List of contents

I	Introduction and aim of the work	1
II	Review of the literature	
	MRI examination techniques of the wrist	3
	Radiological anatomy	
	 osseous anatomy 	7
	 ligamentous anatomy 	11
	• tendons	30
	carpal tunnel	32
	 Guyon's canal 	33
	MRI findings and pathological correlation	
	 Occult fractures and avascular necrosis 	34
	Ligamentous lesions	41
	 Nerve entrapment syndromes 	61
	 Tendon pathology 	72
	 Arthropathies and infectious conditions 	76
	 Masses of the wrist 	95
III	Patients and methods	116
IV	Results	120
V	Case presentation	127
VI	Discussion	155
VII	Conclusion	166
VIII	Summary	167
IX	References	168
X	Arabic summary	181

Abbreviations

AS: Ankylosing spondylitis

AVN: Avascular necrosis

BNST: Benign nerve sheath tumors BNST:

CTS: Carpal tunnel syndrome

DISI: Dorsal intercalated segment instability

DRUJ: distal radioulnar joint

FOV: field of view

GCTTS: Giant cell tumors of the tendon sheath

LT: Lunotriquetral

LTI: Lunotriquetral carpal instability

MRI: Magnetic resonance imaging

RA: Rheumatoid Arthritis

RLT: Radiolunotriquetral

RSC: Radioscaphocapitate

RSL: Radioscapholunate

RSLT: Radioscapholunotriquetral

SL: Scapholunate

SLAC: Scapholunate advanced collapse

SNR: Signal-to-noise ratio

TFC: Triangular fibrocartilage

TFCC: Triangular fibrocartilage complex

TS: Triquetroscaphoid

TT: Triquetrotrapezoid

List of figures

Figure 1: Patient positioned with the arm at the side	4
Figure 2: Patient positioned with the arm above the head	4
Figure 3: Coils for hand and wrist imaging	6
Figure 4: Anatomy of the distal radius and ulna	8
Figure 5: Assessing DRUJ stability. Axial T2 WIs	8
Figure 6: Negative ulnar variance. Coronal FS PD image	10
Figure 7: Positive ulnar variance. Coronal FS PD image	10
Figure 8: Lister's tubercle. Coronal FS PD image	10
Figure 9: The volar extrinsic ligaments: Drawing	14
Figure 10: Anatomy of the RSC, RLT and RSL ligaments. FS T1-weighted arthrogram	14
Figure 11: Anatomy of the RLT ligament (A) Coronal T1-weighted arthrogram. (B) FS sagittal T1-weighted arthrogram	15
Figure 12: The SRL ligament. (A) Coronal T1-weighted arthrogram. (B) FS sagittal T1-weighted arthrogram	17
Figure 13: Anatomy of the RSL and RSC ligaments. (A) Coronal T1-weighted arthrogram. (B) FS Axial T1-weighted arthrogram	17
Figure 14: The TFC complex. Coronal T2*-weighted image	18
Figure 15: Patterns of the dorsal carpal ligaments. (A) Illustration (B) corresponding FS T1-weighted coronal image (C) On an FS PD FSE axial image	20

Figure 16: Anatomy of the scapholunate ligament on three separate coronal images	22
Figure 17: Membranous wedge-shaped component of the scapholunate ligament. (A) Coronal colour illustration. (B) Coronal FS PD FSE image	22
Figure 18: The arcuate or deltoid ligament. (A) T1-weighted coronal image (B) FS T1-weighted arthrogram	23
Figure 19: TFC complex. Volar FS T1-weighted coronal arthrogram 26	26
Figure 20: TFC complex. FS T1-weighted coronal arthrogram	27
Figure 21: Single broad-based attachment of the TFC complex. FS T1-weighted coronal arthrogram	27
Figure 22: Meniscus homologue and prestyloid recess. FS coronal T1-weighted arthrogram	29
Figure 23: (A) The distal aspect of the TFC (B) The extensor carpi ulnaris tendon and sheath. FS coronal T1-weighted arthrogram	29
Figure 24: (A) Extensor tendon compartments (B) Flexor tendons. Axial T2 WIs	31
Figure 25: (A–D) Carpal tunnel and Guyon's canal	32
Figure 26: (A) Coronal colour illustration showing ulnar tunnel. T1-weighted axial image	33
Figure 27: scaphoid fracture with AVN (A) T1-weighted coronal image (B) FS PD FSE coronal image	35

