

**Table 2: Magnetic Resonance (MR) Imaging**

Author (Year)	Title	Study Description	Number of Patients	Classification Process/Evidence Class	Conclusions
Guy (1991) <sup>31</sup>	A comparison of CT and MRI in the assessment of the pituitary and parasellar region.	Patients with or without pituitary adenomas prospectively underwent both CT and MR imaging. The visualization of the pituitary gland, optic chiasm, and tumor was compared between the 2 modalities.	40	Prognostic/ II	<p>Visualization of the optic chiasm and assessment of displacement of the optic chiasm and the carotid arteries were also better with MRI. CT was equally good at showing cavernous sinus displacement or invasion, sphenoid sinus invasion, and erosion of the floor of the sella turcica, and was the only technique able to show calcification of the gland. The percentage agreement between the observers for the identification of pituitary and parasellar structures was better for MRI than for CT and the clinician in particular found interpretation of the MR images easier.</p> <p>MRI thus not only gives more information overall than CT, but it is a more reliable technique between different observers for the assessment of the pituitary and parasellar region.</p>
Davis (1987) <sup>32</sup>	MR imaging of pituitary adenoma: CT, clinical, and surgical correlation.	Clinical experience comparing MR and CT in the assessment of pituitary lesions.	25	Diagnostic / II	<p>CT was more sensitive than MR for detecting focal lesions (7 vs 3) and sellar-floor erosion (12 vs 6). MR was superior to CT in identifying infundibular abnormalities (7 vs 6), focal abnormalities of the diaphragma sellae (10 vs 7), cavernous sinus invasion (4 vs 2), and optic chiasm compression (6 vs 0).</p> <p>MR may be the procedure of choice for optimal identification and localization of macroadenoma.</p>

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Lundin (1991) <sup>25</sup>	Comparison of MR imaging and CT in pituitary macroadenomas.	Clinical experience comparing MR and CT in the assessment of pituitary macroadenomas.	65	Prognostic/ III	<p>MR was superior to CT except in the demonstration of bone changes and tumor calcification. The superiority of MR was most pronounced regarding cavernous sinus invasion, tumor relationship to the carotid arteries and optic chiasm, and tumor hemorrhage. Extensive bone changes were visualized with both methods; erosions were often seen only with CT. It is concluded that MR is the preferable method for evaluation of pituitary macroadenomas.</p> <p>CT is useful as a supplementary modality when detailed information on bone anatomy is required, particularly if a transsphenoidal surgical approach is contemplated.</p>

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Kaufman (1987) <sup>28</sup>	Large pituitary gland adenomas evaluated with magnetic resonance imaging.	Clinical experience using MR for assessing pituitary macroadenomas.	15	Prognostic/ III	<p>Bone destruction and tumor calcification were better detected by CT scanning than by MRI. MRI was as effective as CT scanning in detecting a cyst or variation in tumor consistency. Neither MRI nor CT scanning was capable of distinguishing specific tumor types. In every case, MRI was superior to CT scanning for delineating spatial relationships of the tumor to the 3rd ventricle, the optic apparatus, adjacent brain, and parasellar vasculature. Vessel encasement by tumor was clearly seen on MRI when there was no direct indication of this on other studies. Cavernous sinus invasion was not demonstrated by CT scanning, but was indicated by MRI in 5 cases and was surgically confirmed in 3.</p> <p>MRI can provide more precise spatial information on extrasellar tumor extension. When MRI is available, it is the test of choice for the preoperative evaluation of patients with suspected large pituitary gland (sellar region) tumors. Contrast-enhanced CT scanning and angiography can be used as supplementary studies to add information inherently unique to these techniques.</p>

