Robotic Right Colon Resection: Evaluation of First 50 Consecutive Cases for Malignant Disease

Annibale D'Annibale, MD¹, Graziano Pernazza, MD¹, Emilio Morpurgo, MD², Igor Monsellato, MD¹, Vito Pende, MD¹, Giorgio Lucandri, MD¹, Barbara Termini, MD², Camillo Orsini, MD², and Gianna Sovernigo, MD²

¹Minimally Invasive and Robotic Surgery Unit, San Giovanni-Addolorata Hospital, Rome, Italy; ²Ospedale Civile, Camposampiero, Padua, Italy

ABSTRACT

Background. Colorectal cancer is the fourth leading cause of death in the world. Minimally invasive surgery has been demonstrated to have the same oncological results as open surgery, with better clinical outcomes. Robotic assistance is an evolution of minimally invasive technique. This study aims to evaluate surgical and oncological short-term outcomes of robotic-assisted right colon resection in malignant disease.

Methods. Fifty consecutive patients affected by right-sided colon cancer were operated from May 2001 to May 2009 using the da Vinci[®] surgical system. Data regarding surgical and early oncological outcomes were systematically collected in a specific database for statistical analysis.

Results. Twenty-four male and 26 female patients underwent robotic right colectomy. Median age was 73.34 ± 11 years. Median operative time was 223.50 (180–270) min. No conversion occurred. Specimen length was 26.7 ± 8 cm (range 21–50 cm), number of harvested lymph nodes was 18.76 ± 7.2 (range 12–44), and mean number of positive lymph nodes was 1.65 ± 3 (range 0–17). Surgery-related morbidity was 1/50 (2%): one twisting of the mesentery in one case with extracorporeal anastomosis. All patients were included in a follow-up regimen. Disease-free survival was 90% (45/50), and overall survival was 92% (46/50). Cancer-related mortality was 8% (4/50).

Conclusions. Robotic assistance allows performance of oncologically adequate dissection of the right colon with radical lymphadenectomy and to fashion a handsewn intracorporeal anastomosis as in open surgery, confirming

the safety and oncological adequacy of this technique, with acceptable results and short-term outcomes.

Since 2002, laparoscopic technique has revolutionized the treatment of malignant colorectal disease, showing the same oncological results as open technique.^{1–9} However there are some technical drawbacks to the laparoscopic approach, including lack of three-dimensional (3-D) visualization, limited range of motion due to fixed trocar sites and rigid instrumentation, poor ergonomics, amplification of physiologic tremor, and decreased sense of touch.

In the last 10 years, robotic systems have been developed to overcome the limitations of laparoscopic surgery. The da Vinci[®] surgical system (Intuitive Surgical Inc., Sunnyvale, CA, USA) was the first telerobotic system approved for intra-abdominal surgery in the USA by the Food and Drug Administration (FDA).¹⁰ The first robotic colorectal surgical procedure was reported in 2001.¹¹ After that, various experiences of robotic colorectal surgery were reported for treatment of benign and malignant diseases.^{12–14} However, there are few studies analyzing accuracy in larger series of robotic right colectomy for malignancy. This study aims to evaluate the feasibility and the short-term surgical and oncological outcomes of robotic-assisted right colon resection in malignant disease.

METHODS

This study analyzes 50 consecutive robotic procedures performed for right-sided colon cancer from May 2001 to May 2009.

The data set includes patient characteristics, surgical parameters, complications, pathology, and follow-up. Pathological examination of the resected specimen followed a standard protocol.

The software used for statistical analysis was SPSS version 17 (SPSS Inc., Chicago, IL, USA). Mean $\pm$ standard deviation (SD), median, and interquartile range (IQR) were calculated for appropriate variables. Kaplan–Meier method was used for univariate survival analysis.

Robotic-Assisted Right Colectomy

Operative room setup and placement of ports are shown in Fig. 1.

The procedure is carried out with a full robotic technique. The robotic cart approaches from the right side of the patient, and the three operative arms are connected to the ports. The procedure begins by grasping upward and laterally the mesentery of the last ileal loop. This maneuver, performed with the forceps mounted on the fourth arm, enhances the prominence of the ileocolic vessels (ICVs) and provides stable and durable retraction. The peritoneal layer of the mesentery is incised just below this salience, and an accurate lymphadenectomy is performed along the superior mesenteric axis (SMx). Then, the ICVs are isolated and separately ligated and sectioned. Dissection of the right mesocolon follows a caudocranial pathway, along the right side of the SMx. Following this path, it is possible to remove the lymphatic tissue completely, safely identifying the inconstant right colic vessels (RCVs), which may be sectioned at their origin, until reaching the root of the transverse mesocolon. Dissection along the lateral margin of the middle colic vessels allows the right branch of the middle colic vessels (RMCVs) to be reached more easily, which is then treated as in the standard right colectomy (R1). Resection of the whole pedicle of the middle colic vessels is performed only for localization at the right colic flexure, for which extended right colectomy (R2) is needed.

