Gastric Cancer (2009) 12: 127–131
DOI 10.1007/s10120-008-0516-1

Review article

The role of laparoscopy for gastric surgery in the West

Vivian E. Strong[1], Nicolas Devaud[2], and Martin Karpeh[3]

[1] Department of Surgery, Gastric and Mixed Tumor Service, Memorial Sloan-Kettering Cancer Center, 1275 York Avenue, New York, NY 10065, USA
[2] Division of Surgery, Pontificia Universidad Catolica de Chile, Santiago, Chile
[3] Department of Surgery, Beth Israel Medical Center, New York, NY, USA

Abstract
The only potentially curative treatment available for gastric adenocarcinoma is surgical resection. However, many controversies exist regarding treatment strategy, including whether the laparoscopic approach is appropriate. Many reports of laparoscopic techniques for cancer resection have shown oncologic equivalency to the open technique, with the known benefits of the minimally invasive approach, such as decreased pain, length of hospital stay, blood loss, and complications. The Eastern experience with laparoscopic gastrectomy has been extensive, associated with the increased incidence of early gastric cancers. However, in the West, laparoscopic approaches for gastric cancer have been more slowly accepted, largely due to the lower incidence of gastric cancer in this part of the world. Therefore, we aimed to review the technical feasibility and oncologic efficacy of the laparoscopic versus open approach to resection for gastric adenocarcinoma in the West. Review of the literature demonstrates that laparoscopic gastrectomy is a safe technique with short-term oncologic results that are equivalent in terms of margin status and lymph node retrieval and are associated with additional benefits of the minimally invasive approach, although long-term follow up is necessary. Laparoscopic gastrectomy for adenocarcinoma, similar to findings in the East, resulted in a decreased length of hospital stay, decreased narcotic use, fewer complications, and equivalent short-term oncologic outcomes. It appears that the minimally invasive approach for gastric resection of adenocarcinoma is safe and satisfies oncologic requirements, and is justified for use in selected patients.

Key words Minimally invasive surgery · Laparoscopy · Gastric cancer · Gastric adenocarcinoma · Gastric cancer in the West · Laparoscopic gastrectomy

Offprint requests to: V. E. Strong
Received: September 24, 2008 / Accepted: October 21, 2008

Introduction

Since 1989, when Dubois et al. first reported their experience with laparoscopic cholecystectomy [1], abdominal surgery has increasingly moved toward a minimally invasive approach based on known benefits such as reduced pain, length of hospital stay, and complications. Laparoscopic procedures are now used for staging and therapy; therefore, the number of indications has steadily grown, due in part to the increased experience and skill of surgeons using these techniques, in parallel with improvements in visualization and instrumentation. Endoscopic, laparoscopic, and newly developed techniques such as natural orifice transluminal endoscopic surgery (NOTES) have provided additional tools and approaches for surgeons to improve patients' quality of life during the postoperative period, demonstrating decreased postsurgical pain, shorter hospital stay, and earlier return to work, together with a reduction in late abdominal wall complications, particularly ventral hernia, which occurs in 10%-15% of patients who undergo traditional open procedures [2]. Remaining controversy persists regarding the laparoscopic approach for various oncologic procedures, although support and evidence for the minimally invasive approach is growing [3, 4].

Laparoscopic approaches for gastric cancer, in particular, have been more slowly accepted in the West, largely due to the lower incidence of gastric cancer in these countries. Therefore, although the role of laparoscopic gastric surgery in the West has developed with general acceptance for the treatment of benign conditions such as gastroesophageal reflux and morbid obesity [5, 6], the role of laparoscopic surgery for the treatment of malignant gastric disease remains less clear.

In 1992, Ohgami et al. reported the first laparoscopic wedge resection (LWR) for the treatment of early gastric cancer (EGC) [7]. Ohashi et al. later developed the first intragastric mucosal resection (IGMR) for

EGC of the stomach at the posterior wall [8]. The aim of both procedures was to restrict the extent of gastric resection in the treatment of malignant disease with low risk of lymph node metastasis, therefore reducing the physiologic side effects of a standard gastrectomy.

Studies in EGC, defined by the Japanese Gastric Association classification system as a tumor with invasion restricted to the mucosa or submucosa regardless of the presence of lymph node metastases, have determined the risk of lymph node metastasis based on early gastric tumor characteristics [9]. Therefore, depth of invasion, grade of differentiation, and presence of ulcer [10] in EGC may determine the presence of local or distant nodal disease.

