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RESEARCH ARTICLE

REVOLUTIONIZING ONCOLOGY IMAGING: A PARADIGM SHIFT THROUGH STANDARDIZED MRI PROTOCOLS: VOLUME 2

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Abstract

Introduction: Oncology imaging is always developing, thus rapid and precise diagnosis are essential for cancer therapy. Recognizing the importance of Magnetic Resonance Imaging, our Mahamana Pandit Madan Mohan Malaviya Cancer Centre is standardizing MRI protocols to improve inspection and interpretation. This project aims to standardize, eliminate variance, and speed up patient care choices.

Methods: Our standardized MRI procedures summarize scan parameters, sequences, modes, matrix and other data by body part. A 3 Tesla MRI machine was used to study how scanner differences affect parameters. Detailing appropriate pathological visualization sequences allowed diagnostic versatility. 'Localiser' or' scanogram' was emphasized for exact scan plane alignment, ensuring uniform pictures for smooth comparisons.

Results: Specific procedures were established for certain anatomical locations, with a focus on precise patient placement. Optimizing the localizer setup and selecting the appropriate coil can enhance the quality of images and increase diagnostic accuracy.

Discussion: The conversation emphasizes the crucial need of standardizing MRI methods to ensure prompt and precise cancer diagnosis. The benefits of using this technology, such as maintaining consistency, saving time, and improving picture quality, help speed up the diagnostic process and lead to better outcomes for patients.

Conclusion: Standardizing MRI procedures is a major step toward efficient and patient-centered cancer imaging, addressing varied oncological issues and improving consistency, time efficiency, and picture quality. Staff training and cooperation put our institution at the forefront of technology advances to improve cancer patient outcomes. We aim to enhance cancer care and treatment via cooperation, improvement, and a patient-centric approach.

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Introduction:-

Time is of the importance in the realm of cancer imaging, which always moves at an incredible rate. Timely and correct diagnosis is essential for cancer care. Our Mahamana Pandit Madan Mohan Malaviya Cancer Centre optimises Magnetic Resonance Imaging (MRI) methods to expedite examination and interpretation, benefiting patients and healthcare professionals. Our radiologists examine a variety of oncological situations using particular imaging characteristics. MRI methods might vary picture quality, make study comparisons difficult, and lengthen examination and interpretation durations. A comprehensive endeavor to standardize MRI methods across all cancer imaging procedures addresses these problems. Standardizing MRI techniques enhances imaging uniformity, reducing variability and improving repeatability across all instances. Standardization streamlines radiologists' workflow and reduces picture capture and interpretation time. This simplified procedure speeds report generation and patient care decisions. Standardization improves picture quality by optimizing imaging settings, making images sharper and more uniform. This improved image quality helps diagnose and arrange therapy.

Outline Of Protocols

To facilitate a speedy and convenient reference, the procedures have been organized in accordance with the various areas of the body. The titles for the six columns are as follows: "scan parameters," "sequences," "scan mode," "matrix," "Phase," "NEX," "TR," "TE," "TI," "Band width," "Slice thickness," including "Spacing".

The scan parameters may exhibit modest variations depending on the manufacturer and magnetic field intensity of different MRI scanners. In the 'sequences' column, the authors list certain sequences that have been selected to produce the best possible depiction of identified diseases, while also making it easier to check for other common disorders. After reviewing these specific sequences, further sequences may be added if necessary. The number of sequences depends on the indication of the scan, with variability determined by the individual diagnostic needs.

The 'Localiser' or'Scanogram' is the first image plane used to design scan plane orientation and coverage. In "Scan plane orientation," the authors explain how to place the scan plane. Standardized pictures result from consistent patient placement and scan plane orientation. Standardized pictures allow for easy comparison with follow-up scans. To cover the scanned bodily part's anatomy, the 'coverage' section describes the scan's scope.

MRI For Spine

Spine MRI is recommended for cord compression, trauma, and degenerative tissue problems. Patients lie head-first supine. The localizer is focused on the xiphoid process, and imaging settings are calibrated as needed. The CTL 8ch coil is suggested for this technique because it has enough signal sensitivity to image the spine and adjacent tissues. For spinal pathology evaluation and diagnosis and therapy planning, this technique is useful.

