SERBIAN ARCHIVES OF MEDICINE Est.1872

Address: 1 Kraljice Natalije Street, 11000 Belgrade, Serbia
☎ +381 11 4092 776, Fax: +381 11 3348 653
E-mail: srparhiv@bvcom.net, Web address: www.srpskiarhiv.rs

Paper Accepted* **ISSN Online 2406-0895**

Original Article / Оригинални рад

Miloš Bjelović[1,2,†], Milan Veselinović[2], Dragan Gunjić[2], Tamara Babić[2], Luka Nikolić[3]

Short-term outcomes of laparoscopic radical gastrectomy for advanced gastric neoplasms: single center experience

Лапароскопска радикална гастректомија у лечењу узнапредовалог неопластичног обољења желуца: искуство једног центра

[1] University of Belgrade, School of Medicine, Belgrade, Serbia;
[2] Department for Minimally Invasive Upper Digestive Surgery, University Hospital for Digestive Surgery, Clinical Center of Serbia, Belgrade, Serbia;
[3] University of Edinburgh, Edinburgh Medical School: Biomedical Sciences, College of Medicine and Veterinary Medicine, Edinburgh, United Kingdom

Received: March 23, 2017
Accepted: May 24, 2017
Online First: May 30, 2017
DOI: https://doi.org/10.2298/SARH170323116B

† **Correspondence to:**
Miloš BJELOVIĆ,
Koste Todorovića 6, 11000 Belgrade, Serbia
E-mail: milos.bjelovic@gmail.com

Short-term outcomes of laparoscopic radical gastrectomy for advanced gastric neoplasms: single center experience

Лапароскопска радикална гастректомија у лечењу узнапредовалог неопластичног обољења желуца: искуство једног центра

SUMMARY

Introduction/Objective The objective was to assess the effectiveness of laparoscopic gastrectomy, analyzing the short-term outcomes of laparoscopic radical gastrectomy in the treatment of advanced gastric neoplasms.

Methods We performed a prospective cohort observation study, which included 30 patients who underwent elective radical laparoscopic gastrectomy (total or subtotal) for stomach neoplasms, performed in the period between March 2013. and February 2017.

Results The patients involved had individually been diagnosed with 13 (43%) distal gastric tumors, 7 (23%) proximal gastric tumors, 4 (13%) pangastric tumors, 4 (13%) mediogastric tumor and 2 (7%) bicentric tumors. Mean duration of the operation was 286 minutes. The average blood loss was 183 mL. Conversion rate was 10% (3 patients). Total of 7 (23%) patients had postoperative complications and mean intensive care unit stay was 1 day. Mean hospital stay after surgery was 13.08 days. The average number of harvested lymph nodes was 33.9, and R0 resection was performed in 87% patients. The overall 30-day mortality rate was 0%.

Conclusion Although technically challenging, laparoscopic gastrectomy is a safe and oncologically adequate procedure in the radical surgical treatment of advanced gastric neoplasms.

Keywords: gastric neoplasms; surgery; minimally invasive gastrectomy; laparoscopy

САЖЕТАК

Увод/Циљ Циљ студије је процена ефикасности лапароскопске гастректомије, анализирањем краткорочних резултата лапароскопске радикалне гастректомије у лечењу узнапредовалог неопластичног процеса желуца.

Методе Спроведена је ретроспективна кохортна опсервациона студија са 30 болесника подвргнутих елективној радикалној лапароскопској гастректомији (тоталној или субтоталној) због неопластичног процеса желуца у периоду од марта 2013. до фебруара 2017.

