Evaluation of Imaging Techniques for Detection of Extraocular Extension of Choroidal Melanoma

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Objective: To investigate the sensitivity of echography vs magnetic resonance imaging (MRI) or computed tomography (CT) for detecting extraocular extension of choroidal malignant melanoma.

Design and Setting: Retrospective review at a university referral center.

Participants: All patients with histopathologically proven extraocular extension of choroidal malignant melanoma evaluated at the Bascom Palmer Eye Institute, Miami, Fla, between January 1, 1988, and August 31, 1997.

Interventions: The histopathology records of all patients who underwent enucleation for choroidal malignant melanoma or biopsy of an extraocular nodule during the study period were reviewed. The records and imaging studies of patients who were found to have extraocular extension of choroidal malignant melanoma were then reviewed to determine the sensitivity of preoperative echography vs MRI or CT for detecting extraocular tumor extension.

Results: A review of 297 histopathology records identified 13 patients with extraocular extension of choroidal malignant melanoma. Three patients with only microscopic extraocular tumor extension were excluded from the study. Of the remaining 10 patients, all underwent ocular echography preoperatively, 5 underwent orbital MRI, and 2 underwent orbital CT scanning to evaluate for extraocular extension of tumor. Extraocular tumor extension was demonstrated in 10 patients (100%) with echography and in 2 (29%) of 7 patients with MRI (2 of 5 patients) or CT (0 of 2 patients). In no instance did MRI or CT demonstrate extraocular tumor extension that was not identified with echography.

Conclusion: At this institute, ocular echography is more sensitive than MRI or CT for the detection of extraocular extension of choroidal malignant melanoma.


VEAL MELANOMA is the most common intraocular malignant neoplasm in adults, with an incidence of 6 to 7 cases per million people in the United States. Several studies have demonstrated the poorer prognosis of uveal malignant melanoma associated with extraocular tumor extension. In addition to its prognostic significance, extraocular extension of uveal melanoma has important therapeutic implications. It has recently been reported that magnetic resonance imaging (MRI) has proved to be more sensitive and specific than echography for the detection of extraocular extension of uveal melanoma. In addition, echography has been reported to be unreliable in the assessment for extraocular extension of uveal melanoma. The current study was undertaken to investigate the sensitivity of echography vs MRI or computed tomography (CT) for the detection of extraocular extension of choroidal malignant melanoma.

RESULTS

A review of 297 histopathology reports identified 13 patients with extraocular extension of choroidal malignant melanoma. Three patients with only microscopic extraocular tumor extension were excluded from the study. Of the remaining 10 patients, all underwent ocular echography preoperatively, 5 underwent orbital MRI, and 2 underwent orbital CT scanning to evaluate for extraocular extension of tumor. Extraocular tumor extension was demonstrated in 10 patients (100%) with echography and in 2 (29%) of 7 patients with MRI (2 of 5 patients) or CT (0 of 2 patients). In no instance did MRI or CT demonstrate extraocular tumor extension that was not identified with echography. Figure 1 and Figure 2 demonstrate the echographic and MRI or CT images of 2 patients in whom extraocular tumor extension was identified with echography but not with MRI or CT scan.
METHODS

This study conformed to the policies and procedures outlined by the Institutional Review Board of the University of Miami School of Medicine, Miami, Fla. The histopathologic records of all patients who underwent enucleation for choroidal malignant melanoma or biopsy of an extraocular nodule at the Bascom Palmer Eye Institute, Miami, between January 1, 1988, and August 31, 1997, were reviewed. The records and imaging studies of the patients who were found to have extraocular extension of choroidal malignant melanoma were then reviewed.

The patients who were evaluated with MRI or CT underwent these imaging studies before being seen at the Bascom Palmer Eye Institute. Per the practice pattern at this institute, all new patients with uveal melanoma are evaluated with echography.

All patients who had surgical therapy at the Bascom Palmer Eye Institute for choroidal malignant melanoma during the study period were evaluated preoperatively with echography. Therefore, the rate of false-positive echography reports of extraocular extension of choroidal malignant melanoma could be calculated after reviewing the echographic records of all such patients. All patients with choroidal malignant melanoma evaluated for extraocular extension with MRI or CT scanning could not be accurately identified, and therefore, the rate of false-positive MRI or CT reports of extraocular tumor extension could not be determined.