Mobilization of the colon is performed in medial to lateral direction in the avascular plane between Gerota's and Toldt's fasciae. During this step, the knee of the duodenum constitutes an important landmark to drive the dissection upward, over the duodenal third portion and the pancreatic head, along Fredet's fascia. The right ureter and the gonadic vessels are left below the plane of dissection.

The hepatic flexure is then mobilized, sectioning the lateral portion of the gastrocolic and the hepatocolic ligaments. This step enables the resection to join the previously dissected plane and to complete the lymphadenectomy around the gastroepiploic vessels.

The transverse colon and the last ileal loop are finally sectioned by linear stapler.

The ileum and the transverse colon are joined with a running suture, and an intracorporeal isoperistaltic double-layer side-to-side ileocolic anastomosis is fashioned using a 3-0 absorbable monofilament suture (Fig. 2).

We performed extracorporeal anastomosis in cases 1–5: the daVinci® system is disengaged from the patient, then a median supraumbilical minilaparotomy is performed, through which an isoperistaltic side-to-side ileocolic anastomosis is fashioned.

The specimen is retrieved at the end of the procedure through a small muscle-splitting Pfannenstiel minilaparotomy. This incision is protected from potential contamination by a wound protector.

RESULTS

This study was based on 50 consecutive right colectomies using the da Vinci® S-HD surgical system. Twenty-four male and 26 female patients underwent robotic right colectomy. Patient characteristics are presented in Table 1.

FIG. 1 Operating room and port position: C, camera port; A, assistant port; R1, robotic arm 1; R2, robotic arm 2; R3, robotic arm 3; ML, minilaparotomy (Pfannenstiel)

FIG. 2 Intraoperative view: robotic-assisted intracorporeal hand-sewn ileocolic anastomosis

TABLE 1 Patient characteristics

Parameter	
<i>Sex</i>	
Male	24
Female	26
<i>Age (years)</i>	73.34 ± 11 (30–89)
<i>BMI (kg/m²)</i>	25 ± 3 (18.4–31.9)
<i>ASA^a score, n (%)</i>	
I	5 (10%)
II	31 (62%)
III	13 (26%)
IV	1 (2%)
<i>Tumor site</i>	
Right colon	37
Cecum	11
Hepatic flexure	2 ^b
Total	50

^a American Society of Anesthesiologists

^b R2 right colectomies

Median operative time was 223.50 (180–270) min. We considered four phases in the procedure: (1) port setup time, (2) docking time, (3) robot time, and (4) assisted time. The port setup time includes skin incision and placement of ports; it was 10.50 (IQR 7–13) min. Docking time includes approach of the robot to the operative table and connection of the robotic arms to the ports; it was 8 (IQR 7–8) min. Robot time extends from the first activation of the robotic instruments by the surgeon at the console to the release of the masters at the end of the procedure; it was 184 (IQR 148–233) min. The assisted time includes robot undocking, creation of the minilaparotomy, harvest of the specimen, and

closure of the minilaparotomy; it was 20 (IQR 17–25) min. Intraoperative blood loss was 20 mL (IQR 0–100 mL). Specimen length was 26.7 ± 8 cm (range 21–50 cm). Number of harvested lymph nodes was 18.76 ± 7.2 (range 12–44), and mean number of positive lymph nodes was 1.65 ± 3 (range 0–17). Recovery of bowel function was on day 2.51 ± 1 (range 1–4), oral re-intake was on day 3.47 ± 0.6 (range 2–4), and length of stay was 7 ± 1.2 days (range 5–9 days) (Table 2). Surgery-related morbidity was 2%: one twisting of the mesentery, in case 5 where we performed an extracorporeal anastomosis, which needed a laparoscopic redo. Neither conversions nor 30-day mortality occurred. All patients were treated with curative-intent surgery and adjuvant chemotherapy (CHT) according to current international guidelines for colorectal cancer.¹⁵ At median follow-up of 36 months (range 6–96 months), disease-free survival was 90% (45/50), overall survival was 92% (46/50), and disease-related mortality was 8% (4/50) (Table 1). Stages included in the survival analyses were II, III, and IV.

