



Role of MRI Arthrography compared to conventional MRI In assessment of shoulder joint disorders.

Thesis

Submitted in Partial Fulfillment of the Master Degree in Radiology

Presented by

Duaa Abdulrahman Ahmed Mahmoud El Desouki

M.B.,B.Ch

Under supervision of

Prof. Dr.Mohamed Amin Nassef

Professor of Radiodiagnosis

Faculty of Medicine – Ain Shams University

Dr. Susan Adil Ali AbdulRahim

Lecturer of Radiodiagnosis

Faculty of Medicine – Ain Shams University

Faculty of Medicine

Ain-Shams University

2018

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

سَبِّحْكَ لَا إِلَهَ إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**, the Most Kind and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Mohammad Amin Nasef**, Professor of Radiodiagnosis Faculty of Medicine – Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Dr. Susan Adil Ali AbdulRahim**, Lecturer of Radiodiagnosis Faculty of Medicine – Ain Shams University, for her kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

Duaa Abdulrahman El desouki

Dedication

*Words can never express my sincere thanks to **My Family and My Loving Husband** for their generous emotional support and continuous encouragement, which brought the best out of me. I owe them all every achievement throughout my life.*

*I would like to express my everlasting gratitude to all **My Professors, Colleagues and Friends**, so many of them influenced, encouraged and inspired me throughout the years. I wish them the best of all.*

*I would like also to thank the **Patients** who agreed willingly to be part of my study and without them; I would not have been able to accomplish this work.*

List of Contents

Title	Page No.
List of Tables	6
List of Figures	7
Introduction	1
Aim of the Work.....	22
Review of Literature	
▪ Anatomy of the Shoulder Joint	23
▪ Normal Shoulder MRI Anatomy	43
▪ Pathology.....	51
▪ MR Manifestations of Shoulder Pathology	71
Technique	135
Patients and Methods	143
Results	147
Case Presentation	165
Discussion	181
Summary	192
References	194
Arabic Summary	—

List of Tables

Table No.	Title	Page No.
Table (1):	Mean age of patients 32.5 + 10.5 years.....	147
Table (2):	Table of significance.....	163
Table (3):	Demonstrating sensitivity, specificity, Positive predictive value, negative predictive value and accuracy of conventional MRI compared to MR Arthrography in diagnosis of banker lesion.....	164
Table (4):	Demonstrating sensitivity, specificity, Positive predictive value, negative predictive value and accuracy of conventional MRI compared to MR Arthrography in diagnosis of labral tear.	164

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Osteology of bones forming shoulder joint	25
Figure (2):	Graphic image of a superior view of shoulder ligaments	29
Figure (3):	(a)subacromial bursa,(b)subscabular bursa	32
Figure (4):	(a-b); Coracoacromial arch; type I acromion....	34
Figure (5):	Graphic image of a latral view of the rotator cuff muscle.....	36
Figure (6):	Graphic image of a coronal section A-posterior view B-anterior view of the rotator cuff muscles	37
Figure (7):	Graphic image of a lateral section through the shoulder showing the glenohumeral ligaments as well as the rotator cuff superimposed by the deltoid muscle.....	38
Figure (8):	a-c. Projectional images of rotator cuff muscles and tendons as seen in an anterior.....	39
Figure (9):	Rotator interval capsule.....	41
Figure (10):	(a-b):axial MR anatomy superior images	45
Figure (11):	(a-b) Coronal oblique conventional MRI anatomy.....	47
Figure (12):	(a-c): Sagittal conventional MRI anatomy (mid-sagittal,lateral and medial images)	50
Figure (13):	Anterior labrum avulsion from the anterior glenoid rim.....	52
Figure (14):	Axial graphic showed avulsion of the IGHLL attachment to the glenoid with disruption of the scapular periosteum.	53
Figure (15):	The axial graphic demonstrate an avulsion of the IGHLL attachment to the glenoid with intact periosteum.....	54
Figure (16):	Axial graphic showed medial displacement and inferior rotation of the IGHLL attachment to the glenoid	55

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (17):	GLAD lesion	56
Figure (18a-j):	SLAP I lesion corresponds to fraying of superior labrum(<i>arrow</i>).	61-47
Figure (19):	Diagram showing the frontal extent of a tear of supraspinatus	67
Figure (20):	Diagram showing the sagittal extent of a tear of the rotator cuff.....	68
Figure (21):	A,B. Avulsion of the anterior band of the inferior glenohumeral ligament (IGL)	71
Figure (22):	C – E: (C, D) T2*-weighted axial images show the avulsed anterior labrum (curved arrow) and the anterior band of the IGL (small straight arrow). mgl, middle glenohumeral ligament; s, subscapularis tendon (E) A T2*-weighted sagittal oblique image shows the avulsed anterior band (AB; arrows) of the IGL. G, glenoid; mgl, middle glenohumeral ligament; S, subscapularis tendon.	72
Figure (23):	Avulsed anterior glenoid labrum.....	72
Figure (24):	Inferior glenohumeral ligament lateral complex.....	75
Figure (25):	A - D. Humeral avulsion of the glenohumeral ligament.....	76

