The Characteristics of Celiac Trunk Lymph-node Metastases of Esophageal Cancer in the Thoracic Segment and Clinical Significance for Wide-Excision

Hongjiang Wang
Zuoliang Pang
Sikandaer
Wei Sun
Warasijiang
Zhiqin Fan
Feng Xue

Department of Thoracic Surgery, the Affiliated Tumor Hospital of Xinjiang Medical University, Urumqi 830011, China.

Correspondence to: Zuoliang Pang
Tel: 86-991-7819096
E-mail:pangzuoliang@126.com

Received October 8, 2006; accepted November 14, 2006.

OBJECTIVE To understand the characteristics of celiac trunk lymph-node metastases of thoracic esophageal carcinoma and their influence on prognosis of the patients, and to investigate a reasonable range for regional celiac trunk lymph-node clearance.

METHODS Clinical specimens of 241 patients receiving resection of a thoracic esophageal carcinoma were analyzed retrospectively.

RESULTS The rate of the patient celiac lymph-node metastases was 32.4%(78/241), and of the lymph nodes examined, 9.8% were found to have metastasis. The extent of metastases adjacent to the common hepatic artery and celiac trunk and within the hepatoduodenal ligaments was 6.6%, 6.9% and 6.3%, respectively. The tumor site, extent of invasion and level of cell differentiation were the factors influencing lymph-node metastases, but they were unrelated to the length of the tumor. The overall rate of regional celiac recurrence for the patients 3 years after operation was 5.4%. The 3-year survivals for the patients with metastases of the celiac lymph nodes was 42.3%, which was lower compared to the non-metastatic patients (70.6%) ($P<0.01$).

CONCLUSION Celiac lymph-node metastases are one of key factors affecting the prognosis of the patients receiving resection of esophageal cancer, and extensive clearance of the celiac-trunk lymph nodes can reduce the rate of postoperative regional metastases.

KEYWORDS: esophageal tumor, celiac trunk, lymphatic metastasis, clearance of lymph nodes, prognosis.

Lymph-node metastases are the major metastatic mode of esophageal carcinoma, and are also a key factor influencing the prognosis of postoperative esophageal-cancer patients. Celiac lymph nodes are a common region for lymphatic metastases of thoracic esophageal carcinoma. In order to study the characteristics and extension of celiac lymph-node metastases from esophageal carcinoma of the thoracic segment, as well as their influence on patient prognosis, and approach a reasonable and effective range of celiac lymphatic clearance, a retrospective analysis of 241 cases was conducted. The analysis included unabridged clinical data for celiac lymph-node metastasis and prognosis for patients who received a three-incision operation for esophageal carcinoma.

MATERIALS AND METHODS

Clinical data

From January 2001 to December 2002, 241 patients with esophageal

carcinoma of the thoracic segment received a radical operation, among which 145 were male and 96 female, with a sex ratio of 1.8:1. The age span of the patients ranged from 36 to 78, with a mean age of 62 ±3.6 years. Based on the 1987 UICC segmentation standards, all the cases were divided into three groups, i.e. 42 were cases of the upper-third part of the chest, 135 of the middle-third of the chest, and 64 the lower-third of the chest. In compliance with the 1997 UICC staging standards, the extent of invasion of the tumors was described as the following: 21 cases of T2, 153 of T3 and 67 of T4. Tumor length (with the longitudinal axis length of the esophagus encroached by the tumor, measured after excision, as the standard) was 2 to 12 cm, averaging 6.2±2.8 cm. The tumor length in 72 cases was less than or equivalent to 5 cm and in 169 cases more than 5 cm; the extent of histodifferentiation was as follows: 72 cases were well differentiated, 115 moderately differentiated and 64 poorly differentiated. All were confirmed as squamous cell carcinoma by a postoperative pathological examination.

Operative procedure

The esophagus of the total thoracic segment was dissociated and then dissected via an anterolateral or posterolateral incision of the right thorax; the stomach was disassociated by an incision at the middle of the superior portion of the abdomen and lymph nodes around the stomach were cleared. The stomach was lifted up to the cervical area through the esophageal bed and a cervical esophagogastrectomy was performed via an incision at the left or right cervix. The scavenging area of the celiac lymph nodes included the diaphragmatic hiatus on the top, the superior margin of the pancreas at the bottom, the hilum of the spleen on the left, the hepatoduodenal ligament and base of the right gastric artery on the right and the front of the abdominal aorta to the rear. The skeletonized clearance was mainly conducted in the following areas, i.e. the lymph nodes beside the cardia, left gastric artery, common hepatic artery, celiac artery and splenic artery, the lesser and greater gastric curvature and the hilum of the spleen, and within the hepatoduodenal ligament. Regional celiac lymphatic clearance not only related to the removal of the lymph nodes, but also to the normal fatty tissues around the lesion.

