Original Article

Correlation between hydronephrosis, tumor diameter, and pathologic T stage of upper tract transitional cell carcinoma after nephroureterectomy

Treerat Amornporncharoen, Nattapong Wongwattanasatien, Vorapoj Choonhaklai, Viroj Chittchang, Somkiet Pumpaisanchai, Tanet Thaidumrong, Sermsin Sindhubodee, Chawawat Kosrisirikul, Matchima Huabkong

Division of Urology, Department of Surgery, Rajavithi Hospital, Bangkok, Thailand

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Hydronephrosis, tumor diameter, pathologic T stage, upper tract transitional cell carcinoma, nephroureterectomy

Abstract

Objective: To evaluate the correlation between hydronephrosis, tumor diameter, and pT stage of upper tract transitional cell carcinoma.

Material and Method: From October 2004 to December 2018, the medical records of 98 patients in Rajavithi Hospital who were diagnosed with renal pelvic (47 patients) and ureteral (51 patients) transitional cell carcinoma and treated with nephroureterectomy were retrospectively reviewed. Patient demographics, degree of hydronephrosis, tumor diameter from computed tomography, and pathologic report were collected. Data were analyzed to determine correlations.

Results: In renal pelvic tumor, higher degree of hydronephrosis correlated with higher pT stage (p=0.022) but no significant difference was shown in ureteral tumor (p=0.352). For tumor diameter in both renal pelvis and ureter, there were no correlations with pT stage (p=0.128 and p=0.625). For tumor location, higher pT stage was more common in renal pelvic tumors (p=0.001) and high tumor grade correlated with high pT stage (p=0.037).

Conclusion: In this study, there was significant correlation between the preoperative degree of hydronephrosis and pT stage in renal pelvic transitional cell carcinomas; however, none was found in ureteric tumors. The reason may be that smaller ureteric lumen caused early symptoms, which concerned patients.

Corresponding author: Treerat Amornporncharoen
Address: Division of Urology, Department of Surgery, Rajavithi Hospital, Bangkok, Thailand
E-mail: birdzzy@hotmail.com
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Introduction

Upper tract transitional cell carcinoma is a relatively rare disease, comprising 5% to 10% of all urothelial tumors[1]. The disease occurs in up to 2 per 10,000 per year in Western countries[2]. Most of these occur in the renal pelvis, followed by the ureter[3].

T stage, tumor grade, and lymphovascular invasion are thought to be prognostic factors for upper tract transitional cell carcinoma. Of these factors, the most important is pathologic T stage[4].

With computed tomography (CT), the sensitivity for detecting upper tract malignancy disease has been reported to approach 100%, with a specificity of 60% and a negative predictive value of 100%[5]. However, the accuracy of predicting T stage is not great. In one series, CT was accurate in predicting pathologic TNM stage in 60% of patients, with understaging at 16% and overstaging 24%. Making it difficult to predict the prognosis of patients with upper tract tumors[6].

Generally, upper tract transitional cell tumors originate intraluminally and cause obstructions. Various degrees of hydronephrosis and differences in tumor size were found in preoperative CT. This study aimed to correlate these findings with pathologic T stage. We also evaluated other data, which included correlating tumor grade with T stage and comparing T stage renal pelvic and ureteral tumors.

Material and method

From October 2004 to December 2018, the medical records of patients in Rajavithi Hospital who were diagnosed with renal pelvic and ureteral transitional cell carcinoma and treated with nephroureterectomy were retrospectively reviewed. This research was approved by the Rajavithi Hospital Ethics Committee.

Exclusion criteria:

1) Final pathology was not transitional cell carcinoma.
2) Patients received neoadjuvant chemotherapy before procedure.
3) Concomitant bladder tumor at ureteral orifice.