Echograms were obtained using 1 of 2 ultrasound units: either the Ophthascan S and Mini-A (Alcon Surgical, Irvine, Calif) or System-ABD (Innovative Imaging Inc, Sacramento, Calif). The B-scan (2-dimensional image) probes were 10 MHz, and the A-scan (1-dimensional image) probes were 8 MHz. A- and B-scan images were used to evaluate each tumor and the adjacent orbital tissue. The B-scan sound-beam image sector covered 45° to 60° and was slowly swept through the tumor from margin to margin using transverse and longitudinal orientations. Transverse scans were oriented 90° to the meridian or clock hour of the tumor location and were shifted in an anteroposterior direction, giving successive circumferential sections through the tumor. Longitudinal scans were oriented along meridians or clock hours and were shifted from side to side, displaying successive radial cross-sections. Several millimeters of tissue outside the tumor margins was included in both scan orientations. A medium-gain setting was used to obtain the best resolution. In some cases, a standardized or diagnostic A scan was used to evaluate the integrity of the sclera.

Magnetic resonance imaging was performed at 1.5 T with a commercially available unit (model Edge, Picker International, Cleveland, Ohio). Unenhanced T₁- and T₂-weighted axial images were obtained through the orbits with a section thickness of 2 mm. In addition, axial and coronal T₁-weighted images were obtained with fat suppression and after the intravenous administration of gadopentetate dimeglumine (0.2 mL/kg). Axial and coronal CT scans through the orbits were obtained using a commercially available unit (model TCT600, Toshiba International Inc, Tokyo, Japan) before and after the intravenous administration of diatrizoate meglumine, with a section thickness of 2 mm.

During the study period, there were only 7 false-positive echography reports of extraocular extension of choroidal malignant melanoma. In 6 of these patients, an area
suggestive of extrascleral tumor extension was noted, but follow-up echographic evaluations performed by the same echographer revealed no evidence of extraocular tumor. In the 1 remaining patient, only a single echographic evaluation was performed, which revealed a lesion typical for choroidal melanoma “with possible extrascleral extension” (Figure 3), yet no extraocular extension was noted on histopathologic examination after enucleation. Thus, the rate of false-positive echographic reports of extraocular extension of choroidal malignant melanoma is 7 (2.4%) of 297 if follow-up echographic evaluations are not considered and only 1 (0.3%) of 297 if follow-up echographic evaluations are taken into account.

Figure 3. Longitudinal (top) and transverse (bottom) echographic sections through choroidal malignant melanoma (arrowheads) showing nodular lucency (arrows) suspected to represent extraocular tumor extension. Extraocular tumor extension was not confirmed on histopathologic examination after enucleation.

The ability to demonstrate extraocular extension of choroidal melanoma is important for both prognostic and therapeutic reasons. Although ultrasonography is frequently used to aid in the diagnosis of choroidal melanoma,11 it is commonly believed that CT and MRI scans are superior to echography for detecting extraocular extension of choroidal melanoma.11,15,16 In fact, echography has been reported to be unreliable in the assessment for extraocular extension of choroidal melanoma.12,13 and CT scanning has often been used to confirm or refute echographic evidence of extraocular extension.15,16 Magnetic resonance imaging has reportedly been proved to be more sensitive and specific than echography in the detection of extraocular extension of uveal melanoma.15 In the study reported by Hosten et al,11 as in the current report, MRI was performed at 1.5 T with a section thickness of 2 mm, both unenhanced and enhanced with gadopentetate dimeglumine. Hosten et al reported that among 7 patients in whom extraocular extension of uveal melanoma was confirmed with histological examination, ophthalmoscopy, or surgical procedure, extraocular tumor extension was detected by MRI in 6 patients and by echography in 3 patients.

The current study demonstrates that at our institute, ocular echography is more sensitive than MRI or CT for the detection of extraocular extension of choroidal malignant melanoma, and the false-positive rate of echographic evaluation for extraocular extension of choroidal melanoma is low. Of course, sensitivity (as well as specificity) of any diagnostic modality is a function of the prevalence of the disease, and the prevalence of extraocular tumor extension in the current series is low. Also, the ability to detect extraocular extension of uveal melanoma may vary according to the skill and experience of the echographer, and further studies are needed to compare the sensitivity and specificity of echography vs other imaging modalities for the detection of extraocular extension of uveal melanoma.

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REFERENCES