Preservation of left colic artery with lymph node dissection of IMA root during laparoscopic surgery for rectosigmoid cancer. Results of a retrospective analysis


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Abstract

Background. During sigmoid or rectal cancer surgery, dissection of lymph-nodes at the origin of inferior mesenteric artery is mandatory. Nevertheless, ligation of the origin of IMA should compromise blood supply to left colon and affect anastomosis. The aim of this retrospective evaluation is to compare high IMA ligation and low IMA ligation with preservation of LCA and skeletonization of the origin of IMA during laparoscopic colorectal resection.

Methods. All 120 patients included were affected by clinically M-0 sigmoid or rectal cancer. A laparoscopic colorectal resection with low or high ligature of IMA was performed. Low ligation was carried out with lymphadenectomy of the arterial root. Patients were divided in 2 groups according to type of treatment: Group A, high IMA ligation (N=65), Group B, low ligation with lymphadenectomy of IMA root (N=55).

Results. Preoperatively 59 patients had stage I, 42 patients had stage II and 19 patients had stage III tumor. A mean of 20.3 +/- 4.5 lymph nodes were removed in group A patients and 18.9 +/- 9.1 in group B patients, and this difference was not statistically significant. Operative time, intraoperative and postoperative complication rates were not different between the two groups.

Conclusion. Low IMA ligation combined with lymph-node dissection at its origin is safe and effective, not time consuming and not associated to increased risk of complications and nerve damage. This technique can be considered as alternative to standard high IMA ligation in selected patients. Clin Ter 2019; 170(2):e124-128. doi: 10.7417/CT.2019.2121

Key words: laparoscopic colectomy, colorectal cancer, inferior mesenteric artery, low IMA ligation, lymph-nodes dissection, left colic artery

Introduction

Curative surgery for colorectal cancer is obtained by visceral resection (with safe margins), AND lymph node dissection with ligation of principal arteries at their origin. During surgery for sigmoid or rectal cancer, dissection of lymph nodes located at the origin of inferior mesenteric artery (IMA) is considered mandatory (1-4). Nevertheless, ligation of IMA at its origin from the abdominal aorta could compromise the adequate blood supply of the left colon and affect healing of colorectal anastomosis, thus leading to higher risk of anastomotic leak, which represents a major complication. On the other hand, preservation of the left colic artery (LCA) obtained by a lower IMA ligation may affect a correct dissection of lymph nodes thus affecting oncologic results (5). Skeletonization of the origin of IMA associated with lymph node dissection and preservation of LCA may achieve both results: 1) correct lymphadenectomy and radical resection, and 2) an effective blood supply to the left colic stump, lowering the risk of anastomotic leak. Nevertheless, results of lower IMA ligation with lymphadenectomy at the origin of the vessel remain controversial. The aim of this retrospective evaluation is to compare high and low IMA ligation with preservation of LCA and skeletonization of the origin of IMA to achieve complete lymph node dissection in patients submitted to laparoscopic colorectal resection for sigmoid and rectal cancer.

Materials and methods

From January 2013 to December 2016, 120 consecutive patients undergoing laparoscopic curative surgery for M-0 sigmoid or rectal cancer by two different surgeons (having great experience in both laparoscopy and colorectal surgery) at our Institution were retrospectively evaluated. Surgeon 1 always performed the standard high IMA ligation, and surgeon 2 always performed low IMA ligation with lymph node dissection on IMA root. So, patients were divided in 2 groups according to the type of surgical treatment: Group A, high IMA ligation (N=65) and Group B low IMA ligation with lymphadenectomy beginning from the IMA root (N=55). (Table 1). Operative time, intraoperative morbidity, early postoperative complications, number of dissected lymph nodes and tumor stage were retrieved from patient charts.

Preoperative work-up evaluation consisted of endoscopy with biopsy, whole body CT-scan, blood samples. Additionally, in case of extraperitoneal rectal cancer, endorectal US of MRI were performed to achieve extensive tumor and lymph nodes evaluation.
Exclusions criteria were: tumor distance lower than 5 cm from the anal verge, urgent surgery or previous stenting for colonic obstruction, metastatic disease (M+) and laparotomic approach or conversion to laparotomy.

**Surgical Technique**

Briefly, standard laparoscopic anterior rectosigmoid resection was performed as previously reported (6). In group A the high IMA ligation was gained through a medial access after the section of the inferior mesenteric vein. After the identification of the IMA root, it was divided and the colon mobilized. After rectum division, the proximal colon was exteriorized through a mini-Pfannesteil incision, resected and a stapled end to side anastomosis performed. A similar approach was used for patients of group B, however, the low IMA ligation was performed after the identification and preservation of the LCA, the root of IMA was exposed and the arterial adventitia was dissected free with an en bloc removal of all lymph nodes. The surgical techniques were successfully completed in all cases with radical resection. Standard loop ileostomy was performed in selected patients affected by extraperitoneal rectal tumors.

