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Review Paper

Role of MRI in Diagnosis and Staging of Urinary Bladder Carcinoma – A Systematic Review

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ABSTRACT:
Background: Bladder Carcinoma is a urological malignancy 7th common cancer in Males in comparable to Females. Its main cause is exposure with the chemicals, industry pollution, smoking. Painless hematuria is the most common symptoms among the patients with Urinary Bladder Carcinoma. **Objective**: This investigation provides an overview of published literature with a focus on Role of MRI in diagnosis and staging of Urinary Bladder Carcinoma with the help of the sequences DCEI and DWI. Method: It was a Systematic Review Based study accumulates 97 articles published from 2008 to 2024 examining Role of MRI with DCE, DWI, mp -MRI in the assessment of Urinary Bladder Carcinoma. The authors performed various search platforms such as PubMed, Science Direct, Springer. Web of Science databases to retrieve high original research quality research articles. After that high quality articles were divided into categories endorsing DWI and DCE in MRI. **Result**: A total of 50 original research articles met our inclusion criteria were evaluated in this study. The articles included 23 prospective studies, 14 retrospective studies, 11 literature reviews, 2 cross-sectional studies, and 1 quasi-experimental study. Regarding MRI sequences, 29 articles focused on DWI, 10 on DCE, 6 on standard MRI, and 5 on multi-parametric MRI (mp-MRI). Overall, we found that DWI is responsible for staging of the bladder cancer with the ADC measurements for assessing tumor behavior, correlates with its histopathological grades and DCE is responsible for the treatment planning and improving patient survival rates. Both are playing an vital role in the diagnosis, prognosis and staging of the Urinary Bladder Carcinoma. **Conclusion**: This study highlights that DWI and DCE are the promising diagnostic tools in the evaluation of the bladder cancer with its efficiency in differentiating the characterization of the tumor. It provides biological & physiological information for the prognosis of the Bladder Carcinoma.

Keywords: DCE, DWI, MRI, Bladder Carcinoma, mp- ***MRI.***

INTRODUCTION:

Pathophysiology:
Bladder is a hollow organ part of the urinary system locates peri-vesical fat around the extraperitoneal space in the part of the pelvis. The human urinary bladder is comprised up of muscles, and depending on the surrounding organs and how much pee it can hold, it can vary in its form and dimensions. Between the internal urethral aperture and the two ureteral passageways lies an inverted triangle known as the "trigone". Bladder wall constitutes of four layers: - 1. Urothelium (mucosa) innermost layer, lines the lumen of the bladder, thinner layer than the total thickness of bladder wall. 2. Lamina propria (submucosa) composed of subepithelial connective tissue. The thickness of its layer changes depending on how much the bladder distends. There is overlap, and the lamina propria's total thickness changes depending on where it is located it is thinner at the trigone and broader at the dome. muscularis propria. It is comprised up of detrusor muscle, sometimes referred to as detrusor muscle. It is made by several muscle layers that are interior longitudinal, intermediate circular, and exterior longitudinal. 4.Serosa. it's known as the outermost layer of the bladder.it composed by a loose layer of connective tissue. The Bladder Dome superior surface, roof of the bladder is of smooth muscle fibres called as the detrusor muscle.1

Tumour Classification:

STAGING (MIBC vs NMIBC):
Bladder cancer is graded/staged on the basis of invasion in bladder wall. it's classified by its biologic behaviour or by its morphologic characteristics. There are two categories of bladder cancer: MIBC and NIMBC. NMIBC is grown in lamina propria not into muscle. So, it's also called as superficial cancer, MIBC grown in muscle of bladder wall, In fatty layers or into

surrounding tissues & organs outside the bladder. Cancers are differentiated on the basis of the type of tissue where cancer originates (histological type) and on the basis of primary site / location where cancer developed in body. According to the international classification of diseases for oncology histological type is of two types. First, Carcinoma is a malignant neoplasm of epithelial origin or cancer of the internal and external lining of the body. Epithelial tissue is found throughout the body. Carcinoma has further two subtypes: Adenocarcinoma it develops in organs and glands. It occurs in mucus membrane seems to be thick white plaque. Spread easily through the soft tissues. Squamous Cell Carcinoma originates in squamous epithelium and it occurs in many areas of the body. Second, Sarcoma it's cancer that originates in supportive and connective tissues.

Tumours are widely categorised either epithelial or non-epithelial (mesenchymal). Most.

