

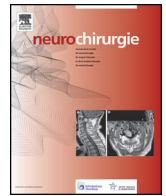


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Original article

# Is it really possible to predict the consistency of a pituitary adenoma preoperatively?



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## ABSTRACT

**Objectives.** – To determine if the consistency of pituitary adenomas can be predicted based on a preoperative MRI study and to assess the surgical outcome of firm pituitary adenomas.

**Materials and methods.** – One hundred consecutive patients with pituitary adenomas and suprasellar extension were operated by a transsphenoidal approach from July 2003 to December 2006. In addition to the neurological examination, the patients were evaluated by ophthalmological, endocrinological and radiological workups. The signal intensity of the lesion on T2WI and other dimensions of the tumors were included in the MRI study.

**Results.** – There were 52 male and 48 female patients with a mean age of 42.47 years. The mean diameter of the tumor was 32.97 mm and the mean SSE was 14.95 mm. Six out of 100 patients had firm adenomas preoperatively. Only one of the six patients had isointense SI on T2 WI. Of these 6 patients, total excision was performed in 1 patient, subtotal in 3 patients and partial excision in 2 patients. Among the six patients with firm adenomas, 4 had preoperative hypopituitarism ( $P < 0.001$ ). There was a statistically significant correlation between consistency and the postoperative permanent hypopituitarism ( $P < 0.001$ ). The average follow up was 43.5 months. The literature is reviewed and various aspects of pituitary adenoma consistency are discussed.

**Conclusions.** – With the present study, the consistency of pituitary adenomas cannot be reliably predicted based on a preoperative MRI study. Patients with firm adenomas likely to have more incidence of preoperative hypopituitarism and postoperative permanent hypopituitarism.

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## 1. Introduction

The transsphenoidal route is preferred for the excision of most pituitary tumors. The factors that determine the extent of tumour excision through this route are tumor size, invasiveness and consistency of the tumor. Soft tumors are easily curetted and removed with suction. They also descend more readily into the field of vision on increasing intracranial pressure. Fibrous tumors, in contrast, are more difficult to excise, often necessitating second stage surgery, stereotactic radiotherapy or transcranial

approaches. Several authors have reported that fibrous adenomas were firm and difficult to remove by curettage or aspiration [1–4]. Therefore, a fibrous/firm pituitary adenoma can be defined as tumor, which could not be removed, by aspiration and/or curettage and required piecemeal resection using a microdissector or tumor forceps. Some authors referred to tumors, which needed to be coagulated or cut with knife as “hard” or “fibrous” [5].

Consistency appears to be a significant determinant of the ease and extent to which a pituitary adenoma can be excised. Knowledge of the consistency of pituitary adenomas preoperatively would help in the operative strategy for the removal of these tumors. Previously, a few studies predicted the consistency of the pituitary adenoma from preoperative MRI T2 WI [1,3,4]. T2 WI MRI shows firm pituitary adenomas as isointense with the surrounding brain [1,4]. According to Snow et al., the possibility of an isointense lesion on T2WI to be fibrous is about 70% [1]. There is no relationship

**Abbreviations:** ADC, apparent diffusion coefficient; DI, Diabetes Insipidus; MRI, Magnetic resonance imaging; SI, Signal intensity; SSE, suprasellar extension.

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between tumor consistency and signal intensity on T1-weighted MR images [3].

The aim of our study was to determine if the consistency of the pituitary adenomas can be predicted based on a preoperative MRI study and to assess the surgical outcome of firm pituitary adenomas.

## 2. Material and methods

One hundred consecutive patients with pituitary adenomas and suprasellar extension operated by transsphenoidal approach from July 2003 to December 2006 were included in the study. One part of the study regarding the predictors of visual outcome with transsphenoidal excision of pituitary adenomas was published [6]. The primary objective of this part of the study was a preoperative MRI prediction of the consistency of pituitary adenoma and the secondary objective was to assess the impact of microsurgery for a firm adenoma based on pituitary function and visual outcome.

The patients were evaluated using a detailed neurological, ophthalmological, endocrinological and radiological workup. All the patients underwent 1.5 T MRI brain plain study. The signal intensity of the lesion on T2WI was recorded as compared to the white matter. The adenomas were classified into microadenoma (up to 10 mm), macroadenoma (> 10–40 mm), giant adenoma (> 40 mm). A spherical volume distribution was assumed and the estimated mean diameter of the tumor was used for further calculations. In the craniocaudal direction, the suprasellar extension was measured. A line was drawn on the mid-sagittal image from the tuberculum sellae to the upper end of the dorsum sellae to define the sella entrance. The maximal suprasellar extension (SSE) perpendicular to that line was measured on the mid-sagittal section. Parasellar extension of the adenoma was done according to Knosp and Steiner classification [7].

