

## Quantification of Thyroid Volume

**TO THE EDITOR:** I read with interest the article of Zaidi (1) for quantifying thyroid volume using planar and SPECT scans. As the author correctly states, this technique is not applicable to clinical situations where there is a poor contrast and high background activity. A recent dissertation by Erdi (2), using the same technique, described by Mortelmans et al. (3) and Otsu (4), indicated an average error between 70% and 230% using the gray level histogram method at 5:1 lesion-to-background ratio for a set of spheres (1–54 ml). The error arises because of the statistical method lacks the ability to distinguish between the peaks corresponding to the lesion and the background in the gray-level histogram when the contrast is low. Erdi (2) suggested methods to overcome this problem, such as using an edge-preserving smoothing filter described by Nagao and Matsuyama (5). However, even with the use of a filter, volume measurement error is in a 30% range.

In clinical thyroid dosimetry studies, we typically encounter thyroid-to-background ratios between 3:1 and 10:1. Consequently, the use of the gray level histogram method can lead to an error in the volume estimation by up to an order of magnitude rendering the method questionable in an actual clinical setting.

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## Functional Brain Imaging in 200 Patients After Whiplash Injury

**TO THE EDITOR:** Distorsion of the cervical spine as a result of acceleration forces may cause neuropsychiatric symptoms in addition to cervical symptoms (so-called “whiplash” syndrome) (1,2). The following study was designed to evaluate brain perfusion and glucose consumption in such patients with whiplash.

Using MR images and  $^{99m}\text{Tc}$ -bicisate (ECD) SPECT imaging of the brain (3), 200 clinically and neuropsychologically controlled patients (150 women, 50 men; aged  $40 \pm 10$  yr) suffering from a distorsion of the cervical spine with chronic headaches, visual symptoms, neck pain and deficits mainly in memory, concentration and attention were investigated together with 20 normal control subjects (15 women, 5 men; aged  $40 \pm 10$  yr) (2). Ten of the 200 patients and all controls additionally had  $^{18}\text{F}$ -fluoro-2-deoxy-D-glucose PET. To exclude acute post-traumatic brain disorder,

all patients were studied at least 1 yr ( $23 \pm 18$  mo) after the trauma. Furthermore, patients were excluded from the study if they had other neurovascular or neurodegenerative disorders. None of the patients received vasoactive or neuroactive drugs, and no patient showed clinical or neurological evidence of brain injury (commotio or contusio). The control subjects were normal volunteers with no anamnestic, clinical, neurological or neuropsychological abnormalities (2).

Standardized cortical regions of interest (ROIs) were determined from the whole brain. For the PET studies, the glucose metabolic index (GMI), and for SPECT studies, the perfusion index (PI) (ROI uptake/global uptake at the level of basal ganglia) were calculated as previously reported (4).

In the patient group, there was a significant reduction of glucose consumption and perfusion as compared to the control group in the posterior parietal occipital region bilaterally:  $\text{GMI} = p < 0.01$  (Mann Whitney test),  $\text{PI} = p < 0.001$ . In contrast, MR images of the brain were normal in all patients and control subjects.

The posterior parietal occipital region is localized to the watershed zone between the territories of the large cerebral arteries. Although hypometabolism and hypoperfusion could be linked to morphological damage of the bigger arteries, we think that it may be caused by activation of nociceptive afferences from the upper cervical spine since experimental stimulation of pain-sensitive afferences of the trigeminal system has been shown to have various effects on local vasoactive peptides and the cranial vascular system (5).

This functional brain imaging study with SPECT ( $n = 200$  patients) and PET ( $n = 10$  patients), although these modalities are extremely costly techniques, may be a critical approach to answering the lasting controversial medico-legal discussion on whiplash-associated disorders and could have implications for other diseases.

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