Резултати Тумор је био локализован: у дисталном желуцу (13 болесника, 43%), на проксималном желуцу (7, 23%), 4 болесника са пангастричним тумором (13%), 4 тумор медиогастричног сегмента (13%), а код два бицентрични тумор желуца (7%). Просечно време трајања операције је било 286 минута, просечан губитак крви 183 ml, а стопа конверзије је била 10% . Укупно 7 болесника (23%) је имало постоперативне компликације. Непосредно постоперативно су боравили један дан у јединици интензивног лечења, а са болничког лечења су отпуштани 13-ог постопера-тивног дана. Просечно је уклоњено 33.9 лимфних чворова, док је P0 ресекција постигнута код 87%. Смртних исхода није било.

Закључак Иако технички захтевна, лапароскопска гастректомија је сигурна и онколошки исправна процедура у лечењу узнапредовалог неопластичног процеса желуца.

Кључне речи: неоплазме желуца; минимално инвазивна гастректомија; лапароскопија

INTRODUCTION

When laparoscopy surgery began in mid-XX century, no one really believed that large and demanding procedures such as esophagectomy and gastrectomy would be performed laparoscopically. The official history of laparoscopic gastric resection began in Singapore in 1992, when Peter Goh et al., performed the first totally intra-abdominal laparoscopic distal gastrectomy with Billroth II reconstruction, in an elderly patient with a chronic gastric ulcer [1].

In 1993, in Belgium, Juan Santiago Azagra et al., performed the first minimally invasive total gastrectomy for gastric cancer [2]. In 2007, Seigo Kitano et al., published a multicenter study conducted in Japan for early stage gastric cancer and confirmed that the laparoscopic treatment is not inferior to open surgery for stages I and II gastric cancer [3]. However, meta-analysis published by

Yashuro Kodera et al. in 2010 opened a whole new perspective for laparoscopic gastrectomy, and its use not only for early, but also for advanced gastric cancer [4].

At the Department for Minimally Invasive Surgery, Clinic for Digestive Surgery, Clinical center of Serbia, radical laparoscopic gastrectomy for gastric neoplasms has been performed since March 2013.

The study objective was to assess the effectiveness of laparoscopic gastrectomy, analyzing the short-term outcomes of laparoscopic radical gastrectomy in the treatment of advanced gastric neoplasms.

METHODS

This prospective cohort observational study included 30 patients who underwent elective radical laparoscopic gastrectomy (total or subtotal), for stomach neoplasms, performed at the Department for Minimally Invasive Surgery, Clinic for Digestive Surgery, Clinical centre of Serbia, in the period between March 2013. and February 2017.

Standard preoperative diagnostics included anamnesis and physical examination, barium swallow radiography, upper flexible endoscopy with biopsy and CT scanning of chest and abdomen.

All of the patients received antibiotic and thromboembolic prophylaxis. Standard surgical technique is described further in the text. A nasogastric tube is routinely placed after subtotal gastrectomy and removed on the first or second postoperative day, depending on the quantity and dynamics of the discharge. All of the patients received early mobilization. Control barium radiography was performed routinely on the seventh postoperative day after total gastrectomy, followed by the clear liquid diet. A control barium meal was not routinely performed in the patients after subtotal gastrectomy, and these patients began with the clear liquid diet on the postoperative day three.

After the procedure, the operating surgeon dissected all of the extracted lymph nodes, separating them from the specimen. Histopathological examination and staging were based on the revised TNM tumor classification including tumor stage grouping.

Demographic data, preoperative diagnostics, intraoperative details (such as the length of the procedure, blood loss, etc.), and details regarding postoperative course were all analyzed as well as the pathohistological data. Postoperative complications were analyzed separately and graded according to Dindo-Clavien classification [5].

After discharge from the hospital, the first check-up was one month post-surgery and then periodically, according to the criteria of the European Society for Medical Oncology [6].

The study objective was to assess the effectiveness of laparoscopic gastrectomy in the treatment of advanced gastric neoplasms (carcinoma, primary gastric lymphoma and mesenchymal tumors). Primary endpoints were significant early postoperative complications (defined as grade II and over according to the Dindo-Clavien classification). Secondary endpoints were analysis of the short-term

outcomes other than postoperative complications i.e. perioperative characteristics (duration of the operation, blood loss, ICU and overall hospital stay) and 30-day mortality and oncological outcomes (based on the number of harvested lymph nodes and R status).

