Magnetic resonance imaging (MRI) vs. whole body scintigraphy (WBS) in detection of regional metastases in patients with differentiated thyroid carcinoma (DTC)

J. Mihailovic[1], L. Stefanovic[1], M. Prvulovic[2], M. Malesevic[1]

[1]Dpt. of Nuclear Medicine, Institute of Oncology Sremska Kamenica, Sremska Kamenica, Serbia, Yugoslavia, [2]MRI Center, Institute of Oncology Sremska Kamenica, Sremska Kamenica, Serbia, Yugoslavia

Introduction:

Well-differentiated thyroid tumors including papillary (70%-80%) and follicular carcinoma (20%-30%) represent 90% of malignant thyroid nodules (1,2). In contrast to follicular thyroid carcinoma that rarely metastases in lymph nodes (3), papillary thyroid carcinoma often metastases in regional lymph nodes with an incidence of up to 90% (4,5). Magnetic resonance imaging (MRI) is effective for detection of recurrence in thyroid bed and in cervical and mediastinal nodes after surgery and radioiodine (^{131}I) therapy (RIT). MR clearly distinguished thyroid remnants (became fibrous after successful surgery and RIT) with low signal intensity on T_2-weighted images and no enhancement on post contrast T_1-weighted images from recurrent thyroid carcinoma, which produces a high intensity on T_2-weighted images and enhances after contrast application (6,7). Sometimes MRI is superior to routine follow-up techniques such as: ultrasound, which is not able to detect mediastinal and large invasive neck metastases; CT, since RIT may be hampered for several weeks due to iodine containing contrast media; and whole body scintigraphy (WBS), particularly if serum thyroglobulin (TG) is negative (7,8). The aim of the study was to evaluate the efficacy of MRI comparing by WBS in detecting the regional (node) metastases in differentiated thyroid carcinoma (DTC) patients.

Methods:

The study was done in 22 DTC patients, 9 men and 13 women, aged from 22 to 73 years (mean = 46.41 years). Histopathologically, papillary thyroid carcinoma (PTC) was found in 21 patients and Hurthle cell carcinoma (HCC) in one patient. Different therapy treatments were done: total thyreoidectomy in all patients (combined with modified radical neck dissection in 7 patients), RIT in 21/22 patients, chemotherapy combined with external beam therapy in 1/22 patients, and life-long levothyroxine therapy in all patients. We checked up in all of them thyroglobulin (TG), thyrostimulating hormone (TSH) and thyroid antibodies (TA) serum level. Whole body scintigraphy and MRI were performed in all patients. MRI was done at 1.5 T imaging system using precontrast T_1-weighted (TR/TE=450/15 ms) and T_2-weighted (TR/TE=2000/80 ms) spin echo images, in axial and coronal planes, with scanning parameters: slice thickness=4 mm with no gap between slices, matrix size=256x256, and imaging field of view (FOV)=230 mm. Postcontrast T_1-weighted images were done after the application of contrast agent Gd-DTPA.

Results:

Criteria of malignant lymph node involvement which we used included: 1) a node diameter >10mm; 2) more than three grouped nodes; 3) complete cystic appearance or general lymph node inhomogeneity, and hyperintensity in T_1- and T_2-weighted images as a sign of either hemorrhage and/or thyroglobulin content; 4) infiltrative growing; 5) fixation at surrounding structures; and 6) hypointensity of central lymph node necrosis with marginal hyperintensity, following the administration of Gd-DTPA. MRI detected enlarged regional lymph nodes in 10/22 patients, all with elevated TG level; WBS was positive in 7 and negative in 3 of them (false-negative WBSs). The reason for false- negative WBSs was tumor dedifferentiation into anaplastic type. The regional (nodal) metastases were excluded by MRI in 12/22 patients, all with normal TG level; WBS was negative in 9 and positive in 3 patients (false-positive WBSs). Foci of iodine accumulation at false-positive WBSs were explained as remaining normal thyroid tissue in thyroid bed. MR images presented these fibrous thyroid remnants as hypointensed on T_2-weighted images, and without enhancement on postcontrast T_1-weighted images.

Conclusions:

Magnetic resonance may be performed in DTC patients without affecting following nuclear medicine procedures such as WBS or RIT. MRI is effective for localizing and detecting cervical and mediastinal lymph node metastases in DTC patients. It is particularly useful in cases if TG level is elevated and WBS is negative.

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