

High Resolution 3T MR Neurography of the Lumbosacral Plexus

Essay

*Submitted for partial fulfillment of Master Degree in
Radiodiagnosis*

By

Marwa Sayed Mohammed Moussa
M.B.,B.Ch.

Supervised by

Prof .Dr \ Marwa Ibrahim Mohamed
*Professor of Radiodiagnosis
Faculty of Medicine-AinShamsUniversity*

Dr \ Ahmed Mohamed Osman
*Lecturer of Radiodiagnosis
Faculty of medicine-Ain Shams University*

*Faculty of Medicine
Ain-Shams University*



2014

List of abbreviations

2D.....Two Dimensional

3D.....Three Dimensional

3T.....Three Tesla

AB.....Adductor Brevis

AC.....Alcock`S Canal

ADC.....Apparent Diffusion Coefficient

AH.....Abductor Hallucis

AL.....Adductor Longus

ASIS.....Anterior Superior Iliac Spine

BF.....Biceps Femoris

BPNST.....Benign Peripheral Nerve Sheath Tumor

CNR.....Contrast To Noise Ratio

CPN.....Common Peroneal Nerve

CPR.....Curved Planar Reformations

CSI.....Chemical Shift Imaging

DPN.....Deep Peroneal Nerve

DTI.....Diffusion Tensor Imaging

DW.....Diffusion Weighted

EMG.....Electromyography

EPI.....Echo Planer Imaging

F.....Fibular Neck

FA.....Fractional Anisotropy

FDA.....Food And Drug Administration

FDG.....Fluro Deoxy Glucose

FDL.....Flexor Digitorum Longus

FHL.....Flexor Halluces Longus

FN.....Femoral Nerve

FOV.....Field Of View

FS.....Fat Suppression

Gr.....Gracilis

GRE.....Gradient

IT.....Ischial Tuberosity

LFCN....Lateral Femoral Cutaneous Nerve

LG.....Lateral Gastrocnemius

LPN.....Lateral Planter Nerve

LSLumbosacral

M.....Medial Calcaneal Tubercle

m.....Muscle

MG.....Medial Gastrocnemius

MIP.....Maximum Intensity Projections

mm.....Millimeter

MN.....Morton Neuroma

MPL.....Medial Planter Nerve

MPNST..Malignant Peripheral Nerve Sheath Tumor

MR.....Magnetic Resonance

MRIMagnetic Resonance Imaging

MRN.....Magnetic Resonance Neurography

MVA.....Motor Vehicle Accident

n.....Nerve

NCV.....Nerve Conduction Velocities

NF.....Neurofibromatosis

NMJ.....Neuromuscular Junction

OE.....Obturator Externus

P.....Pectineus

PD.....Proton Density

PET.....Positron Emission Tomography

PNST.....Peripheral Nerve Sheath Tumor

PSIF.....Reversed Steady State Free Precession

PTN.....Posterior Tibial Nerve

QP.....Quadratus Plantae

RB.....Rectal Branch Of Nerve

RE.....Rectum

SAR.....Specific Absortion Rate

Sar.....Sartorius

Sm.....Semimembranosus

SN.....Sciatic Nerve

SNR.....Signal To Noise Ratio

SPACE...Sampling perfection with application optimized
contrasts using varying flip angle evolutions

SPAIR.....Spectral Adiabatic Inversion Recovery

SPN.....Superficial Peroneal Nerve

St.....Semitendinosus

STIR.....Short T1 Inversion Recovery

T1W.....T1 weighted

T2W.....T2 weighted

TE.....Echo Time

TF.....Turbo Factor

TN.....Tibial Nerve

TR.....Repetition Time

TTS.....Tarsal Tunnel Syndrome

VI.....Vastus Intermedius

VIBE.....Volume Interpolated Breathhold Examination

VL.....Vastus Lateralis

VM.....Vastus Medialis

List of contents

Contents	Page
<i>Introduction & Aim of work</i>	<i>1</i>
<i>Chapter 1: Anatomy of the lumbosacral plexus</i>	<i>4</i>
<i>Chapter 2: Pathology of lumbosacral plexus lesions</i>	<i>42</i>
<i>Chapter 3: Technique of magnetic resonance neurography</i>	<i>52</i>
<i>Chapter 4: Magnetic resonance manifestations of different lumbosacral plexus lesions.</i>	<i>73</i>
<i>Summary & conclusion</i>	<i>123</i>
<i>References</i>	<i>126</i>
<i>Arabic summary</i>	<i>145</i>

List of contents

Contents	Page
<i>Introduction & Aim of work</i>	<i>1</i>
<i>Chapter 1: Anatomy of the lumbosacral plexus</i>	<i>4</i>
<i>Chapter 2: Pathology of lumbosacral plexus lesions</i>	<i>42</i>
<i>Chapter 3: Technique of magnetic resonance neurography</i>	<i>52</i>
<i>Chapter 4: Magnetic resonance manifestations of different lumbosacral plexus lesions.</i>	<i>73</i>
<i>Summary & conclusion</i>	<i>123</i>
<i>References</i>	<i>126</i>
<i>Arabic summary</i>	<i>145</i>