Demographic data of patients were recorded. Hydronephrotic status was assessed by the official preoperative CT, reported by the radiologist, and was classified into no hydronephrosis, mild, moderate and severe degree. Tumor diameter was measured on the transverse section of CT. According to a study by Kang Su Cho et al.[4], the measured diameter was classified into 3 groups: less than 1.5 cm, 1.5 cm or greater but less than 2.5 cm, and 2.5 cm or greater. In patients with multifocal tumors, the tumor diameter was determined from the largest lesion.

We also investigated the correlation of tumor grade and tumor location with T stage. Grade of tumor was classified into grade 1, 2, and 3. If the pathologic report was low grade, it would be arranged into grade 1, and if a high grade was reported, it would be grade 3.

Data were analyzed using SPSS version 17.0 (SPSS Inc., Chicago, Illinois, USA). Baseline characteristics were analyzed using descriptive statistics such as number, percentage, mean and standard deviation, minimum and maximum. Chi-square or Fisher Exact test were used to compare the categorical variables and frequency differences. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 130 patients underwent nephro-ureterectomy. After reviewing the pathologic reports, 32 patients were excluded. One case was sarcoma, 11 were renal cell carcinomas, 3 were papillomas, 10 were infections, 3 had concomitant bladder tumors at ureteral orifice, and 4 received neoadjuvant chemotherapy before procedure.

On the imaging studies, patients with no hydronephrosis, mild, moderate, and severe degrees were 12 (12%), 17 (17.3%), 36 (36.7%), and 33 (33.3%), respectively. Tumor diameter was less than 1.5 cm in 34 patients (34.7%), 1.5 cm or greater but less than 2.5 cm in 29 (29.6%), and 2.5 cm or greater in 35 (35.7%). Location of the tumor in the renal pelvis

was 47 (48%), and in the ureter 51 (52%). pT stage was T1, T2, T3, and T4 in 28 (28.6%), 32 (32.7%), 33 (33.7%), and 5 (5%) patients. And tumor grade 1, 2 and 3 were found in 14 (14.3%), 14 (14.3%), and 70 (71.4%) patients.

In renal pelvic tumor, high degree of hydronephrosis correlated with high pT stage (p=0.022). Non-organ-confined tumors (T3-T4) were found in 77.8% and 81.8% of total cases in the moderate and severe hydronephrosis groups, respectively. But no difference was shown in ureteral tumors (p=0.352). For tumor diameter in both renal pelvic and ureteral tumor: there was no correlation with pT stage (p=0.128 and p=0.625).

For tumor location, high pT stage was found more in renal pelvic tumors significantly (p=0.001). Also, there was no pT4 stage in ureteral tumors. Finally, high tumor grade correlated with high pT stage statistically (p=0.037). pT4 stage tumors were only found in the tumor grade 3 group.

Table 1. Demographic data of patients.

Data	Mean ± SD
Age (year)	67.82 ± 11.27
Body weight (kg)	61.28 ± 13.14
Body height (cm)	159.88 ± 8.20
Characteristic	**Number and Percentage**
Sex	
Male	58 (59.2)
Female	40 (40.8)
Concomitant bladder tumor	
Absent	67 (68.4)
Present	31 (31.6)
History of surgery	
None	86 (87.8)
Radical cystectomy	11 (11.2)
Partial cystectomy	1 (1.0)
Hydronephrosis	
No hydronephrosis	12 (12.0)
Mild hydronephrosis	17 (17.3)
Moderate hydronephrosis	36 (36.7)
Severe hydronephrosis	33 (33.3)
Tumor diameter (cm)	
<1.5	34 (34.7)
1.5-2.5	29 (29.6)
≥ 2.5	35 (35.7)
Tumor location	
Pelvis	47 (48)
Ureter	51 (52)

Table 1. Demographic data of patients. (ต่อ)

