

Dynamic MR Imaging of the Head and Neck: An Idea Whose Time Has Come . . . and Gone?¹

WITH the publication in this issue of *Radiology* of the article by Takashima et al entitled "Dynamic MR Imaging in the Head and Neck" (1), one begins to see the growth of a body of literature examining the role of dynamic gadolinium-enhanced magnetic resonance (MR) imaging of extracranial masses (1-5). The wealth of articles on computed tomography (CT) describing this technique's value (or lack thereof) in the head and neck (6-17) begs the question, "Can't we learn from our CT past?"

The answer to this question after reading the article by Takashima et al is a qualified yes. The patterns of contrast material accumulation with a dynamic MR sequence simulate those that Som et al (14) and Michael et al (11) reported with dynamic CT in the mid-1980s. An arterial pattern with rapid wash-in and rapid washout, a slow accumulation phase, and a hypovascular, avascular flat pattern have now been described in both the MR and CT literature. Are we therefore reinventing the wheel?

Certainly the finding that vascular lesions such as glomus tumors have a dynamic enhancement curve that simulates arterial flow has been well established in the CT literature (8-11,13,16). In fact, two recent articles by Vogl et al have already demonstrated the utility of dynamic MR imaging for this lesion (4,5). Nonetheless, this "arterial signature" pattern on a dynamic image is not 100% specific and has been reported to be present in angiofibromas, arteriovenous malformations, arteriosclerotic vessels, and hemangiomas (7,8,10,11,13,16). These hypervascular lesions can be

clearly distinguished from schwannomas, meningiomas, and hyperplastic lymph nodes with dynamic CT or MR imaging (3,6,11,13,16). That one of the four carotid body tumors in the series of Takashima et al did not show an arterial pattern at dynamic MR imaging is disconcerting—this rate of false negativity is unexpected based on the prior CT experience. Nonetheless, dynamic MR imaging appears to be an effective adjunctive method of evaluating masses in the jugular fossa, parapharyngeal space, and carotid sheath and diagnosing paragangliomas. However, because hemangiomas, angiofibromas, arteriovenous malformations, and aneurysms (from dissections or trauma) may have a similar dynamic curve (7,8,10,11,13,16), caution should be exercised in specifically implying a paraganglioma in a location where these other lesions may appear.

The more intriguing aspect of the findings of Takashima et al relates to the contribution of the B (curve peaks in 30-60 seconds), C (curve peaks in 60-120 seconds), or D (gradual upward slope) patterns of dynamic uptake to signal intensity characteristics in suggesting a head and neck lesion is malignant. If one used just low signal intensity on T2-weighted images to determine if a major salivary gland mass was malignant, one would be correct in 80% of the cases of Takashima et al, but only two of 11 malignancies were hypointense with this pulse sequence. If one adds invasion of adjacent tissues to the equation, the accuracy increases to 86%, with seven of 11 malignancies detected. What is the contribution of a B, C, or D dynamic curve? While the same number of malignant tumors (seven of 11) would be detected by adding a B, C, or D dynamic curve to the other two criteria, one of the false-positive cases would become correctly identified as a benign lesion, leading to an accuracy of 88%. Similar findings are noted with the combination of type B or C curves and invasion of adjacent tissues for non-salivary gland masses. In short, the addition of the dynamic sequence does not increase the test's sensitivity but may eliminate some overdiagnosis of malignancy.

What about the specificity of the technique? How often will a dynamic study suggest a benign tumor when a malignancy

is not present? The specificity of the technique was 29% for major salivary gland and 74% for non-salivary gland tumors. In total, 68% of benign lesions had a B, C, or D signal intensity curve. The high false-positive rate suggests that looking at a B, C, or D curve in isolation has little value. On the other hand, if one suspects a lesion of being a malignancy and it is hypervascular (type A) or avascular (type E), one should reconsider.

How do these results compare with the CT experience? The CT literature suggests that, while it is rare for a malignancy to have an arterial signature pattern (type A in the study of Takashima et al), cancers may demonstrate rapid wash-in, slow wash-in, or flat patterns of initial accumulation as well as high and low plateaus (10,11,13,17). Therefore, one would have reason to expect that a malignancy could be characterized by means of type B, C, D, and E patterns on dynamic MR images. These same four patterns have been reported in meningiomas, schwannomas, lymphangiomas, orbital pseudotumors, epidermoids, dermoid cysts, cholesteatomas, hyperplastic nodes, and chronic inflammation in CT and previous MR studies (3,5,6,10,11,13). A dynamic MR imaging study of skull base masses by Vogl et al reported no difference in the slopes of enhancement in schwannomas, glomus tumors, meningiomas, and carcinomas (5).

The third proposal put forth in the article by Takashima et al relates to the identification of recurrent tumors on the basis of dynamic MR imaging patterns. For those radiologists who struggle with the recurring question, "Is it recurrent tumor, scar tissue, radiation change, or inflammation?" Takashima et al raise hopes. They found that the same dynamic pattern in a tumor is present in recurrences and metastases. The recurrences all occurred after surgery; one wonders whether the sclerosing effect of radiation therapy may alter a dynamic vascular curve. In a similar vein, scar tissue and neoplasms (before therapy) may have the same dynamic pattern. The technique would help little in this situation. If we are to embrace the conclusion of Takashima et al that the technique may allow prediction of recurrences of tumors, it would mean

Index terms: Editorials • Head and neck neoplasms, diagnosis, 20.30 • Magnetic resonance (MR), utilization

Radiology 1993; 189:659-660

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See also the article by Takashima et al (pp 813-821) in this issue.

making a commitment to obtaining dynamic curves for all head and neck masses at initial presentation. The comparison cannot be done retrospectively if an initial dynamic MR study has not been performed. I, for one, will wait until the accumulated experience for recurrences exceeds the three cases reported by Takashima et al and includes postoperative, post-radiation therapy, and postchemotherapy patients. The expectation that an MR technique will obviate the need for biopsy of suspect tissue is overindulgent at this time.

When to employ the technique? I would suggest that, unless invasion or hypointensity on T2-weighted images is present, dynamic MR imaging has a relatively small role to play in evaluating nonvascular masses in the head and neck. Even in these situations, the sensitivity of MR imaging in predicting malignancy is unlikely to be increased. On the other hand, if the study is performed and a type A or E pattern is found, one should be hesitant to call the lesion malignant. I believe the dynamic MR sequence will likely be relegated to the role of dynamic CT—confirming the diagnosis of benign vascular masses (eg, glomus tumors). Dynamic MR imaging as the definitive test for differentiating benign versus malignant tumors or detecting recurrences of neoplasms re-

mains a nocturnal dream that work in the light of day has yet to prove. ■

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