

### 3 Tesla Magnetic Resonance Imaging for Diagnosis and Surgery of Sellar Lesions

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#### Introduction

Standard MRI (1.5) is the standard diagnostic tool for endo- and parasellar structures. However, due to limited resolution it may pose a problem in the detection of small microadenomas and in the diagnosis of tumor infiltration of the cavernous sinus in macroadenomas (1,2).

The aim of the study was to determine the value of high-field magnetic resonance imaging (MRI) for diagnosis and surgery of sellar lesions.

#### Patients and methods

High-field MRI using a 3 Tesla (T) Bruker Medspec® 30/80 scanner with emphasis on sellar and parasellar structures was obtained from 21 patients for the following purpose: (1) To verify a pituitary microadenoma that was suspected endocrinologically and/or with conventional 1.0 – 1.5T (standard) MRI, (2) to preoperatively delineate endo-, supra- and parasellar anatomical structures with special regard to the medial border of the cavernous sinus and a possible invasion of a sellar tumor therein and (3) to assess the application of high-resolution images during intraoperative neuronavigation. 3T MRI was compared with the available standard MRI and with intraoperative findings.

#### Results

3T MRI depicted an endosellar hypointensity in 4 of 5 patients with a suspected pituitary *microadenoma*. In one of them the diagnosis of a microprolactinoma was consecutively confirmed by transsphenoidal surgery that was performed due to intractable side effects of medical therapy. *Anatomical structures* were studied in all 42 cavernous sinuses. In 32 of them, comparison with intraoperative findings was available. The medial cavernous sinus border was rated intact in 53% of standard MRI, in 72 % of 3T MRI and in 81% intraoperatively (figure 1). With a positive correlation to surgical findings in 84% of 3 T MRI compared to 59% of standard MRI, a sensitivity of 83% vs. 67% and a specificity of 84% vs. 58% ( $P=0.016$ , McNemar test) 3T MRI was superior in predicting tumor invasion through the medial cavernous sinus border (table 1). While no difference was noted with the medial, superior and inferior compartments there was a better delineation of the lateral cavernous sinus compartment using 3T MRI. It was clearly visible on 40 sinuses (95%) on 3T MRI vs. 34 sinuses (81%) compared to standard MRI. Identification of the cavernous sinus segments of the cranial nerves III, IV, V1, V2 and VI was improved using high-resolution 3T imaging than standard MRI (figure 2). In average, 4 cranial nerves as hypointense spots (range 2 – 5 spots) was found on 3T MRI vs. 3 (range 0 – 4) on standard MRI. After application of contrast media the anterior pituitary gland was found of high intensity on 78% of T1-weighted 3D-MP-RAGE 3T vs. 73% on standard T1-weighted MRI. The optochiasmatic system was found to be of increased intensity on pre-contrast T1-weighted MP-RAGE 3T compared to standard T1-weighted MRI. It was hyperintense on 76% of 3T vs. 15% of standard MR images, which was helpful for its delineation from suprasellar pituitary and tumor structures. *Intraoperative navigation* with fusion of 3T MR and computed tomography (CT) images was performed in 7 patients. While CT was used during the transsphenoidal approach depicting the bony nasal structures, 3T MR was particularly useful for visualization of parasellar tumor extension during microsurgical and/or endoscopic resection.

#### Conclusion

According to our preliminary results 3T MRI was found superior to standard MRI for diagnosis and surgery of sellar lesions. Due to its higher resolution 3T MRI was able to visualize microadenomas that were only suspected on standard MRI, to improve the diagnosis of cavernous sinus infiltration in macroadenomas by delineating parasellar anatomy to a detail that the medial cavernous sinus border may be visible, which is important for surgery of laterally invasive sellar lesions, and to provide optimal imaging during intraoperative navigation.

#### References

1.Cano et al, Eur J Radiol 199; 31:157-164; 2.Cottier et al, Radiology 2000; 215, 463-469

Table 1. Infiltration of the medial cavernous sinus border

medial border of cavernous sinus (n=32)	3T MR	standard MR	intra-operative
intact	23 (72%)	17 (53%)	26 (81%)
infiltrated	9 (28%)	15 (47%)	6 (19%)
correlation with OP findings	84%	59%	
PPV (positive predictive value)	55%	27%	
NPV (negative predictive value)	96%	88%	
sensitivity	83%	67%	
specificity	84%	58%	

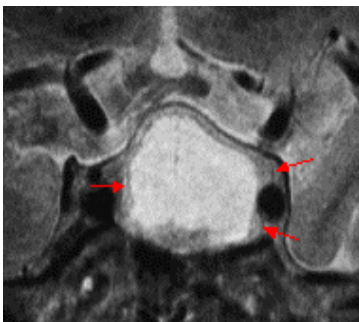


Figure 1 – T2-weighted RARE 3T MR image: Cystic pituitary macroadenoma. Right sided infiltration of cavernous sinus (arrow) as confirmed by surgical findings, left sided delineation of medial cavernous sinus border by a hypointense line (2 long arrows).

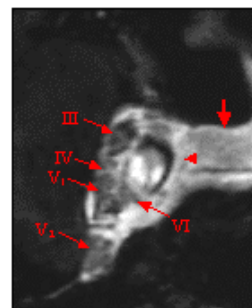


Figure 2– T1-weighted contrast enhanced 3D-MP-RAGE 3T MR image: Right cavernous sinus. Cranial nerves III (inside CSF-filled dural sheath), IV, V1, V2 and VI visible inside lateral wall (long arrows), medial cavernous sinus border (short arrow) pituitary gland (arrow).