Figure 28: Stage I Kienböck's disease (A) Colour coronal illustration (B) Coronal T1-weighted image (C) Coronal FS PD FSE image	39
Figure 29: Stage II Kienböck's disease (A) Coronal reformatted CT scan (B) STIR coronal image	39
Figure 30: Stage III Kienböck's with lunate collapse identified in both coronal and sagittal planes (A) Coronal T1-weighted image (B) Sagittal FS PD FSE image	40
Figure 31: Stage IV Kienböck's disease (A) Coronal T1-weighted image (B) Coronal T2*-weighted image	40
Figure 32: Scapholunate ligament tear without carpal instability (A) FS T1-weighted coronal image (B) FS T1-weighted sagittal image	44
Figure 33: Scapholunate ligament tear with DISI (A) STIR coronal image (B) &(C) Sagittal T1 WI	44
Figure 34: Coronal FS PD FSE images showing complete disruption of the volar (A), membranous (B), and dorsal (C) components of the scapholunate (SL) ligament (D) A corresponding axial T1-weighted arthrogram	46
Figure 35: VISI pattern sagittal T1-weighted image	49
Figure 36: Coronal FS PD FSE images showing tear of the dorsal (A), membranous (B), and volar (C) components of the LT ligament	49
Figure 37: Class IA lesion of the TFC. FS T1-weighted coronal arthrogram	52
Figure 38: Class IB lesion of the TFC. FS T1-weighted coronal arthrogram	52

Figure 39 : FS sagittal T1-weighted arthrogram comparing (A) intact ulnocarpal ligament (B) avulsed osseous insertions of the ulnocarpal ligaments	53
Figure 40: Class ID lesion of the TFC. FS coronal T1-weighted arthrogram	53
Figure 41: Class IIA lesion of the TFC. FS coronal T1-weighted arthrogram	54
Figure 42: Class IIB lesion of the TFC. FS coronal T1-weighted arthrogram	54
Figure 43: Class IIC lesion of the TFC. FS PD FSE coronal image	55
Figure 44: Class IIB lesion of the TFC. FS coronal T1-weighted arthrogram	55
Figure 45: Class IIE lesion of the TFC (A) T2*-weighted coronal image (B) FS T1-weighted coronal arthrogram	56
Figure 46: Dorsal subluxation of the ulna relative to the sigmoid notch (A) Axial colour graphic (B) Coronal T1-weighted image (C) Axial FS PD FSE image	60
Figure 47: (A) Ulnar dorsal dislocation. Sagittal FS PD FSE image (B) Axial section of the distal radioulnar joint demonstrating the positions of subluxation and dislocation of the distal ulna relative to the sigmoid notch of the distal radius	60
Figure 48: Neurofibroma of the motor branch of the median nerve (A) T1-WI (B) STIR WI	63
Figure 49: Fibrolipoma of the median nerve (A) Axial T1-weighted image (B) Axial FS PD FSE image	63

Figure 50: Volar ganglion extending from the triscaphe articulation (A) Axial FS PD FSE image (B) Coronal FS PD FSE image	
Figure 51: Lipoma as a space-occupying lesion deep to the carpal tunnel on a T1-weighted axial image	64
Figure 52: Carpal tunnel syndrome (A) Coronal FS PD FSE image (B) Axial FS PD FSE image	67
Figure 53: Carpal tunnel syndrome (A) Axial FS PD FSE image (B) Axial PD FSE image	67
Figure 54: Flattening of the median nerve at the hamate hook level. Axial T1-weighted image	68
Figure 55 : Bowing ratio of the flexor retinaculum (A) Axial T1-weighted image in a normal patient (B) Axial post contrast fat-suppressed T1-weighted image in a patient with CTS	68
Figure 56: Carpal tunnel release. Axial PD image	69
Figure 57: Fast spin-echo T2-weighted image incomplete release of the flexor retinaculum	69
Figure 58: Ulnar tunnel syndrome (A) Colour axial section (B) Axial T1-weighted image (C) Axial FS PD FSE image	71
Figure 59: Ganglion cyst compressing the ulnar nerve (A) Axial and (B) oblique coronal fat-suppressed T2-weighted images	71
Figure 60: De Quervain's tenosynovitis (A) Oblique colour graphic (B) Axial FS PD FSE image	74
Figure 61: De Quervain's stenosing tenosynovitis (A) T2*-weighted coronal image (B) T1-weighted axial image	74