The Eastern experience in laparoscopic surgery for gastric cancer was limited to the two procedures noted above until 1994, when Kitano et al. performed the first laparoscopy-assisted distal gastrectomy (LADG) with a modified D1 lymph node dissection (D1 + left gastric artery group and D1 + common hepatic artery group) for the treatment of EGC with a high risk of lymph node metastasis [11]. This demonstrated the utility of laparoscopic surgery for gastric malignant disease in the East with regard to feasibility of an oncologically appropriate laparoscopic lymphadenectomy.

The development of laparoscopic surgery for malignant gastric disease in the West has been slower. This is partly related to skepticism regarding oncologic efficacy for this advanced surgical procedure, which has a significant learning curve.

The Western experience with laparoscopic surgery for malignant gastric tumors had, until recently, been primarily confined to diagnostic laparoscopy as an adjunct to preoperative staging and stratification of patients for neoadjuvant treatment of locally advanced tumors [12], and more recently, for gastric LWR for gastrointestinal stromal tumors [13], carcinoid tumors [14], and early-stage adenocarcinoma [15, 16]. Laparoscopic distal, subtotal, and total gastrectomy for early and advanced gastric cancer is now emerging in the West with progressive acceptance among various groups, although this progress has been slowed by the difference in natural history of gastric adenocarcinoma in the East compared with the West.

Our interest is to review the current experience of laparoscopic gastric surgery in the West and the potential for progress as we advance our experience in the field of minimally invasive gastric resection for cancer.

Natural history of gastric adenocarcinoma in the United States and other parts of the West

Gastric adenocarcinoma is the fourth-leading cause of cancer death in the United States, presenting in roughly 22 000 patients per year with more than 14 000 deaths [17]. Despite these alarming statistics, little progress has been made for this disease, perhaps due to the late stage of presentation and lack of surveillance screening programs in the West.

Although the Japanese have reported on an excellent experience where 70% of all gastric cancers are diagnosed at an early stage with an overall 5-year survival of more than 90% [18, 19], there are epidemiologic differences between the East and West that may explain the different philosophy and approach towards gastric cancer treated in the United States and Europe [19].

In the West, the frequency of gastric adenocarcinoma in the proximal third of the stomach is increasing, compared with the East, where adenocarcinoma of the middle and distal third still prevails [19]. Therefore, the increasing incidence of adenocarcinomas arising within the vicinity of the gastroesophageal junction (GEJ) with presentation at more advanced stages makes appropriate treatment recommendations challenging, and weighted toward neoadjuvant strategies, rather than minimally invasive procedures focused on early stages of the disease.

There has been much speculation regarding differences in outcome for gastric cancer patients in the Eastern versus Western world, especially considering the greater frequency of EGC in Japan (78 cases per 100 000 compared with the United States with 10 cases per 100 000) [20]. Hypotheses have included more accurate pathologic staging, extended nodal dissection, and meticulous histopathologic evaluation of surgical specimens [21].

Schlemper et al. looked at pathologic interpretation of specimens and compared results between Japanese and Western pathologists [22]. They hypothesized that Japanese pathologists may classify a lesion as a carcinoma that Western pathologists classify as precursor lesions such as dysplasia or adenoma. The assessments of eight pathologists from North America, Europe, and Japan were compared after all individually reviewed microscopic slides of gastric lesions ranging from EGC to adenoma. The 17 biopsy samples reviewed were obtained from lesions in patients who underwent EMR, selecting only those with intestinal-type adenocarcinoma, since diffuse-type lesions do not give rise to conflicting diagnoses.

In this study, the distribution of diagnoses by all Western pathologists together was different from that by Japanese pathologists; 38% of the total diagnoses made by the Western group were definite carcinoma compared with 87% of the Japanese pathologists' diagnoses. Fifty-six percent of Western pathologists described adenoma and/or dysplasia, compared with 7% of the Japanese pathologists.

Schlemper et al. found that in Japan gastric cancer is diagnosed based on nuclear and structural criteria, not necessarily including invasion, thus potentially "upstaging" early lesions. The high proportion of early gastric carcinoma in Japan may be a reflection of differences in the diagnostic criteria of intestinal-type EGC.

Another important issue concerning the natural history of GC in the West is the discrepancy in extent of lymphadenectomy. Limited DO/D1 surgery continues to be the most common surgical practice at some surgical centers in the West. There is controversy among Western surgeons about whether D2 dissection improves oncologic factors or simply improves tumor staging.

