The THAI Journal of SURGERY 2015;36:104-107.
Official Publication of the Royal College of Surgeons of Thailand

Original Article

Accuracy of Sentinel Lymph Node Mapping in Laparoscopic Surgery for Colorectal Cancer

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Abstract

Background and Objective: **The metastatic status of regional lymph nodes is a major prognostic factor in colorectal cancer and is important for determining adjuvant therapy. The objective of the present study was to determine the accuracy of sentinel lymph node (SLN) mapping in cases of cancer of the colon, compared to the regional lymph node status.**

Methods: **From March 2010 - November 2011, colon cancer patients without distant metastasis were invited to participate in this study. Participants underwent either laparoscopic assisted or a hand assisted laparoscopic colon resection. Isosulfan blue dye was injected at the subserosal and peritumoral sites. After the identification of SLN, a standard colectomy was done. All lymph nodes were stained by hematoxylin and eosin, and multiple sections of each SLN were examined by immunohistochemical (IHC) staining using a cytokeratin antibody.**

Results: **The SLN was identified laparoscopically in all patients. One patient (9 %) was SLN positive. There were three false-negative SLNB results (75 %). The SLN accurately predicted the tumor status of the nodal basin in 72 % of the cases, and the negative predictive value was 70 %.**

Conclusion: **This preliminary report demonstrated the low accuracy of SLN mapping (72 %) and the high false negative rate (75 %) in laparoscopic colon cancer procedures. Large prospective studies should be performed to determine the true accuracy and false-negative rate of the technique.**

Keywords: **Laparoscopic surgery, colon cancer, sentinel lymph node**

Introduction

The metastatic status of regional lymph nodes is a major prognostic factor for cancer of the colon and this information is important for determining the correct adjuvant therapy. The identification of the stage of the colon cancer depends on tumor invasion, regional lymph node metastasis and distant metastasis. The five-year survival for stage I colon cancer is 70-95%, 54-65% for stage II, 39-60% for stage III and 0-16 % for stage IV[1,2,3].

Stage II patients (T3N0M0, T4N0M0) may have been understaged because of a false negative finding of conventional pathological lymph node examination. However, if multilevel sections and immunohistochemistry were carried out on some of these nodes, the accuracy of pathological examination may improve, and staging may be more accurate[4,6,7].

Studies have demonstrated that lymph node

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micrometastases (MM), often understaged, correlated with a poor prognosis. Consequently it was suggested that multilevel sections and immunohistochemistry be included in the lymph node examination in colorectal cancer. But the detailed examination was costly and time consuming, particularly if the techniques were applied to all nodes harvested. Therefore, some authors suggest that these be performed only on the sentinel lymph nodes.

Sentinel lymph node (SLN) mapping, developed to identify and examine regional lymph nodes at the highest risk of metastatic involvement in patients with malignant melanoma and breast cancer, has been shown to improve staging for these diseases. SLN mapping in cases of colon cancer uses the same principles to identify nodes with the highest probability of metastatic involvement, as well as nodes not on conventional lymphatic tracts.

The aim of the present study was to determine the accuracy of SLN in colon cancer, in relation to the regional node status.

Patients and Methods

From March 2010 to November 2011, patients with a pathological diagnosis of colon cancer were enrolled onto the study. The present paper is a preliminary report of that study. Preoperative colonoscopic biopsy, abdominal CT scan, chest x-ray, and serum CEA level were obtained. Exclusion criteria included patients who had distant metastasis, invasion of the tumor to adjacent organs, a history of previous colonic resection and contraindications for laparoscopy. Lesions seen during colonoscopy were recorded and presence of colonic polyps were recorded and removed either through colonoscopy or laparoscopy.

Laparoscopic assisted colectomy or hand-assisted laparoscopic (HAL) colectomy was performed by one surgeon. A complete laparoscopic intraperitoneal examination was performed to confirm the absence of distant metastasis. Once the primary tumor was identified, 2 to 3 mL of isosulfan blue dye was injected at a peritumoral, subserosal site using an endoscopic needle inserted through a laparoscopic port. Four patients who underwent hand-assisted laparoscopy had dye injections performed through the hand port. After 5 to 10 minutes, the first blue stained node was identified and marked with an endoclip. A colectomy was completed with ligation of the mesenteric vessels at their origin followed by a radical lymphadenectomy. For left colon resections, a medial-to-lateral approach was carried out with complete splenic flexure mobilization and intracorporeal transanal double-stapled anastomosis. For right colon resections, the extracorporeal anastomosis was performed, via the median periumbilical mini-laparotomy.