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Lee (1985) <sup>33</sup>	Sellar and juxtaseilar lesion detection with MR.	Clinical experience using MR for assessing pituitary lesions.	21	Prognostic/ III	<p>Although CT scans showed the abnormalities in most cases, MR was superior in delineating distortions of the optic chiasma and other suprasellar structures and in demonstrating the status of the carotid arteries. MR can reveal fat, hematoma, and cyst and can be used to differentiate the pathologic features of many lesions.</p> <p>MR is superior to CT for preoperative evaluation of pituitary adenomas.</p>
Karnaze (1986) <sup>34</sup>	Suprasellar lesions: evaluation with MR imaging.	Clinical experience using MR for assessing pituitary lesions.	15	Prognostic/ III	In comparing MR and CT images, MRI superior in 5, MR equal in 10, CT superior in 0. MR was equivalent to CT in allowing lesions to be detected, and several cases more accurately defined altered perisellar anatomy. Vascular abnormalities can be better evaluated with MR, and use of angiography can be avoided in some cases.
Mikhael (1988) <sup>35</sup>	MR imaging of pituitary tumors before and after surgical and/or medical treatment.	Clinical experience using MR for assessing pituitary lesions.	26	Diagnostic/ III	MR was more accurate than CT at diagnosis of pituitary adenomas. Hemorrhage in pituitary tumors was easily seen on MR and missed on CT.

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Gutenberg (2009) <sup>37</sup>	A radiologic score to distinguish autoimmune hypophysitis from nonsecreting pituitary adenoma preoperatively.	MR imaging of patients with either nonfunctioning pituitary adenomas or autoimmune hypophysitis were compared based on 16 morphological features in addition to sex, age, and pregnancy status. The significant predictors were analyzed in a multiple logistic regression model to identify a radiologic score to predict nonfunctioning pituitary adenomas before surgery.	98	Diagnostic/ III	<p>The diagnostic score had a global performance of 0.9917 and correctly classified 97% of the patients, with a sensitivity of 92%, a specificity of 99%, a positive predictive value of 97%, and a negative predictive value of 97% for the diagnosis of AH.</p> <p>This new radiologic score could be integrated into the management of patients with AH, who derive greater benefit from medical as opposed to surgical treatment.</p>
Kucharczyk (1986) <sup>38</sup>	Pituitary adenomas: high-resolution MR imaging at 1.5 T.	Clinical experience using 1.5 T MR for assessing pituitary lesions.	17	Diagnostic/ III	<p>All of the macroadenomas were accurately localized and their extent delineated, particularly on T1-weighted coronal sections. Adenomas typically appeared hypointense on T1-weighted coronal sections. The appearance on T2-weighted images was variable, and generally the lesions were less well seen. Involvement of parasellar structures, particularly the optic chiasm and cavernous sinuses, was accurately depicted. Cyst formation and hemorrhage could be characterized in some instances.</p> <p>MR imaging is an excellent modality for preoperative localization and identification of pituitary adenomas.</p>

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Steiner (1989) <sup>39</sup>	Gd-DTPA enhanced high resolution MR imaging of pituitary adenomas.	Clinical experience using Gd-DTPA for assessing pituitary lesions.	38	Diagnostic/ III	<p>Compared with the normal pituitary anterior lobe, 8% of the adenomas were hyperintense, 45% were isointense, 42% were hypointense, and 5% were inhomogeneously intense. After Gd-DTPA administration, 13% enhanced to a greater degree, 10% to the same, and 57% to a lesser degree than the normal pituitary tissue. Twenty percent showed inhomogeneous enhancement. In 10%, there was evidence of adenoma only in the enhanced images. The delineation of the adenoma from the cavernous sinus was improved from 47% in unenhanced scans to 91% after Gd-DTPA administration.</p> <p>With 1.5 T spin echo MR imaging, contrast administration leads to improvements in diagnosis and visualization of pituitary adenoma and should be a part of pituitary radiologic investigation.</p>

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Steiner (1994) <sup>40</sup>	MR-appearance of the pituitary gland before and after resection of pituitary macroadenomas.	Clinical experience using MRI for assessing the pre- and postoperative appearances of pituitary lesions.	30	Diagnostic/ III	<p>On preoperative MR images, contrast administration increased the detectability of the anterior lobe from 30% to 80%. Depending on the size and extension of the adenoma, the pituitary gland was displaced to the suprasellar space (53%) and/or deformed to a club-shaped (27%) or sickle-shaped (47%) configuration. In 6 patients, the sickle-shaped pituitary gland was interposed between the cavernous sinus and the adenoma ("rim-sign"), which was seen only on gadopentetate dimeglumine-enhanced images. In these cases, there was no infiltration of the cavernous sinus at surgery. Postoperatively, descent of the pituitary gland was found in 63% and re-expansion in 54%. We conclude that contrast administration improves the detectability of the pituitary gland on preoperative MR images and that the displacement and deformation of the pituitary gland depend on the size, location, and extension of the adenoma.</p> <p>Preoperatively, demonstration of the pituitary gland interposed between the cavernous sinus and the adenoma ("rim-sign") is a very useful sign for exclusion of cavernous sinus infiltration, best seen on contrast-enhanced coronal MR images.</p>

