

Correspondence

Changes in clivus after radiotherapy in patients with nasopharynx cancer

Clivus is the bone area between the foramen magnum and dorsum sellae at the base of the skull and has complex anatomical structures in the surrounding areas. Nasopharyngeal cancer (NPC) has a high proclivity to invade the clivus. This invasion has a prognostic influence on the treatment plan and post-therapy failure. Magnetic resonance imaging (MRI) is preferred in the diagnosis, staging and follow-up of NPC. MRI is preferred because of its capacity for image reception, the rarity of its artefact seen in computed tomography, and because it guides radiotherapy by revealing neighbouring cranial nerves and vascular structures at the posterior fossa.¹⁻³ Tumour recurrence is still one of the most important causes of treatment failure for patients with NPC. After radiotherapy, most patients with NPC still have a local lump, which has to be differentiated from residual tumour, fibrosis or recurrence. Approximately 42.9% of recurrent NPCs are at the clivus of the skull base. Early identification of recurrent NPCs is important to reduce mortality.⁴ Heterogeneity of the signal intensity in clivus is a frequent abnormality in the MRI evaluation after radiotherapy in NPC. It is important to recognize if these changes are due to radiotherapy or due to neoplastic involvement. If the signal intensity in the clivus shows a hypointense signal than the pons in an adult, there is diffuse tumour invasion or bone marrow reconversion.³ After treatment with radiotherapy, recurrent tumours can show various signal intensities and various levels of contrast involvement. In the case of increase in intensity and contrast enhancement, a recurrent mass is likely.^{5,6}

MRI is the preferred imaging modality for primary and metastatic tumours, and for certain inflammatory, vascular and haematopoietic diseases, which are likely to invade the clivus. Besides, the clivus in MRI is a frequently assessed area in examination of the bone marrow pattern. Many studies have shown the importance of MRI images in clivus in the evaluation of bone marrow diseases.^{2,3} There are active bone marrow cells that comprise the red bone marrow in the clivus as in other bones in the body. Clivus bone marrow signal intensity changes as the age advances. As in other parts of the body, yellow (fatty) bone marrow also increases depending on the age. It has been observed that MRI evaluation of the clivus reveals three different types of bone marrow patterns according to age. On routine cranial MRI, the clivus is seen distinctly. In the normal population, the marrow is rich in early adulthood and decreases with age. Accordingly, the MRI features have been studied and graded: grade 1—predominantly low-signal intensity, occupying >50% of the clivus (usually seen in

the third and fourth decades of life); grade 2—low-signal intensity portion occupying <50% but >20% of the clivus (seen around the fifth decade of life); grade 3—predominantly high-signal intensity, with low-signal intensity occupying <20% of the clivus (mainly in elderly after the sixth decade of life).³

Due to these complexities in interpretation of imaging, the enhanced MRI and diffusion-weighted imaging carry additional values to differentiate between post-radiotherapy changes and recurrence in and around the clivus.⁷ Whenever, there is suspicion of recurrent or residual primary disease after radiotherapy, positron emission tomography-computed tomography (PET-CT) scan should be advised.⁸ In regions where NPC is endemic, follow-up MRI can be combined with PET-CT scan to improve the diagnostic accuracy for recurrence.

In conclusion, the signal intensity of the clivus is seen to alter with advancing age. Similarly, radiation therapy is known to cause depletion of the marrow and can give rise to heterogeneous intensities during post-radiotherapy follow-up imaging. In addition, red bone marrow is dominant in childhood and can present a picture of differential signal intensities in childhood NPC, compared to adult NPC.

Conflicts of interest. None declared

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