Short-term and long-term outcome after laparoscopic elective radical rectal cancer resection in octogenarians: is it really a safe procedure?

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Purpose: The aim of our study is to assess short-term and long-term outcomes after laparoscopic radical rectal cancer resection in octogenarians compared with those in patients 60 years old or younger.

Methods: Using a prospectively collected database of laparoscopic colorectal resections by a single surgeon from March 2001 to December 2012, we retrospectively reviewed 49 octogenarian rectal cancer patients and 63 younger counterparts.

Results: The American Society of Anesthesiologists (ASA) score (P < 0.001), history of previous abdominal surgery (P = 0.019), preoperative prevalence of other malignancy (P = 0.001), perioperative transfusion (P = 0.032), and cardiorespiratory comorbidities (P < 0.001) were significantly higher in octogenarians. No difference existed between two groups in terms of preoperative chemoradiation rate, surgical procedures, distal and radial resection margin, harvested lymph node number, and tumor node metastasis (TNM) staging. The rates of at least one complication (P = 0.019), postoperative ileus (P = 0.006) and cardiopulmonary complication (P = 0.021) were higher in octogenarians, but rates of leakage and reoperation were not high. During median follow-up of 53 months, one pelvic recurrence developed in octogenarians. The overall 5-year survival rate was 63.9% in octogenarians and 93.7% in younger patients (P < 0.001). Two-year disease free survival rate for pathologic stage III in octogenarians was 51.0%, much lower (P = 0.008), but not so for stage 0-II than in younger patients.

Conclusion: Octogenarian rectal cancer patients have more preoperative comorbidities and the benefit of laparoscopic rectal resection was still limited for reducing cardiopulmonary complication. More sophisticated preoperative assessment should be needed to find out very frail patients and less invasive alternative treatment should be taken into consideration for them.

Keywords: Rectal cancer, Octogenarian, Laparoscopic surgery, Surgical outcome

INTRODUCTION

Although radical surgical resection remains the most effective treatment for colorectal cancer, there is no consensus about the optimal surgical resection of elderly patients, who are heterogeneous from very fit to very frail individuals [1]. The incidence of rectal cancer increases with age, reaching a peak at around the age of 80 years [2,3] and in the past two decades, laparoscopic surgery for colorectal disease has become popular. Some recent studies have shown that laparoscopic colorectal surgery in the elderly could be safely performed without increasing postoperative mortality or morbidity, compared with open approach [4-6] and even laparoscopic approach in younger counterparts [7-9]. However, these studies included both benign and malignant cases, considered colon and rectal surgery together, and had little specific information about elderly patients with rectal cancer who had undergone laparoscopic radical rectal resection and their long-term outcome.

Therefore, a selective analysis of laparoscopic radical resection for rectal cancer in the elderly patients remains to be performed. We retrospectively reviewed short-term and long-term outcomes from a single surgeon’s team experience with laparoscopic radical rectal
cancer resection in octogenarians compared with those in patients 60 years old or younger.

METHODS

Eligibility and enrollment
Using a prospectively collected database of laparoscopic colorectal surgery from March 2001 to December 2012, we identified 49 octogenarian rectal cancer patients and reviewed the results of them compared with those of 63 patients 60 years old or younger. Data collected from the hospital database and medical records were analyzed retrospectively. Patients who did not give informed consent for laparoscopic surgery were excluded from the study. Patients who had multiple previous abdominal surgeries or a previous left sided colectomy were also excluded. But, patients for all tumor stages were eligible for laparoscopic resection even though the adjacent organs or structures were suspected to be infiltrated by rectal tumor as reported previous study elsewhere [10]. Rectal cancer is defined as a tumor of which the lower margin is within 15 cm of the anal verge.

Surgery and follow-up
For all the patients, preoperative staging was based on following procedures; colonoscopy with biopsy of the tumor, barium enema, computed tomography (CT) of the abdomen and pelvis, trans–rectal ultrasonography, rectal magnetic resonance imaging (MRI), and chest radiography and CT of chest or positron emission tomography (PET) if needed.