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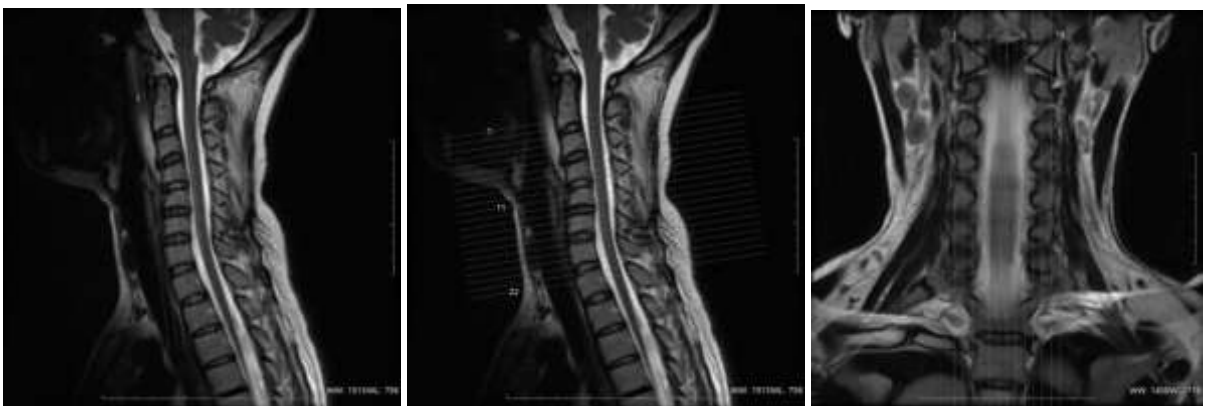

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Table 1:- Shows required sequences and parameters of Spine.

Sequence	Scan Mode	Matrix	Phase	NEX	TR	TE	TI	BAND Width	FLIP ANGLE	SLICE THICKNESS	SPACING
Sag T2 FrFSE	2D	512	320	4	3000	110		41.7		3	1
Sag T1 FSE	2D	448	256	4	300	Min Full		31.3		4	1
Sag STIR	2D	384	192	4	4000	42	150	31.3		4	1
Cor T2 FrFSE	2D	480	320	4	3000	110		41.7		4	1
Ax T2 FrFSE	2D	320	256	4	3000	85		31.3		4	0.5
Ax T1 FSE	2D	320	256	4	300	Min Full		31.3		4	0.5
Sag T1 +C	2D	320	256	4	300	Min Full		31.3		4	1
Ax T1+C	2D	320	256	3	300	Min Full		31.3		5	1.5
Cor T1 + C	2D	320	256	4	300	Min Full		31.3		5	1
Ax 2D MERGE	2D	256	600	2	600			50		4	0.6

MRI For Shoulder

Shoulder discomfort, tendinosis, and glenohumeral joint instability are investigated using the shoulder MRI procedure. Patients lie supine, head-first. Centre the localizer on the coil and calibrate to optimize imaging settings. The shoulder coil, intended for high-resolution shoulder imaging, is suggested for this approach. This procedure evaluates glenohumeral joint stability and soft tissue components like tendons and ligaments. It helps diagnose and treat shoulder issues.

