

Evaluation of a Balanced 3D Turbo Field Echo sequence versus Radial Stack and Thin Slice Single Shot Turbo Spin Echo for detecting small choledochus calculi and depicting choledochus in the papillary region

M. Melhus¹, T. Hirschberg¹, S. W. Ødegård¹, T. H. Storås¹

¹Radiologisk divisjon, Ullevål University Hospital, Oslo, Norway

Introduction

Despite the high sensitivity and specificity of magnetic resonance cholangiopancreatography (MRCP), the method still have some difficulties, in depicting small calculi in the choledochus especially in the papillary region. The widely used Single Shot Turbo Spin Echo (SSTSE) in MRCP has the disadvantages of decreased signal to noise ratio and blurring (1). This may give reduced detection of small stones even in a axial multi slice thin section acquisition, a highly evaluated method for depiction of small stones in the choledochus (2,3). We have therefore tried an Axial Balanced 3D Turbo Field Echo (3D B-TFE) acquisition through the choledochus. This will give a higher signal to noise ratio and potentially a better resolution (4).

Materials and methods

A total of 33 consecutive patients referred for MRCP, (25) with suspicion of calculi, and (8) with other causes, were evaluated for the presence or absence of stone in the distal choledochus. Imaging was performed on a Phillips Intera 1.5T Nova system. Sequences and scan parameters are given in the Table 1 below. The four sequences were evaluated by two radiologists with three and one year of experience with MRI. The resulting images of the choledochus were evaluated for the presence or absence of calculi on a five point scale where 1 was definitively not present and 5 was definitively present. Depiction of the choledochus in the papillary region was also scored on a fivepoint scale where 1 was not interpretable and five was excellent interpretable. The results were correlated to ERCP (14), peroperative cholangiography (3) and patient journal (16). Statistical analysis of results were performed with the software package NCSS and values for the area under the empirical curves (AUC) of the receiver operating characteristics (ROC) plots were extracted.

Table 1

	ssTSE	axial ssTSE	coronal ssTSE	3D B-TFE
TR/TE (ms)	- / 800	- / 60	- / 80	6.4 / 3.2
Flip angle (degrees)	90	90 / 135	90 / 135	75
Number of slices	6 (radial stack)	35	30	50
Slice thickness / gap (mm)	70 / -	5 / 1	5 / 1	3.0 / -1.5
Number of averages	1	1	1	2
Field of view (mm)	300 x 300	375 x 375	375 x 375	105 x 300
Matrix	256 x 320	154 x 256	154 x 256	192 x 240
Half scan factor (%)	100	58.5	62.5	100
Motion correction	Breath hold	Trigger	Trigger	Trigger
Fat suppression	SPIR	SPIR	SPIR	ProSet
Bandwidth (Hz/pixel)	297.6	476.4	443.9	833.2
Scan duration (min:s)	0:48	0:21	0:19	0:33

Results

Prevalence of calculi in choledochus was 28%. An example of image quality is given in Figure 1. Results for detecting calculi are given in Table 2. There are no statistically significant differences between the techniques. The results on depiction of choledochus in the papillary region is shown in Figure 2. The 3D B-TFE proved superior in this area.

Table 2

	Estimate of AUC	Standard Error	Confidence Limit (Lower 95,0%)	Confidence Limit (Upper 95,0%)
3D B-TFE Reader1	0,86473	0,08626	0,56594	0,96274
3D B-TFE Reader2	0,72464	0,10837	0,43826	0,87746
Radial Stack SSTSE Reader 1	0,86957	0,06291	0,67815	0,95050
Radial Stack SSTSE Reader 2	0,71739	0,09652	0,47188	0,85965
Axial SSTSE Reader 1	0,92271	0,04311	0,77725	0,97454
Axial SSTSE Reader 2	0,66184	0,10432	0,40721	0,82100
Coronal SSTSE Reader 1	0,82850	0,08596	0,56901	0,93794
Coronal SSTSE Reader 2	0,66908	0,11000	0,39585	0,83348

Discussion

3D acquisitions are prone to image degradation from motion disturbances. This is not a general problem with SSTSE acquisitions and our patients did not get any antiperistaltic drug when we only used SSTSE sequences, but we should probably have added this when we started with the new sequence. They did fast before the MRCP. The new acquisition gave generally very good and confident pictures when there was no motion disturbances.

References

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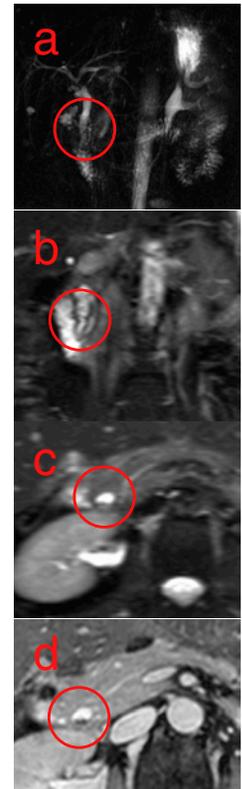


Figure 1. Patient with small calculi (circled) in the distal choledochus. These are not easily detected in the Radial Stack SSTSE images (a), Coronal Thin Slice SSTSE images (b), or the Axial Thin Slice SSTSE images (c), but are clearly depicted in the 3D B-TFE images (d).

Figure 2. Bubble diagram show mean ratings for the depiction of choledochus in the papillary region.

