

Correlation of Histopathological and CT Scan Findings of Urinary Bladder Transitional Cell Carcinoma

*Dr. Md. Towhid Hossain¹, Dr. Morshida Begum², Dr. Abrar Mahbub³, Dr. Maruf Rahman⁴,
Dr. Fauzia Tasnim Hossain⁵

¹Department of Histopathology, National Institute of Kidney Diseases and Urology, Dhaka, Bangladesh

²Department of Radiology and Imaging, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

³MBBS, MO, Doctors Trust Kidney Dialysis and Transplant Center, Dhaka

⁴MBBS, Physician, Phase B Student, National Institute of Traumatology & Orthopaedic Rehabilitation, Dhaka, Bangladesh

⁵MBBS, MO, Doctors Trust Kidney Dialysis and Transplant Center, Dhaka

Received: 04 December 2020

Accepted: 21 December 2020

Published: 28 December 2020

***Corresponding Author:** Dr. Md. Towhid Hossain, Department of Histopathology, National Institute of Kidney Diseases and Urology, Dhaka, Bangladesh.

Abstract

Background: Urinary bladder transitional cell carcinoma (TCC) is a common malignancy and early detection plays a crucial role in treatment planning and prognosis. Imaging techniques, particularly CT scans, have become vital in diagnosing and staging bladder cancer. However, their correlation with histopathological findings remains essential for confirming diagnoses and determining the appropriate course of treatment.

Methods: This cross-sectional study was conducted at the National Institute of Kidney Diseases and Urology (NIKDU), Sher-E-Bangla Nagar, Dhaka, over a one-year period from July 1, 2019, to June 30, 2020. A total of 100 patients diagnosed with urinary bladder TCC were included in this study. CT scans were performed to identify key features such as bladder wall thickening, enhancing masses, muscle invasion, perivesical fat infiltration, lymph node involvement, and hydronephrosis. Histopathological findings were obtained from transurethral resection or biopsy specimens.

Results: The study found a strong correlation between CT scan findings and histopathological results. Irregular enhancing mass had a 97% true positive rate, while bladder wall thickening had a 94% true positive rate. The detection of muscle-invasive TCC on CT was confirmed histologically in 83% of cases, and perivesical fat infiltration was confirmed in 79%. Lymph node involvement was accurately detected in 73% of patients.

Conclusion: CT scans demonstrate a high correlation with histopathological findings in diagnosing and staging urinary bladder TCC, making it a valuable tool in preoperative evaluation. These findings support the role of CT in detecting invasive features and guiding treatment decisions.

Keywords: Transitional cell carcinoma, urinary bladder, CT scan, histopathology, muscle invasion, lymph node involvement.

1. INTRODUCTION

Urinary bladder cancer is one of the most common malignancies affecting the urinary tract, with transitional cell carcinoma (TCC) being the predominant histological type [1, 2]. It accounts for approximately 90% of all bladder cancers and is known for its high recurrence rate and potential for progression [1]. Early and accurate diagnosis

is crucial for effective treatment and improved patient outcomes. In clinical practice, computed tomography (CT) urography and histopathological examination are widely used for the diagnosis and staging of bladder TCC [3].

While CT scan plays a crucial role in identifying tumor characteristics and staging, histopathology remains the gold standard for definitive

diagnosis. Understanding the correlation between these two diagnostic modalities can enhance the accuracy of bladder cancer evaluation and guide appropriate management strategies [4].

Bladder cancer is a major health concern worldwide, particularly in males, with smoking and exposure to industrial chemicals being significant risk factors [5]. The disease presents with hematuria, dysuria, and irritative urinary symptoms, necessitating further imaging and biopsy for confirmation. The prognosis of bladder cancer depends on tumor grade and stage, which influence treatment decisions, including surgical resection, intravesical therapy, chemotherapy, or radiotherapy [6]. Non-muscle-invasive bladder cancer (NMIBC) (Ta, T1) can often be treated conservatively, while muscle-invasive bladder cancer (MIBC) (T2 or higher) requires aggressive intervention [7].