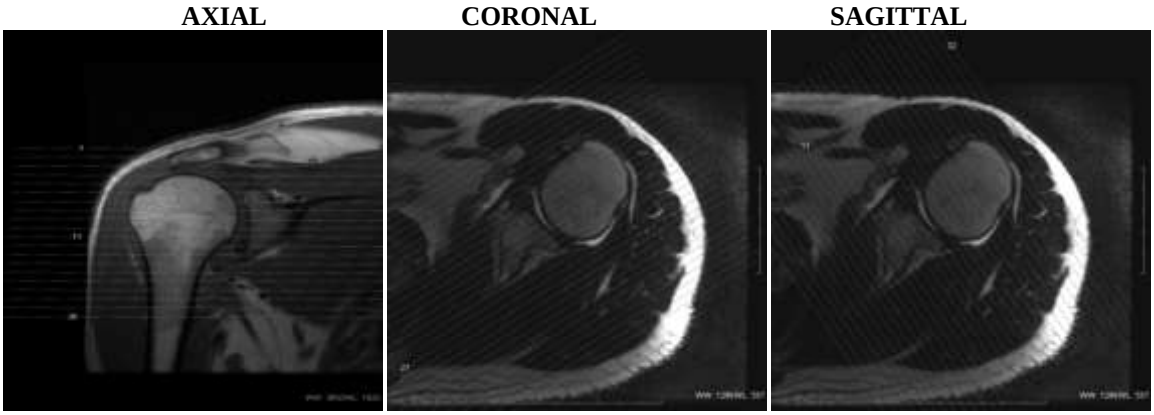

Table 2:- Shows required sequences and parameters of Shoulder.

Sequence	Scan Mode	Matrix	Phase	NEX	TR	TE	TI	BAND Width	FLIP ANGLE	SLICE THICKNESS	SPACING
Cor STIR	2D	256	192	2	4000	34	150	31.3		4	0
Cor T1	2D	256	192	2	500	Min		20.8		4	0
Cor PD FSE	2D	256	192	2	3650	42		20.8		4	0
O/Cor T2 FSE	2D	256	192	2	6000	85		20.8		4	0
O/Sag T2 FSE	2D	256	192	2	3720	85		20.8		4	0
Ax T1 SE	2D	256	192	2	450	Min Full		15.6		3	0.5
Ax T2	2D	320	224	4	3000	120		31.3		3	1
Ax T2 GRE	2D	384	192	2	450	13		11.9		4	0
3D FIESTA	2D	384	256	2		Min		62.5		0.8	
Cor T1+C	2D	256	192	4	300	Min Full		31.3		2	0
SagT1+C	2D	256	192	4	300	Min Full		31.3		2	0
Ax T1+C	2D	256	192	4	300	Min Full		31.3		3	1

MRI For Humerus/ Forearm

Partial tears, fibromatosis, and osteogenic sarcomas in the humerus and forearm are assessed using the MRI technique. Patients lie supine, head-first, with the localizer on the desired anatomy. If needed, imaging parameters are calibrated. Torso coil 8ch is preferred for this technique because it captures precise images of the humerus and forearm, allowing for a complete examination of abnormalities. This approach helps diagnose and treat humerus and forearm disorders.

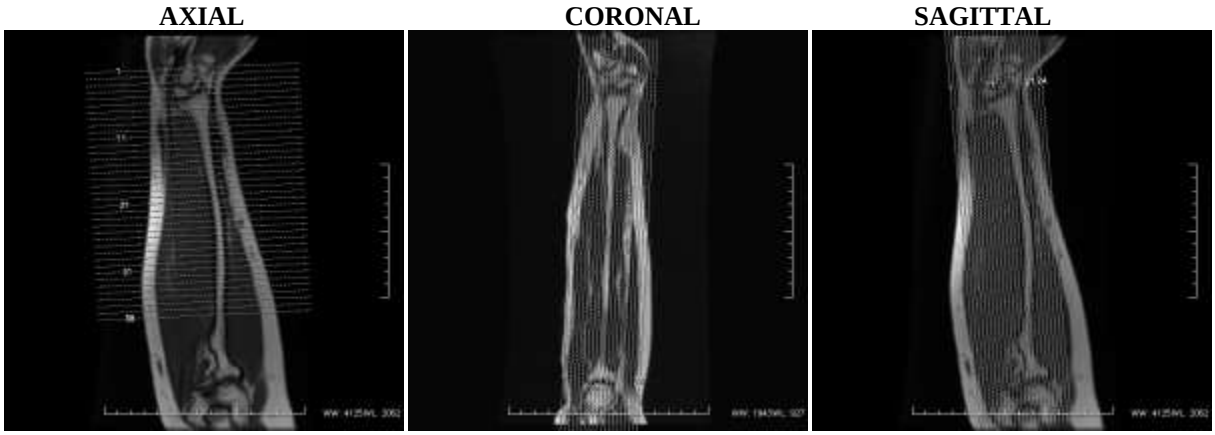

Table 3:- Shows required sequences and parameters of Humerus/Forearm.