TABLE 2 Intraoperative, perioperative results, and pathological findings

Parameter	
<i>Overall operative time (min)^a</i>	223.50 (180–270)
<i>Port setup (min)^a</i>	10.50 (7–13)
<i>Docking time (min)^a</i>	8 (7–8)
<i>Robot time (min)^a</i>	184 (148–233)
<i>Assisted time (min)^a</i>	20 (17–25)
<i>No. of retrieved lymph nodes</i>	18.76 ± 7.2 (12–44)
<i>No. of positive lymph nodes</i>	1.65 ± 3 (0–17)
<i>Specimen length (cm)</i>	26.7 ± 8 (21–50)
<i>Stage (N)</i>	
I	14
II	17
IIIA	1
IIIB	10
IIIC	2
IV	6
Conversions	0
Complications	1
Major	1 ^b
Reintervention	1 ^c
30-day mortality	0
First flatus (days) ^d	2.51 ± 1 (1–4)
Oral re-intake (days) ^d	3.47 ± 0.6 (2–4)
LOS (days) ^d	7 ± 1.2 (5–9)

^a Values are median with interquartile range (IQR)

^b Twisting of the mesentery

^c Laparoscopic redo for twisting of the mesentery

^d Values are mean ± SD (range)

FIG. 3 Overall survival (A) and disease-free survival (B) for each stage (median follow-up 36 months)

There were 17, 13, and 6 patients in stage II, III, and IV, respectively. Overall survival for stage II, III, and IV was 94.1%, 92.3%, and 66.7%, respectively (Fig. 3). Disease-free survival for stage II and III was 100% and 84.6%, respectively. All patients with pathological stage II and III were referred for CHT treatment based on a combination of 5-fluorouracil (5-FU)/leucovorin/oxaliplatin $\pm$ irinotecan (FOLFOX/FOLFOXIRI). Stage IV patients were submitted to different treatments: two patients with single liver metastasis were referred for radiofrequency treatment before CHT (FOLFOX/FOLFOXIRI $\pm$ monoclonal antibodies); four patients, three of whom had more than three liver metastases, were submitted directly to CHT (FOLFOX/FOLFOXIRI $\pm$ monoclonal antibodies): one patient had synchronous resection for both pulmonary and liver metastases after treatment; two patients died during CHT.

DISCUSSION

Robotic surgery is spreading all over the world for many surgical procedures ranging from cardiac to general and urologic surgery thanks to its potential advantages overcoming the negative aspects of laparoscopic approach.^{16–20} The first robot-assisted colectomy was reported by Ballantyne et al. in 2001.¹¹ Since then, several surgeons have performed robotic colorectal surgery.^{12–14,21,22}

To our knowledge, this is the first report on a larger series of robotic right colectomies, evaluating its safety and feasibility, focusing on short-term outcomes and oncological adequacy. Analysis of cost aspects of robotic surgery is outside the scope of this study.

One of the most important prognostic factors in colorectal carcinoma is nodal status at time of surgical treatment. Presence of nodal metastasis and mainly its

distribution are key factors in predicting disease-free and long-term survival and for deciding on postoperative adjuvant therapy.^{23–26} The American Joint Committee on Cancer (AJCC) and College of American Pathologists (CAP) recommend evaluation of a minimum of 12 lymph nodes.^{27,28} Moreover, it has recently been demonstrated that the lymph node ratio (LNR) rather than the number of harvested lymph nodes is a significant prognostic factor for both disease recurrence and overall survival in specimens with more than ten harvested lymph nodes, and that the length of the specimen is a strong and independent predictor of the number of harvested lymph nodes.^{29,30}

In our experience, we were able to perform correct R1 right colectomy for cecal and ascending colon cancer and R2 right colectomy in case of carcinoma of the hepatic flexure, easily indentifying the major colic vessels and carrying out accurate lymphadenectomy over the plane of the SMx, taking advantage of the steady, 3-D image view and of the articulation (Endowrist®) of the robotic instruments, which allowed us to manage organs such as the pancreas or the duodenum gently, especially in narrow spaces. The average length of the resected specimen in this series was 26.7 ± 8 cm, and the mean number of harvested lymph nodes was 18.76 ± 7.2 , above the minimum recommended by the AJCC. pN status was indeed determined based on an adequate number of harvested lymph nodes for each disease stage. Considering LNR as a useful independent prognostic factor, it is evident that the number of retrieved lymph nodes should be as large as possible to avoid risk of stage migration. Our observation is that robotic technique could allow better standardization, leading to improved performance of minimally invasive right colic resection, especially in terms of achieving correct lymphatic resection in a high fraction of cases.

