Correlations Between NMR Relaxation Times and Histopathological Features in Abnormal Thyroid and Parathyroid Glands: Preliminary Results

A. DEGEORGES 1, J. M. BRULE, B. GASSER, Y. MAUSS, C. SCHEIBER, D. GOUNOT, J. M. LANZ, J. MARESCAUX, and J. CHAMBRON

Over a 10-month period (June 1988 to March 1989), 17 patients were referred for primary hyperparathyroidism (HPTH) and one for tertiary HPTH. Fourteen others were seen for thyroid diseases: functioning (3) or non-functioning (10) nodules and one case of Graves' disease. All of them were explored surgically. Histopathological findings and NMR relaxation times were compared in 32 specimens for parathyroid adenomas and in 24 for thyroid disease.

Method

After glandular ablation, the specimens were taken to the physics laboratory. Relaxation time measurements were performed within 30 min to 1 h on a Minispec PC 20 (Bruker), at 20 MHz and 37° C, connected to an HP 9000 computer. T1 was measured with the classical inversion recovery sequence and T2 with the CPMG method with two different interpulses (0.2 and 1 ms). An iterative algorithm was used to check the exponentiality of the decays.

The second step was formaldehyde fixation, within 1–2 h after surgery, followed by hemalum-eosin staining. The pathologist chose a slice considered representative of the whole specimen; the percentage of the surface of this area occupied by different features was then evaluated. The features in question were: edema, fibrosis, hemorrhagic congestion, cysts, lipid, cellular types, and, for thyroid, the size of vesicles; calcium and siderophages were occasionally mentioned.

Results and Discussion

The T1 and T2 measurements are plotted in Fig.1. There was a slight difference between the T1 of thyroid and of parathyroid diseases, but no difference was seen in respect of T2. For parathyroid adenomas, the mean T1 value was 0.844 s (min. 0.539; max. 1.247; SD 0.16) while the mean T2 value was 0.082 s (min. 0.0323; max. 0.1287; SD 0.025).

1 Centre Hospitalier, Service de Radiologie, B. P. 1125, F-73011 Chambery Cedex, France.
For thyroid diseases, findings were as follows:

T1: Nonfunctioning nodules (17): 0.667 max. 1.026
    min. 0.457
    SD 0.174

Functioning nodules (5):

Graves’ disease (2):

Normal (I):

T2: Nonfunctioning nodules (17): 0.0708 max. 0.1560
    min. 0.05
    SD 0.029

Fig. 1. Frequency histogram. NMR relaxation times in parathyroid adenomas (32 specimens) and functioning and nonfunctioning thyroid nodules (24 specimens)