Validity of Virtual Arthroscopy made of fat suppressed 3D GRE direct MR Shoulder Arthrography in Determining the Labral Lesion of the Shoulder

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Introduction

Direct magnetic resonance (MR) arthrography of the shoulder is very useful and accepted method in the evaluation of the shoulder labral lesions. It shows higher sensitivity and specificity in the lesion detection compared to the conventional shoulder MRI. With conventional 2D MR arthrography it is not always easy to discriminate subtle variations in the labral lesions such as Bankart lesion, ALPSA, and Perthes lesion. Fat suppressed 3D gradient echo sequence (GRE) allowed high spatial resolution to increase diagnostic certainty in the assessment of the labral lesion[1]. Feasibility of the virtual MR arthroscopy helped in understanding of the pathology in various joints[2]. The purpose of our study was to validate virtual arthroscopy reconstructed from fat suppressed 3D GRE sequence MR arthrography in discriminating various labral lesions over the multiplanar 3D reformatted image.

Materials and Methods

The study group comprised 19 patients (14 man, 5 women; mean age 24.7) with an episode of recurrent shoulder dislocation who were referred for MR arthrography of the shoulder and then underwent arthroscopy. Mean time interval from initial dislocation episode to the operation was 11 years. Mean dislocation frequency was 14.6 times.

Arthrographic procedure was performed with a 22 gauge angiocath introducer needle placing within the glenohumeral joint under fluoroscopic guidance. 15-18 ml of a gadolinium/saline solution (0.1 ml gadepentetate dimeglumine diluted in 20 ml saline) were injected.

MR examination were performed with a 1.5-T imager (10 patients with Horizon [General Electric Medical Systems, Milwaukee, WI] and 9 patients with Gyroscan Intera [Philips, Best, Netherlands]) with dedicated shoulder coil. The patients were examined in the supine with thumb up neutral position. For each patient we acquired fat-suppressed three-dimensional fast spoiled gradient recalled (3D-FSPGR) sequence in the axial plane with TR/TE = 21/2 msec, flip angle = 15°, slice thickness 1.3 - 1.5 mm, FOV 14 cm, with matrix size 256 x 256, 60 scan images acquired in Horizon imager. At the Gyrocan Intera fat suppressed T1-weighted 3D fast field echo (3D-FFE) sequence in the axial plane with TR/TE = 16/8 msec, filp angle =15°, slice thickness 1.3 – 1.5 mm, FOV 14 cm, with matrix size 512 x 512, and 60 scan images were acquired.

Virtual arthroscopic image was made from postprocessing works with three-dimensional reconstruction software (VoxelPlus; Mevisys, Daejeon, Korea) in a separate workstation. Multiplanar reformatted axial images and virtual arthroscopic images were reviewed, focused on the anterior inferior labral lesion, Bankart, ALPSA, and Perthes lesion respectively. Each lesion scored grade 1 to 5 according to the lesion conspicuousness. Golden standard of the diagnosis was arthroscopic finding.

In each modality the performance in detecting and conspicuously discriminating the lesion was assessed using the area (Az) under the receiver operating characteristics (ROC) curve. Sensitivity and specificity detecting the lesion were calculated cut off value at the grade 2..

Results and Discussion

Total number of lesions on arthroscopy are; Bankart lesion 10, ALPSA 13, Perthes lesion 4 and combined lesion of Bankart lesion and ALPSA 6, ALPSA and Perthes lesion 4. Performance of each modality and sensitivity specificity are shown on Table 1.

	Performance(Az)			Sensitivity (%)			Specificity (%)		
	Bankart	ALPSA	Perthes	Bankart	ALPSA	Perthes	Bankart	ALPSA	Perthes
MPR	0.756	0.821	0.867	80.0	100.0	75.0	66.7	50.0	90.3
VA	0.906	0.788	0.717	100.0	100.0	50.0	66.7	66.7	100.0

Table 1.. Performance, sensitivity, and specificity of the MPR and virtual arthroscopy.

False positive for ALPSA lesion at the virtual arthroscopy was due to the misinterpretation of the longitudinally detached labrum as medialization and due to the insufficient distension of the anterior capsule. False positive for Bankart lesion was due to thick granulation tissue misinterpreted as irregular labrum. Some case shows low signal intensity due to delayed scanning, so contrast difference was insignificant on multiplanar reformatted images, but virtual imaging was not significantly influenced. Subtle Bankart lesion was not confidently or not detected on the MPR image. On the while virtual arthroscopy reliably showed this minute pathology well comparable to the arthroscopy (Fig.1.).

**Fig.1.** A 22-year-old man with recurrent right Shoulder dislocation.
A. Arthroscoy. Posterior portal view. Area of labral defect (open arrows) and medialization of the avulsed labrum are shown (black arrows).
B. Virtual MR arthroscopy. Anterior portal View. Granulation tissue of the ALPSA Lesion(thin arrow) as well as labral defect(open Arrows) and medialization (black arrow).
C. Multiplanar reconstruction axial image was interpreted as Bankart lesion.
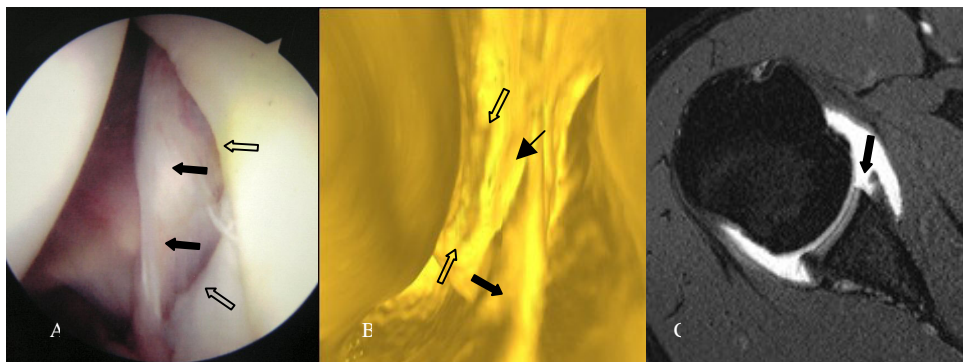
Conclusion

Virtual MR shoulder arthroscopy made of fat suppressed 3D GRE MR arthrography could be a robust and feasible method for assessing labral pathology in recurrent shoulder dislocation, specifically for investigating Barkart lesion. Thus, it could be very beneficial in diagnostic accuracy as well as proper preoperative surgical planning.

References

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