If some advanced rectal cancer patient was classified as eligible for the curative group and had no evidence of unresectable distant metastases, he or she had preoperative chemoradiation therapy (CRT) with either 5–fluorouracil (5–FU) or capecitabine (Xeloda, Roche, Seoul, Korea) and radiation therapy with 4,500 to 5,040 cGy. These patients were as follows T3/T4 and/or N (+) rectal cancer, lateral lymph node positive rectal cancer. The operation was scheduled to be performed 6 to 8 weeks after completion of preoperative CRT.

A single surgeon (HSL) team performed all the surgical procedures following the same oncologic and clinical principles for both groups. The laparoscopic approach was usually performed using 5 ports and medial–to–lateral dissection and consisted of high ligation of the inferior mesenteric artery, total mesorectal excision (TME) as appropriate, and sometimes multivisceral resection for correct clearance of the specimen’s margin. The details have been presented elsewhere [10]. Open conversion was defined as completion of mobilization and ligation of vessels through either an enlarged incision or an abdominal incision larger than 8 cm.

During the follow-up period, physical examination and carcinoembryonic antigen (CEA) and cancer antigen 19–9 (CA 19–9) assays were performed every 3 months. In addition, CT scan of the abdomen and pelvis and chest X-ray were done every 6 months. Colonoscopy was performed at the first-year follow-up assessment, followed within 5–years and additional imaging was sometimes requested based on the clinical suspicion of recurrence.

Complications
Cardiopulmonary complications included ischemic heart disease and pneumonia. Anastomotic leak was defined as clinical and radiologic leaks combined together. Postoperative ileus was defined as the absence of bowel function, dilated air-filled loops of small and large bowel in abdominal radiographies and the need for reinsertion of a nasogastric tube after starting oral diet. We defined wound infection as case of patient who had painful wound with hyperemic change and underwent open drainage.

Statistics
Statistical analysis was performed by appropriate tests (i.e., chi-square and Mann–Whitney U tests) using the SPSS ver. 18.0 (SPSS, Chicago, IL, USA). Survival curves were generated using the Kaplan–Meier method, and the difference between curves was assessed by the log–rank test. A P-value less than 0.05 was set as the statistically significant level.

RESULTS
Demographics of patients were showed in Table 1. Octogenarians had higher American Society of Anesthesiologists (ASA) score (P < 0.001), more history of previous abdominal operation (P = 0.019), more preoperative prevalence of other malignancy (P = 0.001), and higher perioperative transfusion rate (P = 0.032). However body mass index (BMI) (P = 0.003) and initial serum hemoglobin level (P < 0.001) were significantly lower. Octogenarians showed higher prevalence of cardiovascular disease and cerebrovascular disease (P = 0.032 and P < 0.001).

Tumor location and rate of preoperative CRT were similar. No difference existed between the two groups in terms of surgical procedures, pathologic staging, number of lymph nodes harvested, the length of distal margin and the rate of positive circumferential resection margin. There was no open conversion in both groups. In younger patients group, the operation time was longer and blood loss was more (P = 0.022 and P = 0.028). When patients who received preoperative CRT were excluded, the proportion of those who received adjuvant chemotherapy for pathologic stage III was significantly lower in octogenarians (8 of 15 vs. 19 of 20, P = 0.004) (Table 2).
Patients in octogenarians experienced a later first flatus (3.6 days vs. 2.9 days, \(P = 0.013\)), but there was no difference in 1st diet and hospital stay. The 30-day postoperative complications were detailed in Table 3. The rate of at least one complication in octogenarians was higher than in the younger group (42.86% vs. 22.22%, \(P = 0.019\)). The anastomotic leak rate and reoperation rate showed no difference in both groups. Three patients in the octogenarians required reoperation due to small bowel obstruction (\(n = 2\)) and anastomotic leak (\(n = 1\)). Two patients had reoperation because of anastomotic leak in the younger group. Postoperative ileus developed more frequently in octogenarians than in the younger patients (24.49% vs. 6.35%, \(P = 0.006\)). All four cardiopulmonary complications developed in octogenarians (8.16% vs. 0.00%, \(P = 0.021\)). There were two deaths only in octogenarians, one was caused by myocardial infarction on the 2nd postoperative day and the other died from ischemic heart disease on the 25th postoperative day after reoperation for small bowel obstruction.

