

The smoke sign: a secondary sign of unsuspected acute pectoralis major tendon injury on routine shoulder MRI

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The authors assessed 52 routine shoulder MRIs of n=38 patients with and n=14 patients without acute pectoralis major tendon tears, that had either additional pectoralis major focused MRI imaging, which confirmed presence or absence of injury, or unequivocal rupture on transverse slices. The “smoke sign” describes the appearance of the edematous changes anterolaterally of the coracobrachialis/ short head of biceps muscle bellies with sharp posterior and medial margins adjacent to the coracobrachialis/ short head of biceps and smoke-like ill-defined anterior and medial margins on paracoronal and/ or parasagittal shoulder PD or T2 weighted fat saturated MR images. Since the field-of-view on paracoronal and parasagittal images covers the humerus more distally than the transverse slices on standard shoulder MRI, this indirect sign may be depicted, while the rupture itself is not covered by the transverse image stack. The smoke sign showed a sensitivity and specificity of 100% for tendinous ruptures or avulsions. The sensitivity was 50% for detection of myotendinous junction injuries and 0% for intramuscular injuries. None of the controls showed the smoke sign. Presence of the smoke sign on standard shoulder MRI should result in evaluation of the pectoralis major tendon and recommendation for dedicated imaging to confirm and evaluate the full extent of injury. In case of initial suspicion of pectoralis major injury, instead of shoulder MRI, initially pectoralis focused MRI should still be performed.

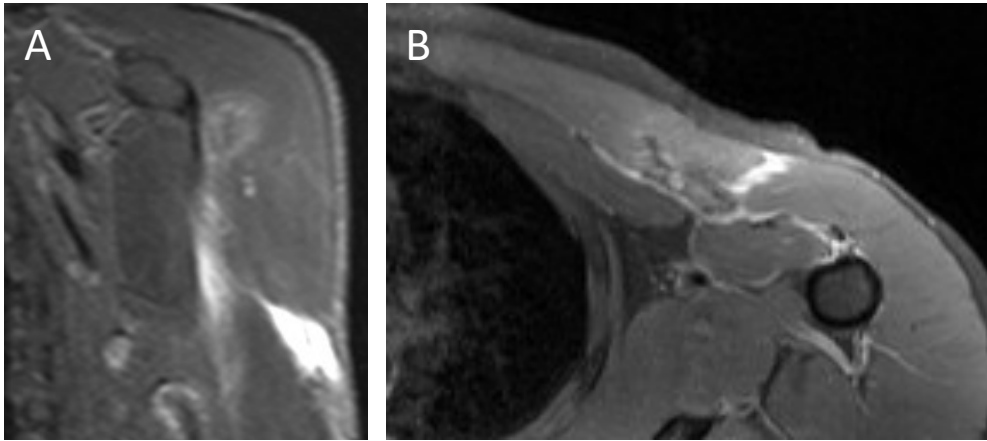


Figure. A: Smoke sign on coronal short tau inversion recovery sequence with sharp medial margins of the edema adjacent to the coracobrachialis/short head of biceps and irregular lateral margins. B: PD weighted fat saturated transverse pectoralis MRI demonstrating the pectoralis tendon tear.

Plus:

- Clinically useful sign, presented in a very readable manner with background information.
- Nice examples for positive and negative findings are provided.
- Anatomy of the pectoralis major is nicely described by use of an illustration.

Limitations:

- Although a good kappa was reported, it is not stated in which cases the two readers disagreed.
- It was not described whether the smoke sign has to be present on both, the sagittal and the coronal images to be positive. Most likely presence on one orientation was sufficient for a positive sign and should lead to further evaluation via pectoralis MRI.
- Inferior partial pectoralis major tears were not assessed. Potentially, including these would reduce the sensitivity.
- The smoke sign is only applicable to detect tendon ruptures or avulsions.
- Since 50% of myotendinous and 100% of intramuscular pectoralis major injuries did not present a smoke sign, in case of clinical suspicion or edematous changes along the pectoralis muscle (also see image 4b) pectoralis MRI should still be performed.