Each patient was evaluated by a thyroid profile, serum cortisol level (8 A.M. sample), serum prolactin level, serum growth hormone level, serum IGF-1, serum LH and serum FSH. Hypopituitarism was detected if one or more of the hormones were deficient. Functioning adenomas were defined by the specific elevated hormone. The only prolactinoma in the series of firm adenomas was not treated preoperatively with dopamine agonists.

A standard endonasal microscopic transsphenoidal approach was used for the surgical excision. If the was easily excised by suction and ring curettes, then it was termed soft adenoma. The lesions, which were difficult to remove with, ring curettes and required sharp dissection, bipolar cautery and/or surgical aspirator were termed firm adenomas. The excision rates were classified into 4

grades based upon the amount of residual lesion that was present in MR Imaging at 3 months follow up after excision—complete (no residual), near-total (< 15% residual), subtotal (> 15% residual) and partial (decompression of lesion).

The diagnosis of pituitary adenoma was confirmed histopathologically in all the patients. The fibrosis was graded semiquantitatively using Masson's trichrome stain to determine the extent of stromal fibrosis and visually graded as mild, moderate and severe. The average follow up was 43.5 (3–82) months. All the patients were assessed at the end of 3 months, 6 months, 1 year and then each year following surgery clinically, ophthalmologically, endocrinologically and radiologically. Postoperative MRI was done between 3 and 6 months following surgery and every year thereafter.

Data was recorded using Excel software (Microsoft, Seattle, WA) and was analyzed using SPSS software, version 13.0 (SPSS, Inc., Chicago, IL). Means and standard deviations were computed for continuous variables and marginal distributions for categorical variables. Comparison of categorical variables between the two groups was performed using the Chi<sup>2</sup> test and a *P* value of <0.05 was considered significant. Comparison of continuous variables between the two groups was performed using Mann-Whitney *U* test and a *P* value of <0.05 was considered significant.

## 3. Results

Of the 100 patients, 52 were males and 48 were females. Age range was 14 to 74 years with a mean of 42.47 ± 1.32 years. The common clinical features of the patients were headache (68%), visual symptoms (66%) and symptoms related to endocrinological disturbances (49%). The mean diameter of the tumor was 14.97 ± 1.03 (13–60) mm. The mean suprasellar extension was 14.95 ± 0.70 (2–40) mm. The parasellar extension was present in 27 patients. The visual parameters of the patients were analyzed and tabulated during the earlier part of the study [1].

Six out of 100 patients had firm adenomas preoperatively. They were non-suckable and were difficult to dissect with ring curettes. Five of them had non-functioning adenomas and the other had a prolactinoma. The clinical features, radiological, operative and endocrinological details of the patients with firm pituitary adenomas are shown in Table 1. Histopathologically, fibrosis was mild in 2 patients, moderate in 3 patients and severe in one patient. The radiological features, the functioning status of the adenoma and the excision rates of the tumours in the soft and firm adenoma groups are shown in Table 2. There were no statistical differences between the two groups as shown in Table 2. MR T2 WI of 3 different patients

**Table 1**  
The clinical features, radiological, operative and endocrinological details of the patients with firm pituitary adenomas.

Sl. no.	Age (yr), gender	Presentation	Endocrine status	Diameter in mm	SSE in mm	PS extension grade	MRI intensity – in relation to white matter on T2 WI	Excision rate	Preoperative hypopituitarism	Postoperative hypopituitarism	HPE – fibrosis
1	42, M	Headache, polyuria	NF	24.2	13	0	Hyperintense	Complete	DI	–	Mild
2	16, F	Seizures	NF	26	12	0	Isointense	Near-total	DI	DI	Mild
3	15, M	Headache, delayed secondary sexual characters	PRL+	27	14	3	Hyperintense	Partial	Hypogonadism	Hypogonadism	Severe
4	66, F	Visual blurring	NF	35	10	4	Hyperintense	Partial	Hypothyroidism, hypocortisolism	Hypothyroidism, hypocortisolism	Moderate
5	45, F	Apoplexy, visual blurring	NF	35.3	18	0	Hyperintense	Subtotal	–	–	Moderate
6	41, M	Visual blurring	NF	34	16	0	Hyperintense	Subtotal	–	Hypothyroidism, hypocortisolism	Moderate

SSE: suprasellar extension; PS: parasellar; NF: non-functioning; PRL: prolactin.

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