Clinical follow-up & statistical analysis

The loss of post-operation visits occurred in 21 cases, which comprised 8.7% of the patients. Three cases of lost visits were regarded as death, and the time of death for the patients of a lost visit was calculated based on the date of the last follow-up. Total follow-up time for the other patients reached 3 years. An abdominal CT-scan examination of the patients was conducted every half year to determine if there was a local recurrence or metastasis of the celiac lymph nodes.

The chi-square test was used for statistical treatment and a value of $P<0.05$ for statistical significance.

RESULTS

Characteristics of celiac lymph-node metastasis from thoracic esophageal carcinoma

Among the 241 esophageal-cancer patients, regional celiac lymph-node metastasis occurred in 78 cases, with a metastatic rate of 32.4%. A total of 3181 celiac lymph nodes was examined, with an average of 13.2 lymph nodes cleared for each case. Among all the lymph nodes examined, 312 positive lymph nodes were detected, with a metastatic rate of 9.8%.

In the cases with celiac lymphatic metastasis, the probability of lymph-node metastasis close to the left gastric artery ranked the highest (21.9%), the next were lymph nodes adjacent to the cardia (10.1%) and by the lesser gastric curvature (8.4%), while the metastatic extent of lymph nodes near the common hepatic artery (6.6%) and celiac artery (6.9%), and within the duodenohepatic ligament (6.3%) was also high (Table 1).

Some lymphatic metastasis did not occur beside the esophagus in the area of the tumor, but were found in the adjacent segment of and/or distant region away from the esophagus. These are termed as "Skipped Metastasis". The total rate for the Skipped Metastasis of celiac lymph nodes was 4.1% (10/241), among which the rate of celiac Skip Metastasis from the upper-third, the middle-third and the lower-third part of the chest was 2.4% (1/42), 3.7% (5/135) and 6.3% (4/64), respectively.

The relationship between lymph-node metastasis and clinicopathologic factors

With regard to the location of the cancer, the rate of celiac lymphatic metastasis, when the esophageal cancer was at the lower-third thoracic segment (61.4%), was significantly higher compared to the middle-third (30.4%) or the upper-third of the chest (4.8%), suggesting that there was a significant correlation between the diseased region and celiac lymphatic metastasis ($\chi^2=9.23$, $P<0.01$, Table 2).

Among these patients, the rate of celiac lymphatic

Table 1. The relationship between site of celiac lymph nodes and degree of metastasis

Site of celiac lymph nodes	Degree of celiac lymphatic metastasis		
	Number of detected lymph nodes	Number of metastasized lymph nodes	Number of metastasized lymph nodes/detected nodes
Right cardia	316	33	33/316 (10.4)
Left cardia	291	28	28/291 (9.6)
Lesser curvature of stomach	523	44	44/523 (8.4)
Greater curvature of stomach	386	21	21/386 (5.4)
Left gastric artery	576	126	126/576 (21.9)
Common hepatic artery	256	17	17/256 (6.6)
Celiac artery	217	15	15/217 (6.9)
Splenic hilus	176	4	4/176 (2.3)
Lienal artery	186	8	8/186 (4.3)
Hepatoduodenal ligament	254	16	16/254 (6.3)

Table 2. The relationship between celiac lymphatic metastasis of esophageal cancer and clinicopatrhologic features

Clinico-pathologic features	Number of cases	Number of cases with metastasis	Number of cases without metastasis	Rate of metastasis (%)
Tumor site				
Upper third	42	2	40	4.8
Middle third	135	41	94	30.4
Lower third	64	35	29	61.4
Extent of invasion				
T2	21	3	18	14.3
T3	153	41	112	26.8
T4	67	34	33	50.7
Degree of histo-differentiation				
Well-differentiated	72	11	61	15.3
Moderately-differentiated	115	32	83	27.8
Poorly-differentiated	54	35	19	64.8
Length of tumor				
≤ 5 cm	72	19	53	26.4
> 5 cm	169	59	110	34.9

metastasis, with an extent of invasion of T4, was 50.7%, considerably higher compared to the rate of seen with T2 (14.3%) and with T3 (26.8%) cases, showing that the deeper the tumor had infiltrated, the higher was the probability of the celiac lymphatic metastasis. There was a significant correlation between any two levels of invasion (χ^2=7.56, P<0.01, Table 2).