**Statistical Analysis**

Data were analyzed with a computer software program (SPSS Ver. 24; SPSS Chicago, IL, USA for OsX El Capitan ver. 10.12.5, Apple Inc. 1983-2016 Cupertino, CA, USA). All results are expressed as the mean ± standard deviation (SD). Continuous variables were analyzed with the Mann-Kruskal-Wallis H test (one-way ANOVA), followed by the Bonferroni post-hoc test calculated dividing the P value (.05) by the number of paired comparisons made. Categorical variables were analyzed using the chi-square test or Fisher’s exact test. Survival rates and disease-free intervals were assessed by the Kaplan-Meier method and the values were included if the standard error (SE) was <10% (i.e. <.1). Comparisons between curves were performed by log-rank test. Differences with α-level of <.05 were considered statistically significant.

**Results**

Patient characteristics, demographics, comorbidities and preoperative clinical findings are reported on table 1. Patients in both groups were homogeneous for age, preoperative tumor stage, comorbidities, and ASA risk score.

All patients included gave their informed consent for inclusion in the study. The tumor was located in the sigmoid colon in 78 patients (respectively 35 in group A and 43 in group B) and in the rectum in 42 patients (23 in group A and 19 in group B, respectively). 12 patients affected by rectal cancer were preoperatively treated with neoadjuvant chemo-radiotherapy (Table 1). Preoperatively 59 patients had stage I (27 in group A and 32 in group B, respectively), 42 patients had stage II (21 in group A and 21 in group B respectively) and 19 patients had stage III tumor (12 in group A and 7 in group B, respectively).

Mean operative time was shorter in group A (158.2 +/- 54.6 minutes in group A vs 177.4 +/- 62.8 minutes in group

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**Table 1. Patients demographics, comorbidities, preoperative tumor stage**

<table>
<thead>
<tr>
<th></th>
<th>Group A n. 65</th>
<th>Group B n. 55</th>
<th>P value</th>
</tr>
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<tbody>
<tr>
<td>Gender (M/F)</td>
<td>29/36</td>
<td>27/28</td>
<td>NS</td>
</tr>
<tr>
<td>Mean age (+/- SD)</td>
<td>63.4 +/- 12.1</td>
<td>62.1 +/- 14.0</td>
<td>NS</td>
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<tr>
<td>Tumor location:</td>
<td></td>
<td></td>
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<tr>
<td>Sigmoid</td>
<td>35</td>
<td>43</td>
<td>NS</td>
</tr>
<tr>
<td>Rectum</td>
<td>23</td>
<td>19</td>
<td>NS</td>
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<tr>
<td>Preoperative Tumor stage:</td>
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<td></td>
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<tr>
<td>I</td>
<td>27</td>
<td>32</td>
<td>NS</td>
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<tr>
<td>II</td>
<td>21</td>
<td>21</td>
<td>NS</td>
</tr>
<tr>
<td>III</td>
<td>12</td>
<td>7</td>
<td>NS</td>
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<tr>
<td>Preoperatively neoadjuvant radio-chemotherapy</td>
<td>7</td>
<td>5</td>
<td>NS</td>
</tr>
<tr>
<td>Comorbidities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>5</td>
<td>4</td>
<td>NS</td>
</tr>
<tr>
<td>Obesity (BMI ≥25)</td>
<td>17</td>
<td>7</td>
<td>NS</td>
</tr>
<tr>
<td>COPD</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Cardiovascular disease</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Hypertension</td>
<td>7</td>
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<tr>
<td>ASA score</td>
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<tr>
<td>IV</td>
<td>2</td>
<td>1</td>
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B), but this was not statistically significant. A mean of 20.3 +/- 4.5 lymph nodes were removed in group A patients and 18.9 +/- 4.1 in group B patients, and this difference was not statistically significant, too. In 7 patients (9.6%) (4 in group A and 3 in group B, respectively) pathologic findings showed metastatic lymph nodes located at IMA origin.

There were no intraoperative complications in the 2 groups. Early post-operative complications were observed in 24 patients (20%), of which 14 were type I, 9 type II and 1 type IIIa (following Clavien-Dindo classification of post-operative complications (7)) (Table 2). 4 patients (3 in group A and only 1 in group B) presented anastomotic leak; among these, 3 were only radiologic findings in patients having rectal cancer treated preoperatively with chemo-radiotherapy, and submitted to colorectal resection with standard ileostomy (and classified as having type II complication), while the other one had sigmoid tumor and a little leak treated by percutaneous drain and total parenteral nutrition until complete clinical and radiologic healing.

