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**Research Article**


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# The CT and MRI findings in staging of Urinary Bladder Carcinoma in correlation with Histopathological findings

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## Abstract

**Background:** More than 12 million new cases of cancer occur annually worldwide. Of those 5.4 million occur in developed countries and 6.7 million in developing countries. Urinary bladder cancer ranks ninth in worldwide cancer incidence. It is the seventh most common malignancy in men and seventeenth in women. **Aim of study:** To evaluate staging of CA bladder by MRI and CT versus histopathological staging after cystectomy or TUR. To help establish a local strategy and guideline on the use of CT and MRI in staging bladder tumors in medical city in accordance with facility availability. **Patients &Methods:** Descriptive, cross sectional study performed in Radiology department in medical city teaching complex in the period from August 2012 to August 2013 During the mentioned period ,42 patients were referred to the CT department then MRI department of medical city teaching complex for local staging of diagnosed bladder cancer. **Results:** Forty two patients were included in this study, all with histopathologicaly diagnosed bladder cancer, but only twenty eight patients had proper surgical histopathological staging . The mean age of the patients was (56 +-10.76) years ranging (21-75) years , most of them were male 34 (81%) . patients were smokers 28 (66.7) ,13(31%) had a history of recurrent UTI among and 39(92.9%) had haematuria. Majority of cases had TCC on histological study :38 cases out of 42 cases (90.47%) ,while SCC only 4 cases (9.53%). To evaluate the use of MR imaging in patients with urinary bladder carcinoma, only its value in staging is important, as the high costs associated with MR imaging make this technique unsuitable for use in early detection. Furthermore, cystoscopy is more accurate for that purpose. Patients with extravesical tumors show significantly higher recurrence rates and worser survival than those with organ-confined tumors. Therefore, distinguishing between organ-confined and nonorgan- confined tumors is essential. **Conclusion:** CT is becoming widely accessible in Iraq and considered a primary noninvasive imaging modality for the assessment of patients with bladder cancer. We concluded that MRI staging of bladder cancer is highly reproducible among experienced reviewers with pathological confirmation & MRI was superior in the local staging of bladder cancer.

**Keywords:** CT- Scan, MRI, Bladder Cancer Staging, Histopathology

## Background

More than 12 million new cases of cancer occur annually worldwide. Of those 5.4 million occur in developed countries and 6.7 million in developing countries (1, 2). Urinary bladder cancer ranks ninth in worldwide cancer incidence. It is the seventh most common malignancy in men and seventeenth in women (3).

Primary bladder tumours are mostly epithelial in origin, less than 10% arising from a nonepithelial source. All epithelial tumours are malignant, the majority being of the transitional cell type, with squamous-cell carcinoma (1.5–10%) and adenocarcinoma (1%) being relatively uncommon (4)

## Aim of study

To evaluate staging of CA bladder by MRI and CT versus histopathological staging after cystectomy or TUR.

To help establish a local strategy and guideline on the use of CT and MRI in staging bladder tumors in medical city in accordance with facility availability.

## Patients and Methods

Descriptive, cross sectional study performed in Radiology department in medical city teaching complex in the period from August 2012 to August 2013 During the mentioned period, 42 patients were referred to the CT department then MRI department of medical city teaching complex for local staging of diagnosed bladder cancer .

Patient with bladder masses on US with no previous intervention were enrolled in study .they were examined by CT and MRI, after surgical intervention **(**cystoscope and biopsy, TUR, or cystectomy) was accomplished ,the histopathological results were taken for documentation of staging exclude patient with shell injury ,intraocular implants & aneurismal clips.

## Results

Forty two patients were included in this study, all with histopathologicaly diagnosed bladder cancer, but only twenty eight patients had proper surgical histopathological staging.

The mean age of the patients was (56 +-10.76) years ranging (21-75) years, most of them were male 34 (81%). Patients were smokers 28 (66.7) ,13(31%) had a history of recurrent UTI among and 39(92.9%) had haematuria table 2.