In the United States, multicenter randomized controlled trials (RCTs) have shown local (29%) and regional (72%) recurrence related to limited D0/D1 node dissection [23], while multiple but nonrandomized prospective or retrospective studies in Japan and European specialized institutions suggest a survival advantage of D2 over D1 node dissection [24–26]. However, current Western philosophy recommends a minimum lymph node dissection of 15 nodes to ensure adequate staging information. In the past, the International Union against Cancer (UICC)/American Joint Committee on Cancer (AJCC) classification system defined N stage by the location of lymph node metastases relative to the primary. Metastatic lymph nodes within 3 cm of the primary were considered N1; lymph node metastases more than 3 cm from the primary were N2. Though, in 1997 the UICC and AJCC redefined the pathologic nodal status based on the number of involved nodes and not by their location, recommending a minimum of 15 lymph nodes to be examined to define N0 [27, 28].

Karpeh et al. demonstrated this via the analysis of 1038 patients with GC, showing that the location of positive nodes did not significantly affect median survival compared with the number of positive nodes resected [29]. Therefore the N categories based on number rather than location would serve as better discriminators of median survival when 15 or more nodes are examined.

Despite these issues, the role of minimally invasive surgery for gastric cancer is expanding, although laparoscopic gastrectomy for cancer has emerged more conservatively than other applications of laparoscopy as a standard technique.

Laparoscopic surgery for early and late gastric cancer in the West

In 1999, Azagra et al. reported the first laparoscopic total gastrectomy for cancer [30]. He and his group from Belgium have been Western pioneers in minimally invasive gastric resection for cancer, performing the first totally laparoscopic distal gastrectomy with Billroth II anastomosis for cancer in 1993 [30] and the first reported laparoscopic total gastrectomy for cancer a few years later [30]. Despite the relatively new advent of these techniques, there has been an aggressive approach to reporting series of patients undergoing laparoscopic resections for gastric cancers (Table 1).

Huscher et al., from Italy, reported in the only Western prospective randomized trial to date so far, on 5-year clinical outcomes of laparoscopic-assisted subtotal gastrectomy compared with open subtotal

Table 1. Gastric adenocarcinoma — laparoscopic gastric cancer series in the West

	Study type	Total	Laparoscopic	Open	Operative mortality	LNs
Huscher, 2005 [31]	Randomized, prospective	59	30	29	1/30	30 ± 15
Huscher, 2004 [36]	Retrospective, advanced gastric cancer	44	44	—	3/44	38 ± 22
Carboni, 2005 [37]	Retrospective	20	20	—	0/20	23–47
Dulucq, 2005 [38]	Prospective	52	24	28	0/24	24 ± 12
Dulucq, 2005 [39]	Prospective, advanced gastric cancer	33	33	—	0/33	22 ± 12
Weber, 2003 [14]	Retrospective, case-matched	25	12	13	0/12	8 (4–14)
Ibáñez Aguirre, 2006 [40]	Prospective	130	130	—	6/120	17 ± 5 (D1) 37 ± 14 (D2)
Feliu, 2007 [41]	Retrospective	23	23	—	0/23	21 ± 5
Pugliese, 2007 [42]	Retrospective	147	48	99	1/48	30 ± 7 (D1) 32 ± 7 (D2)
Varela, 2006 [33]	Retrospective	36	15	21	0/15	15 ± 9
Anderson, 2007 [34]	Robotic gastrectomy	7	7	—	0/7	24 (17–30)
Orsenigo, 2008 [43]	Prospective, sentinel LN	34	34	—	0/34	31 ± 10
Reyes, 2001 [32]	Retrospective, case-matched	36	18	18	0/18	8 (4–14)
Azagra, 1999 [30]	Retrospective	13	13	—	2/13	31 (25–53)
Azagra, 2006 [44]	Prospective	101	91	—	5/91	17 ± 5 (D1) 37 ± 14 (D2)
Besozzi, 2007 [45]	Retrospective, laparoscopic total gastrectomy	24	24	—	3/24	25 (15–50)

LN, lymph node

gastrectomy for stage-matched adenocarcinomas, and demonstrated both safety and feasibility of the laparoscopic approach [31]. In this study, patients with a preoperative diagnosis of distal gastric cancer were prospectively randomized to undergo an open or a laparoscopic surgical procedure. Patients of both groups were matched by pTNM stage showing no significant difference between groups; thus, 5-year survival numbers showed no significant difference between the two groups, but provided patients of the laparoscopic group with the established benefits of minimally invasive surgery.