Surgical technique

The position of the patient and trocars were adopted from Luketich et al [7]. Standard surgical technique in patients with gastric cancer includes omentectomy, D2 lymph node dissection and total or subtotal gastrectomy, according to criteria of the Japanese Gastric Cancer Association – JGCA [8]. In patients with primary gastric lymphoma, total omentectomy is not mandatory in radical surgical – treatment, while in patients with mesenchymal neoplasm of the stomach, there is no need for lymph node dissection. Reconstruction after total gastrectomy was performed using retrocolicaly placed Roux-en-Y limb, followed by mechanical esophago-jejunal anastomosis. The continuity of the digestive tube, in the patients with subtotal gastrectomy, was provided by forming retrocolic, inframesocolic hand-sewn gastro-jejunal anastomoses. After restoring the continuity of the gastrointestinal tract, it is mandatory to close all of the defects created in the mesentery, to prevent internal herniation, both in the early and late postoperative periods. At the end of the procedure, the surgical specimen is placed in an extractionbag, and removed from the abdomen through a 5cm long Pfannenstiel incision.

Statistical analysis

The descriptive statistics, including the numbers and percentages of categorical data or mean, median and range of numerical data were used to summarize sample data. Statistical analyses were performed using SPSS for Windows, version 22.

Table 1. Demographic characteristics and preoperative data.

Feature		Value
Gender	Male	17 (57%)
	Female	13 (43%)
Mean age (years)		61.37 (22–85)
Karnofsky score (%)		87.27 (80–90)
ASA score*		1.83 (1–3)
BMI†		25.51 (19.3–34.47)
Localization of the tumor		
Proximal stomach		7 (23%)
Medial stomach		4 (13%)
Distal stomach		13 (43%)
Pangastric		4 (13%)
Bicentric		2 (7%)
Pathohistology		
Adenocarcinoma		18 (60%)
Lymphoma		11 (37%)
Mesenchymal tumor		1 (3%)

*ASA score - American Society of Anaesthesiologists physical status classification system;
†BMI – Body mass index

RESULTS

Both genders are almost equally distributed (43% female, 57% male) in the patient population, with a mean age of 61.37 years. Average Karnofsky and ASA scores were 87.27 and 1.83 respectively, while the mean BMI of the patients was 25.51 kg/m^2 (Table 1). In the majority of cases, the tumor was localized to the distal parts of stomach (13 patients, 43%), followed by the proximal stomach (7 patients, 23%), while 4 patients had a pangastric tumor (13%), and a further four of them (13%) had a tumor of the mediogastric segment, and only two patients (7%) had a bicentric tumor of the

stomach. Histologically, adenocarcinoma was slightly more prevalent (60%) to primary gastric lymphomas (37%), and one patient was presented with a large mesenchymal tumor of the distal stomach (3%). Seventeen patients (57%) were submitted to total gastrectomy (TG), while the rest, 13 patients (43%), underwent subtotal gastrectomy (STG). The average operative time was 297 min for TG and 272 min for STG (Table 2). The overall conversion rate was 10% (3 patients); in 2 patients submitted to TG (12%) and one patient submitted to STG (8%). In 2 out of 3 patients (67%), the reason for conversion was a locally advanced tumor, while the reason for the third conversion was a technical problem with esophago-jejunostomy. Time spent in the intensive care unit postoperatively was practically the same for both groups - one day. The average blood loss after TG was 215 mL, as opposed to 141 mL in the STG group. Mean hospital stay was 13 days after TG and 12 days after STG. The average number of harvested lymph nodes was 33.9 (34.7 in patients after TG and 32.4 after STG). The majority of our patients had an advanced stage stomach neoplasm. Average tumor size was 73.68 mm in diameter (range 30 to 160 mm). We had no patients with Tis and T1 tumor, 26% of our patients had T2 tumor, while 74% had more advanced tumor. According to the involved lymph nodes, 73% of our patients had N+ stadium of the disease, with more than half of them (56%) with a N2 status or higher. Nevertheless, a clear resection margin (R0) was achieved in 87% of the patients. The overall 30-day mortality rate was 0%.