Majority of cases had TCC on histological study: 38 cases out of 42 cases (90.47%), while SCC only 4 cases (9.53%)

Table:1 Distribution of socio demographic characteristics of patients.

| Variable | | Number | Percent (%) |
|---|---|---|---|
| **Age** | Mean ±Std. | 56.0±10.7 | |
| | Range | 21.0-75.0 | |
| **Sex** | Male | 34 | 81.0 |
| | Female | 8 | 19.0 |
| **Smoking habits** | Smoker | 28 | 66.7 |
| | Non-Smoker | 14 | 33.3 |
| **Hematuria** | Yes | 39 | 92.9 |
| | No | 3 | 7.1 |
| **Recurrent UTI** | Yes | 13 | 31.0 |
| | No | 29 | 69.0 |
| **Total** | | 42 | 100 |

## Local staging

Only 28 cases had proper histopathological staging 20 of them were evaluated with contrast, while in 8 cases contrast was contraindicated.

In CT cases with contrast T2A was present in 10 cases (50%), T2B in 4 cases (20%), T3A in 2 cases (10%), T3B in 3cases (15%) and T4A in 1 case (5%) .

The difference between CT T-staging& histopathological T- staging was statistically significant (P <0.05)

No similar comparison can be made for non contrast – CT evaluated cases because of insufficient data no.

On MRI with contrast, out of 20 cases , 8 (40%) were T2b,3 cases (15%) of T3a,4 cases (20%) of T3b, 4 cases (20%) of T4a and 1 case (5%) of T4b.

The significant difference between MRI and histopathologicaT-staging was not significant (P=0.804) for 8 cases without contrast, T-staging distribution were 2cases (25%) of T2b,4 cases (50%) of T3a and 2 case ( 25% )of T3b.Also there was no significant difference between MRI and histopathological T –staging (P=0.804)

Table: 2 MRI T-stage, CT T- stage versus histopathological T- stage

| | With contrast | | | Without contrast | | |
|---|---|---|---|---|---|---|
| **Stage** | CT-T F. Percent % | MRI-T F. Percent % | Histo-T F. Percent % | CT-T F. Percent % | MRI-T F. Percent % | Histo-T F. Percent % |
| **TX** | 0 | 0 | 0 | 8 100% | - | - |
| **T2a** | 10 50% | 0 | 2 10% | - | 1 | - |
| **T2b** | 4 20% | 8 40% | 12 60% | - | 2 | - |
| **T3a** | 2 10% | 3 15% | 1 5% | - | 2 | 4 |
| **T3b** | 3 15% | 4 20% | 2 10% | - | 3 | 4 |
| **T4a** | 1 5% | 4 20% | 2 10% | - | - | - |
| **T4b** | 0 | 1 5% | 1 5% | - | - | - |
| **Total** | 20 1005st | 20 100% | 20 100% | 8 100% | 8 100% | 8 100% |
| **P value 0.804 of MRI –T versus histopath.- T stage** | | | | P value 0.132 of MRI –T versus histopath.- T stage | | |
| **P value 0.00 of CT –T versus histopath.- T stage** | | | | P value is not calculated of CT –T versus histopath.- T stage | | |