Multiplicity	
Single	65 (66.3)
Multiple	33 (33.7)
Operative detail	
Open surgery	66 (67.3)
Laparoscopic surgery	32 (32.7)
Other procedure performed in same setting	
None	66 (67.3)
Transurethral resection of bladder tumor	19 (19.4)
Radical cystectomy	10 (10.2)
Partial cystectomy	3 (3.1)
pT stage	
T1	28 (28.6)
T2	32 (32.7)
T3	33 (33.7)
T4	5 (5.0)
Margin	
Free margin	90 (91.8)
Positive margin	8 (8.2)
Tumor grade	
Grade 1	14 (14.3)
Grade 2	14 (14.3)
Grade 3	70 (71.4)
Lymphovascular invasion	
Absent	70 (71.4)
Present	28 (28.6)

Table 2. Correlation between hydronephrosis and pT stage (pelvic tumor).

pT stage	Hydronephrosis (%)				
	No	Mild	Moderate	Severe	Total
1	7 (58.3)	5 (33.3)	2 (22.2)	1 (9.1)	15 (31.9)
2	2 (16.7)	4 (26.7)	0 (0)	1 (9.1)	7 (14.9)
3	1 (8.3)	6 (40.0)	5 (55.6)	8 (72.7)	20 (42.6)
4	2 (16.7)	0 (0)	2 (22.2)	1 (9.1)	5 (10.6)
Total	12 (100)	15 (100)	9 (100)	11 (100)	47 (100)

Chi-Square Tests P = 0.022 (<0.05)

Table 3. Correlation between hydronephrosis and pT stage (ureteral tumor).

pT stage	Hydronephrosis (%)			
	Mild	Moderate	Severe	Total
1	2 (100)	6 (22.2)	5 (22.7)	13 (25.5)
2	0 (0)	14 (51.9)	11 (50.0)	25 (49.0)
3	0 (0)	7 (25.9)	6 (27.3)	13 (25.5)
Total	2 (100)	27 (100)	22 (100)	51 (100)

Chi-Square Tests P = 0.352

Table 4. Correlation between tumor diameter and pT stage (pelvic tumor).

pT stage	Tumor diameter (%)			
	< 1.5 cm	1.5-2.5 cm	≥ 2.5 cm	Total
1	4 (80.0)	5 (41.7)	6 (20.0)	15 (31.9)
2	0 (0)	3 (25.0)	4 (13.3)	7 (14.9)
3	1 (20.0)	4 (33.3)	15 (50.0)	20 (42.6)
4	0 (0)	0 (0)	5 (16.7)	5 (10.6)
Total	5 (100)	12 (100)	30 (100)	47 (100)

Chi-Square Tests P = 0.128

Table 5. Correlation between tumor diameter and pT stage (ureteral tumor).

pT stage	Tumor diameter (%)			
	< 1.5 cm	1.5-2.5 cm	≥ 2.5 cm	Total
1	7 (24.1)	6 (35.3)	0 (0)	13 (25.5)
2	14 (48.3)	7 (41.2)	4 (80.0)	25 (49.0)
3	8 (27.6)	4 (23.5)	1 (20.0)	13 (25.5)
Total	29 (100)	17 (100)	5 (100)	51 (100)

Chi-Square Tests P = 0.625

Table 6. Correlation between tumor location and pT stage.

pT stage	Tumor location (%)		
	Pelvis	Ureter	Total
1	15 (31.9)	13 (25.5)	28 (28.6)
2	7 (14.9)	25 (49.0)	32 (32.7)
3	20 (42.6)	13 (25.5)	33 (33.7)
4	5 (10.6)	0 (0)	5 (5.1)
Total	47 (100)	51 (100)	98 (100)

Chi-Square Tests P < 0.001

Table 7. Correlation between tumor grade and pT stage.

pT stage	Tumor grade (%)			
	1	2	3	Total
1	9 (64.3)	5 (35.7)	14 (20.0)	23 (28.6)
2	4 (28.6)	5 (35.7)	23 (32.9)	32 (32.7)
3	1 (7.1)	4 (28.6)	28 (40.0)	33 (33.7)
4	0 (0)	0 (0)	5 (7.1)	5 (5.1)
Total	14 (100)	14 (100)	70 (100)	98 (100)