Table 2. Intraoperative and postoperative course details.

Feature	Subtotal gastrectomy	Total gastrectomy	∑
Number of patients	13 (43%)	17 (57%)	30
Duration of operation (min)	272 (180–330)	297 (190–420)	286 (180–420)
Conversion	1 (8%)	2 (12%)	3 (10%)
ICU* stay (days)	0.77 (0-1)	1.12 (1–3)	0.97 (0–3)
Transfusion (mL)	141 (0–735)	215 (0–1325)	183 (0–1325)
Hospital stay (days)	12.08 (7–27)	13.47 (9–20)	13.08 (7–27)
30-day mortality	0	0	0
Harvested lymph nodes	32.4 (21–45)	34.7 (19–73)	33.9 (19–73)
Tumor size (cm)	60 (30–115)	82.53 (35–160)	73.68 (30–160)

* ICU – Intensive care unit.

In total, 7 patients had a postoperative complication (23%), four in the TG group of patients and three in the STG group. Three of these patients (10%) had diarrheal syndrome. Surgical site infection was also found in three patients (10%), while only one patient (3%) developed biliary peritonitis on the 11th postoperative day, due to post-vagotomic acalculous cholecystitis. The overall reintervention rate was 3%. All of the postoperative complications were graded according to Dindo-Clavien classification (Table 3).

Table 3. Postoperative complications.

Feature		Number
Total number of postoperative complications		7
Diarrhoea syndrome		3 (10%)
Wound/trocar site infection		3 (10%)
Acalculous cholecystitis		1 (3%)
Number of patients with complications		7 (23%)
Dindo-Clavien classification	I	1 (3%)
	II	4 (13%)
	III	1 (3%)
	IV	1 (3%)
	V	0

DISCUSSION

Gastric neoplasms have the 4th highest incidence globally, and 2nd highest in relation to mortality [9, 10]. In spite of all the advantages of chemotherapy, surgery remains the best treatment modality for gastric cancer and GIST as well as second most often used treatment for primary gastric lymphoma [11]. For a long time, open gastric surgery has been presented as a gold standard, with substantial scepticism towards laparoscopic surgery.

Laparoscopy has undergone intense development over the past twenty years, for use in gastric cancer and other gastrointestinal diseases [12]. Indications for laparoscopic surgery have changed year after year [13]. In comparison with former laparoscopic interventions which were almost exclusively associated with benign gastric pathology, laparoscopic gastric surgery is steadily becoming the standard procedure for treatment of malignant gastric disease [14, 15].

The last decade has brought substantial improvement in laparoscopic surgery, which has led to greater appreciation of the many advantages of minimally invasive surgery, which has been validated by various meta-analyses. In recent years, comprehensive meta-analyses have been published, showing both the short and long term effects of minimally invasive approaches, and demonstrating encouraging results in comparison to open surgery [16-19].

In their meta-analysis comparing patients with advanced-stage gastric cancer, Ke Chen et al [20] noted a significantly lower rate of bleeding during laparoscopic gastrectomy (LG) in comparison to open gastrectomy (OG), as well as a shorter hospital stay, faster postoperative recovery, and reduced intensity of postoperative pain, all in favour of LG. The individual parameters that are covered by our study fully correlate with the results of this extensive meta-analysis. Intraoperative blood loss that Ke Chen's analysis reported ranged from 10-250mL, while the length of hospital stay ranged from 5–16.3 days. In our study, patients had lost an average of 183 ml of blood, while the average length of hospital stay was 13.08 days.The most likely explanation for the decreased intraoperative blood loss is certainly reduced tissue trauma, as well as better visualization using the laparoscopic camera, which has a zoom and therefore the possibility to facilitate the perception of small blood vessels.