We were able to check up whether patient survived or not in all but one younger patient who was followed up without recurrence until 31 months after surgery. The median follow-up period after curative resection was 20.5 months (range, 1 to 99 months) for the octogenarians and 78 months (range, 3 to 138 months) for the younger patients. We found one pelvic recurrence in octogenarian group. With curative resection, the overall observed 5-year survival rate was 63.9% in the octogenarians, much lower than 93.7% in younger patients (\(P < 0.001\)) (Fig. 1). Two-year disease-free survival (DFS) rate was 69.5% in the octogenarians, lower than 96.2% in the younger patients (\(P = 0.004\)) (Fig. 2). For pathologic stage 0-I, there was no recurrence and death within 2 years after operation in both groups. 2-year DFS rates remained similar between the two groups when patients were compared for pathologic stage II (\(P = 0.173\)) (Fig. 3). However, in pathologic stage III octogenarians, 2-year DFS rate was much lower (51% vs. 90.9%, \(P = 0.008\)) (Fig. 4).

**DISCUSSION**

Although radical surgical resection remained the most effective treatment for colorectal cancer, various reports showed that conventional open colorectal surgery in the elderly was associated with increased mortality and morbidity [11-13]. Moreover, overall survival was not improved in the elderly rectal cancer patients after introduction of preoperative radiotherapy and TME surgery because non-cancer related mortality was a significant problem [14].

During past two decades since the introduction of laparoscopy in the surgical community, laparoscopic approach for colorectal disease has become popular because of the benefits of reduced surgical trauma leading to decreased morbidity, decreased pain, faster recovery, shorter hospital stay, and possibly reduced immunosup-

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**Table 1. Demographics of patients**

| Variable                          | Age ≥ 80 yr (n = 49) | Age ≤ 60 yr (n = 63) | P-value |
|-----------------------------------|----------------------|----------------------|---------|
| Mean age (yr), median (range)     | 82, 81 (80-89)       | 57, 58 (45-60)       | < 0.001*|
| Sex (male:female)                 | 45:4                 | 55:8                 | 0.441   |
| Mean BMI (kg/m²), median (range)  | 22.1, 22.3 (16.4-28.4) | 23.9, 24.0 (17.0-32.0) | 0.003* |
| Previous abdominal operation (%)  | 21 (43)              | 14 (22)              | 0.019*  |
| Other malignancy (%)              | 10 (20.4)            | 1 (1.5)              | 0.001*  |
| Initial Hemoglobin level (range) (g/dL) | 11.3 (3.6-15.6)       | 13.2 (7.4-16.4)      | < 0.001*|
| Perioperative blood transfusion (%) | 12 (24.5)            | 6 (9.5)              | 0.032*  |
| ASA score                         |                      |                      | < 0.001*|
| I/II                              | 18                   | 58                   |         |
| III                               | 27                   | 5                    |         |
| IV                                | 4                    | 0                    |         |
| Comorbidities                     |                      |                      |         |
| HTN & cardiovascular disease      | 31                   | 27                   | 0.032*  |
| Respiratory disease               | 19                   | 2                    | < 0.001*|
| Diabetes mellitus                 | 13                   | 15                   | 0.741   |
| Cerebrovascular disease           | 10                   | 7                    | 0.194   |
| Other disease                     | 14                   | 5                    | 0.004*  |
| Preoperative CRT (%)              | 14 (28.5)            | 16 (25.3)            | 0.707   |
| Tumor height (cm, from AV), mean (range) | 7.9 (2-15)            | 8.0 (1.5-15)         | 0.892   |

BMI, body mass index; ASA, American Society of Anesthesiologists; HTN, hypertension; CRT, chemoradiation therapy.

*\(P < 0.05\).
pression. Some recent studies have shown that laparoscopic colorectal surgery in the elderly can be safely performed with acceptable morbidity compared with open approach and even laparoscopic approach in younger counterparts and suggested that laparoscopic approach is the better choice for the elderly patients [7-9,15].

We authors would like to know whether laparoscopic radical rectal resection can be extrapolated to the octogenarian rectal cancer patient as a standard practice or it needs to be modified. Therefore, we evaluated the short-term and long-term outcome of laparoscopic rectal cancer resection in octogenarians comparing with those of younger counterparts.

