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Original article

Does the presence of hydronephrosis on preoperative axial CT imaging predict worse outcomes for patients undergoing nephroureterectomy for upper-tract urothelial carcinoma?

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Abstract

Objectives: Hydronephrosis at the time of diagnosis of bladder cancer is associated with advanced disease and is a predictor of poorer outcomes. There is, however, limited information addressing whether a similar relationship exists for upper-tract urothelial carcinoma (UTUC). We investigate the prognostic impact of hydronephrosis on preoperative axial imaging on clinical outcomes after radical nephroureterectomy.

Materials and Methods: The records for 106 patients with UTUC who underwent radical nephroureterectomy at 2 medical centers were reviewed. Preoperative computed tomography (CT) images were evaluated for ipsilateral hydronephrosis by radiologists blinded to clinical outcomes. Association of hydronephrosis with pathologic features and oncologic outcomes after surgery was assessed.

Results: Sixty-seven men and 39 women with a median age of 69 years (range, 36 to 90) were evaluated. One-third of these patients had muscle invasive disease or greater (≥T2), 44% had high grade tumors, and 3% had lymph node (LN) metastases. At a median follow-up of 47 months (range, 1 to 164), 43% of patients experienced disease recurrence, 18% developed metastasis, and 12% died of their cancer. Thirty-nine patients (37%) had hydronephrosis on preoperative axial imaging; 35% of these patients had ureteral tumors, and 27% had multifocal disease. The presence of hydronephrosis was associated with advanced pathologic stage ($P = 0.03$) and disease in the ureter (vs. renal pelvis) ($P = 0.007$). Hydronephrosis was a predictor of non-organ confined disease on final pathology (hazard ratio [HR] 3.7, $P = 0.01$). On preoperative multivariable analysis controlling for age, gender, tumor location, ureteroscopic biopsy grade, and urinary cytology, hydronephrosis was independently associated with cancer metastasis (HR 8.2, $P = 0.02$) and cancer-specific death (HR 12.1, $P = 0.03$).

Conclusions: Preoperative hydronephrosis on axial imaging is associated with features of aggressive disease and predicts advanced pathologic stage for UTUC. Hydronephrosis can be a valuable prognostic tool for preoperative planning and counseling regarding disease outcomes.

Keywords: Preoperative imaging; Computed tomography (CT); Transitional cell carcinoma (TCC); Renal pelvis; Ureter; Recurrence

1. Introduction

Urothelial carcinoma (UC) of the upper urinary tract, including the renal pelvis and ureter, is an uncommon malignancy accounting for approximately 5% of all urothelial cancers and 10% of renal tumors [1,2]. Definitive surgical therapy for upper-tract urothelial carcinoma (UTUC) is radical nephroureterectomy with bladder cuff excision via either an open or laparoscopic approach. Contemporary oncologic outcomes with such extirpative therapy show promise for local control [3].

Final pathologic tumor stage, grade, lymph node (LN) status, and extent of surgery have been documented as significant postoperative prognostic factors in patients with

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UTUC [3,4]. While preoperative imaging is effective in identifying lymphadenopathy or distant metastatic disease, its ability to predict primary tumor stage is limited [5,6]. Ideally, if pathologic T stage or degree of local invasion could be more accurately predicted, such information could be utilized for preoperative planning (i.e., lymphadenectomy, neoadjuvant chemotherapy) and patient counseling regarding disease outcomes.

In patients with bladder cancer, the presence of hydronephrosis at the time of diagnosis is associated with advanced disease and is a predictor of poorer outcomes [7]. When considering patients with UTUC, hydronephrosis can be attributed to one of several factors including luminal obstruction, intramural invasion, or extrinsic compression. Both McCarron et al. [8] and Chung and colleagues [9] previously reported that delayed renal excretion is associated with invasive ureteral cancer. More recently, Cho and colleagues [10] have reported that for ureteral carcinoma, the grade of hydronephrosis and tumor diameter measured on preoperative imaging by CT, excretory urography, or renal ultrasonography correlated with the pathologic tumor stage and disease-free survival.

In this study, we further explore this question by reporting the prognostic impact of hydronephrosis detected on preoperative axial CT imaging on clinical outcomes after radical nephroureterectomy for UTUC.

2. Materials and methods

2.1. Study population

Institutional Review Board (IRB) approval was obtained. Medical charts and imaging studies for patients who underwent a radical nephroureterectomy (RNU) for UTUC at 2 academic medical centers between June 1993 and August 2005 were reviewed. Patients with distant metastases, unresectable disease, or concurrent invasive bladder cancer were excluded from analysis. In addition, patients who received neoadjuvant or adjuvant chemotherapy regimens were excluded to minimize the confounding impact of such therapy on survival outcomes. We further excluded patients who were managed conservatively by endoscopic ablation. These patients were specifically excluded because of the absence of final pathologic specimens that were necessary to accurately correlate radiographic and pathologic variables. With such criteria, a study cohort of 106 patients was available for evaluation. Of these patients, 67 (63%) were men and 39 (37%) were women. The median patient age was 69 years (range, 36 to 90), and the median follow-up was 47 months (range, 1 to 164).

2.2. Pathologic data

Diagnosis of UTUC was confirmed by reviewing pathology reports from surgical specimens. Tumors were staged according to the American Joint Committee on Cancer–Union International Contre le Cancer (AJCC-UICC) tumor-node-metastasis (TNM) classification and were graded using the 2004 World Health Organization (WHO) criteria. Tumor location was divided into 2 groups: renal pelvis and ureter based upon the location of the dominant lesion. In addition, pathologic information regarding presence of multifocal tumors and lymph node (LN) involvement was also recorded. Lymphadenectomy was performed in 21/106 (20%) of patients, and only this cohort of 21 patients was specifically considered when evaluating LN status. Preoperative ureteroscopic biopsy grade was available in 72 patients of whom 41 had low grade disease and 31 had high grade tumors. Seventy-six patients had data available on urinary cytology of which 41 were positive, 20 were atypical, and 15 were normal.

2.3. Radiographic data

Only preoperative computed tomography (CT) images performed less than 1 month prior to RNU, which were evaluated for ipsilateral hydronephrosis by radiologists blinded to clinical outcomes, were considered. Three grades of hydronephrosis (mild, moderate, or severe) were assigned.

2.4. Surveillance regimen

Patients were followed every 3 to 4 months for the first year following RNU, every 6 months from the second through the fifth year, and annually thereafter. Follow-up consisted of a history, physical examination, routine blood work and serum chemistry studies, urinary cytology, chest radiography, cystoscopic evaluation of the urinary bladder, and radiographic evaluation of the contralateral upper urinary tract. Elective bone scans, chest computerized tomography (CT), or magnetic resonance imaging were performed when clinically indicated.

2.5. Statistical analysis

The impact of preoperative hydronephrosis on recurrence-free, metastasis-free, and cancer-specific survival was determined. Disease recurrence was defined as tumor reappearance in the surgical bed, bladder, regional lymph nodes, or metastatic sites. Metastatic disease was specifically considered as tumor recurrence in regional lymph nodes or metastatic sites. Cause of death was determined by the treating physicians, by chart review corroborated by death certificates, or by death certificates alone. Perioperative mortality (any death within 30 days of surgery or before discharge) was censored at time of death for urothelial disease-specific survival analyses.

The Fisher's exact test and the χ^2 test were used to evaluate the association between preoperative hydronephrosis and clinico-pathologic parameters. Differences in vari-