



Motion and solution in hepatobiliary agent-enhanced dynamic MRI: solid evidence and unanswered question

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Hepatobiliary contrast agent, e.g., gadoxetate disodium, has a clear advantage over extracellular Gd-based contrast agent in terms of lesion conspicuity in hepatobiliary phases, which improves the sensitivity of small hepatic lesions. However, intravenous injection of gadoxetate disodium is associated with an unfavorable phenomenon called acute transient dyspnea and transient severe motion (TSM), which are most prominent in the arterial phase imaging [1, 2]. The incidence rates of severe motion artifacts are reported 8–20%, while transient dyspnea can be observed in 7–14% of the patients [1–3]. Recent literature also showed that breath-hold capacity in terms of time length is diminished by ~10 s after gadoxetate disodium injection compared to gadoterate meglumine [4]. The TSM is reported in literature with the Japanese population, in which substantial artifact was observed in 8% of the patients who received gadoxetate disodium. This phenomenon is self-limited and leads to no severe event. However, they are critical, because arterial phase is essential for the characterization of hepatic lesions [5].

Interestingly, the cause of the artifact is still unknown despite of these consistent results about imaging artifacts in arterial phase imaging. It is also well known that ringing artifact can occur due to rapid changing of signals during the acquisition, which leads to image degradation, especially reported in gadoxetate disodium-enhanced arterial phase imaging [6]. However, most authors of recent literatures describing TSM assume that respiratory motion during the image acquisition is the most relevant event leading the artifact in the image.

In this issue of *Japanese Journal of Radiology*, “Ikono H. et al.” have reported quite robust pieces of evidence indicating that abdominal movement due to breath-hold failure is highly correlated to the imaging artifact so-called TSM. Abdominal wall movement recorded with the waveforms of respiratory bellows was a strong indicator of transient artifact in arterial phase images. If no abdominal movement on the waveform, no transient artifact was found in both gadoxetate disodium and extracellular Gd-based contrast material-enhanced arterial phase images, while 7 of 8 patients with severe abdominal wall movement resulted in transient artifact in arterial phase images. According to their results, it is clear that abdominal wall movement due to breath-hold failure is a direct cause of artifact in the images after contrast injection. Although the cause of the TSM remains unanswered, we probably can avoid the artifact by settling the abdominal wall movement and/or gating the movement with advanced technology. Recent advances in the MR technique allow breath-hold-free acquisition of arterial phase MRI using respiratory-gated acquisition [7]. Radial sampling scheme so-called stack-of-stars technique is also promising [8, 9]. By monitoring the respiratory movement from the *k*-space data, stack-of-stars technique may be able to avoid artifact due to abdominal wall motion [10].

Controlling the unexpected signals due to motion of abdominal wall is essential to solve this unfavorable phenomenon by gadoxetate disodium, which may pose a stumbling block to the routine use of hepatobiliary contrast agent in liver MRI in spite of their big advantage in the image contrast.

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