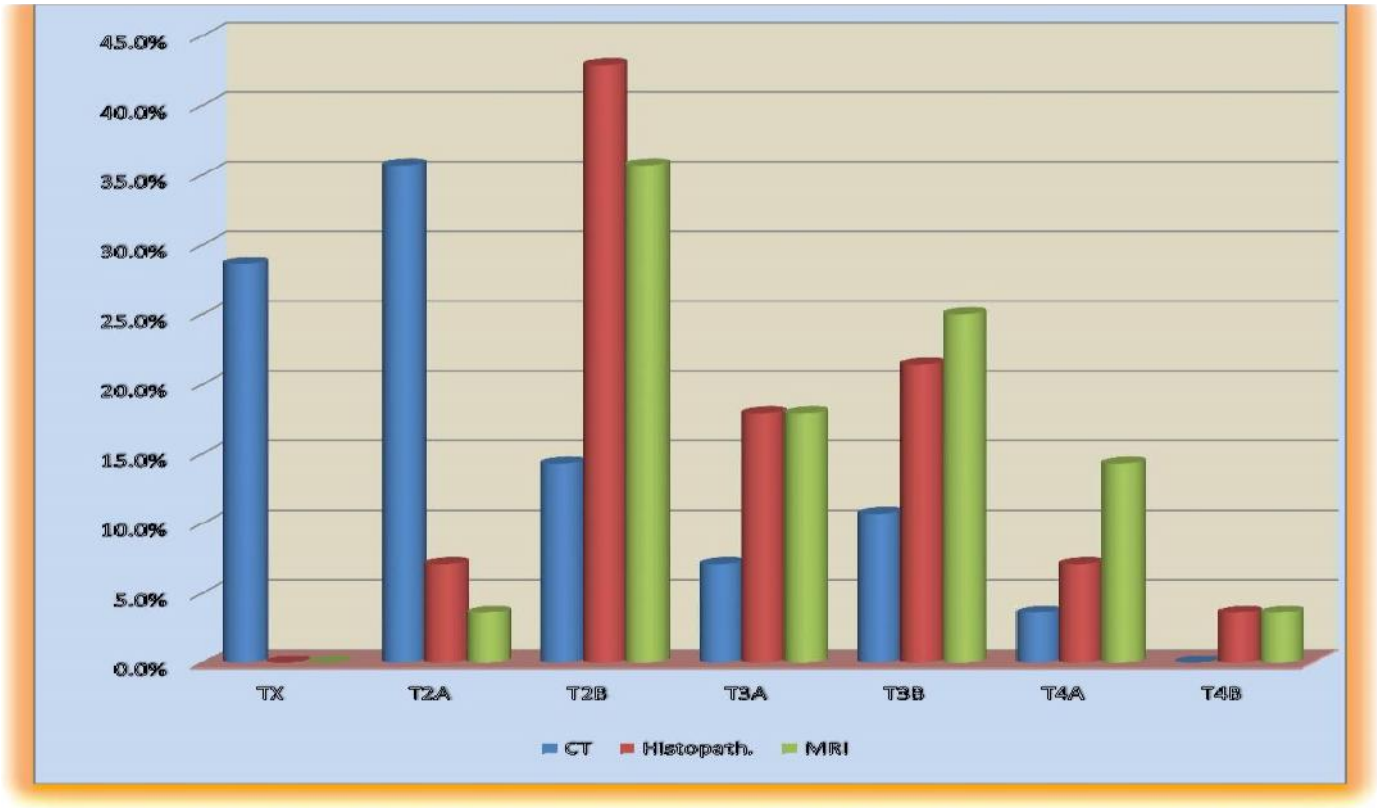


Fig. 1 Show distribution of CT-T stage & MRI-T stage versus histopathological T-stage for 28 cases.

## Discussion

The treatment and prognosis of urinary bladder carcinoma is largely determined by the depth of tumor growth and the extent of metastases (39). Bladder-saving treatment is used for non-invasive tumors (stages T1-T2a), whereas for stage, T2- T3b tumors, radical cystectomy is performed. The treatment for stage T4a and T4b tumors and for metastatic disease is usually palliative radiation and chemotherapy, respectively(39). To evaluate the use of MR imaging in patients with urinary bladder carcinoma, only its value in staging is important, as the high costs associated with MR imaging make this technique unsuitable for use in early detection. Furthermore, cystoscopy is more accurate for that purpose (40).. Patients with extravesical tumors show significantly higher recurrence rates and worser survival than those with organ confined tumors (41). Therefore, distinguishing between organ-confined and non-organconfined tumors is essential.

The age range for the patients included in this study was (21-75), with the mean age (56y). This showed a younger age incidence when compared with the result of previous studies (65y) (42), (64y) (43) & (72y)(44).

This could be due to exposure to external radiation as a consequence of wars in Iraq is a possible risk factor in development of bladder cancer.

Male to female ratio was bout (4.25:1),comparing this with the others ration of previous studies (2.5:1) (44),(3:1) (45) &(4:1) (46), all showed high male incidence .

