Danish University Colleges

Comparison of STIR and T2 FAT SAT in bone bruise imaging for occult scaphoid fracture

Meincke, Louise; Radev, Dimitar; Lauridsen, Carsten Ammitzbøl

Publication date:
2015

Link to publication

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Download policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Comparison of STIR and T2 FAT SAT in bone bruise MRI musculoskeletal imaging of occult scaphoid fracture (1.5T)

Louise Meincke, BA graduate from the Bachelor’s Degree Programme in Radiography (Frederiksberg hospital)
Partner University/ Collaboration Partner : Dimitar Ivanov Radev MD (Gentofte hospital), Carsten Ammitzbøl Lauridsen (Metropol).

Introduction

Since the introduction of Magnetic resonance imaging (MRI), the use of high-field-strength MRI in musculoskeletal imaging has become more common. The benefits of MRI is shown as a desirable method in the diagnostics of occult scaphoid fracture in particular the visualization of bone bruise (1). Different fat suppression sequences with different backgrounds can detect the presence of bone bruise e.g. Short t2 inversion recovery (STIR), Spectral Fat saturation (FAT SAT), Hybrid, Fat – water separation and Dixon (2). However, a majority of published articles describes the standard method for musculoskeletal MRI fat suppression comprising the STIR or T2 FAT SAT sequence, but no unified guidelines is described.

Methods

In the period March 2014 until January 2015 195 patients underwent MRI examinations of the scaphoid bone. Fifty-one patients (average: 19 years, M: 40, F:11) met the inclusion criteria’s.

Inclusion criteria for acute MRI scan of scaphoid bone

- Relevant trauma less than 2 weeks
- Negative X ray of scaphoid bone
- Positive clinical finding
- Age > 10 years (> 3 mm between the scaphoid bone and the lunate bone)
- Bone bruise on coronal STIR and sagittal T2 FAT SAT

Motion artifact free sagittal T2 FAT SAT and STIR images

The fifty-one recruited patients underwent an additional sagittal STIR Sequence scan. The sagittal T2 FAT SAT and STIR were then compared and evaluated.

Imaging Technique

The MRI scans were performed on a 1.5 T extremity scanner (GE Healthcare Systems, ©Optima MR430s, 4.02 software release, Milwaukee, WI, USA). a 123 mm quadrature coil was used.

Aim of the study

To investigate differences between STIR and T2 FAT SAT in detection of bone bruise in a prospective study.

Parameter settings:

- B) Placement of the patient’s hand was allowed the central axis for the STIR and FAT SAT sequences

Results

There was no significant variation relative to the area of the bone bruise (p > 0.005) and the CNR (p > 0.005).

There was a significant variation relative image contrast (C) (p < 0.005).

The PCC showed that the agreement of the tendon (method 3) was considered as fair, as indicated by the correlation coefficient and −1 as total negative.

Image evaluation

Bone bruise and image quality assessment included three methods:

1. Comparison of the area
2. Comparison of CNR
3. Comparison of bone bruise image contrast

The image material was continually and independently assessed by all three readers blinded to each other’s results. All measurements were performed on the same slice and the same PACS monitor, to ensure a identical and comparable image quality.

Data were subsequently analyzed by unpaired Student’s-t test and Pearson correlation analysis (PCG).

Conclusion

An interchangeably usage of the two sequences was found acceptable for the diagnostic (> 1 T) if the protocol is properly composed.

However, the T2 FAT SAT sequence provides a image contrast superior to the STIR sequence.

References


September 2016

Poster presentation: Del Sundhedsfaglige og Teknologiske Fakultet Professionshøjskolen Metropol, Tagensvaj 18,
2200 København N. Denmark.

Parameter settings:

- A) When using a narrow bandwidth (bw), an excitation of only the fat protons will occur (method 1)
- B) Using a low field strength (< 1T) the signal from the water and fat will overlap and it will not be possible to achieve an ideal fat saturation (5-7).

Figure 1: Illustration of STIR principal, chemical shift. The mixture of T1 relaxation and the signal from the fat and water signals T1 Sat = T1 Sat (75% of T1) (5-7).

Figure 2: Illustration of the FAT SAT principal, chemical shift. (A) When using a narrow bandwidth (bw), an excitation of only the fat protons will occur. (B) Using a low field strength (< 1T) the signal from the water and fat will overlap and it will not be possible to achieve an ideal fat saturation (5-7).

Figure 3: Comparison of bone bruise image contrast

Figure 4: Presentation of the parameter settings for the sagittal STIR and T2 FAT SAT sequences

Figure 5: The box-plots show the image contrast (C) y-axis for the STIR and FAT SAT sequences

Figure 6: The box-plots show the CNR (CNR) y-axis for the STIR and FAT SAT sequences.