CT urography is a non-invasive imaging modality widely used for evaluating suspected bladder cancer [8]. It provides detailed anatomical and functional information, detecting bladder wall thickening, enhancing masses, and perivesical fat invasion, which are key indicators of malignancy [9]. Additionally, it helps in assessing tumor extent, lymph node involvement, and upper urinary tract abnormalities. Despite its utility, CT has limitations in differentiating low-grade from high-grade tumors and in accurately determining muscle invasion, necessitating histopathological confirmation [10].

Histopathological examination of transurethral resection of bladder tumor (TURBT) specimens is essential for confirming the presence of TCC, grading the tumor, and assessing the depth of invasion [11]. High-grade TCC is more likely to invade the muscle layer (T2) or beyond, whereas low-grade tumors are usually confined to the mucosa or lamina propria. Identifying these characteristics is crucial for treatment planning and prognostic evaluation [12].

Although CT scan is frequently used for initial evaluation, its accuracy in predicting histopathological findings varies [13]. Several studies have reported that CT urography has high sensitivity in detecting bladder tumors but variable accuracy in assessing muscle invasion and perivesical extension [6]. False-positive and false-negative findings can lead to over staging or under staging, affecting treatment decisions. Establishing a strong correlation between CT

scan findings and histopathology will help in determining the reliability of CT urography in staging bladder TCC and its role in guiding clinical management [14].

This study was conducted at the National Institute of Kidney Diseases and Urology (NIKDU), Sher-E-Bangla Nagar, Dhaka, to evaluate the correlation between CT scan findings and histopathological examination in urinary bladder TCC. The study aimed to determine the diagnostic accuracy, sensitivity, specificity, and predictive values of CT scan in staging bladder cancer, with histopathology serving as the reference standard. By analyzing the agreement between these two modalities, the study sought to improve diagnostic precision and contribute to more effective and timely management of bladder cancer.

2. METHODOLOGY & MATERIALS

This cross-sectional study was conducted at the National Institute of Kidney Diseases and Urology (NIKDU), Sher-E-Bangla Nagar, Dhaka, over a one-year period from July 1, 2019, to June 30, 2020. A total of 100 patients with suspected urinary bladder transitional cell carcinoma (TCC) were included in the study. Patients aged 30 years and above, who underwent both CT urography and histopathological examination, were eligible for inclusion. However, individuals with a prior history of bladder cancer, those who had received chemotherapy, cases with incomplete histopathological reports, or poor-quality CT scans affecting interpretation were excluded.

Data were collected from patient records at NIKDU, including CT scan findings such as bladder wall thickening, enhancing mass lesions, perivesical fat invasion, and lymph node involvement. Histopathological examination of biopsy or transurethral resection of bladder tumor (TURBT) specimens was performed to confirm tumor grade and depth of invasion. The correlation between CT scan findings and histopathological results was analyzed to assess the diagnostic accuracy of CT urography in detecting bladder cancer.

All collected data were entered and statistically analyzed using SPSS version 22. Descriptive statistics, including mean, frequency, and percentage, were calculated for key variables. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of CT urography in detecting bladder cancer and assessing tumor invasiveness were determined.

3. RESULTS

Table 1. Patient Demographics

Variable	Number (n=100)	Percentage (%)
Age Group (Years)		
30 – 40	12	12%
41 – 50	23	23%
51 – 60	34	34%
61 – 70	19	19%
>70	12	12%
Gender		
Male	78	78%
Female	22	22%

Table 1 presents the age and gender distribution of the 100 patients included in the study. The majority of patients (34%) were in the 51–60 years age group, followed by 41–50 years (23%)

and 61–70 years (19%). Patients aged 30–40 years and above 70 accounted for 12% each. The study population had a male predominance, with 78% male and 22% female patients.