In our opinion, these results essentially show the adequacy of robotic technique to achieve oncologically correct right colic resection.

We report median follow-up of 36 months. Disease-free and overall survival were 90% and 92%, respectively; survival rates for stage II and III was 94.1% and 92.3%, and disease-free survival was 100% and 93%, respectively (Fig. 3).

Recent studies have shown 3-year overall survival varying from 68% to 100% for stage II and from 68% to 97% for stage III, and 5-year survival rates for stage II and III of about 72–90% and 44–72%, respectively.^{31–34} Comparison of our results with the literature shows that robotic right colic resection is able to offer the same short-term outcome as right colic resection performed by conventional laparoscopy or laparotomy.

Although the limited number of patients enrolled and probably the time-lag of the follow-up may represent the main limitations of our study, our results may be considered as the first report focused on feasibility and

oncological adequacy of this new approach for treatment of right-sided colon cancer.

Postoperative outcome was acceptable: first flatus and oral resumption were quickly achieved without any complications. However, median operative time was 223.50 min, which is quite long compared with laparoscopic and open approaches as widely reported in the literature. This could be justified by three independent factors: docking time, the learning curve, and intracorporeal fashioning of the anastomosis. The first of these required short training in the first cases for optimal assessment, whereas the second of these was completed during the first phase of the experience. Moreover, in our experience, systematic application of robotic technique even in other procedures could help shorten the learning curve for right colic resection. In the final cases, indeed, docking time and robot time were significantly reduced, confirming that adequate preparation and continuous team training are essential to improve performance in robotic surgery (Fig. 4).

FIG. 4 Learning curve for robotic right colectomy

We performed extracorporeal anastomosis (EA) in the first five cases of our experience. This choice was justified in the first phase of the experience during the initial development of the learning curve. In case 5 we experienced twisting of the mesentery after having completed the EA. Therefore, we chose to routinely perform intracorporeal anastomosis (IA) starting from case 6, taking advantage of the robotic features for fashioning of hand-sewn sutures.

In the literature there are few reports comparing outcomes based on different anastomotic techniques in minimally invasive procedures for colon cancer. Only four studies describe experience with intracorporeal laparoscopic anastomosis in right colectomies.^{35,36} Franklin et al. reported 82 laparoscopic right colectomies with IA, showing its safety and feasibility.³⁷ Bergamaschi et al. reported their experience in terms of short-term outcome of 111 right colectomies with totally stapled IA, concluding that it is potentially faster and easy to perform but can increase risk of inadvertent stricture caused by posterior bowel wall involvement during the stapling procedure.³⁸ Hellan et al. reported a series of 80 patients submitted to right laparoscopic colectomy for right colon cancer. In this experience, they compared 57 EA and 23 IA, registering anastomotic-related morbidity in 4 patients (7%) of the EA group versus 1 (4.3%) patient of the IA group. However, they experienced longer operative time in the IA group.³⁵

We did not experience any complications related to robot-assisted handsewn IA, which was easily performed without additional stress for the surgeon and without any bowel trauma possibly caused by gross manipulation. These two considerations lead us to believe that the da Vinci[®] surgical system is highly suitable for performance of microsutures and anastomoses and that the intracorporeal approach avoids the risk of preternatural tension and twisting of the mesentery which may occur in the extracorporeal approach.^{35, 38,39}

The intracorporeal technique has the potential advantage, in addition, of allowing the surgeon to choose the optimal abdominal location for harvesting the specimen and consequently to perform a smaller skin incision. Some studies reported the rate of incisional hernia after midline laparotomy, ranging between 2% and 20%, while others reported a 2% rate after a Pfannenstiel incision.^{40–42} In the present series we always performed a Pfannenstiel incision, which is currently our favored choice, and we did not experience any incisional hernias or wound infections.

CONCLUSIONS

Our experience has demonstrated the safety and technical feasibility of using the da Vinci[®] system to perform

oncologically adequate right colectomy. The advantages of robotic technique may lead to better standardization of the procedure and further dissemination of the minimally invasive approach for treatment of right colon cancer. However, further investigations and randomized clinical trials (RCTs) are needed to establish the effective role of robotic assistance in minimally invasive treatment of right-sided colon cancer.

