REVIEW

WHEN SHOULD CLEARANCE OF THE HEPATODUODENAL LIGAMENT (STATION 12) DURING RADICAL RESECTION FOR GASTRIC CANCER BE PERFORMED

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Abstract

In Western countries gastric cancer continues to remain a biologically aggressive tumor, with poor long-term oncological outcomes. In Romania, the estimated gastric cancer was the fifth cause of oncological death in men and the eighth cause of oncological death in women in 2012.The objective of the study is to detail when should the hepatoduodenal ligament (station 12) be cleared surgically as a part of D2 dissection during radical gastrectomy.We have performed a review of the English language literature using PubMed/Medline library. As keywords we used a combination of the following terms: 'gastrectomy', 'stomach', 'cancer', and 'lymphadenectomy'. According to the Japanese Gastric Cancer Association, the hepatoduodenal ligament includes the lymph nodes station 12, which are further divided in 12a – along left side of the proper hepatic artery, 12b – right side of the ligament and posterior to the common bile duct, and 12p – posterior to the portal vein. For middle and lower third gastric tumors, station 12a represents the N2 tier, while for upper third gastric tumors, it represents the N3 tier. Lymph nodes 12b and 12p represent N3, irrespective of the tumor location. For middle and lower third gastric tumors the clearance of the lymph nodes surrounding the proper hepatic artery is a part of the D2 dissection. Dissection of the lymph nodes surrounding the proper hepatic artery is a component of the D2 spleen and pancreas preserving lymphadenectomy, for lesions which extend further than submucosa.

Keywords*: gastric cancer; lymphadenectomy; hepatoduodenal ligament; D2 dissection*

Introduction

In Romania, the estimated gastric cancer was the fifth cause of oncological death in men (2711 and 2217 cases) and the eighth cause of oncological death in women in 2012 (1364 and 1149 cases) [1]. Worldwide the gastric cancer rates decreased significantly during the latest years, especially due to dietary changes, such as food refrigeration, an increase in fresh fruits and vegetables intake, and a decrease in salted and preserved food [2]. On the other hand, the incidence of esophagogastric junction cancer increased sixfold during the last three decades in the Western countries, while it remained constant in the Eastern countries [3, 4]. Nevertheless, starting with the 7th edition of the TNM staging, tumors located in the esophagogastric junction are staged similar with the esophageal adenocarcinoma [5].

Excepting the Eastern countries, where screening is used, the majority of patients with malignant tumors of the stomach are diagnosed in advanced stages of their disease, 60% - 90% of the tumors penetrating the serosa and at least 50% having lymph nodes involvement, with poor results regarding the long-term survival, even after potentially curative resections [6].
The biology of the gastric cancer continues to be aggressive, even after an R0 resection, the recurrence occurring in almost half of the patients, usually within the first two years [6]. The 5-year survival rate of patients with stage Ib undifferentiated adenocarcinoma is 84%, with a 5-year cumulative recurrence rate of 12.8% [7].
The current curative-intent gastric resection necessitates R0 resection with concurrent extended D2 lymphadenectomy [8]. A local, regional and national audit regarding the quality of the resection compared with postoperative morbidity and mortality in patients with gastric cancer is mandatory to improve short and long-term results [9].
The objective of this research is to detail when the hepatoduodenal ligament (station 12) should be surgically cleared as a part of D2 dissection during radical gastrectomy.

Materials and methods

We have performed a review of the English language literature using PubMed/Medline library. As a keywords we have used a combination of the following terms: 'gastrectomy', 'stomach', 'cancer', and 'lymphadenectomy'.

Discussions

Surgical anatomy of the hepatoduodenal ligament

The hepatoduodenal ligament is a peritoneal structure, component of the lesser omentum, containing the portal vein, the proper hepatic artery and the common bile duct. The right gastric artery branches off the proper hepatic artery in 53%, the bifurcation area of the common hepatic artery in 20%, the left hepatic artery in 15%, the gastroduodenal artery in 8%, the common hepatic artery in 4% [10]. The left gastric vein drains into the main portal vein in 65% of cases [11]. According to the Japanese Gastric Cancer Association, the hepatoduodenal ligament includes the lymph nodes station 12, which are further divided in 12 a – along left side of the proper hepatic artery, 12b – right side of the ligament and posterior to the common bile duct, and 12p – posterior to the portal vein. The proper hepatic artery lymph nodes are located below the confluence of the right and left hepatic ducts and superior to the pancreatic margin [12].

