Stomach Cancer with Ureteral Metastasis: CT Findings and Mode of Metastasis

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INTRODUCTION

Since the first case report of ureteral invasion of stomach cancer by Schlaginweit in 1911, less than 30 cases have been documented in the literature. Most of the ureteral invasion have not been diagnosed in living patients until the new imaging modalities, especially computed tomography (CT) became available. CT is being used popularly in the staging workup of stomach cancer.

We experienced 19 cases of ureteral metastasis during the period from June 1989 to May 1991. Except for four cases, one each from pancreatic cancer, colon cancer, uterine leiomyosarcoma and unknown origin, the rest of the 15 cases were from stomach cancer leading to our suspicion that ureteral metastasis of stomach cancer is much more frequent than other cancers. Therefore, we analyzed CT findings and mode of metastasis to the ureter by stomach cancer.

MATERIALS AND METHODS

The study group consisted of 15 cases of ureteral metastasis from histologically proven stomach cancer which were examined CT scan for 2 years.

Index Words: Stomach, neoplasms 72.321
Ureter, neoplasms 82.339
Abdomen, CT 70.1211
Lymphatic system, neplasma 0.331

RESULTS

All of our cases had advanced stomach cancer with 12 poorly differentiated adenocarcinoma, two signet ring-cell carcinoma and one moderately differentiated adenocarcinoma. Regarding the involvement site of the stomach, there were six antrum, seven antrum and body, and one each involving the body and entire stomach. There were 11 males and 4 females, between 21 and 82 years of age. There were six cases of right, five left, and four of bilateral ureteral involvement. Table 1 summarizes the associated CT findings of 15 cases of ureteral metastasis of stomach cancer. Perigastric lymphadenopathy was present in all 15 cases and para-aortic lymphadenopathy in 13 patients (Fig.1). Omental and mesenteric infiltrations and/or ascites were found in 11 patients (Fig.2). Para-aortic lymphadenopathy was seen on the right side in one case, on the left in six, on both in six, and
none in two cases. Two cases with non-identification of para-aortic lymphadenopathy had only involvement of the right ureter. One of them had signet ring-cell carcinoma with massive mesenteric infiltrations (Fig. 3).

For the relationship between para-aortic lymphadenopathy and ureteral involvement, the left para-aortic lymphadenopathy showed left ureteral involvement in four and both ureters involvement in two cases. Bilateral para-aortic lymphadenopathy showed involvement in two cases. Two cases with non-identification of para-aortic lymphadenopathy had only involvement of the right ureter. One of them had signet ring-cell carcinoma with massive mesenteric infiltrations (Fig. 3).

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Table 1. Associated CT Findings of Stomach Cancer with Ureter Metastasis (N = 15)

<table>
<thead>
<tr>
<th>Ureter</th>
<th>Right</th>
<th>Left</th>
<th>Both</th>
<th>Total</th>
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<tr>
<td>Perigastric Lymphadenopathy</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>15</td>
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<td>Para-aortic Lymphadenopathy</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Omental &amp; Mesenteric Infiltration</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Ascites</td>
<td>4</td>
<td>3</td>
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<td>11</td>
</tr>
<tr>
<td>Liver metastasis</td>
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Fig. 1. Perigastric and para-aortic lymphadenopathy.
a. Enhanced CT scan shows conglomerated lymphadenopathy with multipe low-density of central necrosis in left gastric group. Right retrocrural lymphadenopathy is also seen.
b. Enhanced CT scan shows multipe bilateral para-aortic lymphadenopathy with right hydronephrosis.