Some centres, depending on the treatment practice and the experience of the operating team, demonstrated that patient's postoperative stay in hospital was shortened by more than 3 days when operated with a minimally invasive approach compared to open surgery, with an average length of hospital stay of 10 days and a range from 6–21 and 7–24 days [21, 22]. Our research shows similar results, with an average length of postoperative recovery of 13 days and a range of 7–27 days. It is certain that, with an enlargement of the operative experience in this pathology, length of hospitalization can be significantly reduced, particularly in conjunction with full utilization of Enhanced Recovery after Surgery (ERAS) concept. Lower intensity of pain after laparoscopic surgery has been demonstrated by earlier exclusion of analgesic therapy [20].

One parameter in favour of open surgery is certainly the duration of the operation [23]. It is assumed that this is a consequence of the extensive surgical dissection which must becarried out in advanced stages of gastric cancer, although many authors suggests that the time difference can be equated with open surgery by overcoming the learning curve, that is, by acquiring the skills in laparoscopic surgery. Data suggest that a plateau, which determines the time spent in the operating room even with open surgery, is achieved after performing 40 operations [24-26]. In the previously mentioned meta-analysis conducted by Ke Chen and his associates [20], the average length of surgery ranged from 144–369.7 min, while the average duration of surgery in our study amounted 286 min. Effect of the learning curve was more than obvious, with the average duration of more than 300 minutes at the very beginning, and less than 200 minutes in the last couple cases.

What is particularly important when comparing these two methods is the oncological principle itself? It was noted that LG is equal, and in some segments superior to OG, as far as oncological validity [20]. In advanced gastric cancer, D2 dissection is considered standard, and is essential for the quality of the operation [27]. In a meta-analysis of Zhen-Hong et al. [28], it is demonstrated that the OG with D2 dissection and LG with D2 dissection, at similar stages of disease, have identical prognosis. The only problem which sets itself is the learning curve and it is recommended that LG should not be performed in centers with limited experience in the treatment of this pathology. It was also observed that there was no significant difference in the number of harvested lymph nodes between OG and LG [20]. The average number of removed lymph nodes after LG in this meta-analysis ranges from 20.5–63.7, while in our series, an average of 33.9 lymph nodes has been removed.

The resection margins are an important prognostic factor for the appearance of local recurrence [29]. In a meta-analysis of Ke Chen et al [20], it is demonstrated that there is no statistically significant difference in the percentage of positive resection margins after OG and after LG.

Ke Chen et al. also record that there are significantly fewer post-operative complications in patients after LG in comparison with OG [20]. In our study, the overall rate of postoperative complications was 23%, which matches the average values of the meta-analysis (from 5–39%). This is most likely a consequence of the minimally invasive approach itself [11]. There was no statistically significant difference between LG and OG in regards to the probability of anastomotic leakage, while the probability of pulmonary complications was lower after LG [23]. In our series, a significant number of postoperative complications had been caused by diarrheal syndrome, which occurred despite the fact that the patients were given antibiotics in the protocol of antibiotic prophylaxis.

Given the small percentage of postoperative complications and consequential shorter postoperative hospitalization, it is assumed that patients can begin with postoperative chemotherapy sooner, and are more likely to benefit from chemotherapy, but in practice these assumptions have not yet been proven. This applies both to patients with invasive adenocarcinomas, as well as to patients with primary gastric lymphomas, who are candidates for postoperative adjuvant chemotherapy.

Based on the foregoing, it can be said that the use of LG in advanced gastric cancer is equally effective to OG concerning their oncological standing, with a lot of favourable factors. The only benefit of OG compared to LG is the shorter duration of surgery, which, most authors believe, could be equated through greater surgical operative experience.