Table 2. CT Scan Findings of Urinary Bladder TCC

CT Scan Findings	Number (n=100)	Percentage (%)
Focal bladder wall thickening	38	38%
Irregular enhancing mass	47	47%
Diffuse bladder wall thickening	15	15%
Perivesical fat infiltration	27	27%
Lymph node involvement	14	14%
Hydronephrosis	21	21%

Table 2 summarizes the CT scan findings of 100 patients with suspected urinary bladder transitional cell carcinoma (TCC). The most common finding was an irregular enhancing mass (47%), followed by focal bladder wall thickening (38%). Perivesical fat infiltration was

observed in 27% of cases, while hydronephrosis and lymph node involvement were noted in 21% and 14% of patients, respectively. Diffuse bladder wall thickening was the least common finding, seen in 15% of cases.

Table 3. Histopathological Findings of Urinary Bladder TCC

Histopathology Findings	Number (n=100)	Percentage (%)
Low-grade TCC	28	28%
High-grade TCC	72	72%
Muscle-invasive TCC (T2+)	57	57%
Non-muscle-invasive TCC (Ta, T1)	43	43%
Lymphovascular invasion	18	18%

Table 3 outlines the histopathological findings of 100 patients diagnosed with urinary bladder transitional cell carcinoma (TCC). The majority of cases were high-grade TCC (72%), with low-grade TCC observed in 28%. Regarding tumor

invasiveness, 57% of patients had muscle-invasive TCC (T2+), while 43% had non-muscle-invasive TCC (Ta, T1). Lymphovascular invasion was identified in 18% of cases.

Table 4. Correlation of CT Scan and Histopathological Findings

CT Scan Findings	Histopathology Confirmation	True Positive (%)	False Positive (%)
Bladder wall thickening	Confirmed as TCC	94%	6%
Enhancing mass	Confirmed as TCC	97%	3%
Muscle invasion suspected on CT	Confirmed histologically (T2+)	83%	17%
Perivesical invasion on CT	Confirmed histologically (T3/T4)	79%	21%
Lymph node involvement	Confirmed histologically	73%	27%

Table 4 presents the correlation between CT scan findings and histopathological confirmation in 100 patients with urinary bladder TCC. The CT scan findings of bladder wall thickening and enhancing mass showed high true positive rates of 94% and 97%, respectively, with false positive rates of 6% and 3%. For muscle invasion suspected on CT, histopathology confirmed 83% of cases as muscle-invasive (T2+), with a false positive rate of 17%. Perivesical invasion and lymph node involvement on CT were confirmed histologically in 79% and 73% of cases, respectively, with false positive rates of 21% and 27%.

4. DISCUSSION

The correlation between CT scan findings and histopathological results in urinary bladder transitional cell carcinoma (TCC) is critical in determining the appropriate treatment strategies and assessing prognosis. This study aimed to evaluate these correlations in 100 patients with bladder TCC, and the results were consistent with findings from earlier research that emphasized the importance of imaging techniques like CT scans in detecting bladder tumors and their invasiveness [7, 11, 13].

In our study, irregular enhancing masses on CT scans were the most commonly observed findings (47%), and these correlated strongly with histopathology, confirming the presence of TCC in 97% of cases. This result aligns with previous studies, such as Picchio et al., which demonstrated that CT scans are highly sensitive in detecting bladder cancer, especially when looking for enhancing masses [15]. Moreover, the bladder wall thickening observed in 38% of patients had a true positive rate of 94%, indicating that this finding is a reliable diagnostic indicator. This result is consistent with research by Blick et al., which confirmed that CT is effective in identifying bladder wall abnormalities that often correspond to malignancy [16].

The study also found that muscle invasion suspected on CT scans was confirmed in 83% of cases, indicating good diagnostic accuracy for muscle-invasive TCC (T2+). This result is in line with previous findings, such as those by Kibel et al., who showed that CT urography is effective in assessing muscle invasion in bladder cancer, which is crucial for treatment planning, particularly regarding radical cystectomy [17]. Similarly, perivesical fat infiltration was confirmed histologically in 79% of cases,

suggesting that CT imaging is a valuable tool for assessing local invasion, as corroborated by studies like Prasad et al., which highlighted CT's role in detecting locally advanced bladder cancer [18].

