Table 4: Specific MR Sequences

Author (Year)	Title	Study Description	Number of Patients	Classification Process/ Evidence Class	Conclusions
Davis (2013)[51]	Evaluation of the pituitary gland using magnetic resonance imaging: T1-weighted vs VIBE imaging.	Patients underwent both coronal T1-weighted and volumetric interpolated breath-hold examination imaging (VIBE). The 2 sequences were compared in terms of contrast enhancement, cavernous sinus appearance, and optic chiasm appearance. For each subject, VIBE was rated as better, equal, or worse to T1-weighted images and statistically compared using chi-square tests. These comparisons were also made while stratifying for macroadenomas and post-surgical patients.	32	Diagnostic / III	There was a trend to VIBE being superior to T1W for visualization of pituitary adenomas, but these data were not statistically significant. Visualization of chiasm in macroadenomas was similar for both techniques. VIBE was significantly superior to T1W with respect to pituitary and cavernous sinus contrast enhancement and cavernous sinus anatomy. Although not statistically significant, VIBE may improve the resolution of MR images for preoperative visualization of pituitary adenomas, cavernous sinus invasion, and optic chiasm compression. This strength may be even larger with higher tesla magnets.

Yamamoto (2014)[53]	Tumor consistency of pituitary macroadenomas: predictive analysis on the basis of imaging features with contrast-enhanced 3D FIESTA at 3T.	Patients underwent both conventional MRI and contrast-enhanced 3D FIESTA sequences preoperatively. Two neuroradiologists evaluated MR imaging findings, specifically those on the FIESTA scan. During surgery, neurosurgeons classified the tumors as soft or hard. Postoperatively, collagen content and residual tumor size was calculated. Fisher exact probability tests and independent sample *t* tests were used to compare predictions of MR imaging findings to intraoperative tumor consistency, tumor collagen content, and postoperative tumor size.	29	Diagnostic / III	Sensitivity and specificity were higher for contrast-enhanced FIESTA (1.00 and 0.88-0.92, respectively) than for contrast-enhanced T1WI (0.80 and 0.25-0.33, respectively) and T2WI (0.60 and 0.38-0.54, respectively). Compared with mosaic-type adenomas, solid-type adenomas tended to have a hard tumor consistency as well as a significantly higher collagen content and lower postoperative tumor size. Contrast-enhanced FIESTA can provide preoperative characterization of the consistency of pituitary adenomas.
Rofsky (1999)[54]	Abdominal MR imaging with a volumetric interpolated breath-hold examination.	Clinical experience using VIBE MRI for assessment of pituitary lesions	20	Prognostic / III	VIBE offer superior resolution of anatomic structures relative to conventional MRI.

Davis (2013)[51]	Evaluation of the pituitary gland using magnetic resonance imaging: T1-weighted vs VIBE imaging.	Patients underwent both coronal T1-weighted and volumetric interpolated breath-hold examination imaging (VIBE). The 2 sequences were compared in terms of contrast enhancement, cavernous sinus appearance, and optic chiasm appearance. For each subject, VIBE was rated as better, equal, or worse to T1-weighted images and statistically compared using chi-square tests. These comparisons were also made while stratifying for macroadenomas and post-surgical patients.	32	Prognostic / III	There was a trend to VIBE being superior to T1W for visualization of pituitary adenomas, but these data were not statistically significant. Visualization of chiasm in macroadenomas was similar for both techniques. VIBE was significantly superior to T1W with respect to pituitary and cavernous sinus contrast enhancement and cavernous sinus anatomy. Although not statistically significant, VIBE may improve the resolution of MR images for preoperative visualization of pituitary adenomas, cavernous sinus invasion, and optic chiasm compression. This strength may be even larger with higher tesla magnets.

Cao (2013)[55]	Magnetic resonance imaging appearance of the medial wall of the cavernous sinus for the assessment of cavernous sinus invasion by pituitary adenomas.	Patients underwent MRI with both conventional and proton density weighted images preoperatively. The appearance and invasion of medial wall of the cavernous sinus in the proton density weighted scans was compared to the Knosp grading system, percentage encasement of the internal carotid artery, and replacement of cavernous sinus compartment criteria on conventional MR scans, surgical findings, and Ki-67 labeling index results.	48	Prognostic / III	The sensitivity of MRI visualization of the medial wall of the cavernous sinus for detection of CSI was 93.3% with a specificity of 93.8%, which was significantly higher than other preoperative radiologic signs including KGS, PEICA, and RCSC (P = .007, P = 0.008, and P = .056, respectively). Histopathological results showed no significant differences between MRI visualization of the MWCS and the Ki-67 LI. Proton density weighted scans can permit adequate visualization of the medial wall of the cavernous sinus. This sign was found to be the best in comparison to other radiologic signs with conventional MRI. This new type of scan may be the best way of identifying if tumor invades the cavernous sinus.