Chi-Square Tests P = 0.037 (<0.05)

Discussion

Radical nephroureterectomy with excision of a bladder cuff is the gold standard for large, high-grade, suspected invasive tumors of the renal pelvis and proximal ureter. Radical surgery also retains a role in the treatment of low-grade, noninvasive tumors of the renal pelvis and upper ureter when they are large, multifocal, or rapidly recurring despite maximal efforts at conservative surgery[7].

The most commonly used staging system is the TNM system. Among these, stage is currently the most important predictor of survival in patients with upper tract transitional cell carcinoma[8]. A study by Ricardo L. et al. reported that pathologic stage was the only predictor for disease recurrence, and associated with worse cancer specific survival[9]. And research by Hall MC et al. also reported that actuarial 5-year disease-specific survival rates by primary tumor stage were 100% for Ta/cis, 91.7% for T1, 72.6% for T2, and 40.5% for T3. Patients with primary stage T4 tumors had a median survival of 6 months[10].

Computed tomography (CT) has a high sensitivity in detecting upper tract malignancy disease but its accuracy in predicting T stage is not great. In a study by Scolieri MJ et al., CT was accurate in predicting pathologic TNM stage in 60% of patients, with understaging in 16% and overstaging in 24%[6]. And in a review by Gerald AF et al., TCC confined to the organ (stage 0a-II) was correctly staged by CT in 96.6% of patients.

Stage III-IV tumors were correctly staged in 66.6%. Overall, CT was accurate in predicting pathologic TNM stage in upper urinary tract TCC in 87.8% of patients[11].

Generally, ureteral tumors cause gradual ureteral obstructions that result in the development of hydronephrosis. The continuous obstruction causes renal function impairment. Consequently, the degree of obstruction and T stage might correlate[12]. A study by Kang Su Cho et al. found that in ureteral tumors, grade of hydronephrosis and tumor diameter correlated with the T stage. Invasive tumors were found 86% within grade 3 to 4 hydronephrosis and with a tumor diameter of 1.5 cm or greater. In addition, the grade of hydronephrosis and the tumor diameter had a significant influence on disease-specific survival[4]. Another study from Yujiro et al. also found that high-grade hydronephrosis predicted high pathological stage (T3 or greater), high-grade tumor, and positive lymphovascular invasion[13].

For tumor grade and T stage, Gordon A. et al. retrospectively determined that tumor grade from endoscopic biopsy correlated with T stage from nephroureterectomy and concluded that this information could be used to counsel patients before surgery, as well as to identify patients for whom neoadjuvant chemotherapy would be most beneficial[14].

In our study, we found a correlation between hydronephrosis and T stage only in renal pelvic tumors. All cases of ureteral tumor had hydronephrosis. Smaller luminal size of the ureter may cause more obstructive symptoms.

We found no correlation between tumor diameter and pT stage in both renal pelvic and ureteral tumors. But renal pelvic tumors usually present in larger sizes and at a higher pT stage than ureteral tumors. The reason might be the same as mentioned: the tumors in the renal pelvis must be large and progressive enough to cause obvious obstructive symptoms.

Finally, most of the upper tract transitional cell carcinomas were high-grade lesions, and correlated with a high pT stage. This information supports the treatment of high-grade tumors with radical surgery more than nephron sparing procedures.

Conclusion

In this study, there was significant correlation between preoperative hydronephrosis and pT stage in renal pelvic transitional cell carcinomas; however, none was found in ureteral tumors. There was no correlation between tumor diameters in both locations with pT stage. In the studied groups, renal pelvic tumors had an overall higher pT stage than ureteral tumors. Early symptoms in ureteral lesions might be the cause.

Conflict of interest

The authors declare no conflict of interest.

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