Sequence	Scan Mode	Matrix	Phase	NEX	TR	TE	TI	BAND Width	FLIP ANGLE	SLICE THICKNESS	SPACING
Cor T1	2D	256	192	2	300	Min Full		31.3		3	1
Cor STIR	2D	256	192	2	4000	42	150	31.3		3	1
Sag T2 FSE	2D	256	192	2	4000	42		31.3		3	1
Cor PD	2D	256	192	3	2080	30		31.3		3	1
Ax T1	2D	256	192	4	300	Min Full		31.3		4	1
Ax T2	2D	320	224	4	3000	100		31.3		4	1
Ax 2D MGRE	2D	288	192	2	300			31.3		4	1
Ax DWI	2D	288	192	2	300			31.3		4	1
Cor T1+C	2D	256	192	4	300	Min Full		31.3		2	0
SagT1+C	2D	256	192	4	300	Min Full		31.3		2	0
Ax T1+C	2D	256	192	4	300	Min Full		31.3		3	1

MRI For Wrist/Hand

Trauma, bone lesions, cartilage anomalies, fibrosarcoma, and other disorders are investigated using the wrist and hand MRI technique. Patients can be supine, prone, head-first, or feet-first, depending on clinical needs. For optimal imaging characteristics, the localizer is located in the middle of the anatomy of interest and calibrated. The GP Flex and Extremity coils are recommended for this technique because they produce high-resolution wrist and hand images for thorough diagnosis. For wrist and hand patients, this procedure improves diagnosis and treatment planning.

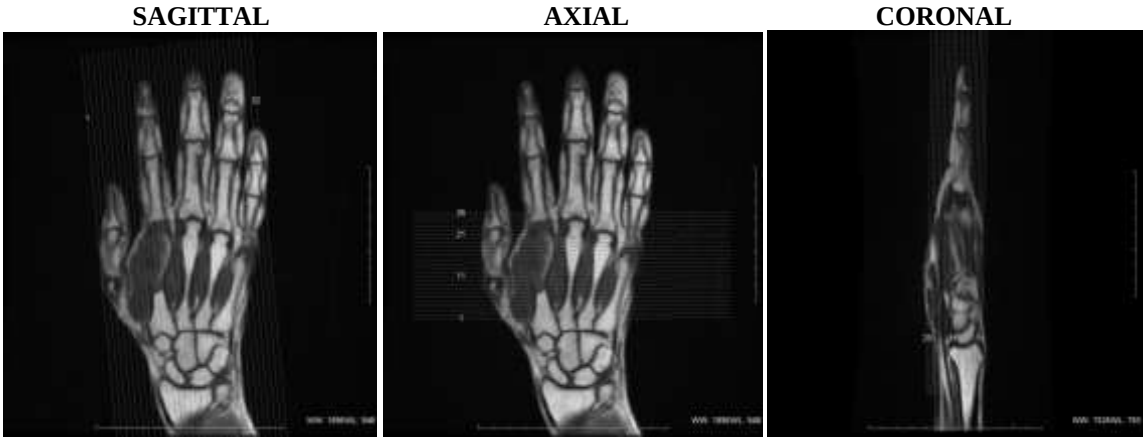

Table 4:- Shows required sequences and parameters of Wrist/Hand.