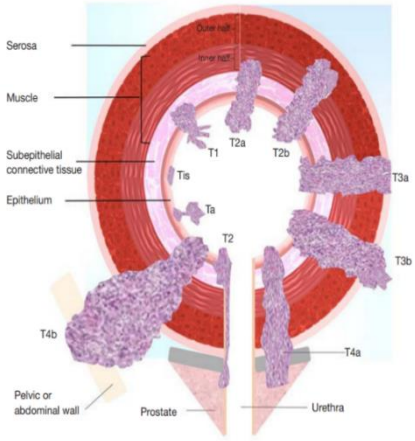


Figure 1.1: Bladder Tumour Stage.[1]

Common type of bladder cancer occurs in cells lining, inside of the bladder, known as the Transitional Cell Carcinoma (Urothelial Carcinoma).[1] Second type of bladder cancer is squamous cell carcinoma that originates from the thin, flat cells that result in the inflammation/ irritation for a longer span of time. Third type is Adenocarcinoma that originates in glands, specialised structures that releases fluid such as mucus. 90% of bladder cancer cases are caused by UC, squamous cell carcinomas (6–8%), and adenocarcinomas (2%). Approx. 70-80% of urothelial tumors are NMIBC (superficial or papillary). 10-20% initially, squamous carcinoma and bladder adenocarcinoma are MIBC. The remaining 5% of bladder tumours are mesenchymal tumours, which include adult leiomyosarcomas and rhabdomyosarcomas, etc. Ninety to ninety-five percent of bladder malignancies are epithelial in origin and are classified as transitional cell carcinomas. The key factors influencing prognosis and therapy include endometrial cancer, disease phase, their level of myometrial invasion of the tumour, and histologic grades acquired later.[2]

The worst of the conditions was brought on by bilharziasis in Egypt. Since bilharziasis was found in the bladder of mummies that were descended from pharaohs, it is thought to be a disease of the past. Squamous cell cancer and bilharzial bladder are commonly linked. Squamous cell carcinoma is the most prevalent histologic type in many poor nations worldwide due to the high frequency of schistosomiasis (Schistosoma hematobium), which accounts for 75% of cases of bladder cancer. Adenocarcinoma, lymphoma, carcinosarcoma, small cell carcinoma, pheochromocytoma, and sarcoma are among the uncommon histologic forms.[3] Staging is simple in low-grade non – invasive lesions, but in higher stage lesions its difficult because of the errors. There has been no evidence of improved staging accuracy in past period of 25 years. Even, the rate of upstaging was reported to increased.[3]

TNM-GRADING:

Clinicians can choose the optimal treatment plan based on the TNM classification by having an early diagnosis of bladder cancer, which depends on four crucial factors: - Lymph Node Metastasis (N) N0, N1, N2, N3 & Distant Metastasis (M) M0, M1; BC Staging T (T1, T2, T3, T4); G (G1, G2, G3).[4] The American Joint Committee on Cancer (AJCC) TNM staging approach is often used to stage bladder cancer. The initial tumour is denoted by T, lymph node metastases by N, and distant metastases by M.[3]

Table 1.1 TNM classification for staging of urinary bladder carcinoma.[3]

Tumor
Tx Primary tumor cannot be evaluated
T0 No primary tumor
Ta Non-invasive papillary
Tis Carcinoma in situ
T1 Tumor invades connective tissue under the epithelium (surface layer)
T2 Tumor invades muscle
T2a Superficial muscle affected (inner half)
T2b Deep muscle affected (outer half)
T3 Tumor invades peri-vesical fat
T3a Tumor is detected microscopically
T3b Extravesical tumor is visible macroscopically
T4 tumor invades the prostate gland, uterus, vagina, pelvic wall or abdominal wall
Node
Nx Regional lymph nodes cannot be evaluated
N0 No regional lymph node metastasis
N1 Metastasis in a single lymph node <2 cm in size
N2 Metastasis in a single lymph node >2 cm but 5 cm in size, or multiple lymph nodes <5 cm in size
N3 Metastasis in a lymph node> 5 cm in size
Metastasis
Mx Distant metastasis cannot be evaluated
M0 No distant metastasis
M1 Distant metastasis

Magnetic Resonance Imaging:

When imaging a bladder tumour, (MRI) is a useful modality with an accuracy range of 73% to 96%.[5] Because of its greater tissue contrast resolution and capacity to gauge the magnitude of bladder wall invasion, it is utilized for preoperative local staging or extravesical extension; multi- planar imaging capabilities and its possibility of tissue characterization. It has been discovered to be extremely important for the early detection and identification of bladder cancer invasiveness.[6] MRI is in high demand for the visualization of bladder cancer, improves the tumour extent. The accuracy of MR imaging in local staging is the best protocol for staging of bladder cancer. It is considered most ideal and accurate modality in pelvic examination for evaluation of endometrial pathology in pretreatment period.[7]

Aetiology:

There are numerous reasons for the cause of Bladder Cancer such as exposure to carcinogens and genetic predisposition, additional physiological elements, such being around chemicals and industrial pollution, but Cigarette / Tobacco smoking is the major risk factor, first most common cause for the development of Bladder Cancer that contributes to approx. 50% of cases.[1]The risk is 2.5 times higher for smokers than for people who do not smoke Urothelial carcinogens found in tobacco smoke, such as ß-naphthylamine and polycyclic aromatic hydrocarbons, are eliminated by the kidneys and directly cause cancer of the urinary

system. The latency period for the initiation of smoking into bladder cancer is approx. of 20-30 years. From immediate break from smoking leads to immediate risk reduced of bladder cancer in 1-4 years by 40%. Second, being exposed to urothelial carcinogens at work is a prevalent cause. These include chlorinated hydrocarbons, aromatic amines, and polycyclic aromatic hydrocarbons, which are typically found in industrial settings that handle petroleum products, paint, rubber, dyes, and metals. Increased workplace knowledge is necessary to lower the risk of bladder cancer.[5] The most prevalent visual symptoms seen in individuals with carcinoma of the bladder are asymptomatic hematuria; the least common symptoms include pelvic pain and urinary blockage restricted to advanced illness; symptoms related to the lower urinary tract encompass dysuria, urgency, and frequency.[1]

Epidemiology and Statistics:

Among the most widespread urological diseases, bladder cancer is a genitourinary tract cancer, cancer of urinary tract and a human malignancy with an expensive expenditure.[8] fifth frequent occurring cancer in the USA, second common urothelial carcinoma malignancies of Genitourinary system after prostate cancer.[1] Urothelial carcinoma is primarily preferred due to the presence of the quite little proportionate ratio of urothelial malignancies. It also known as the seventh most common cancer in men incomparable to women with the ratio of (3:1). It normally affects old aged persons of age greater than 50 yrs., rarely seen in persons below the 40 years. It has a high recurrence rate. It's more common in occurrence from fifth to seventh decades over the world. The United States Centres for Disease Control and Prevention report that, with 73,067 new cases and 16,254 deaths, bladder cancer is the sixth most common kind of cancer.[10] Around 200,000 people globally lost their lives to cancer in 2018, out of the 550,000 new cases that were diagnosed. It has been steadily rising over the last few decades. It is a high prevalence and significant morbidity, costs & mortality. It can contribute for as much as 6-8% of all malignancies in males and 2-3% in women; incidence rates are higher in North Europe and the United States, however they are lower in regions where schistosomiasis is widespread (Africa & Middle East).[6]

Semiology of Tumour of the Bladder:

Various techniques consist of anatomic conventional T1-(T1WI) & (T2WI) have advance functional sequences such as DCE-MRI; DWI; & multi-parametric (mp – MRI). The application of following sequences is to improves the accuracy of tumour detection and staging.[9]

T1W IMAGING:

The tumour's signal is comparable to that of the bladder wall, ranging from moderate to low. It is hypointense to peri-vesical fatty tissue, somewhat hyperintense to muscle, and hyperintense to urine.

T2W IMAGING:

T2WI is utilised for tumour identification, location, size, and morphological assessment. It also displays the architecture of the bladder. The signal from the tumour is either the same or lower than that of fat, considerably lower than the signal from urine, and greater than the hypo-signal from the wall. A stage T1 tumour is indicated by its existence of a hypo-signal border, or muscle layer, at the base of the tumour. A stage T2a cancer is characterised by an uneven internal contour, whereas a stage T2b tumour is indicated by a hypersignal interrupting the hypo-signal border and showing no accumulation of peri-vesical fat. Lastly, a lesion exhibiting patterns in the peri-vesical fats and an uneven internal shape is indicative of a stage T3b tumour.[7] There is only identification of the muscularis propria, either as a small region of moderate signal intensity band or with minimal signal intensity.[1]

Multi-parametric – (mp-MRI):

It combines functional sequences such as DWI, DCEI, T1WI, T2WI. It increases the precision of staging and detecting primary and recurring tumours.[4] It further shows promising results in monitoring treatment response. Additionally, it is utilised to assess local lymph nodes, tumours that have migrated to the pelvic bones, and the upper portion of the urinary tract. The VIRADS score is a (mp – MRI) standardised reporting method for local bladder cancer staging that was recently released to define the probability of aggression (NMIBC vs. MIBC).[2] The overall grade was determined by evaluating the muscularis propria using T2WI, and identifying the existence of muscles invading using DCEI and DWI. If any deviation in present between the results of T2WI, DWI & DCEI can improve the accuracy.[10] It is widely used for the cancer diagnosis and staging. It has high sensitivity & specificity in diagnosing and staging. It provides information about morphology & blood supply of bladder used for the pre-operative diagnosis of the cancer.[15]

VIRADS:

With the use of the 5-point VI-RADS classification grade for the bladder MRIs, radiologists may classify bladder abnormalities numerically based on their likelihood of being muscle invasive.[11] Bladder cancer clinical management strategies and prognosis depend on two main types: - NMIBC (stage< T1) and MIBC (stage > T2). Of NMIBC, 20–30% go on to MIBC. It takes a prompt diagnosis to prevent BC from getting worse. Compared to MIBC, NMIBC has a greater risk of aggression and mortality. The NMIBC (superficial)

managed with TURBT & MIBC managed by radical cystectomy, irradiation, and chemotherapeutic adjuvants.[12] The VI-RADS aims to simplify reporting with an emphasis on precise and repeatable local staging of bladder cancer, as well as to optimise the image capture of bladder MRIs. As per VI-RADS, an intravesical lesion with T2 signal strength intermediate concentrations. between urine and muscle, a significant signal intensity on DWI matching to an inadequate signal intensity at the ADC map, and early amplification at DCE-MRI are all indicative of bladder cancer on MRI. Tumours should be evaluated separately on T2W imaging, DWI, and DCE in order to calculate an overall invasion risk score.[17]

Table 1.2 T-Staging & Final VI-RADS Score.[12]

T-stage	T2WI	DCE	DWI	Final VI-RADS score
T1	Exophytic mass <1cm with a continuous underlining detrusor layer(stalk &thickened inner layer) **SC1**	No early enhancement of detrusor layer **CE1**	Mass hyperintense on DWI; hypointense on ADC map with a continuous underlining detrusor layer on DWI **DW1**	VIRADS 1
T1	Mass with a continuous underlining detrusor layer (hyperintense thickened inner layer if exophytic or with hyperintense thickened inner layer if sessile)**SC2**	No early enhancement of detrusor layer with early enhancement of inner layer **CE2**	Mass hyperintense on DWI & hypointense on ADC map with a continuous underlining detrusor layer on DWI (with hypointense stalk, hypointense thickened inner layer on DWI, if exophytic; with low/ intermediate SI thickened inner layer on DWI, if sessile) **DW2**	VIRADS 2
T1	Disappearance of category 2 findings,	**CE 2**	**DW2**	VIRADS 2

	but no clear disruption of low SI detrusor layer **SC3**			
T2	**SC3**	Lack of category 2 findings with no clear disruption of hypointense detrusor layer **CE3**	Lack of category 2 findings with no clear disruption of hypointense detrusor layer **DW3**	VIRADS 3
T2	**SC3**	Early enhancing mass that extends focally to detrusor layer **CE 4**	High SI tumour on DWI & low SI tumour on ADC map extending focally to detrusor layer **DW4**	VIRADS 4
T2	Extension of the intermediate SI tumour tissue with interruption of low SI line (detrusor layer) **SC4**	**CE4**	**DW4**	VIRADS 4
T2	Extension of intermediate SI tumour to extravesical fat, with invasion of the extravesical tissues **SC5**	**CE4**	**DW4**	VIRADS 4
>T2	**SC5**	Tumour early enhancement extends to the extravesical fat **CE5**	High SI tumour on DWI & low SI tumour on ADC map extending to the extravesical fat **DW5**	VIRADS 5

T2WI = T2-weighted imaging; **DCE** = dynamic contrast enhanced; **DWI** = diffusion weighted imaging; **VI-RADS** = Vesical Imaging Reporting and Data System**; SC** = structural category; **CE** = contrast enhanced category; **DW** = diffusion weighted category.

DYNAMIC CONTRAST- ENHANCED (DCEI):

DCEI is useful in demonstrating tumour invasion of tissues around it and superficially bladder carcinomas. The analysis of dynamic gadolinium-enhanced MRI is a valuable tool in the staging and diagnosis of bladder cancer, with data precision ranging from 88 to 97.6%.
The urothelium and lamina propria, which make up the innermost portion of the mucosa in DCEI, exhibit initial enhancing that may be distinguished from the delayed enhancement seen in the muscularis propria, which makes up the outermost membrane. As a result, the urothelium and lamina propria cannot be distinguished from the muscularis propria. There was an abundance of lamina propria in the vascular structures, which led to early arterial enlargement. There are three basic layers from radiological perspective that all are essential for local Bladder cancer staging. 1. Mucosa;2. Detrusor muscle; and 3. Peri-vesical fat. All respective layers appeared as single layer on imaging. The peri-vesical fat tissue is observed on imaging.[2]

DWI:

It is an MR-based method that illustrates how tissues work. This non-contrast MRI method is helpful in assessing bladder cancer. Stejskal & Tanner invented it in 1965. Alteration in water permeability at the intracellular and physiological levels are reflected in DWI. It is based on quantifying the water molecules that are different' random Brownian motion inside a tissue voxel. The organization, the density, and integrity of the membrane of cells are negatively correlated with the diffusion of water molecules. Diffusion of micro molecules is revealed. Pathologic lesions with strong tissue contrast in relation to a diminished underlying signal would be identified in this way. It offers helpful information for bladder cancer staging and diagnosis. It's a highly demandable sequence for detecting the various forms of malignancy in numerous kinds of organs & in bladder. It serves as an imaging biomarker that's useful for characterizing the pathophysiology of malignancy.it doesn't require any administration of contrast. So, its applicable for the patients who have contrast allergies with renal insufficiency. When evaluating myometrial invasion, DWI can take advantage of DCE T1W representations. It can also be employed in standar.[17]
In tissue of the body, the extent of water diffusion between molecules and saturation is represented by ADC, which has an inverse relationship with tissue cellularity and cell membrane integrity. ADC levels in bladder cancer are lower than surrounding soft tissues. Benign tumours have high ADC values than malignant tumours. It was found that DWI has high sensitivity and specificity in tumour detection.[13] The cells that make up malignant tumours are arranged erratically and form a dense cluster. Diffusion restriction results from this action, which stops water molecules from moving freely. ADC are reported as potential biomarker, because it predicts histological grading and the aggressiveness of bladder cancer.[14]

DKI:

This sophisticated non-gaussian modality measures the departure out of the gaussian distribution. In comparison with the conventional DWI, DKI is more useful & provides more data on non- gaussian diffusion, would be related to irregularity & heterogeneity of cellular microstructures.[15]
Purpose of the Study
The goal of this research was to assess the potential value of MRI in the diagnosis of urinary bladder cancer using the DWI, DCE, and mp-MRI sequences.

AIM & OBJECTIVE:

AIM:

To evaluate the role of MRI in the diagnosis and staging of urinary bladder carcinoma.

OBJECTIVE:

1. To know the accuracy of DCE – MRI & DWI in staging of bladder cancer.
2. Comparison and co-relation between the retrospective and prospective review article in the urinary bladder carcinoma.

MATERIAL AND METHOD:

MATERIAL:

Study Area:

This systematic review- based study will be carried out in the department of Radio- Diagnosis & imaging, SGT Medical college, Hospital & Research Institute. This study will be based on the role of MRI in diagnosis and staging of urinary bladder carcinoma.

Study Type:

It was a systematic review-based study on the role of MRI in diagnosis and staging of urinary bladder carcinoma.

Study Design:

The articles that were published in SCOPUS, UGC Listed, PUB MED, WEB OF SCIENCE.

Sample Size:

50 articles will be taken through Prisma technique.

Study Duration:

The study duration was from October 2022 – June 2024 as per English Calendar.

Selection Criteria:

Inclusion Criteria:

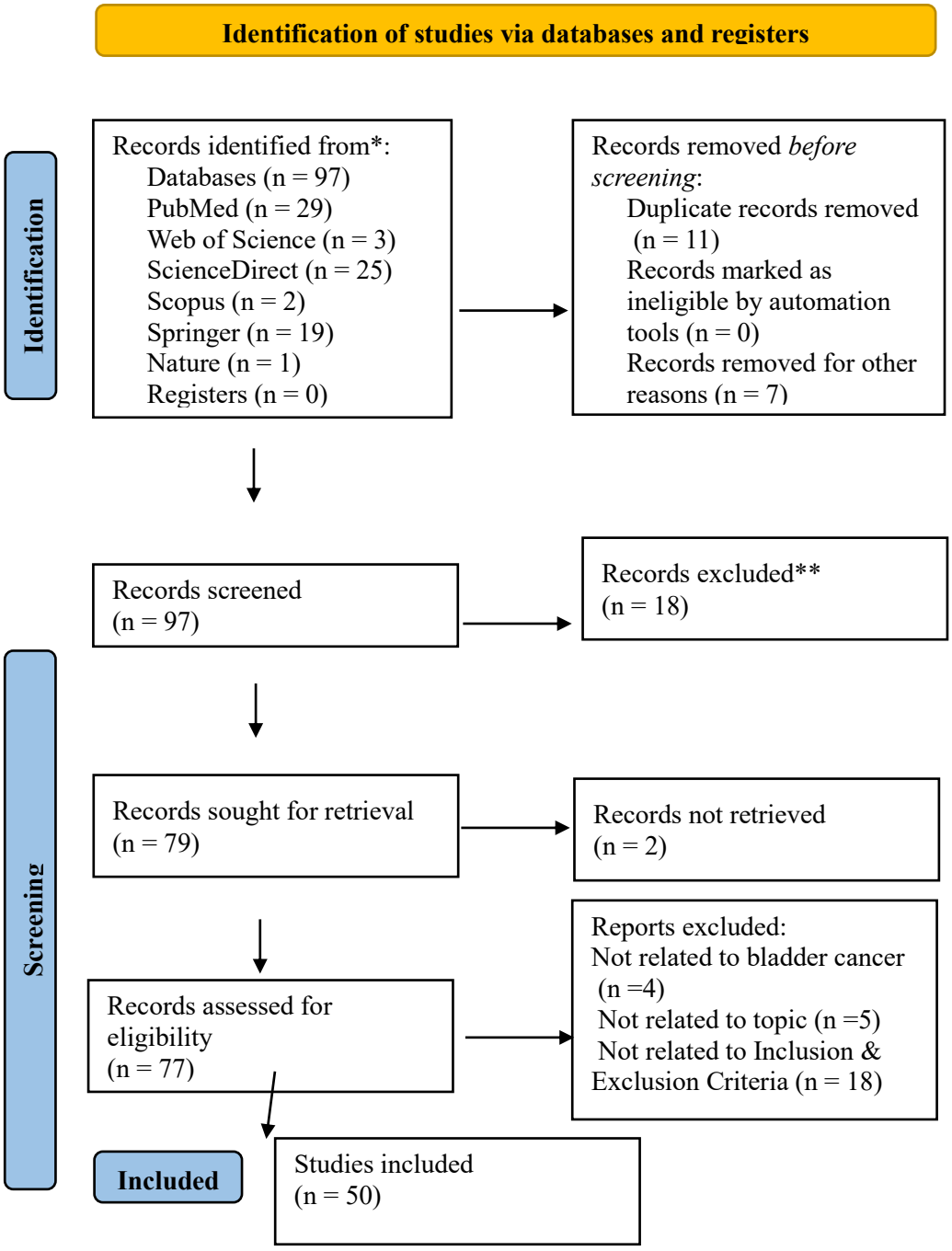
- Articles published after 1st January 2008-March 2024.
- All the articles those are published in Scopus, PubMed, web of science &UGC care journal will be included.