Discussion

Colorectal surgery for cancer still face with several major issues: the extent of visceral and mesocolic (or mesorectal) resection, the extent of lymph node dissection and the risk of anastomotic leak, the last affecting the early postoperative course (3-4, 8-12). During surgery for left-sided and rectal cancer, IMA ligation is one of the key points to achieve complete mesocolic mobilization and optimal lymph node dissection. Despite this, preservation of the left colic artery, not recommended in case of descending colon cancer, can be a crucial issue in resection for sigmoid or rectal cancer, given the fact that this artery could guarantee an adequate blood supply to the proximal colonic stump. So, this matter still remains controversial (8-9, 13). In a review of clinical trials published between 1980 and 2007, Lange et al found that patients treated with high IMA ligation did not show any improvement in long-term survival and disease-free intervals (15). At present, preoperative tumor stage influences the choice of surgical strategy. In patients having stage I or II cancer, conversely from those affected with more advanced stages, radical lymph node dissection has not shown any improvement in survival rates and disease-free intervals (15). Recently Hida et al. showed that high IMA ligation does not significantly affect survival rates (8). In Japan, lymph node dissection up to the IMA root (D3) is considered mandatory, thus limiting D2 dissection to early stages (16). Surtees at el. analysed a spectrum of 250 patients affected by Dukes C cancer showing that there was no improvement in survival in those who underwent a colorectal resection with high ligation of the IMA (17). This observation can be explained by the evidence of the systemic tumor spread in case of central lymph nodes involvement (18).

The present study does not show significant difference in the number of excised lymph nodes in case of standard IMA ligation or LCA preservation and dissection of IMA root. Adachi et al. (19) analyzed the incidence and the distribution of lymph nodes metastasis in rectum and rectosigmoid junction tumors, there was a very low rate of metastasis in lymph nodes at the origin of IMA (0.7%) and was related to the presence of an advanced tumor.

The presence of positive lymph nodes at the level of the IMA root should be considered as distant metastases (M+), since patients having involvement of apical lymph nodes, (18-20) show survival rates comparable to those having distant metastases. These patients have a mortality rate of 2.5 fold higher than patients without IMA root lymph nodes

| Table 2. intraoperative and postoperative outcomes, complications, pathological findings |
|-----------------------------------|-----------------|-----------------|-----------------|
| Mean operative time (min. +/- SD) | 158.2 +/- 54.6  | 177.4 +/- 62.8  | 0.075 |
| N. of excised lymph nodes (+/- SD) | 20.3 +/- 4.5    | 18.9 +/- 4.1    | 0.079 |
| Postoperative complications*      | 11              | 13              | 0.45 |
| I                                | 8               | 6               | 0.83 |
| II                               | 4 (2 leaks)     | 5 (1 leak)      | 0.57 |
| IIIa                             | 1 (1 leak)      | -               | 0.95 |
| Pathological Tumor stage:         |                 |                 |       |
| I                                | 26              | 31              | 0.28 |
| II                               | 20              | 21              | 0.55 |
| III                              | 13              | 9               | 0.66 |
| Patients having metastatic nodes at the origin of IMA | 4 | 3 | 0.87 |

*: According to Clavien-Dindo classification of post-operative complications
involvement (8, 21-22). So, high ligation should be recom-
mended in advanced tumors with a high-risk of involvement
of central lymph nodes aiming to a proper definition of the
stage (8, 21, 23-27).

Preservation of LCA may decrease the risk of inadequate
blood supply to the left colonic stump; in fact, Seike et al.
notice, that after IMA ligation at origin there is a pivotal
reduction in blood flow at the level of the proximal stump.
Noticeably, high IMA ligation technique is more likely to
influence the proximal anastomotic stump vascularization.
(4, 13). Our results show a higher rate of anastomotic leaks
in patients submitted to standard high IMA ligation; these
results, even if not supported by a significant difference
(since the low incidence, 3 vs 1), support the evidence of
a better colonic blood supply in case of LCA preservation,
and need to be confirmed by further evaluation on larger
series. Recently, the use of fluorescence technology with
indocyanine green (ICG) has been introduced in several
fields of general and specialist surgery, in order to assess
tissue perfusion intraoperatively, even during laparoscopic
colorectal surgery, with the aim to minimize the risk of
anastomotic leaks (27). However, a subjective evaluation of
fluorescence intensity based on the surgeon’s visual remains
a major issue of this technique, that is usually used at the end
of demolitive procedures, prior to the anastomosis creation.
Instead, the decision to preserve (or not) the left colic artery
must be taken at the beginning of the surgical procedure,
and this can affect both early as well as late outcomes.
Nevertheless, all patients in the present series have been
submitted to surgery before the use of this new technology
at our department, and further studies are ongoing.

The present study, even with several limitations mainly
due to the retrospective evaluation and the small series of
patients, shows that low ligation technique with skeleton-
ization at IMA root can be proposed as an effective and
safe procedure in selected patients, thus confirming previous
studies (28-30).

Conclusions

The present study has several limitation such as the
number of patients enrolled and the retrospective analysis
of data. Despite this, as we observed, low IMA ligation
combined with lymph node dissection at its origin, is safe
and effective, is not time consuming and is not associated
to increased risk of complications. Furthermore this tech-
nique can lead to an appropriate number of excised nodes
and to a correct tumor staging. Maintaining and adequate
blood supply to the colonic stump may decrease the risk of
anastomotic leaks, and for these reasons this technique can
be considered as a safe and effective alternative in patients
affected by sigmoid and rectal cancer.

Conflict of interest statement

DC, GC, MT, AC, AP, PS, EF, GDT declare no conflict
of interest regarding this manuscript.

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