This study showed that 66.7% of the patients were smokers ,and 33.3% were non smokers .this is agree with Zeegers MPet and Steiner Het al who mentioned that cigarette smoking is thought to be the causative factor in 50-60%of men and one third of women who develop bladder CA(47) .

Chronic UTI are another predisposing factor to bladder CA (45). In this study 31 %of patients had history of recurrent UTI.

Most of the studied cases had TCC (90.47%) this agrees with Messing DM et al in which 90% of epithelial bladder tumor are TCC(45).

For the role of CT in CA bladder imaging, CT is becoming widely accessible in Iraq and considered a primary noninvasive imaging modality for the assessment of patients with bladder cancer.

Multiplanar reformations and multiphasic contrast studies can be performed which may enhance the performance of CT in the evaluation of bladder cancer (28).

In our study for the 28 cases who have histological staging only 20 cases were examined with contrast , Bladder cancers enhance more intensely than adjacent normal bladder wall on contrast-enhanced CT scans which differentiate it from blood clots, while when contrast is not used tumor masses neither can be differentiated from blood clots nor their characteristics can be described precisely .

CT can also show the obstructive complication when the tumor or a clot occlude a ureteric orifice ,mass less than 1 cm in size cannot be detected in our studies ,while mass less than 1 cm can now be routinely detected on MDCT(28) .

. For staging of CA bladder in CT, In this study all enrolled cases were of T2 stage or above. CT cannot determine the depth of bladder wall invasion, ie, differentiating T2a from T2b disease(28,48 ) ,similar result were found in our study in which we have 12 cases of histopathology proved T2b stage ,4 of them was staged properly by CT ,while the other 8 cases were understaged. While Koss el al. & Bindu N. Setty stated that CT is better in differentiating higher stage tumors T3a, T3b &T4( 28,48 ) , however in our study we found were T3A in 2 cases(10%) ,T3b in 3cases (15%) and T4a in 1 case (5%) of those cases only 2 cases agree with the histopatho-logical result while the others were understated. Delay between date of exam and the result of surgical histopathological staging because of patient delay in taking a decision of cystectomy, could be a cause of this discrepancy.

T3b tumors produce an irregular outer bladder wall, or soft-tissue infiltration or stranding into the perivesical fat in the region of the tumor.

Adjacent organ invasion can be excluded if a clear plane of separation is preserved, although unfortunately the presence or absence of the fat plane is not completely reliable for determination of microscopic invasion.

The tumor tissue within the invaded organ enhances similar to the bladder tumor with associated enlargement of the invaded organ (49) see fig (17) that all true for cases examined with contrast which show accurate staging of 50% was proved by histopathological staging, this result less than Bye et al. (50)in which (60%) was accurate staging ,& more than Amendola et al. & Branetsz et al (51,52) . in which (40%),(45%) respectively were accurate staging, but for NC cases which were proved by surgical staging as T3a&T3b by CT only described as non specific thickening or undetermined mass which is considered as Tx.

The major diagnostic criterion for CT evaluation of a lymph node is its size. Pelvic nodes are often considered abnormal if the lymph node measures 10 mm or more in its short-axis dimension, although micros-copic involvement of normal-sized nodes can lead to false negatives and subsequent under staging using this threshold. Lymph nodes tend to become rounded with metastatic involvement.(53)

In our series, 20 cases who were examined by CT with contrast for LN ,19 cases agree with surgical result while only one case was missed ,15 cases of were detected accurately by CT ,out of the 5 cases of N1, 4 cases were detected accurately by CT, The overall accuracy of CT with contrast was 95% ,this agree with previous study Koss el al in which 25 patients with lymph node dissections, the overall accuracy of CT was 92% (23/25)(48), also agree with other study 92% the accuracy of CT in detecting pelvic LN metastasis (28) .

On the other hand, of those cases that examined without contrast (8cases), 6 of them diagnosed accurately as N0, while 2 cases, of N1 stage, were missed by CT this could be due to microscopical involvement of LN with malignancy .

For the role of MRI in CA bladder imaging , All the 42 cases, show iso intense signal intensity relative to bladder wall muscles on T1 –weighted images, this agrees with Tekes et al**.** (39).