Last but not least, when LG is performed with concordanceto the ERAS concept, there is a positive relationship between the costs and the effects of LG compared to OG, with no significant difference in short-term postoperative morbidity and mortality.

In addition to LG, robotically performed gastrectomy is also slowly advancinginto surgery, but time and scientific research have yet to show the advantages and disadvantages of this type of surgery.

CONCLUSION

There is no doubt that there is an intuitive attraction towards laparoscopic gastrectomy both among surgeons and patients. Although technically challenging, laparoscopic gastrectomy is a safe and oncologically adequate procedure in the radical surgical treatment of advanced gastric neoplasms. At the moment, this advanced laparoscopic procedure should be reserved for surgeons with sufficient experience in both advanced laparoscopic surgery and gastric tumor surgery. At the Department for Minimally Invasive Surgery, Clinic for Digestive Surgery, Clinical center of Serbia, radical laparoscopic gastrectomies for gastric neoplasms have been performed since March 2013.

REFERENCES

1. Goh P, Tekant Y, Kum CK, Isaac J, Shang NS. Totally intra-abdominal laparoscopic Billroth II gastrectomy. Surg Endosc. 1992; 6(3): 160.
2. Azagra JS, Goergen M, De Simone P, Ibanez-Aguirre J. Minimally invasive surgery for gastric cancer. Surg Endosc. 1999; 13(4): 351–7.
3. Kitano S, Shiraishi N, Uyama I, Sugihara K, Tanigawa N. A multicenter study on oncologic outcome of laparoscopic gastrectomy for early cancer in Japan. Ann Surg. 2007; 245(1): 68–72.
4. Kodera Y, Fujiwara M, Ohashi N, Nakayama G, Koike M, Morita S, et al. Laparoscopic surgery for gastric cancer: a collective review with meta-analysis of randomized trials. J Am Coll Surg. 2010; 211(5): 677–86.
5. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004; 240(2): 205–13.
6. Waddell T, Verheij M, Allum W, Cunningham D, Cervantes A, Arnold D. Gastric cancer: ESMO-ESSO-ESTRO clinical practice guidelines for diagnosis, treatment and follow-up. Eur J Surg Oncol. 2014; 40(5): 584–91.
7. Pennathur A, Awais O, Luketich JD. Technique of minimally invasive Ivor Lewis esophagectomy. Ann Thorac Surg. 2010; 89(6): S2159–62.
8. Japanese gastric cancer treatment guidelines 2010 (ver. 3). Gastric Cancer. 2011; 14(2): 113–23.
9. Guggenheim DE, Shah MA. Gastric cancer epidemiology and risk factors. J Surg Oncol. 2013; 107(3): 230–6.
10. Siegel R, Ma J, Zou Z, Jemal A. Cancer statistics, 2014. CA Cancer J Clin. 2014; 64(1): 9–29.
11. Saka M, Morita S, Fukagawa T, Katai H. Present and future status of gastric cancer surgery. Jpn J Clin Oncol. 2011; 41(3): 307–13.
12. Bjelovic M, Babic T, Spica B, Gunjic D, Veselinovic M, Trajkovic G. Could hybrid minimally invasive esophagectomy improve the treatment results of esophageal cancer? Eur J Surg Oncol. 2016; 42(8): 1196–201.
13. Bjelovic M, Sabljak P, Spica B, Keramatollah E, Gunjic D, Sljukic V, et al. Minimally invasive surgery in the treatment of gastric cancer. Acta Chir Iugosl. 2011; 58(4): 37–40.

