The Journal of Laryngology & Otology (2011), ***125***, *877–878*.

doi:10.1017/S0022215111001022

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

J Laryngol Otol 2011;**125**:376–80

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 'Casselman and De Foer *et al.* continue to report on their success with their particular non echo planar imaging sequences. Further studies should assess the reproducibility of results, using Casselman and De Foer and colleagues' protocols and MRI machines'.

Our group was the first to describe, in 2006, the 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,[2] both in patients prior to first stage surgery[3] and in patients prior to 'second-look' surgery for residual cholesteatoma.[4] 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.

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 '[turbo spin-echo diffusion weighted] MRI holds a great promise in screening for cholesteatoma as an alternative to exploratory second-look surgery'.[5] In another paper, the same group concluded that '[turbo spin-echo] ([half-Fourier acquired single-shot turbo spin-echo]) [diffusion-weighted] MRI is emerging as a cost effective, noninvasive alternative to second-look surgery for detection and screening for cholesteatoma in pediatric patients'.[6]

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 '[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.[7]

Huins' and Lingam's group (Northwick Park Hospital, London, 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]) [diffusion-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.

B DE FOER
Department of Radiology,
GZA Hospitals, Sint-Augustinus Antwerp, Belgium

References

1 Kasbekar AV, Scoffings DJ, Kenway B, Cross J, Donnelly N, Lloyd SWK *et al*. 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. *J Laryngol Otol* 2011;**125**:376–80
2 De Foer B, Vercruysse JP, Pilet B, Michiels J, Vertriest R, Pouillon M *et al*. Single-shot, turbo spin-echo, diffusion-weighted imaging versus spin-echo-planar, diffusion-weighted imaging in the detection of acquired middle ear cholesteatoma. *AJNR Am J Neuroradiol* 2006;**27**:1480–2
3 De Foer B, Vercruysse JP, Bernaerts A, Maes J, Deckers F, Michiels J *et al*. The value of single-shot turbo spin-echo diffusion-weighted MR imaging in the detection of middle ear cholesteatoma. *Neuroradiology* 2007;**49**:841–48
4 De Foer B, Vercruysse JP, Bernaerts A, Deckers F, Pouillon M, Somers T *et al*. Detection of postoperative residual cholesteatoma with non echo-planar diffusion-weighted magnetic resonance imaging. *Otol Neurootol* 2008;**29**:513–17
5 Dhepnorrarat RC, Wood B, Rajan GP. Postoperative non-echo-planar diffusion-weighted magnetic resonance imaging changes after cholesteatoma surgery: implications for cholesteatoma screening. *Otol Neurotol* 2009;**30**:54–8
6 Rajan GP, Ambett R, Wun L, Dhepnorrarat RC, Kuthubutheen J, Chow Z *et al*. Prelimary outcomes of cholesteatoma screening in children using non-echo-planar diffusion-weighted magnetic resonance imaging. *Int J Pediatr Otorhinolaryngol* 2010;**74**: 297–301
7 Plouin-Gaudon I, Bossard D, Ayari-Khalfallah S, Froehlich P. Fusion of MRIs and CT scans for surgical treatment of cholesteatoma of the middle ear in children. *Arch Otolaryngol Head Neck Surg* 2010;**136**:878–83
8 Huins CT, Singh A, Lingam RK, Kalan A. Detecting cholesteatoma with non-echo planar (HASTE) diffusion-weighted

First published online 17 June 2011

magnetic resonance imaging. *Otolaryngol Head Neck Surg* 2010; **143**:141–6
9 Schwartz KM, Lane JL, Bolster BD Jr, Neff BA. The utility of diffusion-weighted imaging for cholesteatoma evaluation. *AJNR Am J Neuroradiol* 2011;**32**:430–6

Authors' reply

Dear Sirs,

In reply to De Foer, the primary aim of our study[1] was to attempt to replicate the success obtained by Lehmann *et al.*,[2] 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.*[3] 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 paper 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.*[4] 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.*,[5] 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.[6] This was not a convincing conclusion.

Plouin-Gaudon *et al.*,[7] 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.*[8] (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.

AV KASBEKAR[1]
D SCOFFINGS[2]
[1]Department of Otolaryngology, Cambridge University Hospitals NHS Trust, UK, and
[2]Department of Neuroradiology, Cambridge University Hospitals NHS Trust, UK

References

1 Kasbekar AV, Scoffings DJ, Kenway B, Cross J, Donnelly N, Lloyd SWK *et al*. 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. *J Laryngol Otol* 2011;**125**:376–80
2 Lehmann P, Saliou G, Brochart C, Page C, Deschepper B, Vallee JN *et al*. 3T MR imaging of postoperative recurrent middle ear cholesteatomas: value of periodically rotated overlapping parallel lines with enhanced reconstruction diffusion-weighted MR imaging. *Am J Neuroradiol* 2009;**30**:423–7
3 De Foer B, Vercruysse JP, Bernaerts A, Deckers F, Pouillon M, Somers T *et al*. Detection of postoperative residual cholesteatoma with non-echo-planar diffusion-weighted magnetic resonance imaging. *Otol Neurotol* 2008;**29**:513–17
4 Huins CT, Singh A, Lingam RK, Kalan A. Detecting cholesteatoma with non-echo planar (HASTE) diffusion-weighted magnetic resonance imaging. *Otolaryngol Head Neck Surg* 2010; **143**:141–16
5 Dhepnorrarat RC, Wood B, Rajan GP. Postoperative non-echo-planar diffusion-weighted magnetic resonance imaging changes after cholesteatoma surgery: implications for cholesteatoma screening. *Otol Neurotol* 2009;**30**:54–8
6 Rajan GP, Ambett R, Wun L, Dhepnorrarat RC, Kuthubutheen J, Chow Z *et al*. Preliminary outcomes of cholesteatoma screening in children using non-echo-planar diffusion-weighted magnetic resonance imaging. *Int J Pediatr Otorhinolaryngol* 2010;**74**: 297–301
7 Plouin-Gaudon I, Bossard D, Ayari-Khalfallah S, Froehlich P. Fusion of MRIs and CT scans for surgical treatment of cholesteatoma of the middle ear in children. *Arch Otolaryngol Head Neck Surg* 2010;**136**:878–83
8 Schwartz KM, Lane JI, Bolster BD Jr Neff BA. The utility of diffusion-weighted imaging for cholesteatoma evaluation. *AJNR Am J Neuroradiol* 2011;**32**:430–6

https://doi.org/10.1017/S0022215111001022 Published online by Cambridge University Press