Concerning the degree of cancer differentiation, the rate of celiac lymph-node metastasis of the patients with poorly-differentiated esophageal carcinoma was 64.8%, much higher compared to the patients with well-differentiated (15.3%) and moderately differentiated cancers (27.8%), showing that there was a close correlation between the extent of histodifferentiation and the rate of celiac lymphatic metastasis (χ^2= 8.62, P<0.01, Table 2).

In this study, the lengths of the cancerous lesion were divided into two, i.e. less than 5 cm and more than 5 cm. The results indicated that there was no significant correlation between the length of esophageal cancer and the rate of the celiac lymphatic metastasis (χ^2=2.34, P>0.05, Table 2).

Postoperative survivals

The 1, 2 and 3-year survivals of the total patients after operation were 87.1% (210), 72.6% (175) and 61.4% (148). However, 1, 2 and 3-year survivals for the 78 patients with celiac lymphatic metastasis were 79.5%

(62), 65.4% (51) and 42.3% (33), and for the 163 patients without celiac lymphatic metastasis were 85.9% (140), 80.4% (131) and 70.6% (115), respectively.

The postoperative 1, 2 and 3-year recurrence rate for the 241 patients was 3.3% (8), 4.1% (10) and 5.4% (13), respectively. The abdominal CT examinations showed that there were liver and adrenal metastases, but no lymph-node recurrences were found after clearance of the nodes in the upper abdominal region.

DISCUSSION

The spread of esophageal carcinoma mainly is by means of the lymphatic drainage. Weather or not the removal of lymph nodes during surgical treatment is thorough will directly influence the prognosis. Clinical research on esophageal carcinoma has always focused on celiac lymphatic metastasis because it relates to the mode and extent of the operation and post-operation recurrence and metastasis. At present the route of celiac lymphatic metastasis for esophageal cancer is believed to be as follows: it spreads to the cardia along the lymphatics from the esophageal wall and then metastasizes towards the lateral part of the left gastric and celiac arteries, etc., along the lesser gastric curvature, and then joins into the thoracic duct via celiac lymphatic ducts. The process has been called, Serial Metastasis. In addition, since the dissemination under the mucous membrane of the lymphocapillary vessel is not successional, celiac lymphatic metastasis occurs, i. e. "Skipped Metastasis" without thoracic lymph- node metastasis.[1] Data from our patients showed that the rate of celiac lymphatic metastasis was 32.4%, the proportion of lymph node metastasis was 9.8%, while the incidence rate of "Skipped Metastasis" of the celiac lymph nodes was 4.2%. Therefore, clearance of the celiac lymph nodes should not be ignored and systematic and normal removal of celiac lymph nodes for patients with thoracic-segment esophageal carcinoma is necessary.

In our study, the main factors influencing celiac lymph-node metastasis included the location of the tumors, the depth of invasion and the degree of histodifferentiation of the tumors. The rates of celiac lymphatic metastasis were significantly different ($P<0.01$) for patients with a tumor in the upper-third, middle-third and lower-third part of the chest (4.8%, 30.4% and 61.4%, respectively). This demonstrates that there was a higher probability of the lymphatic metastasis when the cancer approached the abdominal cavity. These findings are in accord with other reports in the literature.[2] In our patients, the rate of celiac lymphatic metastasis with well, moderately and poorly-differentiated esophageal carcinoma was 15.3%, 27.8% and 64.8%, and that of the patients with T2, T3 and T4 stages was 14.3%, 26.8 and 50.7%, respectively. The postoperative pathological T-staging results suggest that there was a significant correlation between the histodifferention level and the rate of celiac lymphatic metastasis ($P<0.01$). Namely, the lower the degree of histodifferentiation and the higher the T staging, the greater the probability of celiac lymph nodes metastasis, resulting in difficulty in attaining complete surgical therapy.[3,4] With the same extent of invasion, the length of the carcinomas was compared to rule out the influence of the infiltrative depths. The results showed that the length of the tumors had no influence on the degree of celiac lymph-node metastasis ($P>0.05$).[5] So the carcinoma length should not be used as the exclusive standard for determining the scope of the lymphatic clearance.

The mode of operation using an epigastic median incision was adopted for all the cases of this group, thus revealing the upper abdominal operating field. The skeletonized clearance of celiac lymph nodes was performed by the cardia, greater and lesser gastric curvature, left gastric artery, common hepatic artery, celiac artery, hilum of the spleen and splenic artery, and within the hepatoduodenal ligament, with the hope that the postoperative local recurrence or lymphatic metastasis can be reduced or avoided as far as possible.

