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Huang's three-step maneuver shortens the learning curve of laparoscopic spleen-preserving splenic hilar lymphadenectomy

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ABSTRACT

Background: The goal of this study was to investigate the difference between the learning curves of different maneuvers in laparoscopic spleen-preserving splenic hilar lymphadenectomy for advanced upper gastric cancer.

Methods: From January 2010 to April 2014, 53 consecutive patients who underwent laparoscopic spleen-preserving splenic hilar lymphadenectomy via the traditional-step maneuver (group A) and 53 consecutive patients via Huang's three-step maneuver (group B) were retrospectively analyzed.

Results: No significant difference in patient characteristics were found between the two groups. The learning curves of groups A and B were divided into phase 1 (1–43 cases and 1–30 cases, respectively) and phase 2 (44–53 cases and 31–53 cases, respectively). Compared with group A, the dissection time, bleeding loss and vascular injury were significantly decreased in group B. No significant differences in short-term outcomes were found between the two maneuvers. The multivariate analysis indicated that the body mass index, short gastric vessels, splenic artery type and maneuver were significantly associated with the dissection time in group B. No significant difference in the survival curve was found between the maneuvers.

Conclusions: The learning curve of Huang's three-step maneuver was shorter than that of the traditional-step maneuver, and the former represents an ideal maneuver for laparoscopic spleen-preserving splenic hilar lymphadenectomy.To shorten the learning curve at the beginning of laparoscopic spleen-preserving splenic hilar lymphadenectomy, beginners should beneficially use Huang's three-step maneuver and select patients with advanced upper gastric cancer with a body mass index of less than 25 kg/m^2 and the concentrated type of splenic artery.

Contents

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1. Introduction

With the development of laparoscopic techniques, the safety and feasibility of laparoscopic spleen-preserving splenic hilar lymphadenectomy (LSPL) have been increasingly accepted [1–4]. On this basis, the identification of an appropriate operative approach is conducive to LSPL. Therefore, scholars have developed a medial or retropancreatic approach [5,6]. Since January 2010, our center has utilized the left-sided approach, in which the retropancreatic splenic artery is entered along the superior border of the pancreatic tail to perform LSPL; this approach is referred to as the traditional-step maneuver. Moreover, we summarized a programmed procedure of LSPL after more than 100 cases of accumulated experience in April 2012. We divided the originally complex operative steps into the following three steps: the first step includes the dissection of lymph nodes (LNs) in the inferior pole region of the spleen; the second step includes the dissection of LNs in the region of the splenic artery trunk; and the third step includes the dissection of LNs in the superior pole region of the spleen. This operation is referred to as Huang's three-step maneuver [7,8]. The characteristics of Huang's three-step maneuver are clear in procedure and division, which can help beginners master the operation more easily than the traditional maneuver. However, there are no reports comparing the learning curves of these two maneuvers. Therefore, this study used the cumulative sum method (CUSUM) to systematically compare the learning curves of the application of Huang's three-step maneuver and the traditional maneuver in LSPL for advanced upper gastric cancer and to select suitable cases to help beginners accelerate the learning curve.

2. Materials and methods

2.1. Study population and evaluation parameters

Two groups of consecutive patients who underwent LSPL via the traditional-step maneuver (group A, n = 53) [9] or via Huang's three-step maneuver (group B, n = 53) (video) [7,8] at Union Hospital of Fujian Medical University between January 2010 and April 2014 were evaluated in this study. The advantages and disadvantages of the procedures were explained to the patients prior to surgery, and an informed consent form was signed by the patient and his or her family.

Supplementary video related to this article can be found at http://dx.doi.org/10.1016/j.suronc.2017.07.010.

The dissection time (DT) represented the time from the dissection of the gastrosplenic ligament to the division of the last short gastric vessel (SGV). Blood loss (BL) was estimated according to the volume of blood absorbed by the gauze and suction pumped following subtraction of the fluid volume used for irrigation. There were two types of splenic artery, the concentrated type and the distributed type [10]. The concentrated type was present when the splenic artery divided into its terminal branches less than 2 cm from the splenic hilum. If the distance was equal to or greater than 2 cm, the case was considered the distributed type. The splenic lobar artery refers to the terminal branch of the splenic artery at the splenic hilum and is divided into four types [10]. The preoperative status of the patients was assessed by the American Society of Anesthesiologists (ASA) classification, and postoperative complications were classified as morbidities within 30 postoperative days. Vascular injuries were characterized by intraoperative vascular bleeding as a result of the operation that required electric coagulation or a titanium clip stanch. The $CUSUM_{DT}$ and $CUSUM_{BL}$ or the moving average $method_{DT}$ (MA_{DT}) and MA_{BL} were defined as the CUSUM or moving average (MA) based on the DT or BL, respectively.

Follow-up was performed by trained investigators through telephone calls, recording patient consultations at the outpatient clinic, mailings or patient visits every 6 months. The follow-up period ended in August 2015. Survival time was defined as the time from the surgical intervention to the last contact or date of death.

2.2. Statistical analysis

All of the statistical analyses were performed using SPSS (Statistical Package for the Social Sciences 18 for Windows; SPSS Inc., Chicago, IL, USA) with the exception of the MA and CUSUM plots, which were generated in Excel 2010 (Microsoft, Redmond, WA, USA). Continuous data are reported as the means ± standard deviations and were compared using t-tests. Qualitative data were compared using Chi-squared or Fisher's exact tests.

Variables with a $P < 0.05$ were selected for multivariate stepwise logistic regression. The survival rate was calculated using the Kaplan-Meier method and was compared using the log-rank test. $P < 0.05$ was considered statistically significant.

In this study, we analyzed the DT and BL to evaluate the learning curves using two statistical methods, including the (MA) method and the CUSUM.

2.2.1. MA

The MA is created by an average of subsets, which were modified by adding new data to the subsets and then shifting forward all of the datasets. In this study, the MA was defined as the average of the DT or BL, as subsequently described, in which x_n is either the DT or BL. In this study, an MA order of 20 was used.

$$MAn = \frac{xn + xn + 1 + xn + 2 + \ldots + xn + 19}{20}$$

2.2.2. CUSUM

CUSUM is a statistical technique that indicates the sequential difference between individual data and the mean value. In this study, the CUSUM technique was applied via the following equation, where xi is an individual DT or BL, and μ is the mean overall operation time.

$$CUSUM = \sum_{i=1}^{n} (xi - \mu)$$