Exclusion Criteria:

Articles that do not match with the inclusion criteria were excluded in the study.
Local journal will be excluded.

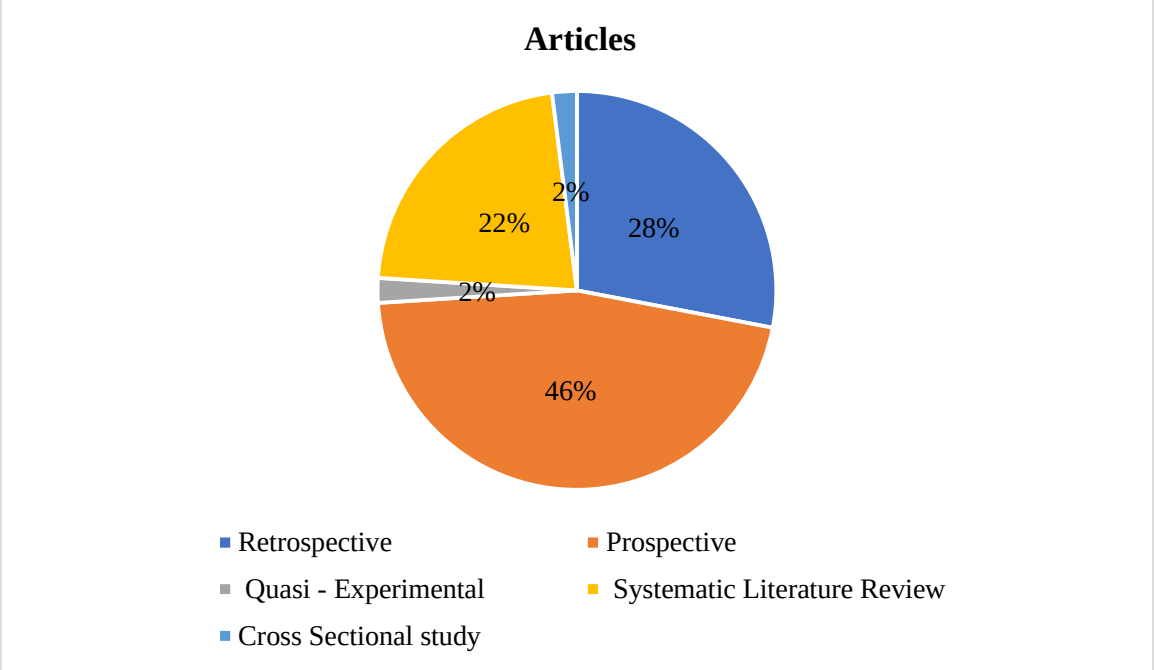
METHOD & STATISTICAL ANALYSIS:

This Systematic Study is based on Review of Literature. The analysis was carried out using several suggested platforms including, PubMed, Scopus, Web of Science, Springer, ScienceDirect, Nature, etc. The original English – language research articles for evaluating the role of MRI sequences – DWI, DCEI in diagnosing and staging the Urinary Bladder Carcinoma were gathered and examined. The PRISMA approach was used in 50 out of the 97original articles that met the inclusion criteria were examined.