Compared with other modes of surgical operations for esophageal carcinoma of the thoracic segment in China, usually the operating field at the upper abdomen can not be completely revealed due to limitations of factors, such as the first incision of the chest, or the second incision of the neck and chest, etc. Therefore, thorough lymph node clearance can merely be conducted by the cardia, greater and lesser gastric curvature and left gastric artery, while the complete clearance by the common hepatic artery, celiac artery, hilum of the spleen and splenic artery, as well as within the hepatoduodenal ligament, fails owing to insufficient incision exposure. Otherwise, the 3-incision operative procedure may be used as well, but the extent of clearance of the celiac lymph nodes is also restricted, i.e. by the cardia, greater and lesser gastric curvature and left gastric artery, ignoring the possibility of lymphatic metastasis around the celiac trunk.[6-8] Based on the data from this group of patients, besides the common sites of lymphatic metastasis by the left gastric artery (21.9%), cardia (10.1%) and lesser gastric

curvature (8.4%), there was also considerable metastasis of the lymph nodes by the common hepatic artery (6.6%), celiac artery (6.9%) and within the hepatoduodenal ligament (6.3%). So these findings can explain, from an another view, why there was a very high probability for postoperative lymphatic metastasis or local recurrence. For this reason, selection of the appropriate operating incision is very necessary for systematic and normal clearance of the celiac lymph nodes.

Postoperative follow-up of our patients showed that the overall 3-year survival rate was 61.4%. However the 3-year survival rate for patients with celiac lymph-node metastasis was 42.3%, much lower than those without celiac lymph-node metastasis (70.6%), indicating that the status of the celiac lymph nodes is essential for the prognosis of the patients.[9,10] It was also observed in the follow-up, that the third year after operation was a peak time for local recurrence or distant metastasis. In the second year after operation, there was little significant difference in comparison with the metastatic cases. As with this circumstance, on one hand, the thoroughness of the clearance of the celiac lymph nodes should be taken into consideration, but in our research, only the data of celiac lymph-node metastasis was analyzed for these patients as the influence of metastasis in the neck and thoracic lymph nodes on prognosis was neglected.

The follow-up data also showed that the abdominal regional recurrence rate 3 years after operation was 5.4%. Abdominal CT scans demonstrated the presence of hepatic and adrenal metastasis but no lymph node recurrence was found in the clearing region of the upper abdomen. These results suggest that the degree of clearance of the celiac lymph nodes in the correlative draining zone will directly relate to the rate of abdominal recurrence. In our patients, the removal of celiac lymph nodes also involved elimination of the normal adipose tissue, so as to ensure thoroughness of the clearance. Since extensive and skeletonized clearance of the draining region correlated with the celiac lymph nodes, the rate of celiac local recurrence of the patients with thoracic-segmental esophageal cancer can be significantly reduced, and thus increase the rate of postoperative patient survival.

REFERENCES

1 Hosch SB, Stoecklein NH, Pichlmeier U, et al. Esophageal cancer: the mode of lymphatic tumor cell spread and its prognostic significance. J Clin Oncol. 2001;19:1970–1975.

2 Toshiki M, Mamoru U, Shouichi K, et al. Localization of initial lymph node metastasis from carcinoma of the thoracic esophagus. Cancer. 2000;89:1869– 1873.

3 Thomas WR, Gregory ZJ, David JA, et al. Esophageal carcinoma: depth of tumor invasion is predictive of regional lymph node status. Ann Thorac Surg. 1998;65:787–792.

4 Nigro JJ, Hagen JA, DeMeester TR, et al. Prevalence and location of nodal metastases in distal esophageal adenocarcinoma confined to the wall: implication for therapy. J Thorac Cardiovas Surg. 1999;117:16–25.

5 Wang YG, Wang LJ, Zhang DC, et al. The characteristics and clinical significance of lymphatic metastasis of squamous cell carcinoma of esophagus at thoracicsegment. Chin J Oncol. 2000;22:241–243 (Chinese).

6 Fujita H, Sueyoshi S, Tanaka T, et al. Three–field dissection for squamous cell carcinoma in the thoracic esophagus. Ann Thorac Cardiovase Surg. 2002;8:328–335.

7 Altorki NK. Three–field lymphadenectomy for esophageal cancer. Chest Surg Clin N Am. 2002;10:553–560.

8 Altorki N, Skinner D. Should en bloc esophagectomy be the standard of care for esophageal carcinoma? Ann Surg. 2001;234:581–587.

9 Nishimaki T, Suzuki T, Suzuki S, et al. Outcome of extended radical esophagectomy for thoracic esophageal cancer. J Am Coll Surg. 1998;186:306– 312.

10 Chirurgische K, Stadtischen KD. Esophageal carcinoma: surgical treatment concepts, access and resectability. Schweiz Med Wochenschr. 1999;129:1211–1216.