List of Figures

FIGURE NO	TITLE	PAGE NO
Figure (1)	Structure of nerve	4
Figure (2)	Major nerves of the lumbar and sacral plexuses	6
Figure (3)	Lumbosacral plexus	7
Figure (4)	Normal lumbosacral (LS) plexus	8
Figure (5)	Normal exiting nerve roots at the pelvis	8
Figure (6)	DW MRN obtained :showing anatomical details of the sacral plexus.	9
Figure (7)	Femoral nerve in the anterior thigh	10
Figure (8)	Normal femoral nerve	11
Figure (9)	lateral femoral cutaneous nerve	12
Figure (10)	Both LFCN and femoral nerve	13
Figure (11)	obturator nerve	15
Figure (12)	Normal obturator nerve	15
Figure (13)	sciatic nerve	17
Figure (14)	Normal sciatic plexus and femoral nerves	17
Figure (15)	Normal sciatic plexus and femoral nerves	18

FIGURE NO	TITLE	PAGE NO
Figure (16)	Normal sciatic nerves	19
Figure (17)	Schematic anatomy of pudendal nerve	20
Figure (18)	distal pudendal anatomy	21
Figure (19)	superior and inferior gluteal nerve	22
Figure (20)	Normal superior gluteal nerve	23
Figure (21)	posterior femoral cutaneous nerve	24
Figure (22)	Split right sciatic nerve	25
Figure (23)	iliohypogastric and ilioinguinal nerves	26
Figure (24)	Normal iliohypogastric and ilioinguinal nerves	27
Figure (25)	Genitofemoral nerve	28
Figure (26)	Common peroneal nerve and its branches at the knee	30
Figure (27)	Normal anatomy of the tibial & common peroneal	30
Figure (28)	Normal tibial and peroneal nerves	31
Figure (29)	the three most common sites for Deep Peroneal nerve entrapment	33
Figure (30)	Normal Deep Peroneal Nerve branches	34
Figure (31)	Superficial Peroneal Nerve in the distal leg	35

FIGURE NO	TITLE	PAGE NO
Figure (32)	Course of the posterior tibial nerve in the tarsal tunnel	38
Figure (33)	Inferior calcaneal nerve	39
Figure (34)	Normal plantar innervation of the foot	40
Figure (35)	sural nerve	41
Figure (36)	Normal sural nerve	41
Figure (37)	1.5T MRN shows tibial nerve ganglion	55
Figure (38)	1.5T MRN common peroneal nerve ganglion	55
Figure (39)	acute muscle denervation change with common peroneal nerve injury at 3T study	58
Figure (40)	Three dimensional (3D) T2 SPACE of sciatic nerve	61
Figure (41)	Three dimensional (3D) STIR SPACE of LS plexus	61
Figure (42)	Limitation of 3D anatomic non selective MRN	63
Figure (43)	3D anatomic nerve selective MRN	64
Figure (44)	A 65-year-old woman with tarsal tunnel syndrome	65
Figure (45)	Isotropic and anisotropic diffusion	68
Figure (46)	3D functional nerve selective MRN of LS plexus	68

FIGURE NO	TITLE	PAGE NO
Figure (48)	Magic angle artifacts of sciatic nerves	75
Figure (49)	Ewing's sarcoma of left S1 nerve	76
Figure (50)	Multifocal inflammatory/infectious neuritis	77
Figure (51)	Idiopathic polyneuropathy	78
Figure (52)	lumbar plexitis	80
Figure (53)	Multiple Tarlov cysts causing plexopathy	81
Figure (54)	Stretch injury to lumbosacral (LS) plexus	82
Figure (55)	Subacute hematoma compressing the left sciatic plexus	83
Figure (56)	right piriformis syndrome	85
Figure (57)	Piriformis syndrome	86
Figure (58)	neurofibromatosis type 1 (NF-1) and plexiform neurofibroma presenting with right leg pain	88
Figure (59)	iatrogenic femoral nerve transection	88
Figure (60)	Neurofibroma of femoral nerve	89
Figure (61)	Schwannoma of deep peroneal nerve	91
Figure (62)	amputation neuroma of the tibial nerve	93

FIGURE NO	TITLE	PAGE NO
Figure (64)	tarsal tunnel syndrome	96
Figure (65)	Failed tarsal tunnel release with medial and lateral plantar neuritis	96
Figure (66)	The master knot of Henry	97
Figure (67)	Medial plantar neuropathy	98
Figure (68)	lateral plantar nerve (LPN) branch schwannoma	99
Figure (69)	Two potential sites of entrapment of first branch of lateral plantar nerve	99
Figure (70)	Pudendal neuralgia	101
Figure (71)	Tail sign of deep peroneal nerve schwannoma	105
Figure (72)	Split fat of tibial nerve schwannoma	106
Figure (73)	Target sign of deep peroneal nerve schwannoma	106
Figure (74)	Fascicular sign of tibial nerve schwannoma	106
Figure (75)	Neurofibromatosis-1 and right sciatic MPNST	107
Figure (76)	Schwannomatosis	108
Figure (77)	Sciatic perineuroma	109
Figure (78)	Common peroneal nerve perineuroma	109
Figure (79)	right sciatic primary lymphoma	110

FIGURE NO	TITLE	PAGE NO
Figure (80)	Morton's neuroma	111
Figure (81)	Traumatic neuroma in continuity	112
Figure (82)	Sciatic end-bulb stump neuroma	113
Figure (83)	Common peroneal nerve ganglion cyst	114
Figure (84)	Fibrolipomatous Hamartoma of sciatic nerve	115
Figure (85)	Endometriosis	116

List of tables

TABLE NO	TITLE	PAGE
Table (1)	Magnetic resonance neurography examination for the Lumbosacral plexus using 3T scanner	71
Table (2)	3T magnetic resonance neurography (MRN) examination protocol for the evaluation of sciatic neuropathy	72