Axial TSE T1-weighted images were useful for evaluating the perivesical fat planes (T3) ,for extravesical tumor infiltration ,and pelvic LAP .The urine in the bladder has low signal intensity on T1 –weighted images whereas the bladder wall intermediate signal intensity and the adjacent fat has high signal intensity .non –fat saturated TSE T2-

weighted images are obtained on three orthogonal planes where ,the urine appears as high signal intensity and the muscle of the wall appears as a hypointense line .

The tumor when stages as muscle invasion (T2b or above) this hypoin-tense line is interrupted by the tumor, while when the tumor is superficial the line appears uninterrupted this can be identified in T1 and T2sequence even without contrast.

Those patient with extravesical spread whether micro (T3a) or macro (T3b) pervesical fat infiltration, and adjacent organ invasion (T4), All can be visualize in MRI sequences.

Gadolinium could not be given to 12patient of (42) cases because of low GFR (<60 ml/min/1,73 m2), and was given to 30 patients ,axial T1-vibe –fs were obtained before after gadolinium administration .

All tumors had increased enhancement compared with uninvolved bladder wall (54).

Mean size of tumor for the 42 cases was 3.9 cm, result is larger than that of Tekes et al. in which the mean size was 2.5 cm ( 39).

Most patient of this study had lateral wall involvement (62%), this agreed with a study mentioned that bladder tumors most commonly located in the lateral wall of the bladder ( 45) .

In this study 66.6% had mass lesion and 33.3%has infiltrative pattern of growth, from those that had mass lesion (59.7%) had papillary shaped tumor and (7.1%) had sessile shaped tumor.

In comparison with previous study Tekes et al. which show tumors were detected in 62 (87%) of the 71 patients on pathologic confirmation. Of these patients, 45 patients (63%) had mass lesions, patients, whereas 17 (24%) had diffuse wall thickening. Of the mass lesions, 20 were papillary and 25 were sessile (39).

So both studies showed that patients who had a mass shape of a tumor were a higher percentage than patients with infiltrative pattern of growth.

For MRI staging, those cases which were org.confined by histopathology (14) cases three of them under staged by MRI, while those cases that non- org. confined (14), 3 of them over staged by MRI, this result is lower than that with Tekes et al where Of the 62 cases, 51 were correctly classified, seven were over staged and four were under staged (39) and much lower than that reported in a 1988 study by Buy et al. (50) & A.Rajesh et al.(55)

The overall correct staging of MRI for cases with contrast 70 % this result more than Tekes et al which reported accuracy of 60% with dynamic contrast study (39) .

For those cases without contrast 8cases of (28), 5 cases were concordance with histopathological result 62.5% the others were uderstaged, this result agree with Buy et al (50) which reported an accuracy of 60%. The most common staging error reported in that study was underestimation of tumor extent , but not current with Amendola et al& Husband et al which both had been reported an accuracy of 73% ,this could be because small sample size of our study (51,56).

## Conclusion

CT is becoming widely accessible in Iraq and considered a primary noninvasive imaging modality for the assessment of patients with bladder cancer.

We concluded that MRI staging of bladder cancer is highly reproducible among experienced reviewers with pathological confirmation & MRI was superior in the local staging of bladder cancer.

The routine use of gadolinium-enhanced images is not required and can be reserved for equivocal findings while CT without contrast is useless in CA bladder staging.

CT as well as MR rely on morphological criteria and are both useful in the detection of metastases to the lymph nodes.

In conclusion, it is clear that cross- sectional imaging plays a growing, important role in the evaluation of patients with bladder cancer.

## Recommendations

Make MRI more readily available for patients bladder tumor in their 1st evaluation.

We recommended that, if the bladder tumor by u/s is in its early stages, then we should do MRI for local staging, & if the bladder tumor of higher stage beyond the bladder wall by u/s, we recommend to proceed with CT scan with contrast which is more readily available, non time consuming & can demonstrates in details the upper abdomen, the kidneys and pelvis including lymph nodes.

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