The lymph node involvement on CT scans was confirmed in 73% of cases, with a false positive rate of 27%. This is slightly lower than expected, as studies such as Novara et al. suggest that while CT is useful for detecting lymph node metastasis, its accuracy can vary, and sometimes lymphadenopathy may not correlate with pathological findings [19]. Nevertheless, the relatively high true positive rate supports the utility of CT in staging bladder cancer.

The high correlation between CT findings and histopathological results supports the use of CT scans as an essential tool in the preoperative assessment of bladder cancer. The accurate detection of muscle-invasive TCC, perivesical invasion, and lymph node involvement on CT imaging helps guide therapeutic decisions, such as whether to proceed with radical cystectomy or conservative management. Additionally, CT scans play a critical role in evaluating treatment response and detecting recurrence post-surgery, as indicated by studies such as Modlich et al., which emphasized the importance of imaging in tracking tumor progression and response to therapy [20].

5. LIMITATIONS OF THE STUDY

While the study provides valuable insights into the correlation between CT and histopathological findings, it is important to note that CT urography may not always be as accurate in detecting small or superficial lesions. Additionally, the study's sample size of 100 patients might not fully represent the broader population, and further research with larger cohorts is needed to confirm these findings.

6. CONCLUSION

In conclusion, our study confirms that CT scans are highly effective in detecting and staging bladder transitional cell carcinoma and correlate well with histopathological findings. The high true positive rates observed for features such as enhancing masses, bladder wall thickening, and muscle invasion suggest that CT imaging is an invaluable tool for the preoperative evaluation of bladder cancer. However, further studies with larger sample sizes and additional imaging modalities could provide a more comprehensive

approach to improving diagnostic accuracy and staging of bladder cancer.