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Hayashi (1995) <sup>41</sup>	Dynamic MRI with slow injection of contrast material for the diagnosis of pituitary adenoma.	Clinical experience using dynamic MRI for assessing pituitary lesions.	14	Diagnostic / III	<p>The most remarkable contrast between adenoma and normal tissue was obtained from the fourth to eighth images. In other words, we could obtain the strongest contrast at 144.8 to 299.6 seconds from the start of contrast injection.</p> <p>Slow injection suggests that stronger images can be obtained a longer period after contrast injection, defining differences in contrast enhancement between normal tissue and pituitary adenomas.</p>
Hald (1994) <sup>42</sup>	MR imaging of pituitary region lesions with gadodiamide injection.	Clinical experience using gadodiamide MRI for assessing pituitary lesions	12	Diagnostic/ III	<p>No additional diagnostic information was obtained using 0.3 mM/kg gadodiamide injection compared to 0.1 mM/kg gadopentate dimeglumine in the same patients. The high dose (0.3 mM/kg) gadodiamide injection in 7 patients did not shorten the T2 value sufficiently to overwhelm the T1 shortening and leave pathologic lesions hypointense compared to precontrast studies.</p> <p>Consistent with previous reports, gadodiamide injection was found to be a safe and effective contrast medium for MR imaging of the pituitary region, and this was not dependent on levels of contrast. With the comparable relaxivities of gadodiamide injection and gadopentetate dimeglumine, similarities in results have to be expected when using these media for MR image enhancement.</p>

Author (Year)	Title	Study Description	Number of Patients	Classification Process/Evidence Class	Conclusions
Davis (1991) <sup>43</sup>	Pituitary adenoma: correlation of half-dose gadolinium-enhanced MR imaging with surgical findings in 26 patients.	Clinical experience using half-dose gadolinium MRI for assessing pituitary lesions.	12	Diagnostic/ II	The high signal intensity of the posterior pituitary and of intrasellar hemorrhage was obscured on postcontrast studies. Delayed images proved unnecessary. This prospective evaluation suggests that a half-dose study is comparable to retrospective studies, in which full-dose techniques were used for detection of micro- and macroadenomas. Imaging times are reasonably short, and cost of contrast material is potentially reduced.
Cury (2009) <sup>44</sup>	Non-functioning pituitary adenomas: clinical feature, laboratorial and imaging assessment, therapeutic management and outcome.	Patients with nonfunctioning pituitary adenomas were retrospectively analyzed and results of biochemical evaluation, radiologic studies, visual studies, and management are described.	104	Diagnostic/ III	Preoperative imaging classified 93% of the tumors as macroadenomas.  MR preoperative imaging can reliably identify NFPAs.

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Lundin (1992) <sup>45</sup>	Gd-DTPA-enhanced MR imaging of pituitary macroadenomas.	Patients with nonfunctioning pituitary adenomas and secretory adenomas were evaluated with conventional MR imaging with and without contrast enhancement. The pre- and post-contrast images were compared, as well as between the different groups of pathologies.	40	Diagnostic/ III	<p>Compared with pre-contrast T1-weighted images only, post-contrast images provided considerable additional information; but, not infrequently, this information could also be extracted from pre-contrast T2-weighted images. Post-contrast images were superior regarding the tumor relationship to the cavernous sinus and to the normal pituitary tissue. T2-weighted images were helpful in the diagnosis of degenerative changes, in particular intratumoral hemorrhage. A positive correlation was found between the T2 value (from dual echo sequences) and the degree of enhancement in areas with an appearance of solid tumor tissue, and the enhancement was significantly lower in GH-secreting tumors than in non-secreting ones.</p> <p>The use of Gd-DTPA is often justified in pituitary macroadenomas, particularly in preoperative evaluation.</p>