In this study, octogenarian group had unfavorable conditions such as higher ASA score (P<0.001), more history of previous abdominopereineal operation (P=0.019), higher prevalence of other malignancies (20.4% vs. 1.5%, P=0.001) and anemia (mean Hb level 11.3 vs. 13.2, P<0.001) with perioperative transfusion (P=0.032), and more cardiorespiratory comorbidities (P=0.032, P<0.001). In terms of surgical quality, octogenarian patients showed no difference in the surgical procedures, length of distal resection margin, positive circumferential margin rate, and number of lymph node harvested and also less blood loss and shorter operation time, which might be explained by small number of multivisceral resection and subtotal proctocolectomy.

Some studies showed no difference of overall morbidity between elderly and younger groups [7,15,16]. However, these results had some limitations such as selection bias that elderly group showed low proportion of high ASA score, preoperative chemoradiation, and

### Table 2. Operative findings

| Variable                              | Age ≥ 80 yr (n = 49) | Age ≤ 60 yr (n = 63) | P-value |
|---------------------------------------|----------------------|----------------------|---------|
| Laparoscopic procedure                | 0.633                |                      |         |
| Low anterior resection                 | 37 (2)               | 47 (3)               |         |
| Anterior resection                    | 5                    | 5                    |         |
| APR or Hartmann operation             | 7 (1)                | 9 (4)                |         |
| Total or subtotal proctocolectomy     | 0                    | 2                    |         |
| Operation time (min)                  | 245                  | 284                  | 0.022*  |
| Estimated blood loss (mL)             | 114                  | 194                  | 0.028*  |
| Diverting stoma (%)                   | 17 (40)              | 11 (19)              | 0.069   |
| Open conversion                       | 0                    | 0                    |         |
| Number of lymph node harvested        | 22; 20 (3-59)        | 22; 20 (7-64)        | 0.964   |
| Length of distal resection margin     | 3.0; 2.9 (0.7-9.0)   | 3.4; 3 (0.3-10.0)    | 0.226   |
| Positive circumferential margin (%)   | 2 (4)                | 2 (3)                | 0.827   |
| T stage (yp)                          |                      |                      | 0.319   |
| Tis                                   | 3 (2)                | 4                    |         |
| T1                                    | 6                    | 8 (3)                |         |
| T2                                    | 9 (3)                | 12 (2)               |         |
| T3                                    | 23 (9)               | 19 (5)               |         |
| T4                                    | 8                    | 20 (6)               |         |
| N stage (yp)                          | 0.746                |                      |         |
| N0                                    | 31 (10)              | 35 (8)               |         |
| N1                                    | 10 (4)               | 14 (4)               |         |
| N2                                    | 8                    | 13 (4)               |         |
| Pathologic stage                      | 0.359                |                      |         |
| 0 (CR)                                | 3 (2)                | 1                    |         |
| I                                     | 12 (1)               | 21 (5)               |         |
| II                                    | 15 (5)               | 12 (2)               |         |
| III                                   | 16 (5)               | 23 (7)               |         |
| IV                                    | 3 (1)                | 6 (2)                |         |

APR, abdominopereineal resection; CR, complete remission.

*Multivisceral resection [10]; en bloc removal of any organ or structure to which the primary tumor was adherent including seminal vesicles, prostate, posterior wall of bladder, lateral lymph node or coccyx.

*P < 0.05.
advanced tumor stage, which were reported risk factors affecting postoperative morbidity for rectal cancer [17,18]. In the multicenter study by Scheidbach et al. [19], overall morbidity was higher in elderly patients than in younger patients, mainly because of cardiopulmonary complications, not surgical complications. Our results were very similar except higher postoperative ileus, which might be explained by higher preoperative abdominal surgery history and delayed physiological bowel functional recovery in octogenarian. In terms of cardiopulmonary complication on which we are focusing, several studies had suggested that the benefit of laparoscopic colorectal approach in elderly patients may be associated with the reduction of cardiopulmonary complications compared with open approaches [4,5,15]. In our study, four cardiopulmonary complication
devolved only in octogenarians (8.16% vs. 0.00%, P = 0.021) and two of them were associated with death. The benefit of laparoscopic approach for octogenarian rectal cancer patient was not enough for decreasing cardiopulmonary complications, which was associated with mortality. These results were compatible with the report by

