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Prospective trial of a navigator setting under left hepatic lobe on magnetic resonance cholangiopancreatography using a free-breathing prospective acquisition correction technique

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Abstract

Purpose: To prospectively compare the image acquisition time and image quality obtained by navigator setting under the left hepatic lobe vs. on the right diaphragm on magnetic resonance cholangiopancreatography (MRCP) using a free-breathing navigator-triggered prospective acquisition correction technique (PACE).
Materials and Methods: Fifty consecutive patients prospectively underwent three-dimensional T2-weighted turbo spin-echo MRCP using PACE with the navigator randomly set either under the left hepatic lobe or on top of the right diaphragm. Image acquisition time and subjective image quality were compared on a five-point scale using Student's *t*-test and Mann–Whitney's *U* test, respectively.
Results: There was no significant difference for mean acquisition time (6.1±1.6 vs. 6.3±1.2 min, *P*=.689) between the left hepatic lobe group and right diaphragm group. Mean subjective image quality was significantly worse in the left hepatic lobe group than in the right diaphragm group (4.1 vs. 4.7, *P*=.044).
Conclusion: Setting the navigator under the left hepatic lobe for MRCP using PACE causes the data processing to be more difficult. As well, under current circumstances, it does not contribute to reducing acquisition time or improving the image quality.

Keywords: Navigator; Diaphragm; Magnetic Resonance Imaging; PACE; Hepatic

1. Introduction

The free-breathing navigator-triggered prospective acquisition correction technique (PACE) has recently been used for obtaining high-quality magnetic resonance cholangiopancreatography (MRCP) [1,2]. This technique obtains images by correcting for respiratory motion during free breathing using a navigator echo, which monitors respiration directly in real time. Although image quality can be improved using this method, as it enables more accurate triggering compared to the conventional respiratory triggering technique, the major drawback remains its long acquisition time.

Since the development of PACE, the navigator position has conventionally been set on top of the right diaphragm [1,2]. This is probably because the top of the right diaphragm is easily determined visually for navigator setting and is not surrounded by other organs that disturb accurate navigator triggering. However, this placement is not mandatory because the navigator echo itself does not disturb the signal of the surrounding tissues for imaging.

This real-time navigator triggering method has also been utilized for coronary magnetic resonance angiography [3,4]. A recent report revealed the feasibility of a cardiac fat navigator, which is set on the epicardial fat to monitor coronary artery motion directly, for reducing acquisition time and improving image quality [5]. This trial was based on the

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Table 1
Average values for acquisition time and subjective image quality according to navigator position

	Under left hepatic lobe	On right diaphragm	*P* value
Acquisition time (min)	6.1±1.6	6.3±1.2	.689
Subjective image quality	4.1	4.7	.044

Data are mean±S.D.

fact that a diaphragmatic navigator does not directly monitor the motion of coronary arteries, as hysteresis may occur between the heart and the diaphragm during the respiratory cycle [5].

We hypothesized that this theory could also be adapted to MRCP using PACE because the target organs for evaluation on MRCP — the biliary tract or pancreatic duct — are usually separated from the top of the right diaphragm. The degree of movement of the top of the right diaphragm during the respiratory cycle might be larger than for most other abdominal organs because it borders on the lung, which is the most mobile organ due to respiration. Setting the navigator on organs with less movement might reduce image acquisition time because navigator triggering would become more stable.

In this context, the inferior surface of the lateral segment of the left hepatic lobe, which is usually located in the center of the upper abdomen, might be less mobile than the top of the right diaphragm and closer to the majority of the biliary tract and pancreatic duct. This surface usually borders the peritoneal fat and is easily grasped visually. Therefore, the present study sought to evaluate the feasibility of navigator setting under the left hepatic lobe on MRCP using PACE with regard to image acquisition time and image quality.

2. Materials and methods

2.1. Study group

This prospective single-institution study was approved by the institutional review board of this facility. Informed written consent was not required. A total of 50 patients (29 men and 21 women; median age, 69 years; range, 34–88 years) were referred for MRCP examinations at our institution between April 2007 and June 2007. The reasons for referral for MRCP examination included gallbladder or biliary stone (n=10), pancreatic cancer (n=10), pancreatitis (n=7), dilatation of pancreatic duct (n=7), pancreatic cystic

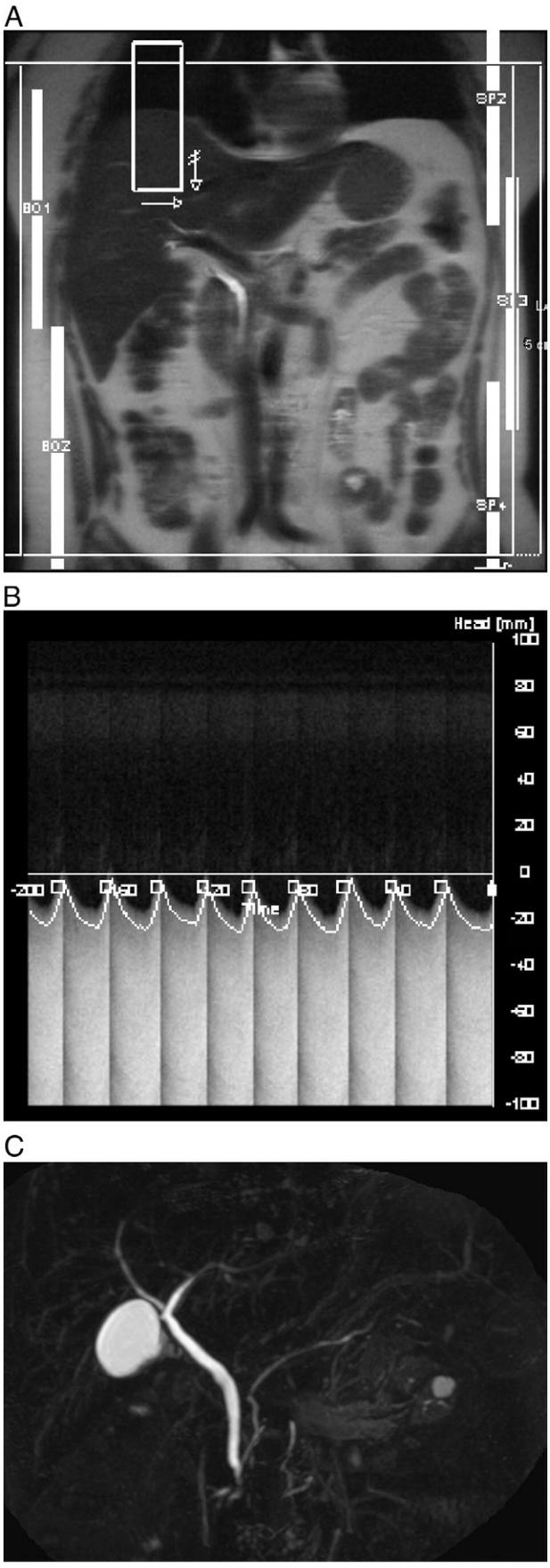

Fig. 1. Example of MRCP using a free-breathing navigator-triggered prospective acquisition correction technique with the navigator set on top of the right diaphragm; images of suspected pancreatic malignancy in a 55-year-old woman. (A) The scout image shows the navigator (small box) set on top of the right diaphragm. (B) The monitor image shows the navigator following the movement of the right diaphragm accurately (wavy line); data (small boxes) are acquired regularly at the expiratory phase. (C) The MIP image of T2-weighted turbo spin-echo MRCP demonstrates that image quality is sufficient.