The experience in laparoscopic gastrectomy for the treatment of gastric adenocarcinoma in the West has therefore been mostly encouraged in Europe, with a small early experience in North America and South America published in recent years [32–35], with the largest United States series consisting of 15 patients who underwent minimally invasive gastrectomy or esophagogastrectomy for gastric cancer [33].

In the United States, the first group to describe their experience with laparoscopic gastrectomy with curative intent for GC was Reyes et al. from Mount Sinai Medical Center, in 2001 [32]. In this retrospective case-matched study with 36 patients (25 with malignant disease), they compared 18 laparoscopic surgeries with 18 open gastrectomies. Of those with GC, from the laparoscopic group, 9 patients had histologically confirmed adenocarcinoma and 3 with carcinoid tumors compared with 12 adenocarcinomas and 1 gastric lymphoma in the open group. All resected margins in the laparoscopic group were free of tumor, whereas 2 patients in the open group (stages II and III) had R1 resections, likely related to selection bias for these more advanced, open cases [32]. There were no significant differences in extent of lymph node dissection or in intraoperative complications between the two groups. The laparoscopic approach required a significantly longer operative time (4.2 h vs 3.0 in the open group) likely related to the learning curve of this procedure. However, there was significantly lower blood loss with fewer transfusions required, earlier return to normal bowel function, lower postoperative ileus, and significantly reduced hospital stay in the laparoscopic versus open groups (6.3 vs 8.6 days).

In 2006, Varela et al. published the second experience with laparoscopic gastrectomy for GC in the United States, representing to date the largest American experience reported. After 15 consecutive laparoscopic gastrectomies, of which 2 were total, 4 proximal, 4 subtotal, 2 distal, and 3 laparoscopic esophagogastrectomies, no conversion to open surgery was reported, and there were no significant differences in operative time, transfusion rate, number of lymph nodes resected, median length of stay, and morbidity, although there was significantly lower blood loss among the laparoscopic group [33], demonstrating both the feasibility and safety of the laparoscopic approach.

Conclusion

Open gastrectomy with a minimal lymph node dissection of 15 for staging purposes remains an appropriate surgical treatment for gastric adenocarcinoma in the West. With increasing experience and expertise of oncologic surgeons in the minimally invasive approach to gastric resection for cancer, it is becoming evident that laparoscopy, as a technique for resection, provides equivalent oncologic resections with lymphadenectomy that is comparable to the open approach, with no compromise in recurrence or long-term survival, based on preliminary studies. In addition, based on the known benefits of the minimally invasive approach, including reduced surgical trauma, blood loss, and pain, and quicker recovery for the patient, we are encouraged to expand our indications for this approach. This has been prompted also by advances in minimally invasive surgery for benign abdominal disease, and the results from multiple Eastern studies of early-stage cancer. Although an open approach should be applied for any case with concern over local resectability, definition of anatomy, or surgeon comfort level, it appears that the minimally invasive approach is here to stay. However, until more mature long-term follow-up data on advanced gastric cancer treated by minimally invasive approaches are defined in the West, where local clearance has been an issue in the open setting, we recommend that in centers that do not treat a large volume of gastric cancer, minimally invasive approaches should be limited to those patients with well-staged T1 and T2aN0 adenocarcinomas, as defined by computed tomography (CT) scan and endoscopic ultrasound. As the indications continue to expand for more advanced tumors and with the data from additional prospective studies, we will be able to more clearly define the oncologically appropriate application of laparoscopic gastrectomy for all stages of gastric adenocarcinoma.

References

1. Dubois F, Berthelot G, Levard H. Cholecystectomy by coelioscopy. Presse Med 1989;18:980–2.
2. Heniford BT, Park A, Ramshaw BJ, Voeller G. Laparoscopic repair of ventral hernias: nine years' experience with 850 consecutive hernias. Ann Surg 2003;238:391–9.
3. Weeks JC, Nelson H, Gelber S, Sargent D, Schroeder G. Short-term quality-of-life outcomes following laparoscopic-assisted colectomy vs open colectomy for colon cancer: a randomized trial. JAMA 2002;287:321–8.