DISCLOSURE Authors report no financial and/or commercial interests or potential conflicts of interest.

REFERENCES

- Koopmann MC, Heise CP. Laparoscopic and minimally invasive resection of malignant colorectal disease. *Surg Clin North Am*. 2008;88:1047–72.
- Law WL, Lee YM, Choi HK, et al. Impact of laparoscopic resection for colorectal cancer on operative outcomes and survival. *Ann Surg*. 2007;245(1):1–7.
- Stage JG, Schulze S, Moller P, et al. Prospective randomized study of laparoscopic versus open colonic resection for adenocarcinoma. *Br J Surg*. 1997;84(3):391–6.
- Lacy AM, Garcia-Valdecasas JC, Delgado S, et al. Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomised trial. *Lancet*. 2002;359(9325):2224–9.
- Guillou PJ, Quirke P, Thorpe H, et al. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet*. 2005;365(9472):1718–26.
- Jayne DG, Guillou PJ, Thorpe H, et al. Randomized trial of laparoscopic-assisted resection of colorectal carcinoma: 3-year results of the UK MRC CLASICC trial group. *J Clin Oncol*. 2007;25(21):3061–8.
- Fleshman J, Sargent DJ, Green E, et al. Laparoscopic colectomy for cancer is not inferior to open surgery based on 5-year data from the COST study group trial. *Ann Surg*. 2007;246(4):655–62.
- Nelson H, Sargent DJ, Wieand HS, et al. A comparison of laparoscopically assisted and open colectomy for colon cancer. Clinical Outcomes of Surgical Therapy Study Group. *N Engl J Med*. 2004;350(20):2050–9.
- Veldkamp R, Kuhry E, Hop WC, et al. Laparoscopic surgery versus open surgery for colon cancer: short-term outcomes of a randomised trial. *Lancet Oncol*. 2005;6(7):477–84.
- US Food and Drug Administration (FDA). FDA clearance. Available: <http://www.intuitivesurgical.com/products/fdaclearance/index.aspx>. Accessed 6 April 2010.
- Ballantyne GH, Merola P, Weber A, Wasielewski A. Robotic solutions to the pitfalls of laparoscopic colectomy. *Osp Ital Chir*. 2001;7:405–12.
- Weber PA, Merola S, Wasielewski A, Ballantyne GH. Telero-botically-assisted laparoscopic right and sigmoid colectomies for benign disease. *Dis Colon Rectum*. 2002;45:1689–94.
- Delaney CP, Lynch AG, Senagore AJ, Fazio VW. Comparison of robotically performed and traditional laparoscopic colorectal surgery. *Dis Colon Rectum*. 2003;46:1633–9.
- Giulianotti PC, Coratti A, Angelini M, Sbrana F, Cecconi S, Balestracci T, et al. Robotics in general surgery: personal experience in a large community hospital. *Arch Surg*. 2003;138(7):777–84.

