Non echo planar, diffusion-weighted magnetic resonance imaging (periodically rotated overlapping parallel lines with enhanced reconstruction sequence) compared with echo planar imaging for the detection of middle-ear cholesteatoma

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Dear Sirs,

We read with great interest the above paper by Kasbekar et al.1

In the conclusion of this paper, it is stated that ‘[t]he second-look surgery could be replaced by the use of half-Fourier acquired single-shot turbo spin-echo diffusion-weighted sequences.’ Despite the above-mentioned conclusion, it should be noted that several groups have in the meantime reported similar findings in peer-reviewed journals.

Dhepnorrarat and Rajan’s group at the University of Western Australia, Perth, Australia, concluded in 2009 that ‘[t]he half-Fourier acquired single-shot turbo spin-echo diffusion-weighted magnetic resonance imaging (MRI) sequence, and to compare it to the routinely used echo planar diffusion-weighted sequences, both in patients prior to first-stage surgery and in patients prior to ‘second-look’ surgery for residual cholesteatoma. In this last, 2008 paper, we concluded that second-look surgery could be replaced by the use of half-Fourier acquired single-shot turbo spin-echo diffusion-weighted sequences.

In their study of a paediatric cholesteatoma series, the group led by Plouin-Gaudon (Centre Hospitalier de Valence) and Bossard (Hôpital Privé Jean Mermoz, Lyon, France) reported that ‘[t]he half-Fourier acquired single-shot turbo spin-echo diffusion-weighted MRI revealed a cholesteatoma in all true-positive cases. Moreover, no false-positive nor false-negative cases were found’. Furthermore, they were the first to fuse non echo planar diffusion-weighted images and high resolution computed tomography (CT) images in order to precisely localise cholesteatomas.

Huins and Lingam’s group (Northwick Park Hospital, UK) concluded that ‘[o]ur study supports the increasing but small body of evidence that non-echo planar imaging’ (i.e. half-Fourier acquired single-shot turbo spin-echo) ‘[d]iffusion-weighted MRI performs well in detecting cholesteatoma. Its application in detecting residual cholesteatoma in particular is fast becoming a widely accepted practice. We propose that [half-Fourier acquired single-shot turbo spin-echo] [diffusion-weighted] MRI should be performed on all patients before second-look surgery to provide valuable information to the operating surgeon’.8

Schwartz, Lane and colleagues, from the Mayo Clinic (Rochester, Minnesota, USA), concluded in their extensive review article that ‘[n]ewer [diffusion-weighted imaging] techniques with thinner section acquisition and decreased susceptibility artifacts allow detection of small lesions. [Diffusion-weighted imaging] can be useful as the primary imaging technique when visualization is impaired by canal wall up mastoidectomy or cartilaginous reconstruction. The [diffusion-weighted imaging] technique may be used in place of second-look surgery, sparing patients the morbidity of repeat exploration’.9

All the above-mentioned papers used and/or discussed extensively the half-Fourier acquired single-shot turbo spin-echo diffusion sequence, and, in our opinion, reported similar results and findings to our group, confirming our reported findings.

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Authors’ reply

Dear Sirs,

In reply to De Foer, the primary aim of our study was to attempt to replicate the success obtained by Lehmann et al., in France, obtained with the periodically rotated overlapping parallel lines with enhanced reconstruction sequence. This sequence is commonly used in UK hospitals but not in the field of otology, and as such warrants further evaluation within the UK ENT setting. Our work essentially served to highlight to the UK otolaryngological community the fact that simply using any non echo planar imaging sequence to detect cholesteatoma is unlikely to yield success. We agree that the half-Fourier acquired single-shot turbo spin-echo sequence, used by De Foer et al., to detect middle-ear cholesteatoma, shows the most promise in the literature to date, but not in a UK setting at the time when our work was originally written. In our view, the art of accurately detecting middle-ear cholesteatoma on imaging is very operator-dependent, hence the need for local departments to trial the method themselves. For every published paper that finds non echo planar imaging very useful, there will be several departments that have not published their experience.

Unfortunately, Huins et al., published their findings after our paper had been accepted for publication; therefore, their study was not identified by our literature search. Their experience with the half-Fourier acquired single-shot turbo spin-echo sequence was quite favourable, with cholesteatoma detection down to 3 mm and good negative and positive predictive values.

Dhepnorrarat et al., in Australia, examined the half-Fourier acquired single-shot turbo spin-echo sequence, assessing post-operative changes (and not the size of cholesteatoma detected) in MR images compared with ‘second-look’ surgery. Their work found encouraging results for this sequence in detecting cholesteatoma within post-operative ears. Their subsequent, 2010 paper described only 15 paediatric patients, with two cholesteatomas present at surgery within the group. They retrospectively correctly detected the two cholesteatomas, and concluded that the half-Fourier acquired single-shot turbo spin-echo sequence was an ‘emerging’ form of paediatric imaging. This was not a convincing conclusion.

Plouin-Gaudon et al., in France, found the half-Fourier acquired single-shot turbo spin-echo sequence to be useful, but only in combination with superimposed CT images. Their series included only 10 patients, and the authors themselves declared that there was a lack of statistical power with which to draw any firm conclusions.

The review paper from Schwartz et al. (Rochester, Minnesota, USA) assessed several papers (excluding ours). We would strongly argue that their conclusion, that ‘[t]he [diffusion-weighted imaging] technique may be used in place of second-look surgery…’, should be interpreted with caution. Diffusion-weighted imaging can only replace surgery in the correct hands, and when used with an appropriate technique proven to have suitable results in the literature. Perhaps more importantly, the diffusion-weighted imaging technique should be adequately audited within the department to demonstrate that it is being employed correctly. There is an understated element of the learning curve when using such imaging, which may be unfamiliar in both execution and interpretation.

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4 Huins CT, Singh A, Lingam RK, Kalan A. Detecting cholesteatoma with non-echo-planar (HASTE) diffusion-weighted magnetic resonance imaging. Otol Neurosurg 2008;29:141–16