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (26):	E - G (E) The corresponding arthrogram confirms extravasation of contrast (curved arrow) through the tear in the IGL complex (straight arrow) (F) Enhanced axial (left) and sagittal oblique (right) images demonstrate abnormal anterior and lateral displacement of the anterior band of the IGL (small curved arrow). (G) An inferior axial image shows an avulsed humeral attachment of the IGL (large curved arrow) and associated ligamentous and lateral fraying (small curved arrow).....	77
Figure (27):	Axial PDWI demonstrate avulsion of the labrum (arrow) & ligament with disrupted scapular periosteum (open arrow).	79
Figure (28):	A posterolateral Hill-Sachs fracture.....	80
Figure (29):	(A) A T1-weighted axial image shows an osseous Bankart lesion with fracture of the anterior inferior glenoid (arrows) (B) A linear tear of the anterior labrum (large arrow) can be seen. However, the osseous Bankart lesion (small arrows) demonstrates poor contrast on this T2*-weighted axial image. Sagittal graphic image showed fracture of the anteroinferior glenoid margin consistent with osseous Bankart lesion.	81
Figure (30):	Bankart and Hill-Sachs lesions.....	81
Figure (31):	Axial MR arthrography axial and axial oblique after abduction demonstrating tear of the anterior labrum at the midglenoid level with intact scapular periosteum.....	82

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (32):	Fat-suppressed T1-weighted MR arthrogram of an anterior labral avulsion	83
Figure (33):	Chronic Bankart lesion (arrow) in an injured football player is seen on T2* (A), fat-F suppressed T2-weighted fast spin-echo (B), and axial CT (C) images. On the fat-suppressed T2- weighted fast spin-echo image there is a lack of bone marrow edema at the fracture site or in adjacent glenoid subchondral bone marrow. Sclerotic changes are seen in the anterior inferior glenoid rim on corresponding CT scan (C).	83
Figure (34):	Axial graphic showed medial displacement and inferior rotation of the IGHLL attachment to the glenoid	84
Figure (35):	ALPSA lesion associated with a traumatic anterior dislocation.....	85
Figure (36):	GLAD lesion. Axial STIR MRA demonstrate a hyaline cartilage defect with adjacent fraying and partial tear of the base of the labrum in a clinically stable patient.	86
Figure (37):	HAGL lesion with avulsion of the humeral attachment of the inferior glenohumeral ligament (arrow) on fat-suppressed T2-weighted fast spin-echo coronal oblique.	87
Figure (38):	Posterior instability and labral tear	88
Figure (39):	Axial radiograph showed a tear at the base of the avulsed posterior labrum.....	88
Figure (40):	Traumatic posterior instability with complete fragmentation of the posterior labrum.....	89

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (41):	Posterior capsular rupture	90
Figure (42):	Reversed Bankart lesion with anteromedial humeral head impaction	90
Figure (43):	Bennet lesion with posterior extraarticular ossification in the coronal graphic image and coronal T1WI.....	92
Figure (44):	36-year-old man with shoulder pain and clinical findings suggestive of impingement.....	93
Figure (45):	Coronal proton density-weighted fat-suppressed image (TR/TE, 3,000/30) obtained in 61-year-old man with superior labral anteroposterior lesion surgically confirmed	94
Figure (46):	MR arthrogram in 38-year-old man shows transitional zone	95
Figure (47):	MR arthrograms of right shoulder in man with shoulder pain and superior labral anteroposterior (SLAP) lesion.....	95
Figure (48):	Full-thickness tear.....	98
Figure (49):	Articular- and bursal-surface partial-thickness tears.....	98
Figure (50):	MR arthrographic, full-thickness tear of the supraspinatus tendon	99
Figure (51):	Tendinopathy	100
Figure (52):	MR arthrographic, full-thickness tear of the supraspinatus tendon	102
Figure (53):	Articular-sided partial-thickness tear	104
Figure (54):	Bursal-sided partial-thickness tear	104
Figure (55):	Both articular - and bursal-sided partial-thickness tears.....	105
Figure (56):	Articular-sided partial-thickness tear	107
Figure (57):	MRI Partial-thickness tear	108