Figure 62: intersection syndrome (A) Illustration (B) Axial fast spin echo, fat-suppressed T2W (C) Coronal fast spin echo, fat-suppressed T2W MR Images	75
Figure 63: Rheumatoid arthritis of the wrist (a) Coronal T1-weighted MR image (b) Coronal STIR-weighted MR image (c) Axial fat-suppressed T2-weighted MR image (d) Sagittal gadolinium-enhanced fat-suppressed T1-weighted MR image	78
Figure 64: Rheumatoid arthritis of the wrist (a) Axial T1-weighted image (b) fat-suppressed T2-weighted image (c) Coronal gadolinium enhanced fat-suppressed T1-weighted MR image,	80
Figure 65: Rheumatoid arthritis of the wrist (a) Coronal T1-WI (b) Axial fat-suppressed, heavily T2-WI (c) Axial contrast—enhanced fat suppressed T1-WI	81
Figure 66: Gouty tophus (A) Axial T2-weighted image (B) Coronal T1-weighted image	86
Figure 67: (A) Normal radioscaphoid congruous joint surfaces (B) Lost radioscaphoid congruous joint surfaces (C) Corresponding T1-weighted sagittal image	92
Figure 68: Stage I SLAC (A) Coronal colour graphic (B) Coronal T1-weighted image	92
Figure 69: Stage III SLAC (A) Colour coronal graphic (B) Coronal T1-weighted image	94
Figure 70: Triscaphe arthritis (A) Coronal colour graphic (B) Coronal T1-weighted image (C) Coronal FS PD FSE image	94
Figure 71: Ganglion cyst extending from the TFCC (A, B) Coronal and (C) axial T2-weighted images	99
Figure 72: Scapholunate ligament ganglion (A) Axial FS PD FSE image (B) Coronal FS PD FSE image	99

Figure 73: Recurrent giant cell tumour of the tendon sheath (A) Axial T1-weighted (B , C) Coronal contrast-enhanced images	100
Figure 74: Coronal MRI (A) Scapholunate Ligament tear (B) demonstrate normal and torn Lunotriquetral Ligament	104
Figure 75: Coronal MR Images demonstrate TFCC tear	104
Figure 76: Coronal MRI (A) Normal radiocarpal joint (B) Radiocarpal arthrosis	106
Figure 77: Coronal MRI demonstrates triscaphe arthrosis	106
Figure 78: Coronal MRI demonstrates carpometacarpal joint arthrosis	106
Figure 79: Coronal MRI demonstrates (A) Normal DRUJ (B) DRUJ synovitis (C) Ulnar impingement	107
Figure 80: Coronal MRI demonstrates (A) & (B) Scaphoid fractures (C) AVN of the lunate	107
Figure 81: Axial MRI demonstrates (A) Normal SL Ligament (B) & (C) SL Ligament tear	109
Figure 82: Axial MRI demonstrates (A) & (B) Tenosynovitis of the extensor tendons (C) Torn extensor pollicis longus tendon	109
Figure 83: Axial MRI demonstrates tenosynovitis of the flexor tendons	109
Figure 84: Axial MRI demonstrates median nerve pathology	111
Figure 85: Axial MRI demonstrates carpal bones lesions (A) & (B) fractures (C) pisotriquetral arthrosis	111
Figure 86: Axial MRI demonstrates ganglion cysts	111
Figure 87: Axial MRI at the level of the DRUJ	112

Figure 88: Sagittal MRI demonstrate (A) & (B) scaphoid & lunate fractures (C) lunate collapse	113
Figure 89: Sagittal MRI demonstrate carpal alignment	113
Figure 90: Sagittal MRI demonstrate ganglion cysts	114
Figure 91: Sagittal MRI demonstrate tendineous lesions	114
Figure 92: Sagittal MRI demonstrate Normal (A) & Torn (B) TFC	115
Figure 93: Stage III Kienböck's disease (A) Coronal T1 WI (B) MRI Coronal T2 WI (C) Sagittal T2* WI	128
Figure 94: Stage I/II Kienböck's disease (A) Coronal T2 WI (B) Coronal T1 WI (C) Coronal STIR WI	130
Figure 95: Scaphoid fracture with AVN (A) Coronal T1 WI (B) Coronal T2 WI (C) Coronal STIR WI	132
Figure 96: Carpal tunnel syndrome secondary to lipoma (A) Axial T1 WI (B) Axial T2 WI (C) Axial STIR WI	134
Figure 97: Carpal tunnel syndrome (A) Axial T2 WI (B) Axial T2 WI	136
Figure 98: Guyon's canal syndrome (A) Axial & Coronal STIR WI (B) Axial T1 WI (a) Pre & (b) Post Contrast	138
Figure 99: Pathologically proven giant cell tumour (A) Coronal T1 WI (B) Coronal STIR WI	140
Figure 100: Extensor carpi ulnaris tendon dislocation (A) Coronal T1 WI (B) Coronal STIR WI	142

Figure 101: Tenosynovitis of the extensor carpi ulnaris tendon (A) Axial STIR WI (B) Axial T1 WI	144
Figure 102: Dorsal ganglion cyst (A) Axial T1 WI (B) Sagittal T2WI	146
Figure 103: Traumatic lunotriquetral ligament and TFC tears with VISI (A) MRI Sagittal T1 WI (B) MRI coronal PD SPIR WI	148
Figure 104: Scapholunate ligament tear with DISI (A) Sagittal T2* WI (B) Coronal STIR WI	150
Figure 105: Distal radioulnar joint instability (A) Axial T2 WI (B) Axial T1 WI	152
Figure 106: Rheumatoid arthritis (A) Coronal STIR WI (B) Coronal T1 WI	154