrast administration. Macroadenoma hypophysis are soft tumors which usually indent at the diaphragma sellae, giving them a 'snowman' configuration. This is one feature that can help distinguish between a pituitary macroadenoma and a meningioma.^{2,9} In our report,¹⁰ (66.7%) out of 15 patients showed a positive waist configuration and also 4 patients (21%) of tuberculum sellae meningiomas also had this feature.

As shown on table 2, there were more than 50% of tuberculum sellae meningioma that did not show signs of hyperostosis (10 patients, 52%) nor peritumoral edema (11 patients, 57%) which are usually characteristics for this type of tumor. Adjacent hyperostosis, best seen on CT, is present in more than one third of cases and is a helpful sign in meningiomas.^{12,13} In some previous reports, the sellae turcica is usually not expanded or only slightly enlarged in tuberculum sellae meningiomas. This is in accordance to our report where 3 patients (15.7%) with tuberculum sellae meningiomas had sellar enlargement, in contrast to macroadenoma hypophysis (11 patients, 68.7%).^{9,11}

Sellar floor thinning or erosion are other criterias that could be useful in diagnosing macroadenoma hypophysis. Eleven patients (68.7%) with macro-

adenoma hypophysis showed sellar floor thinning but there were 4 cases (26.7%) that did not have this feature. Obtuse dural margins and dural tail enhancement of lesions involving the sella, are helpful in the preoperative diagnosis.¹² Most of the specific CT scan features that we analyze in our series, showed significance in helping to diagnose macroadenoma hypophysis and tuberculum sellae meningioma.

After analyzing various variables in determining difference in the two types of tumors, we can state that there were eight variables demonstrating significance ($p < 0.05$) such as: endocrine abnormalities ($p = 0.002$), hyperostosis ($p = 0.002$), thinning of sellae ($p < 0.001$), waist configuration ($p = 0.008$), peritumoral edema ($p = 0.004$), dural attachment ($p < 0.001$), CT homogeneity of mass ($p = 0.001$) and contrast enhancement ($p = 0.001$). After analyzing using a ROC curve as shown on graph 1, we found a cut off point of 3 from these variables. Using our simple method, we came up with a very accurate scoring system to discern between macroadenoma hypophysis and tuberculum sellae meningioma as shown on table 3. This scoring system has a p value of < 0.001 with sensitivity of 84.2% and specificity of 100%. PPV value is 100% and NPV is 83.3% with accuracy of 94.1%.

Using our simple method we can help to diagnose these two entities. It is important to differentiate tuberculum sellae meningioma from the macroadenoma hypophysis, because craniotomy is done for meningioma, whereas a transsphenoidal route is preferred for most macroadenoma hypophysis.^{3,4,11,14} Transsphenoidal surgery is the approach of choice for macroadenoma hypophysis.¹⁵ Tuberculum sellae meningiomas usually have a firm, rubbery consistency and often require sharp

dissection rather than simple suctioning for their removal.¹¹ Based on our preference, all of our patients diagnosed with tuberculum sellae meningioma were operated using a pterional approach.

Conclusion

The superiority and usefulness of MRI is unquestionable as it is the gold standard imaging to distinguish macroadenoma hypophysis and tuberculum sellae meningioma but this modality is often not available in many countries. A simple scoring system can be useful as a tool for preoperative surgical strategy in differentiating these two entities. A score of more than 3 is most likely to be diagnosed as tuberculum sellae meningioma whereas less than 3 is representative for macroadenoma hypophysis.

Source of support

Nil

Conflict of interest

Authors have no conflict of interests.

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