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (58):	(A) Coronal oblique T2W image demonstrates focal intermediate signal intensity and tendon thickening (arrow), compatible with moderate tendinosis (B) Cross-referenced sagittal oblique T2W image confirms moderate tendinosis with no fluid-signal intensity or tendon disruption to indicate a tear.....	109
Figure (59):	Normal intratendinous MRI signal	111
Figure (60):	Sagittal oblique T1-weighted (T1W) image demonstrates normal rotator cuff musculature	111
Figure (61):	Sagittal oblique T1W image shows mild supraspinatus and infraspinatus volume atrophy (each is even with its tangent line) and only minimal fatty infiltration.....	112
Figure (62):	Sagittal oblique T1W image demonstrates moderate volume atrophy and fatty infiltration of the supraspinatus and infraspinatus muscles.....	112
Figure (63):	Sagittal oblique T1W image shows severe atrophy and advanced fatty infiltration of the supraspinatus and subscapularis muscles	113
Figure (64):	Sagittal oblique T1-weighted (T1W) image demonstrates normal rotator cuff musculature	113
Figure (65):	Sagittal oblique T1W image shows mild supraspinatus and infraspinatus volume atrophy (each is even with its tangent line) and only minimal fatty infiltration.....	114

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (66):	Sagittal oblique T1W image demonstrates moderate volume atrophy and fatty infiltration of the supraspinatus and infraspinatus muscles.....	114
Figure (67):	Sagittal oblique T1W image shows severe atrophy and advanced fatty infiltration of the supraspinatus and subscapularis muscles.....	115
Figure (68):	Sublabral foramen (arrow) shown above the equator (above the anterior glenoid notch) on a fat-suppressed T1-weighted sagittal oblique MR arthrogram.....	117
Figure (69):	A normal adherent anterior superior glenoid labrum (L) as seen on an enhanced T1- weighted axial image.....	118
Figure (70):	Sublabral foramen (A through D) Enhanced T1-weighted axial images illustrate the normal anatomic relationship of subscapularis tendon (s), middle glenohumeral ligament (m), and anterior labrum (al) from anterior to posterior. Note the sublabral foramen (arrow) as a normal anatomic variant above (A) and at the level of (B) the superior coracoid (C)	119
Figure (71):	Buford complex (A) Thick cord-like middle glenohumeral ligament (mgl) attaching directly to the superior labrum (sl) on fat-suppressed T1-weighted sagittal oblique arthrogram (B) Corresponding fat-suppressed T1 axial image identifies cord-like middle glenohumeral ligament (m) with an absent anterior superior labrum as a normal variant.....	122

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (72):	Buford complex showing cord-like middle glenohumeral ligament (mgl) and hypoplastic anterior labral tissue at the level of the subscapulis tendon	124
Figure (73):	(A, B) Enhanced T1-weighted axial images show the superior wedge labrum with a firm attachment between the anterior labrum (al) and the glenoid articular surface at the level of the subscapularis tendon (s)	126
Figure (74):	Posterior wedge labrum with superior labrum firmly attached to the anterior glenoid (straight arrow) and posterior labrum overlapping the glenoid articular surface with a free central edge.....	126
Figure (75):	Six arrangements of synovial recesses (ie, joint capsule variations, arrows) are described by Itoigawa and Itoi (2016)	128
Figure (76):	A single type 4 synovial recess.....	129
Figure (77):	A type 3 synovial recess with hemorrhagic capsular distention	130
Figure (78):	Cord-like middle glenohumeral ligament (MGL).....	133

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (79):	(A, B) Cord-like middle glenohumeral ligament (MGL) on T1-weighted enhanced axial images at the level of the coracoid (A) and inferior to the coracoid at the level of the subscapularis tendon (B). Curved arrow, filamentous attachment to cord-like MGL; large straight arrow, cord-like portion of MGL; small straight arrows, thin portion of MGL; AGL, anterior glenoid labrum (C) The corresponding T1-weighted enhanced sagittal oblique image shows the relationship of the MGL to the anterior band of the IGL (AB; straight arrow), the anterior glenoid labrum (AGL; curved arrow), the middle glenohumeral ligament (MGL), and the subscapularis tendon (S). The MGL is located in the plane between the subscapularis tendon and the anterior band of the IGL or anterior glenoid labrum.	134
Figure (80):	Pseudolabral tear	134
Figure (81):	Medial dislocation of the long head of the biceps tendon (arrow) and associated full thickness subscapularis tendon tear	138
Figure (82):	Coronal T1 weighted image of a normal left shoulder.....	139
Figure (83):	Sagittal T2 -weighted image of a normal right shoulder.	140
Figure (84):	Axial STIR image of a normal right shoulder.....	141
Figure (85):	Pie chart demonstrating percentage of male and female patients.....	147