4. Strong VE, D'Angelica M, Tang L, Prete F, Gonen M, Coit D, et al. Laparoscopic adrenalectomy for isolated adrenal metastasis. Ann Surg Oncol 2007;14:3392–400.
5. Perdikis G, Hinder RA, Lund RJ, Raiser F, Katada N. Laparoscopic Nissen fundoplication: where do we stand? Surg Laparosc Endosc 1997;7:17–21.
6. Nguyen NT, Ho HS, Palmer LS, Wolfe BM. A comparison study of laparoscopic versus open gastric bypass for morbid obesity. J Am Coll Surg 2000;191:149–55.
7. Ohgami M, Otani Y, Kumai K, Kubota T, Kim YI, Kitajima M. Curative laparoscopic surgery for early gastric cancer: 5 years experience. World J Surg 1999;23:187–92.
8. Ohashi S. Laparoscopic intraluminal (intragastric) surgery for early gastric cancer. A new concept in laparoscopic surgery. Surg Endosc 1995;9:169–71.
9. Hiki Y, Sakakibara Y, Mieno H, Shimao H, Kobayashi N, Katada N. Endoscopic treatment of gastric cancer. Surg Endosc 1991;5: 11–3.
10. Yasuda K, Shiraishi N, Suematsu T, Yamaguchi K, Adachi Y, Kitano S. Rate of detection of lymph node metastasis is correlated with the depth of submucosal invasion in early stage gastric carcinoma. Cancer 1999 15;85:2119–23.
11. Kitano S, Iso Y, Moriyama M, Sugimachi K. Laparoscopy-assisted Billroth I gastrectomy. Surg Laparosc Endosc 1994;4: 146–8.
12. Burke EC, Karpeh MS, Conlon KC, Brennan MF. Laparoscopy in the management of gastric adenocarcinoma. Ann Surg 1997; 225:262–7.
13. Novitsky YW, Kercher KW, Sing RF, Heniford BT. Long-term outcomes of laparoscopic resection of gastric gastrointestinal stromal tumors. Ann Surg 2006;243:738–45.
14. Weber KJ, Reyes CD, Gagner M, Divino CM. Comparison of laparoscopic and open gastrectomy for malignant disease. Surg Endosc 2003;17:968–71.
15. Ludwig K, Klautke G, Bernhard J, Weiner R. Minimally invasive and local treatment for mucosal early gastric cancer. Surg Endosc 2005;19:1362–6.
16. Schubert D, Kuhn R, Nestler G, Kahl S, Ebert MP, Malfertheiner P, et al. Laparoscopic-endoscopic rendezvous resection of upper gastrointestinal tumors. Dig Dis 2005;23:106–12.
17. Jemal A, Siegel R, Ward E, Murray T, Xu J, Smigal C, et al. Cancer statistics, 2006. CA Cancer J Clin 2006;56:106–30.
18. Siewert JR. Gastric cancer: the dispute between East and West. Gastric Cancer 2005;8:59–61.
19. Ichikura T, Ogawa T, Kawabata T, Chochi K, Sugasawa H, Mochizuki H. Is adenocarcinoma of the gastric cardia a distinct entity independent of subcardial carcinoma? World J Surg 2003;27:334–8.
20. Al-Refaie WB, Abdalla EK, Ahmad SA, Mansfield PF. Gastric Cancer. In: Feig BW, Berger DH, Fuhrman GM, editors. The M. D. Anderson surgical oncology handbook, 4th ed. Philadelphia: Lippincott, Williams and Wilkins, 2006, p 205.
21. Noguchi Y, Yoshikawa T, Tsuburaya A, Motohashi H, Karpeh MS, Brennan MF. Is gastric carcinoma different between Japan and the United States? Cancer 2000 1;89:2237–46.
22. Schlemper RJ, Kato Y, Stolte M. Review of histological classifications of gastrointestinal epithelial neoplasia: differences in diagnosis of early carcinomas between Japanese and Western pathologists. J Gastroenterol 2001;36:445–56.
23. Hundahl SA, Phillips JL, Menck HR. The National Cancer Data Base Report on poor survival of U.S. gastric carcinoma patients treated with gastrectomy: fifth edition. American Joint Committee on Cancer: staging, proximal disease, and the "different disease" hypothesis. Cancer 2000 15;88:921–32.
24. Fujii M, Sasaki J, Nakajima T. State of the art in the treatment of gastric cancer: from the 71st Japanese Gastric Cancer Congress. Gastric Cancer 1999;2:151–7.