15. National Comprehensive Cancer Network (NCCN). Available: http://www.nccn.org/professionals/physician_gls/PDF/colon.pdf. Accessed 6 April 2010.
16. Piazza L, Caragliano P, Scardilli M, Sgroi AV, Marino G, Giannone G. Laparoscopic robot-assisted right adrenalectomy and left ovariectomy (case reports). *Chir Ital.* 1999;51(6):465–6.
17. Reichenspurner H, Boehm DH, Gulbins H, et al. Three-dimensional video and robot-assisted port-access mitral valve operation. *Ann Thorac Surg.* 2000;69(4):1176–81.
18. Kappert U, Cichon R, Schneider J, et al. Closed-chest coronary artery surgery on the beating heart with the use of a robotic system. *J Thorac Cardiovasc Surg.* 2000;120(4):809–11.
19. Gill IS, Sung GT, Hsu TH, Meraney AM. Robotic remote laparoscopic nephrectomy and adrenalectomy: the initial experience. *J Urol.* 2000;164(6):2082–5.
20. Chen CC, Falcone T. Robotic gynecologic surgery: past, present, and future. *Clin Obstet Gynecol.* 2009;52(3):335–43.
21. Rawlings AL, Woodland JH, Crawford DL. Telerobotic surgery for right and sigmoid colectomies: 30 consecutive cases. *Surg Endosc.* 2006;20(11):1713–8.
22. Spinoglio G, Summa M, Priora F, Quarati R, Testa S. Robotic colorectal surgery: first 50 cases experience. *Dis Colon Rectum.* 2008;51(11):1627–32.
23. Erlichman C, Fine S, Wong A, Elhakim T. A randomized trial of fluorouracil and folinic acid in patients with metastatic colorectal carcinoma. *J Clin Oncol.* 1988;6:469–75.
24. Dukes CE, Bussey HJ. The spread of rectal cancer and its effect on prognosis. *Br J Cancer.* 1958;12:309–20.
25. Newland RC, Chapuis PH, Pheils MT, MacPherson JG. The relationship of survival to staging and grading of colorectal carcinoma: a prospective study of 503 cases. *Cancer.* 1981;47:1424–29.
26. Chapuis PH, Dent OF, Fisher R, et al. A multivariate analysis of clinical and pathological variables in prognosis after resection of large bowel cancer. *Br J Surg.* 1985;72:698–702.
27. Greene FL, Page DL, Fleming ID, et al. American Joint Committee on Cancer staging manual. Sixth Edition. New York: Springer-Verlag, 2002.
28. Kobayashi H, Ueno H, Hashiguchi Y, Mochizuki H. Distribution of lymph node metastasis is a prognostic index in patients with stage III colon cancer. *Surgery.* 2006;139(4):516–22.
29. Shen SS, Haupt BX, Ro JY, Zhu J, Bailey HR, Schwartz MR. Number of lymph nodes examined and associated clinicopathologic factors in colorectal carcinoma. *Arch Pathol Lab Med.* 2009;133(5):781–6.
30. Berger AC, Sigurdson ER, LeVoyer T, et al. Colon cancer survival is associated with decreasing ratio of metastatic to examined lymph nodes. *J Clin Oncol.* 2005;23(34):8706–12.
31. Gattaj G, Ciccolallo L. Differences in colorectal cancer survival between European and US populations: the importance of sub-site and morphology. *Eur J Cancer.* 2003;39:2214–22.
32. Roxburgh CS, Salmond JM, Horgan PG, Oien KA, McMillan DC. The relationship between the local and systemic inflammatory responses and survival in patients undergoing curative surgery for colon and rectal cancers. *J Gastrointest Surg.* 2009;13:2011–8.
33. Cancer Statistics in Japan: Colon Cancer (1985–1996). National Cancer Center. <http://www.ncc.go.jp/en/statistics/1999/figures/f10-2.html>. Accessed 6 April 2010.
34. Overview: colon and rectum cancer: how is colorectal cancer treated? American Cancer Society 2006. Available at: http://www.cancer.org/docroot/CRI/content/CRI_2_2_4X_How_Is_Colorectal_Cancer_Treated.asp?sitearea=. Accessed 6 April 2010.
35. Hellan M, Anderson C, Pigazzi A. Extracorporeal versus intracorporeal anastomosis for laparoscopic right hemicolectomy. *JSLs.* 2009;13(3):312–7.
36. Raftopoulos I, Courcoulas AP, Blumberg D. Should completely intracorporeal anastomosis be considered in obese patients who undergo laparoscopic colectomy for benign or malignant disease of the colon? *Surgery.* 2006;40:675–82.
37. Franklin ME Jr, Gonzalez JJ Jr, Miter DB, et al. Laparoscopic right hemicolectomy for cancer: 11-year experience. *Rev Gastroenterol Mex.* 2004;69 Suppl 1:65–72.
38. Bergamaschi R, Schochet E, Haughn C, Burke M, Reed JF, Arnaud JP. Standardized laparoscopic intracorporeal right colectomy for cancer: short-term outcome in 111 unselected patients. *Dis Colon Rectum.* 2008;51(9):1350–55.
39. Young-Fadok TM, Nelson H. Laparoscopic right colectomy: five-step procedure. *Dis Colon Rectum.* 2000;43:267–71.
40. Höer J, Lawong G, Klinge U, Schumpelick V. Factors influencing the development of incisional hernia. A retrospective study of 2,983 laparotomy patients over a period of 10 years. *Chirurg.* 2002;73:474–80.
41. Halm JA, Lip H, Schmitz PI, Jeekel J. Incisional hernia after upper abdominal surgery: a randomised controlled trial of mid-line versus transverse incision. *Hernia.* 2009;13:275–80.
42. Luijendijk RW, Jeekel J, Storm RK, Schutte PJ, Hop WC, Drogendijk AC, Huikeshoven FJ. The low transverse Pfannenstiel incision and the prevalence of incisional hernia and nerve entrapment. *Ann Surg.* 1997;225:365–9.