RESULT AND DISCUSSION:

In this review study 50 studies, were included which met the inclusion criteria and supports the aim and objective of this study. We categorised the data on the basis of study type:-Prospective, Retrospective, Quasi – Experimental, Literature Review, and Cross – Sectional study , and on the basis of MRI in DWI, DCEI & mp- MRI. Out of 50 (n=50/50;100%) articles, 23 (n=23/50;46%) were Prospective, 14 (n= 14/50;28%) were Retrospective, 11(n=11/50;22%) were Literature Review, 2 (n=2/50; 2%) were Cross- Sectional and 1 (n=1/50;2%) were Quasi-Experimental Study.

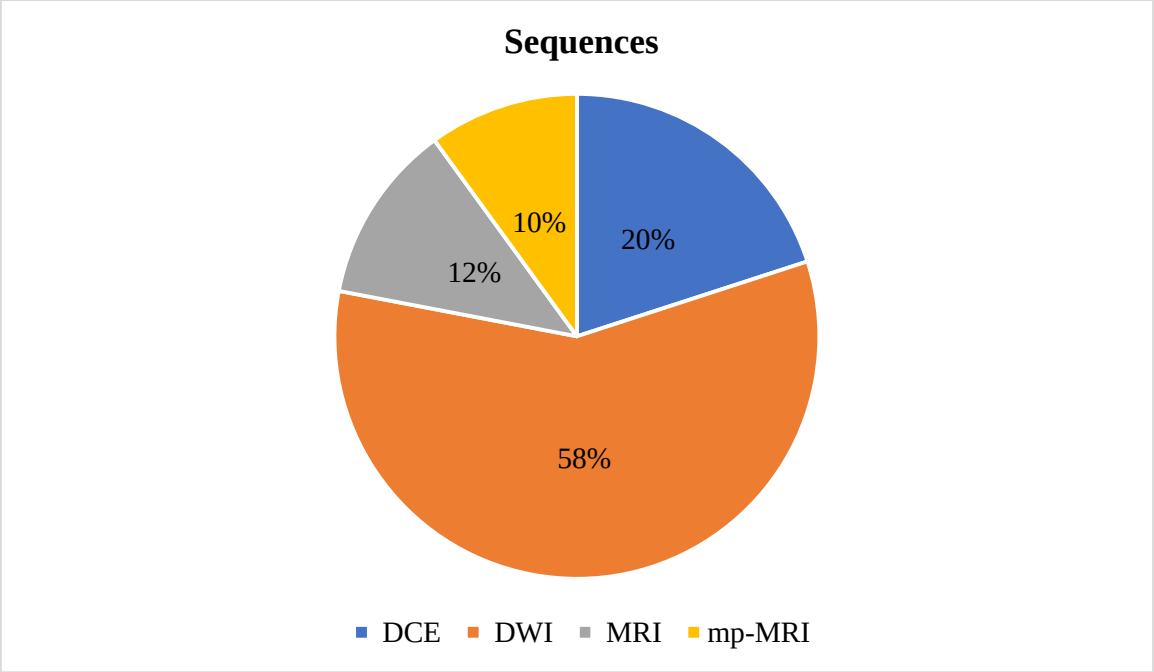


Graph 5.1: Shows the type of study.

Type of Study	Total No.	Percentage
Prospective	23	46 %
Retrospective	14	28 %
Literature Review	11	22 %
Cross - Sectional	1	2 %
Quasi - Experimetal	1	2 %

Table 5.1: Shows about the percentage of different types of studies.

On the basis of the DWI, DCE MRI and mp- MRI. Out of 50 (n=50/50;100%) articles, 29 (n=29/50;58%) were DWI, 10(n=10/50;20%) were DCE, 6 (N=6/50;12%) were MRI and 5 (5/50;10%) were mp- MRI.



Graph 5.2: Shows the Percentage of Sequences more appropriate in research papers.

Sequences	Total No. of Articles	Percentage
DWI	29	58 %
DCE	10	20 %
MRI	6	12 %
mp-MRI	5	10 %

Table 5.2: Shows the no. of articles, Percentage discussed about the different sequences.