Sequence	Scan Mode	Matrix	Phase	NEX	TR	TE	TI	BAND Width	FLIP ANGLE	SLICE THICKNESS	SPACING
Cor T1	2D	256	196	4	300	Min Full		31.3		3	0
Cor STIR	2D	256	160	4	3000	42	150	31.3		3	0
Ax T2	2D	256	192	4	3000	100		31.3		3	1
Ax T1	2D	256	192	4	300	Min Full		31.3		3	1
Sag T2 FSE	2D	256	192	4	3000	102		31.3		2	0
Ax 2D MERGE	2D	256	192	4	300			31.3		3	1
Cor T1+C	2D	256	192	4	300	Min Full		31.3		2	0
SagT1+C	2D	256	192	4	300	Min Full		31.3		2	0
Ax T1+C	2D	256	192	4	300	Min Full		31.3		3	1

MRI For Lower Extremity Long Bones

The lower extremity long bone MRI procedure assesses bone cancers, staging, osteomyelitis, bone infarcts, avascular necrosis, osteochondritis, and fibrosarcoma. Patients are feet-first and spine-first, with the localizer in the middle of the anatomy. Imaging parameters are calibrated if needed. Torso 8ch coils are indicated for this technique to collect complete images of lower extremity long bones. Clinicians may plan treatment for bone-related disorders using this imaging approach to accurately diagnose and stage them.

Table 5:- Shows required sequences and parameters of lower extremity long bones.

Sequence	Scan Mode	Matrix	Phase	NEX	TR	TE	TI	BAND Width	FLIP ANGLE	SLICE THICKNESS	SPACING
Cor T1	2D	256	160	2	300	Min Full		31.3		4	1
Cor STIR	2D	256	160	2	4000	50	150	41.7		4	1
Sag T2	2D	256	192	4	3000	105		41.7		4	1
Ax T1	2D	256	160	2	300	Min Full		31.3		5	1
Ax T2	2D	256	160	2	3000	85		41.7		5	1
Ax GRE T2*	2D	256	160	2	300	13		11.9	25	5	1
Ax DWI	2D	128	128	4	7000	Min				5	1
Cor T1+C	2D	256	192	4	300	Min Full		31.3		2	0
SagT1+C	2D	256	192	4	300	Min Full		31.3		2	0
Ax T1+C	2D	256	192	4	300	Min Full		31.3		3	1

MRI For Knee

The knee MRI protocol evaluates osteoarthritis, patella chondromalacia, knee discomfort, instability, and patellofemoral joint problems. Patients lie supine with feet first during imaging. Localization is accurate when the localizer is focused on the inferior patella and calibrated to improve imaging parameters. The knee coil, which provides high-resolution knee joint images, is suggested for this procedure to examine structural abnormalities and diseases. This methodology helps professionals diagnose and treat knee problems.

Table 6:- Shows required sequences and parameters of knee.

Sequence	Scan Mode	Matrix	Phase	NEX	TR	TE	TI	BAND Width	FLIP ANGLE	SLICE THICKNESS	SPACING
Sag T2	2D	320	256	2	5400	85		41.7		3.5	0.5
Cor T1	2D	512	256	2	400	Min full		31.3		3	1
Cor STIR	2D	320	192	2	6000	50		41.7		3	1
Ax T1	2D	448	256	2	600	Min full		31.3		3	0
Ax T2	2D	320	256	2	6000	85		41.7		3	0
Sag PD FS	2D	320	256	2	3000	30		31.3		3.5	0.5
Sag 3D GRE	2D	256	192		35			10	20	2.8	
Sag MERGE	2D	288	192	2	425			41.7		3.5	0.5
Sag STIR	2D	320	192	2	5900	50	150	41.7		3	1
Ax PD	2D	320	224	3	2100	30		27.8		3	0
Cor T1+C	2D	256	192	4	300	Min Full		31.3		2	0
SagT1+C	2D	256	192	4	300	Min Full		31.3		2	0
Ax T1+C	2D	256	192	4	300	Min Full		31.3		3	1

MRI For Foot

The foot MRI procedure evaluates bone and soft tissues in and around the foot and ankle, emphasizing for osteomyelitis. Patients lie supine with feet first during imaging. Localization is accurate when the localizer is

centered on the coil and calibrated to improve imaging characteristics. Extremity coils are preferred for this approach because they provide high-resolution foot images. This methodology helps professionals diagnose and treat foot disorders.

