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Risk factors for perineal wound infection after abdominoperineal resection of advanced lower rectal cancer

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HIGHLIGHTS

- NCRT is a risk factor for perineal wound infection after APR.
- Perineal wound infection was found in 19% of the cases after APR.
- Creativity is a key for a closure of the perineal wound infection after APR.

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ABSTRACT

Purpose: Abdominoperineal resection (APR) of advanced lower rectal cancer carries a high incidence of perineal wound infection. The aim of this study was to retrospectively evaluate risk factors for perineal wound infection after APR.

Methods: The study group comprised 154 patients who underwent APR for advanced lower rectal cancer in our department from January 1990 through December 2012. The following 15 variables were studied as potential risk factors for perineal wound infection: sex, age, body-mass index, American Society of Anesthesiologists score, diabetes mellitus, preoperative albumin level, preoperative hemoglobin level, neoadjuvant chemoradiotherapy(NCRT), surgical procedure (open surgery vs. laparoscopic surgery), operation time, bleeding volume, intraoperative transfusion, tumor diameter, invasion depth, and histopathological stage.

Results: Among the 154 patients, 30 (19%) had perineal wound infection. Univariate analysis showed that a hemoglobin level of $\leq$11 g/dL ($p = 0.001$) and NCRT ($p = 0.001$) were significantly related to perineal wound infection. On multivariate analysis including the preoperative albumin level ($\leq$3.5 g/dL) in addition to the above 2 variables, neoadjuvant chemoradiotherapy (NCRT) was the only independent risk factor for perineal wound infection. Perineal wound infection developed in 31% of patients who received NCRT, as compared with 10% of patients who did not receive NCRT. The relative risk of perineal infection in the former group was 4.092 as compared with the latter group ($p = 0.0002$).

Conclusions: NCRT is a risk factor for perineal wound infection after APR in patients with advanced lower rectal cancer.

1. Introduction

Abdominoperineal resection (APR) is used to treat conditions such as lower rectal cancer and anal canal cancer. APR is associated with a high incidence of postoperative complications, such as perineal wound infection, dehiscence, and refractory fistula [1].

Abbreviations: APR, Abdominoperineal resection; NCRT, Neoadjuvant chemoradiotherapy.

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Although such complications seriously compromise patients' quality of life, few studies have assessed the status of perineal wound infection after APR in Japan.

Perineal wound infection postoperatively develops in 10%–40% of patients who undergo APR [2,3]. General risk factors for postoperative wound infection include a high body mass index (BMI) [4], poor nutritional status [5], diabetes mellitus [6], and advanced age [7]. Surgical risk factors include a prolonged operation time [8], massive bleeding [9], and intraoperative blood transfusion [10]. To prevent wound infection, the duration of antimicrobial prophylaxis, preoperative bowel preparation, drain management, and surgical wound care should be considered. The development of wound infection causes pain and discomfort to patients, prolongs the hospital stay, and substantially increases healthcare costs. Our study demonstrated that preoperative chemoradiotherapy is a risk factor for perineal wound infection after abdominoperineal resection. Therefore, the advantages and disadvantages of currently available preoperative chemoradiotherapy for advanced lower rectal cancer should be reconsidered to establish new preventive measures. To more clearly define risk factors for perineal wound infection, we retrospectively studied patients who underwent a standard procedure for APR performed by the same team of surgeons in the same hospital and received a similar level of perioperative care.

2. Methods

The study group comprised 154 patients who underwent APR for advanced lower rectal cancer in our department from January 1990 through December 2012 (Table 1). This study was conducted only in the Department of Surgery, Kitasato University. There were no exclusion criteria for hospitals. This study was approved by the ethics committee of our hospital. Patients who underwent total pelvic exenteration or sacral resection were excluded. Perineal wound infection was evaluated according to the Guideline for Prevention of Surgical Site Infection, 1999. Patients who had pyorrhea or dehiscence of the perineal wound within 30 days after surgery were considered to have perineal wound infection.

The following 15 variables were studied as potential risk factors for perineal wound infection: sex, age, BMI, American Society of Anesthesiologists (ASA) score, diabetes mellitus, preoperative albumin level, preoperative hemoglobin level, neoadjuvant chemoradiotherapy, surgical procedure (open surgery or laparoscopy), operation time, bleeding volume, intraoperative blood transfusion, tumor diameter, invasion depth, and histopathological stage. In our study, no patient had rectal perforation. Ten patients had clinical T4 disease. After surgery, 2 patients were found to have pathological T4 disease. These patients were not excluded. Neoadjuvant chemoradiotherapy for clinical stage II to IV lower rectal cancer was started in January 2004.

