

Value of online frequency correction for total choline containing compounds peak detection of breast tumors during single-voxel proton MR spectroscopy at 1.5 T

A. Fausto¹, M. Vorbuchner², and F. Sardanelli¹

¹Radiology, IRCCS Policlinico San Donato, University of Milan School of Medicine, San Donato Milanese, Milan, Italy, ²Siemens AG, Erlangen, Germany

Introduction

Proton spectroscopy at 1.5 T (¹H-MRS) demonstrated its utility to increase MR imaging specificity and predictive positive values for tumor diagnosis when a total containing compounds (tCho) peak is detected [1-3]. Respiratory motion are reported to cause B0 field distortions with a shot-to-shot frequency shifts even at 4 T. If not corrected, these shifts reduce spectral resolution and increase peak fitting errors [4]. Recently, a ¹H-MRS sequence were improved using a new tool: the online frequency correction (OLFC). This tool allows correct the frequency shifting for each individual spectra prior to averaging even at 1.5 T.

Patients and Methods

Fifty-five breast lesions in 55 patients (54±13 years) were studied with ¹H-MRS using water- and fat-suppressed spin-echo sequence (TR/TE=1500/136 ms) at 1.5 T (Siemens AG, Sonata). The sequence allows an OLFC of zero order phase and frequency variation, implemented within the Ice-program (Siemens). Corrected and uncorrected raw-data were stored in the database, obtaining two spectra per voxel, processed using filtering, zero-filling, frequency shift, baseline/phase correction, and curve fitting. A tCho peak with an integral >1.80 was considered as a marker of malignancy. Gold standard was pathological examination obtained with core/open biopsy. McNemar test was used.

Results

All spectra were adequate for analysis. Pathology demonstrated 28 malignancies and 27 benignancies. Seven false negatives and four false positives were observed without OLFC, only 3 and 2 with OLFC, respectively. In four malignant lesions (3 IDC, 1 DCIS), OLFC allowed to detect a tCho peak >1.90 missed without OLFC; in two benign lesions (one inflamed lymph node and one fibroadenoma), OLFC showed no tCho peak >1.90 wrongly displayed without OLFC. Sensitivity was 75% (21/28) without OLFC and 89% (25/28) with OLFC, specificity 85% (23/27) and 93% (25/27), PPV 84% (21/25) and 93% (25/27), NPV 77% (23/30) and 89% (25/28), accuracy 80% (44/55) and 91% (50/55), respectively, with a significant gain in diagnostic accuracy (p=0.0313).

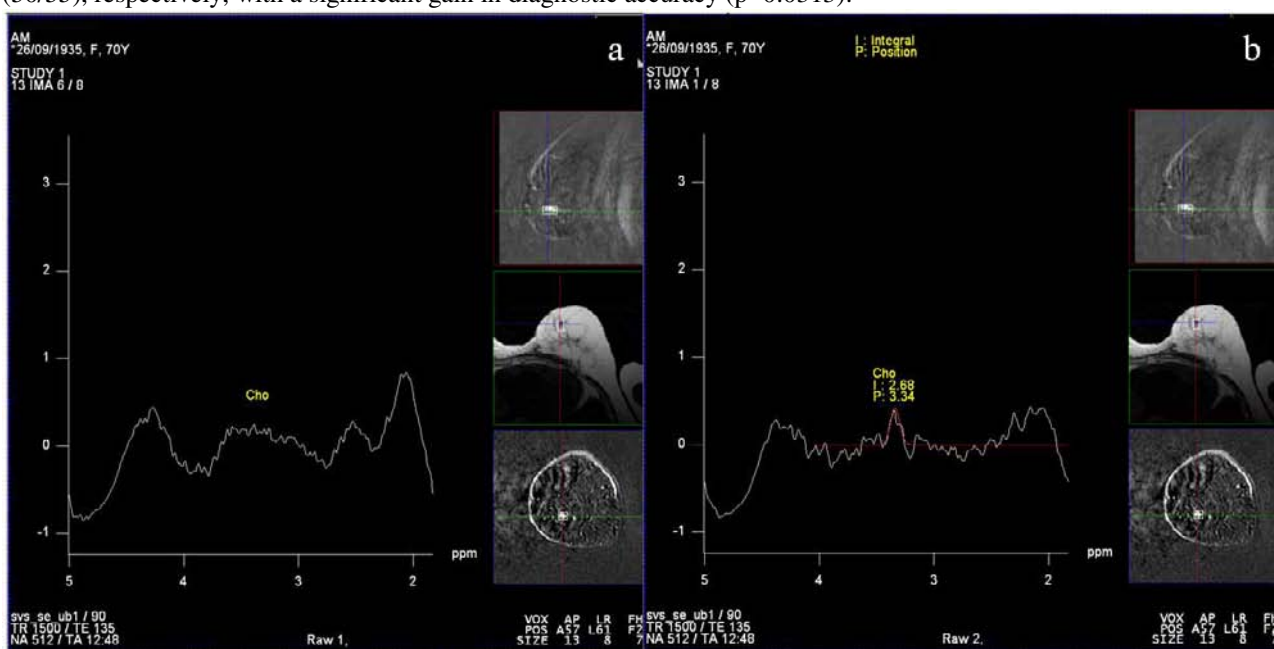


Figure 1: (a) Postprocessed ¹H-MRS spectra of a biopsy proved cancer of the left breast. No significant tCho peak can be detected. (b) Postprocessed spectra of the same voxel adding the online frequency correction. The tCho peak can be easily detected and its integral value estimated.

Discussion

These data confirmed that OLFC increases the diagnostic accuracy of ¹H-MRS of breast lesions at 1.5 T.

References

- [1] Katz-Brull R et al. J Natl Cancer Inst 94:1197-1203 (2002)
- [2] Huang W et al. Radiology 232:585-591 (2004)
- [3] Bartella L et al. Radiology 239:686-692 (2006)
- [4] Bolan PJ et al. Magn Reson Med 52:1239-1245 (2004).