25. Sasako M. Principles of surgical treatment for curable gastric cancer. J Clin Oncol 2003 1;21(23 Suppl):274s–5s.
26. Siewert JR, Bottcher K, Stein HJ, Roder JD. Relevant prognostic factors in gastric cancer: 10-year results of the German Gastric Cancer Study. Ann Surg 1998;228:449–61.
27. Fleming ID, Cooper JS, Henson DE, Hutter RVP, Kennedy BJ, Murphy GP, et al., editors. American Joint Committee on Cancer. Manual for staging of cancer. 5th ed. Philadelphia: J.B. Lippincott; 1997.
28. Sobin LH, Wittekind CH, editors. International Union Against Cancer. TNM classification of malignant tumors. 5th ed. New York: John Wiley & Sons; 1997.
29. Karpeh M, Leon L, Klimstra D, Brennan M. Lymph node staging in gastric cancer: is location more important than number?. An analysis of 1038 patients. Ann Surg 2000;232:362–71.
30. Azagra JS, Goergen M, De Simone P, Ibanez-Aguirre J. Minimally invasive surgery for gastric cancer. Surg Endosc 1999; 13:351–7.
31. Huscher CG, Mingoli A, Giovanni S, 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;241:232–7.
32. Reyes CD, Weber KJ, Gagner M, Divino CM. Laparoscopic vs open gastrectomy. A retrospective review. Surg Endosc 2001; 15:928–31.
33. Varela JE, Hiyashi M, Nguyen T, Sabio A, Wilson SE, Nguyen NT. Comparison of laparoscopic and open gastrectomy for gastric cancer. Am J Surg 2006;192:837–42.
34. Anderson C, Ellenhorn J, Hellan M, Pigazzi A. Pilot series of robot-assisted laparoscopic subtotal gastrectomy with extended lymphadenectomy for gastric cancer. Surg Endosc 2007;21:1662–6.
35. Escalona A, Perez G, Crovari F, Boza C, Pimentel F, Devaud N, et al. Laparoscopic gastrectomy in gastric cancer: experience in four patients. Rev Med Chil 2007;135:512–6.
36. Huscher CG, Mingoli A, Sgarzini G, Sansonetti A, Lirici M, Napoletano C, Piro F. Videolaparoscopic total and subtotal gastrectomy with extended lymph node dissection for gastric cancer. Am J Surg 2004;188:728–35.
37. Carboni F, Lepiane P, Santora R, Mancini P, Lorusso R, Santoro E. Laparoscopic surgery for gastric cancer: preliminary experience. Gastric Cancer 2005;8:75–7.
38. Dulucq JL, Wintringer P, Stabilini C, Solinas J, Peissat J, Mahajna A. Laparoscopic and open gastric resections for malignat lesions: a prospective comparative study. Surg Endosc 2005;19:933–8.
39. Dulucq JL, Wintringer P, Perissat J, Mahajna A. Completely laparoscopic total and partial gastrectomy for benign and malignant diseases: a single institute's prospective analysis. J Am Coll Surg 2005;200:191–7.
40. Ibanez-Aguirre FJ, Azagra JS, Erro Azcarate ML, Goergen M, Rico Selas P, Moreno Elola-Olaso A, et al. Laparoscopic gastrectomy for gastric adenocarcinoma. Long-term results. Rev Esp Enferm Dig 2006;98:491–500.
41. Feliu X, Besora P, Claveria R, Vinas X, Salazar D, Fernandez E. Laparoscopic treatment of gastric tumors. J Laparoendosc Adv Surg Tech A 2007;17:147–52.
42. Pugliese R, Maggioni D, Sansonna F, Scandroglio I, Ferrari GC, Di Lernia S, et al. Total and subtotal laparoscopic gastrectomy for adenocarcinoma. Surg Endosc 2002;21:21–7.
43. Orsenigo E, Tomajer V, Di Palo S, Albarello L, Doglioni C, Masci E, et al. Sentinel node mapping during laparoscopic distal gastrectomy for gastric cancer. Surg Endosc 2008:22:118–21.
44. Azagra JS, Ibanez-Aguirre JF, Goergen M, Ceuterick M, Bordas-Rivas JM, et al. Long-term results of laparoscopic extended surgery in advanced gastric cancer: a series of 101 patients. Hepatogastroenterology 2006;53:304–8.
45. Besozzi A, Besozzi S, Lanza V, Mitolo CI, Novelli D, Sisto T. Laparoscopic treatment gastric cancer with advanced techniques: technical notes and follow-up. Chir Ital 2007;59:63–7.