The specimen was sent for routine pathological examination of the primary tumor and regional lymph nodes by H&E staining. The additional marked SLN was removed from the specimen and sent for examination separately. The sentinel nodes were bisected along the longest axis and embedded in paraffin blocks (nodes smaller than 5 mm were not sectioned).

Paired sections 4 μm thick were taken at 50 μm intervals. Each section of a pair was routinely examined. Slices were stained using H&E staining. When no metastasis was observed in these sections, other sections of the pair would undergo immunohistochemical staining to search for small macrometastases and/or micrometastases.

Results

There were 11 patients (eight men and three women) in the present study, with a mean age of 66.6 years (range, 36 to 81 years). Nine primary tumors were in the sigmoid colon, one in the caecum and one in the ascending colon.

The T staging of the primary tumors was at most T3. Four patients underwent a laparoscopic anterior resection, three a laparoscopic sigmoidectomy, three a HALS anterior resection and one patient a HALS sigmoidectomy (Table 1). The average operative time was 266 minutes.

Sentinel lymph node mapping was successful in all patients (100 %). Positive regional lymph nodes were found in four patients. One patient had both a positive SLN and positive regional lymph nodes. Three cases had negative SLN, but positive regional lymph nodes. Thus, three of four patients (75 %) had a false negative SLNB result. In the eight remaining cases both the SLNs and regional nodes were negative for malignancy. The accuracy was 72 % and the negative predictive value was 70 % (Table 2).

Table 1 Characteristics patients undergoing sentinel lymph node mapping during laparoscopic colectomy for colon cancer

Patient characteristics	Number of patients
Number of patients	11
Sex	
Male	8
Female	3
Mean age (years)	66.6
Location of primary tumor	
Caecum	1
Ascending colon	1
Transverse colon	0
Descending colon	0
Sigmoid colon	9
T stage of primary tumor	
T1	0
T2	0
T3	10
T4	1
Operative procedure	
Laparoscopic anterior resection	4
Laparoscopic sigmoidectomy	3
HALS right hemicolectomy	3
HALS sigmoidectomy	1
Mean operative time (minutes)	266

HALS: hand-assisted laparoscopic surgery

Table 2 Results of sentinel node mapping in 11 patients undergoing laparoscopic colectomy for colon cancer

Sentinel node mapping	Patients	Percent
SLN detection rate	11/11	100
Patients with positive SLN	1/11	9
Patients with regional LN positive	4/11	36
False negative rate	3/4	75
SLN only positive	0/11	0
SLN concordance with regional nodes	8/11	72
Negative predictive value	7/10	70

SLN: sentinel lymph node; LN: lymph node

Discussion

The present study showed that laparoscopic sentinel lymph node mapping using isosulfan blue was feasible for colonic cancer, with an identification rate of 100 %. However, a high false negative rate (75 %) and low accuracy (72 %) for SLN mapping in colon cancer were found. This result was different from those of other studies[1,12]. Bianchi et al.[2] obtained 95.4 % accuracy and a 16.7 % false negative rate, and Bilchik et al.[12] reported 93 % accuracy but the false negative rate was not shown. Our result may have been different because of the small sample size of the present study, that is, a statistical artifact.

The reasons for the small size of our study are many. First, the study period was short and we managed to perform laparoscopic sentinel lymph node mapping in 14 patients during this period. Second, isosulfan blue dye was not always available for use. Third, some patients had to be excluded from the study due to advanced disease, or because of complications such as obstruction or perforation.

The potential usefulness of SLN mapping in colon cancer, for example in the better selection of patients for chemotherapy, is such that a large prospective study should be performed to validate this technique.

Conclusion

A small number of patients cannot be used to confirm whether SLN mapping of colon cancer should be routinely performed to provide a more precise staging of disease. A larger study is needed to determine the true accuracy and false-negative rate of this technique.

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