Fig. 2. Omental, mesenteric infiltrations and ascites.
a. CT scan shows matted omental cake and massive ascites. Both ureters reveal thickened enhanced wall with luminal narrowing in right and hydroureret in left.
b. CT scan shows disseminated omental, mesenteric infiltrations and ascites. Left ureter reveals and periureteral infiltrations. Left para-aortic lymphadenopathy is also seen.
ed right ureteral involvement in three, left in one, and both in two patients. However, right para-aortic lymphadenopathy revealed only involvement of the right ureter in one patient (Table 2). Therefore it can be said that the site of para-aortic lymphadenopathy were correlated with the involving site of the ureter. The main findings of ureteral metastasis on CT were both thickened enhanced ureteral wall and periureteral in-

**Fig. 3.** Ureter metastasis without lymphadenopathy.

a. Enhanced CT scan shows diffuse thickened wall in the entire stomach with omental infiltrations and ascites.
b. CT scan at the level of renal hilum shows right hydroureter without para-aortic lymphadenopathy.
c. Right mid-ureter reveals thickened enhanced wall and periureteric infiltration (arrowheads).

**Fig. 4.** Main findings of metastatic ureter on CT

a. Left distal ureter reveals thickened enhanced wall with luminal narrowing (arrowheads).
b. Right proximal ureter shows thickened enhanced wall (larger arrowhead) with periureteral infiltrations (smaller arrowheads).
c. Left mid-ureter reveals mild hydroureter with slight enhanced wall and periureteric lymphadenopathy (arrowheads).
Table 2. Correlation Side of Para-aortic Lymphadenopathy with Ureter

<table>
<thead>
<tr>
<th>Ureter</th>
<th>Para-aortic Lymphadenopathy</th>
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<tbody>
<tr>
<td></td>
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<tr>
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</table>

filtrations in 14 patients and obstructive hydronephrosis and hydrourerter in 15 patients (Fig. 4). The one with no identification of thickened enhanced ureteral wall had periureteral infiltrations and the other with no periureteral infiltrations had thickened enhanced ureteral wall. Each case showed massive mesenteric infiltrations and multiple liver metastasis respectively.

**DISCUSSION**

Metastatic invasion of the ureter is rare and has been diagnosed only at autopsy. Seki et al (1) reported that the incidence of ureteral invasion of stomach cancer at autopsy was 1.7%. Fitch et al (2) reviewed the literature on metastatic ureteral tumors, and found 160 cases and added three of their own. Jerome et al (3) reviewed appropriate cases for 10 years at the UCLA hospital and found 82 cases of ureteral metastasis. The most common primary sites of ureteral metastasis were breast, stomach, bladder, colon, prostate, lung, and lymphoid tissue (4, 5). We found 19 cases of ureteral metastasis. Among them, 15 cases were from stomach cancer. Apparently, advanced stomach cancer metastasized to the ureter more frequently than we expected. In 1948, Presman and Ehrlich (6), in a review of the clinical and pathologic features of secondary ureteral tumors, have listed the criteria for true metastasis. Unfortunately we couldn’t get pathologic proof at metastatic ureteral portion as none of the our patients were surgical candidates due multiple lymphadenopathy and omental and mesenteric infiltration and they were treated by chemotherapy only with or without palliative gastrojejunostomy.

We know that stomach cancer usually spreads to other sites via the lymphatics, but the mechanism of metastasis to the ureter from stomach is unclear. Kost et al (7) suggested that the route of metastasis to the ureter was through the perivascular lymphatic channel as their cases revealed perivascular lymphatic invasion at the metastatic ureter with paraureteral lymph node invasion. There are there mechanisms of cancer spread though the lymphatics. The first is by permeation of perineural lymphatics in which contiguous stands of cancer cells invade and grow along lymphatic vessels in late stages of cancer. The second is discontinuous spread by embolism in which individual cancer cells are carried through the lymphatics to be arrested in lymph nodes during early stages of cancer. The third is retrograde spread via pericapsular channels (8).

In this study, most of the patients showed advanced stomach cancer with multiple perigastric, paraaortic lymphadenopathy and diffuse omental and mesenteric tumor infiltrations, suggesting that the mode of metastasis to the ureter is correlated with lymphatic spread through lymphatic channels representing adenopathy and omental and mesenteric infiltrations and also with retrograde spread via pericapsular channels representing involvement of any level of the ureter.