Extent of the gastric resection

The resection margin should be larger than 3 cm in tumors with an expansive growth pattern and larger than 5 cm in infiltrative tumors [12]. For tumors which invade the esophagus, the 5 cm rule is not mandatory, but the proximal transection margin should be always verified by frozen-section analysis [12].

In cases of locally advanced T4b gastric tumors, which invade surrounding organs, there is still a survival benefit for surgically resected patients. The analysis of 2208 patients from 7 Italian centers, with curative resection for gastric cancer included 206 patients with T4b tumors [13]. This subgroup of patients presented a mortality, morbidity and 5-year survival rate of 3.6%, 33.9% and 27.2%, respectively [13].

Dissection of the station 12

The seventh edition of TNM staging system proposed by American Joint Committee on Cancer (AJCC) and International Union Against Cancer (UICC) and published in 2010 defines the N stage according to the number of involved lymphnodes: pN1 (1 to 2), pN2 (3 to 6), pN3 (7 or more) [14]. The latest version of the Japanese Staging System for gastric carcinoma was published in 1998 [15]. This thorough classification defines 18 lymph node stations, stratified into three tiers (N1 to N3), according to their anatomic relations with the primary tumor. Usually the perigastric lymph nodes (stations 1 – 6) are classified as N1, stations 7 – 12 as N2, and paraaortic (station 16) lymph nodes as N3. Nevertheless, some perigastric nodes are not regarded as involved regional nodes in specific tumor locations, but as distant metastasis [16]. The explanation for this is that their involvement for some specific tumor

locations is very rare, and when they do occur the prognosis is very poor. This is the case of left paracardial lymph nodes (station 2) in antral tumors. The lymph nodes around the proper hepatic artery (12a) and superior mesenteric vein (14v) are common sites of involvement for lower gastric cancers, their dissection being associated with increased survival, and are classified as N2 [16].

According to the Japanese Gastric Cancer treatment guideline published in 2011, the D2 lymphadenectomy is indicated in N+ and/or T2-T4 tumors, and includes dissection of 12a lymph nodes, in total and distal gastrectomy [12].

Study/Location	Outcome	D1 group	D2 group	Statistical significance
Dutch gastric Cancer Trial/ Netherlands [18, 19]	Number of patients	380	331	
	Postoperative mortality	4%	10%	P=0.0004
	Postoperative morbidity	25%	43%	P<0.001
	Five-year overall survival	45%	47%	P=ns
	11-year overall survival	30%	35%	P=ns
	15-year overall survival	21%	29%	P=ns
	15-year gastric cancer specific death	48%	37%	P=0.01
	15-year local recurrence	22%	12%	P=0.015
	15-year regional recurrence	19%	13%	
	15-year liver metastasis	17%	11%	
Medical Research Council Trial/United Kingdom [20, 21]	Number of patients	200	200	
	Postoperative mortality	6.5%	13%	P<0.04
	Postoperative morbidity	28%	46%	P<0.001
	Five-year overall survival	35%	33%	P=ns
Italian Gastric Cancer Study Group/Italy [22-24]	Number of patients	133	134	
	Postoperative mortality	3%	2.2%	P=ns
	Postoperative morbidity	12%	17.9%	P=ns
	Five-year overall survival	66.5%	64.2%	P=ns
Wu et al./Taiwan [25] (D1 versus D3)	Number of patients	110	111	
	Postoperative mortality	0%	0%	P=ns
	Postoperative morbidity	10.1%	17.1%	P=0.012
	Five-year overall survival	53%	59.5%	P=0.041

Table 1 - Randomized Control Trials comparing D1 with D2/D3 lymphadenectomy in patients with gastric cancer.

In Table 1 the main evidence comparing D1 with D2 lymphadenectomy in patients with gastric cancer can be observed.

For middle and lower third gastric tumors, station 12a represents the N2 tier, while for the upper third gastric tumors, it represents the N3 tier. Lymph nodes 12b and 12p represent N3, irrespective of the tumor location. The reported incidence of cancer dissemination into the station 12 lymph nodes was between 2.9% - 22% [26-28, 20]. According to Maruyama et al. the incidence of station 12 involvement was 8%, 2% and 1% in cancers of the lower, middle and upper third of the stomach, respectively [28]. The reported 5-year survival rate in patients with positive station 12 lymph nodes was 9% [28].

Conclusions

Dissection of the lymph nodes surrounding the proper hepatic artery is a component of the D2 spleen and pancreas preserving lymphadenectomy, for lesions which extend further than the submucosa.

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