14. Blackmore AE, Wong MT, Tang CL. Evolution of laparoscopy in colorectal surgery: an evidence-based review. World J Gastroenterol. 2014; 20(17): 4926-33.
15. Son T, Kwon IG, Hyung WJ. Minimally invasive surgery for gastric cancer treatment: current status and future perspectives. Gut Liver. 2014; 8(3): 229–36.
16. Kim HH, Han SU, Kim MC, Hyung WJ, Kim W, Lee HJ, et al. Prospective randomized controlled trial (phase III) to comparing laparoscopic distal gastrectomy with open distal gastrectomy for gastric adenocarcinoma (KLASS 01). J Korean Surg Soc. 2013; 84(2): 123–30.
17. Nakamura K, Katai H, Mizusawa J, Yoshikawa T, Ando M, Terashima M, et al. A phase III study of laparoscopy-assisted versus open distal gastrectomy with nodal dissection for clinical stage IA/IB gastric Cancer (JCOG0912). Jpn J Clin Oncol. 2013; 43(3): 324–7.
18. Nam BH, Kim YW, Reim D, Eom BW, Yu WS, Park YK, et al. Laparoscopy Assisted versus Open Distal Gastrectomy with D2 Lymph Node Dissection for Advanced Gastric Cancer: Design and Rationale of a Phase II Randomized Controlled Multicenter Trial (COACT 1001). J Gastric Cancer. 2013; 13(3): 164–71.
19. Kim HI, Hur H, Kim YN, Lee HJ, Kim MC, Han SU, et al. Standardization of D2 lymphadenectomy and surgical quality control (KLASS-02-QC): a prospective, observational, multicenter study [NCT01283893]. BMC Cancer. 2014; 14: 209.
20. Chen K, Pan Y, Cai JQ, Xu XW, Wu D, Mou YP. Totally laparoscopic gastrectomy for gastric cancer: a systematic review and meta-analysis of outcomes compared with open surgery. World J Gastroenterol. 2014; 20(42): 15867–78.
21. Huscher CG, Mingoli A, Sgarzini G, Sansonetti A, Di Paola M, Recher A, et al. Laparoscopic versus open subtotal gastrectomy for distal gastric cancer: five-year results of a randomized prospective trial. Ann Surg. 2005; 241(2): 232–7.
22. Pugliese R, Maggioni D, Sansonna F, Scandroglio I, Ferrari GC, Di Lernia S, et al. Total and subtotal laparoscopic gastrectomy for adenocarcinoma. Surg Endosc. 2007; 21(1): 21–7.
23.Quan Y, Huang A, Ye M, Xu M, Zhuang B, Zhang P, et al. Comparison of laparoscopic versus open gastrectomy for advanced gastric cancer: an updated meta-analysis. Gastric Cancer. 2016; 19(3): 939–50.
24. Hu WG, Ma JJ, Zang L, Xue P, Xu H, Wang ML, et al. Learning curve and long-term outcomes of laparoscopy-assisted distal gastrectomy for gastric cancer. J Laparoendosc Adv Surg Tech A. 2014; 24(7): 487–92.
25. Hyung WJ, Song C, Cheong JH, Choi SH, Noh SH. Factors influencing operation time of laparoscopy-assisted distal subtotal gastrectomy: analysis of consecutive 100 initial cases. Eur J Surg Oncol. 2007; 33(3): 314–9.
26. Kim HG, Park JH, Jeong SH, Lee YJ, Ha WS, Choi SK, et al. Totally laparoscopic distal gastrectomy after learning curve completion: comparison with laparoscopy-assisted distal gastrectomy. J Gastric Cancer. 2013; 13(1): 26–33.
27. de Steur WO, Dikken JL, Hartgrink HH. Lymph node dissection in resectable advanced gastric cancer. Dig Surg. 2013; 30(2): 96–103.
28. Zou ZH, Zhao LY, Mou TY, Hu YF, Yu J, Liu H, et al. Laparoscopic vs open D2 gastrectomy for locally advanced gastric cancer: a meta-analysis. World J Gastroenterol. 2014; 20(44): 16750–64.
29. Kim BS, Oh ST, Yook JH, Kim HS, Lee IS. Appropriate gastrectomy resection margins for early gastric carcinoma. J Surg Oncol. 2014; 109(3): 198–201.