FINANCIAL SUPPORT AND SPONSORSHIP

No funding sources.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

- [1] Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. *CA: a cancer journal for clinicians*. 2018 Jan;68(1):7-30.
- [2] Antoni S, Ferlay J, Soerjomataram I, Znaor A, Jemal A, Bray F. Bladder cancer incidence and mortality: a global overview and recent trends. *European urology*. 2017 Jan 1;71(1):96-108.
- [3] Giannarini G, Crestani A, Ficarra V. Re: robot-assisted radical cystectomy versus open radical cystectomy in patients with bladder cancer (RAZOR): an open-label, randomised, phase 3, non-inferiority trial. *European urology*. 2018 Dec;74(6):840-1.
- [4] Akiyama Y, Maeda D, Katoh H, Morikawa T, Niimi A, Nomiya A, Sato Y, Kawai T, Goto A, Fujimura T, Fukuhara H. Molecular taxonomy of interstitial cystitis/bladder pain syndrome based on whole transcriptome profiling by next-generation RNA sequencing of bladder mucosal biopsies. *The Journal of urology*. 2019 Aug;202(2):290-300.
- [5] Hoyle AP, Ali A, James ND, Cook A, Parker CC, De Bono JS, Attard G, Chowdhury S, Cross WR, Dearnaley DP, Brawley CD. Abiraterone in “high-” and “low-risk” metastatic hormone-sensitive prostate cancer. *European urology*. 2019 Dec 1;76(6):719-28.
- [6] Chou R, Gore JL, Buckley D, Fu R, Gustafson K, Griffin JC, Grusing S, Selph S. Urinary biomarkers for diagnosis of bladder cancer: a systematic review and meta-analysis. *Annals of internal medicine*. 2015 Dec 15;163(12):922-31.
- [7] SAHA PP, HALDER B, ROY SK, SAZZAD M, HOSSAIN FK, RAHMAN MS, MAZUMDER M, AZIM M. Evaluation of Ultrasonography as a Diagnostic Modality for Urinary Bladder Mass with Histopathological Correlation. *Bangladesh Journal of Radiology and Imaging Vol*. 2015 Jan;23:1.
- [8] Browne RF, Meehan CP, Colville J, Power R, Torreggiani WC. Transitional cell carcinoma of the upper urinary tract: spectrum of imaging findings. *Radiographics*. 2005 Nov; 25(6):1609-27.
- [9] Wang J, Wang H, Tang G, Hou Z, Wang G. Transitional cell carcinoma of upper urinary tract vs. benign lesions: distinctive MSCT features. *Abdominal imaging*. 2009 Jan;34:94-106.
- [10] Shinagare AB, Ramaiya NH, Jagannathan JP, Fennessy FM, Taplin ME, Van den Abbeele AD. Metastatic pattern of bladder cancer: correlation with the characteristics of the primary tumor. *American Journal of Roentgenology*. 2011 Jan;196(1):117-22.
- [11] Wong-You-Cheong JJ, Woodward PJ, Manning MA, Sesterhenn IA. Neoplasms of the urinary bladder: radiologic-pathologic correlation. *Radiographics*. 2006 Mar;26(2): 553-80.
- [12] Muglia VF, Prando A. Renal cell carcinoma: histological classification and correlation with imaging findings. *Radiologias*. 2015 May;48:166-74.
- [13] Takeuchi M, Sasaki S, Ito M, Okada S, Takahashi S, Kawai T, Suzuki K, Oshima H, Hara M, Shibamoto Y. Urinary bladder cancer: diffusion-weighted MR imaging—accuracy for diagnosing T stage and estimating histologic grade. *Radiology*. 2009 Apr;251(1):112-21.
- [14] Martin JW, Vernez SL, Lotan Y, Abdelhalim A, Dutta R, Shokeir A, Abol-Enein H, Mosbah A, Ghoneim M, Youssef RF. Pathological characteristics and prognostic indicators of different histopathological types of urinary bladder cancer following radical cystectomy in a large single-center Egyptian cohort. *World journal of urology*. 2018 Nov;36:1835-43.
- [15] Picchio M, Treiber U, Beer AJ, Metz S, Bössner P, van Randenborgh H, Paul R, Weirich G, Souvatzoglou M, Hartung R, Schwaiger M. Value of 11C-choline PET and contrast-enhanced CT for staging of bladder cancer: correlation with histopathologic findings. *Journal of Nuclear Medicine*. 2006 Jun 1;47(6):938-44.
- [16] Blick CG, Nazir SA, Mallett S, Turney BW, Onwu NN, Roberts IS, Crew JP, Cowan NC. Evaluation of diagnostic strategies for bladder cancer using computed tomography (CT) urography, flexible cystoscopy and voided urine cytology: results for 778 patients from a hospital haematuria clinic. *BJU international*. 2012 Jul;110(1):84-94.
- [17] Kibel AS, Dehdashti F, Katz MD, Klim AP, Grubb RL, Humphrey PA, Siegel C, Cao D, Gao F, Siegel BA. Prospective study of [18F] fluorodeoxyglucose positron emission tomography/computed tomography for staging of muscle-invasive bladder carcinoma. *Journal of Clinical Oncology*. 2009 Sep 10;27(26): 4314-20.
- [18] Prasad SR, Humphrey PA, Catena JR, Narra VR, Srigley JR, Cortez AD, Dalrymple NC, Chintapalli KN. Common and uncommon histologic subtypes of renal cell carcinoma:

- imaging spectrum with pathologic correlation. Radiographics. 2006 Nov;26(6):1795-806.
- [19] Novara G, De Marco V, Aragona M, Boscolo-Berto R, Cavalleri S, Artibani W, Ficarra V. Complications and mortality after radical cystectomy for bladder transitional cell cancer. The Journal of urology. 2009 Sep;182(3):914-21.
- [20] Modlich O, Prisack HB, Pitschke G, Ramp U, Ackermann R, Bojar H, Vögeli TA, Grimm MO. Identifying superficial, muscle-invasive, and metastasizing transitional cell carcinoma of the bladder: use of cDNA array analysis of gene expression profiles. Clinical cancer research. 2004 May 15;10(10):3410-21.

Citation: Dr. Md. Towhid Hossain et al. Correlation of Histopathological and CT Scan Findings of Urinary Bladder Transitional Cell Carcinoma. ARC Journal of Public Health and Community Medicine. 2020; 5(4):34-39. DOI: doi.org/10.20431/2456-0596.0504006.

Copyright: © 2020 Authors. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.