The usual radiographic feature on intravenous pyelography is either ureteral sticture or intraluminal filling defect with varying degree of proximal hydronephrosis and hydrourerter (2, 5). The most common pattern was involvement of all layers of ureteral wall by constricting metastasis and the next common pattern was periureteral tumor infiltrations with concentric compression of the lumen. The ureter can be involved by mural and/or periureteral infiltrations leading to hydronephrosis and hydrourerter regardless of which form of the ureteral metastasis is present (9). Until now, to our knowledge, CT findings of ureteral metastasis from stomach cancer have not documented. The main findings in urinary systems on ureter metastasis were thickened enhanced ureteral wall with periureteral infiltrations and obstructive hydronephrosis and hydrourerter. These findings are also well related to findings of in-
travenous pyelography. In our experience and knowledge, the most important and specific findings of ureteral metastasis were thickened enhanced ureteral wall with periureteral infiltrations. Differential diagnosis of ureteral metastasis includes benign obstructive lesions, such as benign retroperitoneal fibrosis, nonopaque ureteral stone, endometrial implants, ureteral fibrosis to irradiation and other retroperitoneal disease since the enhanced ureteral wall can also be identified benign obstructive ureteral lesions. In our opinion, periureteral infiltration is differential point between benign and malignant obstructive lesions.

Cohen et al(9)reviewed 31 cases and found that the majority of the patients(85%) were asymptomatic and ureteral metastasis were only discovered at autopsy. Behalf and Leonard(10)demonstrated that less than 50% of the patients with actual ureteral obstruction had signs or symptoms related to the urinary tract. The most common complaints are flank or back pain and frequency. Hematuria is not frequent as the mucosa of the ureter is left intact and the main portion of the lesions usually occupy the muscularis layer as the lymphatics in the ureter progress through submucosal, intramucosal, and adventitialplexuses which communicate with each other(11,12). In our study, two cases revealed decrease of urine output because of simultaneous involvement of both ureters and three cases complained of frequency, voiding difficulty and flank pain. Otherwise, most of our cases represented no specific urinary symptoms. These findings leads us to stress the value of CT examination which has an important role in early detection of ureteral metastasis in patients without urinary symptoms and signs.

We conclude by saying that when evaluating generalized metastatic stomach cancers, ureteral metastasis should also be considered even if there is no urinary symptoms and CT is the only invaluable modality which can meet this goal.

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위암의 뇨관 전이에 대한 고찰 : 전산화 단층 소견 및 전이기전
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최혜영·조경식·이문규·오용호

지금까지 위암의 뇨관전이는 문헌상 드문 것으로 보고되어 있으며 대부분이 부검결과에 의한 것이었다. 그러나 저자들은 1989년 6월부터 1991년 5월까지 전산화 단층촬영으로 예상보다 많은 위암의 뇨관전이 환자 15명을 발견하였다. 위암의 전이소견을 보기 위해서는 전산화 단층촬영이 가장 좋은 검사로 이때 뇨관전이의 유무도 꼭 확인해야 할 것으로 생각되어 전산화단층촬영 소견을 분석하였다. 전산화 단층촬영상 뇨관전이는 나타내주는 주소견은 뇨관벽의 비후와 조영증강 및 뇨관 주위의 침윤에 의한 뇨관협착이었으며 뇨관폐쇄에 의한 수신증과 수뇨관증을 나타내었다. 또한 대부분의 환자에서 위 주변부 및 대동맥 주위의 임파절 증대와 복부내의 대방 및 장간막에 미세암전이 및 복수를 나타내어 위암의 뇨관전이는 임파 절 및 임파관전이에 의한 것으로 사료되어 다른 문헌고찰과 함께 보고하는 바이다.