### Table 3. Postoperative course and complications

| Variable                  | Age ≥ 80 yr (n=49) | Age ≤ 60 yr (n=63) | P-value |
|---------------------------|--------------------|--------------------|---------|
| Gas passing               | 3.6, 3 (1-8)       | 2.9, 3 (1-6)       | 0.013*  |
| Defecation                | 5.1, 5 (1-11)      | 5.2, 4 (1-16)      | 0.940   |
| Diet                      | 5.7, 6 (3-11)      | 6.2, 6 (2-14)      | 0.337   |
| Hospital stay             | 18, 13 (2-83)      | 20, 15 (4-118)     | 0.530   |

**Morbidity**

- At least one complication: 21 (42.86%) vs. 14 (22.22%), P = 0.019
- Cardiopulmonary: 4 (8.16%) vs. 0 (0.00%), P = 0.021*
- Anastomotic leak: 1 (2.44%) vs. 3 (5.55%), 0.440
- Postoperative ileus: 12 (24.49%) vs. 4 (6.35%), 0.006*
- Wound infection: 3 (6.12%) vs. 1 (1.59%), 0.199
- Urologic complications: 2 (4.08%) vs. 3 (4.76%), 0.860
- Miscellaneous: 3 (6.12%) vs. 2 (3.17%), 0.454
- Reoperation: 3 (6.12%) vs. 2 (3.17%), 0.454
- Readmission: 1 (2.04%) vs. 0 (0.00%), 0.255
- Mortality: 2 (4.08%) vs. 0 (0.00%), 0.106

Values are presented as mean, median (range) or number (%). *P < 0.05.

**Fig. 1.** Overall 5-years survival.

**Fig. 2.** Disease-free survival at 2-years of overall patients (stage 0 to III).

**Fig. 3.** Disease-free survival at 2-years in stage II.

**Fig. 4.** Disease-free survival at 2-years in stage III.
Scheidbach et al. [19] that postoperative mortality was higher in elderly patients than in the younger patients, but not significantly so. Rutten et al. [2] derived from the Dutch trial repeated that postoperative complications including anastomotic leakage, abscess, cardiopulmonary complication were more severe in elderly patients and its occurrence was associated with increased mortality [19]. Therefore, more sophisticated preoperative assessment should be needed to find out these very frail patients. And alternative treatments such as chemoradiation alone, chemoradiation with local excision or trans-anal minimal invasive surgery, and radiation alone should be taken into consideration for them.

As far as we know, no previous comparative study has reported survival results after laparoscopic curative rectal cancer resection in octogenarians. In this study, 5-year overall survival rate for octogenarians was 63.9%, significantly lower than 93.7% for the younger counterparts. This result is well in keeping with previous reports [14,16,20]. This discrepancy was explained by higher non-cancer related mortality in elderly patients, which developed in the early postoperative phase [14], though conditional relative survival does not change with age [21]. Owing to the relatively short duration of median follow-up of 20.5 months in octogenarians, we reviewed 2-year DFS rate. In octogenarian group, 2-year DFS rates for overall stage and particularly pathologic stage III were lower, but not so for pathologic stage 0-II than younger counterparts. It could be explained by that octogenarian group had lower adjuvant chemotherapy and radiation like other studies [7,16,20] and also it might be some effects on the survival that there were higher prevalence of other malignancy, lower BMI, more anemia along with perioperative blood transfusion. In our retrospective study for the experience of a single surgeon in one hospital, our octogenarian patients were less likely to receive adjuvant treatment like others [16,20]. Therefore, perioperative adjuvant chemoradiation treatment should be encouraged to improve DFS for stage III octogenarian patients, as far as patient’s condition permits.

In this retrospective study, we had statistical limitation due to small number of enrolled patients. Ideally, randomized and large volume multicenter studies for octogenarian rectal cancer patients are needed to prove the true value of laparoscopic approach.

The benefit of laparoscopic radical rectal cancer resection for octogenarians was limited for reducing cardiopulmonary complications. Therefore, more sophisticated preoperative assessment should be needed to find out these very frail patients. In addition, for these very frail octogenarians alternative treatments such as chemoradiation alone, chemoradiation with local excision should be taken into consideration.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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