This study highlights the MRI imaging techniques in the diagnosis and management of bladder cancer, and focused on role of MRI and advanced imaging modalities. It was discussed Urinary Bladder Carcinoma is a common genitourinary tumour more common among the Male incomparable to Female at older ages. The Sex ratio for the tumour is 3:1. Accurate pre-operative staging and diagnosing is a pivotal factor for the appropriate prognosis and increasing the survival rates among the population. Early diagnosis of Bladder Carcinoma plays a keen role with the help of MRI modality for the imaging. MRI uses DWI, DCEI, T_2 W, and mp- MRI sequences for the preoperative diagnosis and later on helpful in prognosis and treatment planning for the patients. Hence, the goal of our study was to evaluate the role of DWI and DCE in diagnosing of Urinary Bladder Carcinoma. In addition, we conducted this study to assess the comparison between the retrospective and prospective study. Role of DWI and DCE in diagnosing of Urinary Bladder Carcinoma? DW – MRI is a promising sequence helpful in diagnosing and staging of bladder tumour has been reported by Yamada et al. retrospectively reviewed 160 patients, MRI revealed that 127 (79.4%) of the 160 individuals had tumours. Out of 127 individuals with identifiable tumours, 96 (75.6%) had the right diagnosis at each stage of the tumour. Of the 100 patients, 80 (80.0%) had a valid diagnosis with DW-MRI; only 16 (59.3%) of the 27 instances (P = 0.026) had a diagnosis without DWI. When it came to T staging, DW-MRI provided a higher level of accuracy (83.0%) in identifying muscle invasion (T ≤_ 1 vs. T ≥_ 2) than did 66.7% of the time. The accuracy of DW-MRI (98.0%) in differentiating between peri vesical fat invasion (T ≤_2 vs. T ≥_3) was similarly higher than that of 92.6% in the absence of DW-MRI. shown that DW-MRI is a helpful predictive factor for bladder cancer patients as well as being helpful for bladder cancer T staging.[22] In our study it was found that DWI has higher accuracy than conventional sequences; Rehman et al. Prospectively reviewed 40 individuals;14 (35%) were T1, 18 (45%) were T2, and 8 (20%) were T3. In terms of distinguishing superficial from invasive tumours, the overall accuracy of T2WI, DWI, and postcontrast imaging sequences was 60%, 85%, and 75%, respectively. When separating organ-confined tumours from non-organ-confined tumours, the overall accuracy of T2WI, DWI, and postcontrast imaging sequences was 80%, 90%, and 70%, respectively. bladder cancer T staging, DWI is more accurate overall than both T2WI and postcontrast T1WI.

Additionally, the tumour grade may be predicted by the ADC value. Therefore, DWI is advised as a potential MRI sequence for T staging and grading of the urinary bladder.[11]DWI in our study finds that bladder cancer nature is linked to histopathological findings; Gupta et al. Retrospectively reviewed sixty bladder cancer patients. Every patient received 1.5-T magnetic resonance imaging (MRI) using a phased-array pelvic coil. Compared to DCE-MRI (κ=0.619), the degree of agreement between the radiologic staging and histological staging was comparatively higher with DW-MRI (κ=0.669). For stage T4 tumours in both DCEMRI (100.0, 96.2, and 96.7) and DW-MRI, the maximum and comparable values of sensitivity, specificity, and accuracy are observed. The lowest values for stage T2 tumours were seen in DWI-MRI (91.7, 72.2, and 80) and DCE-MRI (83.3, 72.2, and 76.7). When establishing the T stage and histological grade of bladder tumours, MRI is a useful technique. Only DCE-MRI is capable of differentiating between stages T2a and T2. Combining ADC and DCE-MRI yielded more accurate results; hence, a combination strategy is recommended.[56] Our study reveals that DCE has higher accuracy and specificity in analysing the behaviour of the tumour; Hassa Nien et al. revealed that 71 instances were malignant; DCE-MRI sensitivity was 80% in bladder tumours in stage T1, 90.9% in stage T2, and 96.9% in stage T3. The DCE-MRI showed an overall tumour staging accuracy of 89.5% and a significant P ¼.001. DCE-MRI can therefore be a valuable tool in preoperatively predicting the behaviour of tumours and influence antiangiogenetic treatment planning.[58] Limitations of the study that it was a Review based study needed to perform a Prospective study to validate these findings and redefine the role of MRI with a large sample size for the comprehensive management of Bladder Cancer.

CONCLUSION:

An evolving technique for the diagnosis, staging, and grading of urinary bladder cancer is MRI. Owing to its intrinsic high soft tissue contrast. When compared to other imaging modalities, it offers the finest staging. It is superior in detecting small and advanced tumour and plays a vital role in treatment. Newer advances like DCE & DWI as a part of mp-MRI may provide additional details for the assessment of bladder cancer. DWI, highlighted as a non-invasive & reliable modality for accurate staging grading of Bladder Cancer provides qualitative and quantitative information of the tumour. It's ability to provide detailed physiological and biological information make it a valuable tool in management and prognosis of Bladder Cancer. In DWI, the ADC value is used as a biomarker to gauge the extent of bladder cancer appears, 3T MRI methodology provides high quality DWI images with high ADC measurements leading to high SNR, better image resolution and shorter scan time and improves the tumour characterization in comparable to 1.5 T MRI. DCE-MRI is a powerful imaging modality that provides detailed information about tissue vascularity by tracking the dynamic distribution of contrast agents over time. This technique can yield critical insights into tumor angiogenesis, which is a key factor in cancer growth and progression. It's routine use in staging causes significant improvement of diagnosis, prognosis of patients and their survival rates. The combination of both the sequences in Diagnosis and prognosis of Bladder Carcinoma used when differentiation between superficial and muscle invasive disease during pre-operative workup.

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