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Table 7:- Shows required sequences and parameters of foot.

Sequence	**Scan Mode**	**Matrix**	**Phase**	**NEX**	**TR**	**TE**	**TI**	**BAND Width**	**FLIP ANGLE**	**SLICE THICKNESS**	**SPACING**
Sag T2	2D	320	256	2	5520	85		41.7		3.5	0.5
Cor STIR	2D	256	160	2	6725	50	150	41.7		4	1
Cor T1	2D	320	224	2	340	Min full		31.3		4	1
Sag STIR	2D	256	160	2	3675	50	150	41.7		3.5	0.55
Ax T1	2D	256	192	2	400	Min full		31.3		5	1
Ax T2	2D	320	256	2	4180	85		41.7		5	1
Ax T2 GRE*	2D	256	160	1	425	13	25	11.9		5	1
DWI B 500	2D	128	128	4	4325	Min				5	1
Sag T1+C	2D	256	192	2	340	Min full		31.3		3.5	0.5
Cor T1+C	2D	256	192	1	340	Min full		31.3		4	1
Ax T1+C	2D	256	192	1	560	Min full		31.3		5	1
Sag PD	2D	384	192	3	2650	25		20.8		3	0.5

Discussion:-

The ongoing conversation over the standardization of MRI procedures at our Oncology Institute highlights the significant influence and strategic significance of this endeavor in the field of oncology imaging. The need to streamline examination and interpretation procedures is emphasized by the need of quick and accurate diagnosis in cancer care. Given the wide range of cancer situations, it is necessary to establish certain imaging criteria in order to standardize the evaluation process and get the best possible results. The achieved advantages of this standardization endeavor, such as better uniformity, time effectiveness, and higher image quality, are in line with the wider objectives of accelerated diagnoses and superior patient results. The discussion also highlights the inherent connection between consistent imaging methods, efficient processes, and the expediting of decision-making in patient care. The beneficial consequences go beyond just improving productivity. The standardization of MRI techniques is crucial for enabling meaningful comparisons across studies, which in turn contributes to the wider field of cancer research. Importantly, the debate explores the essential components of standardization, such as sequencing parameters, imaging location, and reporting templates, all of which are crucial for the success of the endeavor. The Institute places great importance on training and cooperation among its personnel, highlighting its commitment to a multidisciplinary approach. This approach fosters a culture of ongoing progress and excellence. The Institute aims to establish a standard for cancer imaging. The debate offers a thorough perspective on the continuous efforts to remain at the forefront of technical progress. The Mahamana Pandit Madan Mohan Malaviya Cancer Centre aims to enhance its internal processes and have a significant influence on the area of oncology. This demonstrates a dedication to innovation, accuracy, and ultimately, better patient care.

Conclusion:-

In conclusion, the standardization of MRI procedures is not only a procedural improvement but a crucial step towards a more effective and patient-focused approach to cancer imaging. Through careful standardization, we have addressed the obstacles presented by varied oncological patients. This has allowed us to increase consistency, save time, and boost the quality of our imaging processes. The advantages obtained from this program, which include standardized imaging methods, efficient processes, and enhanced diagnostic precision, directly support the main objective of accelerating and accurate cancer diagnosis. The dedication to uniformity goes beyond technical criteria and includes important factors such as sequencing, location, and reporting templates. These extensive steps guarantee that our radiologists have the necessary tools to handle the complexities of oncological imaging effortlessly. Furthermore, the focus on staff training and promoting cooperation highlights our commitment to a multidisciplinary approach, strengthening the Institute's position as a leader in technical developments. As we aim for exceptional quality, we see our standardized MRI protocols not only as a standard for comparison with others in our field, but also as a driving force for achieving excellent results for our patients. Essentially, the pursuit of standardized MRI procedures reflects our steadfast dedication to improving patient care in the constantly changing field of cancer. Our Oncology Institute strives to make significant contributions to the field by continuously improving, collaborating, and maintaining a patient-centric approach. We want to ensure that each diagnostic imaging plays a crucial part in the overall story of cancer care and therapy.

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