Mahmoud (2010)[57]	Role of PROPELLER diffusion weighted imaging and apparent diffusion coefficient in the diagnosis of sellar and parasellar lesions.	Patients with conventional MR and periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER) diffusion weighted imaging were retrospectively analyzed. ADC values were calculated from the PROPELLER scans. DC values for pituitary adenomas and other sellar mass lesions were analyzed using intraoperative and histological diagnoses as the gold standard.	38	Diagnostic / III	ADC-MIN of hemorrhagic pituitary adenomas was lower than of the other lesions with similar appearance on conventional MRI (non-hemorrhagic pituitary adenomas, craniopharyngiomas, Rathke's cleft cysts; accuracy 100%); the useful cut-off value was 0.700 x 10(-3)mm(2)/s. ADC-MAX of meningiomas was lower than of non-hemorrhagic pituitary adenomas (accuracy 90.3%; *P* < .01). ADC-MIN of craniopharyngiomas was lower than of Rathke's cleft cysts (accuracy 100%; *P* < .05). As PROPELLER DWI can be useful in the examination of sellar and parasellar lesions, calculation of the ADC values helps to differentiate between various sellar and parasellar lesions.

Bladowska (2013)[60]	Usefulness of perfusion weighted magnetic resonance imaging with signal-intensity curves analysis in the differential diagnosis of sellar and parasellar tumors: preliminary report.	Patients underwent both conventional MRI and perfusion weighted MR imaging. Mean and maximum values of relative cerebral blood volume, relative peak height, and relative percentage of signal intensity recovery were calculated from the perfusion weighted MR images. These parameters were compared between different pathologies (pituitary macroadenomas, meningiomas, craniopharyngioma, hemangioblastoma, glioma, and metastasis).	23	Diagnostic / III	There were statistically significant differences in the mean and maximum rCBV values (P = .026 and P = .019, respectively). The maximum rCBV values >7.14 and the mean rCBV values >5.74 with the typical perfusion curve were very suggestive of the diagnosis of meningioma. Perfusion weighted MR imaging can provide supplemental information to differentiate pituitary adenomas from meningiomas. However, it is unclear how this improves the sensitivity and specificity of diagnosis of sellar/parasellar tumors.
Manfre (1997)[61]	Perfusion MRI in normal and abnormal pituitary gland. A preliminary study.	Patients with pituitary adenomas, other sellar/parasellar pathology, and non-tumor controls underwent perfusion MR imaging. Differences in maximal contrast percentual variation, timing of enhancement, and patterns of enhancement were compared between the different groups of pathologies.	13	Diagnostic / III	The timing of enhancement in normal patients matched perfectly with normal pituitary vascularization, while there was abnormal timing in pathological condition. These tumors had significant enhancement either simultaneously or in the frame after the enhancement of the dural sinuses. Pituitary adenomas have specific characteristics on perfusion MRI.

Sakai (2013)[62]	Arterial spin-labeled perfusion imaging reflects vascular density in nonfunctioning pituitary macroadenomas.	Patients underwent both conventional MR imaging and arterial spin-labeled perfusion imaging. Degree of enhancement was calculated by dividing the signal intensity on T1-weighted with contrast to the T1-weighted without contrast. Normalized tumor blood flow values were calculated by dividing the mean value of the tumor region of interest by mean region of interest values in the cerebellar hemispheres. Relative microvessel attenuation was calculated by dividing the total microvessel wall area by entire CD31 stained tissue area. These parameters were compared with each other as well as the presence of intra- or postoperative hemorrhage by surgeon visualization.	11	Prognostic / III	A statistically significant difference in normalized tumor blood flow values was observed visually between the intraoperative hypovascular and hypervascular groups ($P < .05$). One of these hypervascular cases actually did have symptomatic postoperative hemorrhage. ASL perfusion imaging can reflect the vascular density of NFPAs and may be a viable test in predicting intra/postoperative tumor hemorrhage.

Mahmoud (2011)[63]	Role of PROPELLER diffusion-weighted imaging and apparent diffusion coefficient in the evaluation of pituitary adenomas.	Patients who underwent conventional MR and periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER) DWI were retrospectively analyzed. Mean, max, and min values from the PROPELLER DWI images were calculated. Intraoperative tumor consistency was recorded by neurosurgeons. ADC values were compared to tumor consistency experienced intraoperatively and percent collagen content.	19	Prognostic / III	Tumor consistency was strongly associated with the percent collagen content. However, neither the tumor consistency nor the percent collagen content was correlated with MRI findings or ADC values. The SI of growth hormone-producing adenomas on T2-WI was lower than that of the other pituitary adenomas studied ($P < .01$); no other significant difference was found in the ADC or on conventional MRI between pituitary adenomas with different secretory functions. The MIB-1 LI of pituitary adenomas was not correlated with their appearance on conventional MRI or their ADC values. Unlike other studies, this study found tumor consistency was not correlated with ADC findings.
Suzuki (2007)[64]	Apparent diffusion coefficient of pituitary macroadenoma evaluated with line-scan diffusion-weighted imaging.	Patients prospectively underwent line-scan diffusion weighted imaging (LSDWI) and had ADC values calculated. These ADC values were correlated with the consistency recorded at surgery.	19	Prognostic / II	A soft consistency was found at surgery in 13 patients (mean ADC: 0.84+/-0.1x10(-3) mm2/s); an intermediate consistency was observed in 6 patients (mean ADC: 0.81+/-0.16x10(-3) mm2/s). No tumors of hard consistency were found. There was no significant difference in ADC values between tumors of soft consistency compared with tumors of intermediate consistency ($P = 0.37$). A relationship between tumor consistency and the ADCs of soft and intermediate macroadenomas was not shown in this study using LSDWI.