Table 1
Demographic characteristics of patients.

	n = 154
Sex (male: female)	102(66%): 52(34%)
Age (years)	60.8(±10.6)
ASA score[a] (1: 2:3)	60(39%):86(56%):8(5%)
Diabetes mellitus (present: absent)	18(12%):136(88%)
Body mass index (kg/m^2)	22.2(±3.2)
NCRT[b](present: absent)	71(46%):83(54%)
Smoking (present: absent)	72(47%):82(53%)
Preoperative albumin level (g/dl)	3.9(±0.5)
Preoperative hemoglobin level (g/dl)	12.6(±2.1)
Surgical technique(open surgery:laparoscopic surgery)	139(90%):15(10%)
Operation time (min)	326.7(±83.2)
Bleeding volume (ml)	1051.9(±1182.6)
Blood transfusion (present: absent)	54(35%):100(65%)
Tumor diameter (cm)	5.1(±2.6)
pT (CR:1:2:3:4)	6(4%):2(1%):18(13%):124(81%):2(1%)
pStage (CR:I:II:III:IV)	6(4%):13(8%):57(37%):65(43%):13(8%)

[a] ASA:American society of anesthesiologists.
[b] NCRT:Neoadjuvant chemoradiotherapy.

A skin incision was made about 2 cm from the anal orifice, and the extent of resection included the anal sphincter. In our study, no patient underwent extralevator APR. As for perioperative care related to perineal wound closure, mechanical bowel preparation was performed on the day before surgery to reduce intraoperative contamination of the operative field by intestinal contents, and the anal opening was closed with a double purse-string suture immediately before surgery. All patients underwent mechanical bowel preparation. Mechanical bowel preparation was performed to prevent fecal contamination in the surgical field and to make it easier to perform surgical procedures. After proctectomy, the site of the perineal wound was washed with 3 L of warm physiological saline solution. Up to December 2003, the subcutaneous tissue of the wound was closed with a single-layer of interrupted absorbable monofilament sutures, and the skin was closed with vertical mattress sutures of the same material. From 2004 onward the skin was closed with subcuticular absorbable monofilament sutures. Since August 2006, the skin was closed with subcuticular absorbable monofilament sutures after washing the perineal wound with 1 L of warm physiological saline solution under high pressure. A closed silicone drain was placed in the floor of the lesser pelvis from the right or left hypogastric region and was removed when the drainage volume had reached 50 mL/day.

As for the antibiotic regimens during and after surgery, cefmetazole sodium was given in a dose of 1 g at the start of surgery. Additional doses were then given every 3 h and for 1–2 days after surgery.

2.1. Neoadjuvant chemoradiotherapy

2.1.1. Eligibility criteria

Eligible patients had to have previously untreated advanced lower rectal cancer, a histopathologically confirmed of adenocarcinoma, and an Eastern Cooperative Oncology Group performance status of 0–2. Other eligibility criteria were based on the seventh edition of the International Union Against Cancer (UICC) TNM Classification system. Patients also had to be 20–80 years at the time of registration and to have no severe dysfunction of main organ systems (including the spinal cord, heart, lungs, liver, and kidneys).

2.1.2. Treatment regimens

Radiotherapy was administered in fractions of 1.8 Gy per day 5 days per week for 5 consecutive weeks. The total radiation dose was 45 Gy. Computed tomography was performed to determine the planned target volume (PTV). The clinical target volume (CTV) was then determined, allowing for setup errors and organ movement. The CTV included a 1-cm margin around visible lymph nodes (macroscopic tumor volume) adjacent to the main tumor, including surrounding regions of organ and tissue invasion. The PTV was treated with a 10 MV radiation beam delivered by an accelerator in the rectum, using a 4-field box technique. The CTV of the main tumor used in our study included the perirectal lymph nodes (Fig. 1). S-1 (80 mg/m^2/day) was given orally after breakfast and dinner on days 1–5, 8 to 12, 22 to 26, and 29 to 33. Irinotecan (80 mg/m^2/day) was given as a continuous intravenous infusion over the course of 90 min on days 1, 8, 22, and 29. The chemoradiotherapy regimen included a 1-week rest period to allow