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Robotic versus open total mesorectal excision for rectal cancer: Comparative study of short and long-term outcomes

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Abstract

Background: Despite the several series in which the short-term outcomes of robotic-assisted surgery were investigated, data concerning the long-term outcomes are still scarce.

Methods: The prospectively collected records of 65 consecutive patients with extraperitoneal rectal cancer who underwent robotic total mesorectal excision (RTME) were compared with those of 109 consecutive patients treated with open surgery (OTME). Patient characteristics, pathological findings, local and systemic recurrence rates and 5-year survival rates were compared.

Results: There were no statistically significant differences in postoperative complications, reoperation and 30-day mortality. There were significant differences comparing groups: number of lymph nodes harvested (RTME: 20.1 vs. OTME: 14.1, $P < 0.001$), estimated blood loss (RTME: 0 vs. OTME: 150 ml, $P = 0.003$), operation time (RTME: 299.0 vs. OTME: 207.5 min, $P < 0.001$) and length of postoperative stay (RTME: 6 vs. OTME: 9 days, $P < 0.001$). The rate of circumferential resection margin involvement and distal resection margin were not statistically different between groups. There were no statistically significant differences at the 5-year follow-up: overall survival, disease-free survival and cancer-specific survival. The cumulative local recurrence rate was statistically lower in the robotic group (RTME: 3.4% vs. OTME: 16.1%, $P = 0.024$).

Conclusion: RTME showed a significant reduction in local recurrence rate and a higher, although not statistically significant, long-term cancer-specific survival with respect to OTME. Prospective randomized studies are needed to confirm or deny significantly better local control rates with robotic surgery.

Keywords: Robotic surgery; Total mesorectal excision; Low anterior resection; Rectal cancer; Colorectal surgery; Long term outcomes; Comparative study; Minimally invasive surgical procedures

Introduction

The last century has witnessed significant progress in the management of colorectal cancer (CRC).[1] From the oncologic point of view the standardization of the total mesorectal excision (TME) proposed by Heald in the 1980s was undoubtedly the greatest advance in the surgical treatment of rectal cancer.[2] More recently, the introduction of minimally-invasive surgery represented another important improvement in the management of rectal cancer. During the two last decades it was demonstrated that laparoscopic total mesorectal excision (LTME) is associated with better short-term results in comparison to open surgery (OS).[3] However, LTME is a technically challenging procedure.[4] Large controlled series of patients with rectal cancer treated with laparoscopic surgery (LS) have demonstrated higher

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rates of conversion and alarming rates of circumferential resection margin involvement.[3,5,6]

The application of robotic surgery (RS) systems in the treatment of CRC at the beginning of this century was perceived as the way to overcome the technical limitations imposed by LS and to optimize its surgical outcomes.[7] In the USA, Europe and the Far East, groups with considerable RS experience have standardized techniques of robotic TME (RTME).[8–13] Comparative studies have shown that short-term outcomes of RTME are equivalent to, or in some cases even better than open TME (OTME) and LTME.[14–19] However, few groups have investigated the long-term outcomes of RTME in terms of local and systemic recurrence and overall as well as disease-free survival.[20,21] This study compares the short-term and long-term outcomes of patients with extraperitoneal rectal cancer submitted to RTME and OTME.

Patients and methods

Groups of patients

The prospectively collected records of 65 consecutive patients with extraperitoneal rectal cancer who underwent RTME from December 2006 to December 2010 were compared to 109 consecutive patients treated with OTME from January 2004 to November 2006. Extraperitoneal rectal cancer was defined as biopsy-proven adenocarcinoma within 10 cm from the anal verge.[22] Patients who had tumor with intestinal obstruction or perforation, early rectal cancer resectable with transanal access, or distant metastasis were excluded from the analysis.

Preoperative workup and neoadjuvant treatment

Preoperative workup consisted of physical examination, complete blood count, liver tests, serum carcinoembrionic antigen (CEA); colonoscopy, chest X-ray and/or computed tomography (CT); abdominopelvic CT; endorectal US and/or pelvic magnetic resonance imaging. Patients were staged according to the TNM Classification (seventh edition) of the American Joint Committee on Cancer (AJCC) Staging Manual.[23] Patients with locally advanced disease (cT3-4 and/or cN1-2) were administered long-course preoperative chemoradiotherapy (45–50.4 Gy divided into 25–28 fractions over five weeks and systemic 5-fluorouracil based chemotherapy in the first and fifth week of radiation). Surgery was performed within 8 weeks from the end of chemoradiotherapy (CRT). Extensive explanations of the treatment were provided and informed consent was obtained from each patient before the surgical procedure.

Surgical technique

All procedures followed the same surgical principles as those for the management of extraperitoneal rectal cancer. The inferior mesenteric vessels were separately divided at their origin. Total mesorectal excision was performed under direct vision with sharp dissection to the level of the pelvic floor. Care was always taken to preserve the components of the autonomic nerve plexus during both vascular ligation and pelvic dissection. Total mesorectal excision was carried out in all patients. A sphincter-saving procedure was proposed for all patients whenever adequate resection margins could be obtained and an appropriate anorectal stump was present for anastomosis In the case of low anterior resection the rectum was transected at the level of the pelvic floor and a straight or a lateral-to-end anastomosis was created using a mechanical circular stapler. Patients with very low rectal cancers extending close to the internal sphincter or with the distal rectal stump too short for an intracorporeal stapled anastomosis, underwent intersphincteric dissection with an external handsewn coloanal anastomosis. Abdominoperineal amputation of the rectum (AAR) was performed whenever an adequate distal resection margin could not be assured. The same pathological parameters of resection adequacy were routinely applied in both groups, as previously recommended elsewhere: distal resection margin of at least 2 cm, negative circumferential resection margin (CRM), complete mesorectal excision and harvesting of 12 or more lymph nodes.

Robotic surgery group

All the procedures were carried out with the aid of the Da Vinci S surgical system (Intuitive Surgical®, Sunnyvale, CA, USA) and performed by two experienced surgeons with postgraduate specialist training in colorectal surgery (RB and FL). The full robotic technique previously reported by the authors was employed in all cases.[10]

Open surgery group

All operations were performed by the same surgical team led by one of five senior surgeons with postgraduate specialist training in colorectal surgery (BA, RB, AC, UP and FL).

Postoperative management, adjuvant treatment and follow-up

Postoperative management was conducted in accordance with institutional guidelines. Pathologic examination included the tumor and nodal status, distal resection margin (DRM) and CRM, pathologic post-CRT response and number of lymph nodes harvested. When traditional dissection failed to identify an adequate number of lymph nodes (>12), an enhancing lymph node technique with Carnoy solution was used. The final treatment plan for all patients was decided at a weekly multidisciplinary consensus meeting with surgeons, medical oncologists, radiotherapists, endoscopists and radiologists. Whenever indicated, adjuvant chemotherapy lasted 4–6 months and consisted of regimens containing 5-fluorouracil (5-FU) or