



Should total gastrectomy and total colectomy be considered for selected patients with severe tumor burden of pseudomyxoma peritonei in cytoreductive surgery?

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Abstract

Background: This study aims to evaluate the safety and efficacy of cytoreductive surgery (CRS) including total gastrectomy and total colectomy in selected pseudomyxoma peritonei (PMP) patients with entire stomach and colon covered by mucinous tumor.

Methods: A total of 48 patients received this extensive treatment between January 2006 and January 2014. The main focus of this study was survival after CRS as well as perioperative morbidity and mortality.

Results: Twenty-eight patients were male, and median age was 52.5 years. Median peritoneal cancer index was 33. Complete cytoreduction was achieved in all 48 patients, and 26 patients received hyperthermic intraperitoneal chemotherapy (HIPEC). Until last follow-up, the estimated median survival after CRS was 54.0 months (95% CI 36.5–71.6 months). The 1-, 2-, 3-, and 5-year survival rates were 91.7%, 81.3%, 70.1%, and 48.6%, respectively. Histology was significantly associated with survival ($P = 0.020$). The median disease-free survival was 32.0 (95% CI 25.7–38.3) months. HIPEC ($P = 0.048$) and histology ($P = 0.002$) was significantly associated with disease-free survival after CRS. Overall Grade 3–5 complications occurred in 18 (37.5%) patients with mortality of 2.1%. For patients who received surgery over 6 months, they could gradually have an acceptable quality-of-life similar as other patients receiving ordinary CRS and HIPEC.

Conclusion: CRS including total gastrectomy and total colectomy can be performed in experienced specialized institutions as a feasible option to achieve complete cytoreduction with acceptable safety in selected PMP patients with stomach and colon covered by mucinous tumor. Perioperative management should be carried out cautiously to decrease and avoid complications.

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Introduction

Pseudomyxoma peritonei (PMP) is a rare local-regional disease which is characterized by disseminated

intraperitoneal mucinous tumor producing excessive amount of mucinous ascites.¹ It is mainly secondary to appendiceal mucinous neoplasm. Mucinous neoplastic cells pass through ruptured appendiceal neoplasm and spread widely in peritoneal cavity. They are transported by intraperitoneal fluid current or gravity, which is referred as “redistribution phenomenon”.² Perforated appendix, greater omentum, and right hemidiaphragm are the most frequent sites where tumor cells implant. However, small bowel

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may be free from tumor. As disease progresses, intraperitoneal tumors increase and adhere to organs and intestine, causing severe bowel obstruction and starvation eventually.

In the past, PMP was treated by serial debulking procedures. Recently, a new treatment strategy combining cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) markedly ameliorated its course. With optimal CRS and HIPEC, tumors can be reduced as far as possible, potentially achieving a complete CRS. Numerous studies have demonstrated that patients undergoing CRS plus HIPEC had a significant better survival.^{3–6} As a result, CRS plus HIPEC has been accepted as the standard treatment for patients with PMP.⁷ Complete cytoreduction is one of the most important factors predicting better survival. In order to achieve complete cytoreduction, visceral resection is often necessary. For patients with stomach and/or relevant vascular supply covered by mucinous tumor, Sugarbaker⁸ reported that total gastrectomy could be performed to facilitate complete cytoreduction. In some patients, however, not only stomach also colon is completely covered or even fixed by mucinous tumor. Under such condition, total gastrectomy and total colectomy might be necessary for the purpose of complete cytoreduction. No prior study focusing specifically on CRS including total gastrectomy and total colectomy has been reported. This study presents our experience of treating selected patients with severe tumor burden of PMP with CRS including total gastrectomy and total colectomy, investigating the safety and efficacy of this extensive treatment.

Patients and methods

From January 2006 to January 2014, a total of 48 patients received treatment of optimal CRS including total gastrectomy and total colectomy and HIPEC with an intent of complete cytoreduction in Peritoneal Dissemination Centers of Kishiwada Tokushukai Hospital and Kusatsu General Hospital, NPO to Support Peritoneal Surface Malignancy treatment, Osaka, Kyoto, Japan. All patients treated in our institution provided written informed consents, and the protocol of this study was approved by Ethics Committee of Kishiwada Tokushukai Hospital (H 25-3).

Patient selection criteria included: (1) age 30–72 years old; (2) Karnofsky performance status (KPS) score >50; (3) acceptable liver, renal, cardiovascular, pulmonary, and coagulation function, and other major organ functions were able to endure a major operation; (4) stomach and colon were confirmed totally covered by mucinous tumor from radiological examination and operative finding, (5) without diffusible small bowel dissemination or pleural dissemination, and (6) with definite pathological diagnosis.

CRS and HIPEC

The surgery was performed under general anesthesia and hemodynamic monitoring with meticulous preoperative

assessment and preparation. Preoperative radiological examination included contrast enhanced computed tomography (ceCT) or magnetic resonance imaging (MRI). Preoperative preparation included preoperative nutritional support, correction of anemia, and exercise for improving lung function. During the surgery, once abdominal wall was opened, 20 mL of ascites was submitted for cytological examination. After removing ascites and an intraperitoneal lavage with 1 L of saline for 10 times, detailed evaluation of peritoneal cancer index (PCI) was conducted according to a principle of Sugarbaker.⁹ Maximal CRS was then carried out to remove all visible tumors. In addition to six peritonectomy procedures described by Sugarbaker,⁸ total colectomy and proctectomy were added as the seventh peritonectomy procedure in this study. Peritonectomy procedures included total parietal peritonectomy including subphrenic areas, Morrison's pouch, paracolic gutters, pelvis, and anterior abdominal wall, lesser omentectomy, omentectomy with splenectomy, cholecystectomy, total gastrectomy, total colectomy, and proctectomy. Hysterectomy and ovariectomy were also performed in female patients with patients' permission. Small nodules <2.5 mm on small bowel surface or mesentery were seared by Argon Beam Coagulator (Japanese Medical Next Company, Osaka, Japan).

Considering the extent of surgery, HIPEC was performed with following exclusion criteria: (1) age >65 years; (2) blood loss >2500 mL; and (3) patients with higher operative risk according to American Society of Anesthesiologist (ASA) classification. HIPEC was performed with an open technique for 60 min, with mitomycin C (Kyowa Hakko Kirin, Co., Ltd. Tokyo, Japan) at a dose of 15 mg/m² and cisplatin (Nippon Kayaku Co., Ltd, Tokyo, Japan) at a dose of 60 mg/m² at 42.9–43.5 centigrade in 4L of saline.

After CRS and HIPEC, the reconstruction was performed with a Roux-en-Y jejunal loop. A termino-lateral esophagojejunal anastomosis was performed. About 30 cm distant from this anastomosis, another termino-lateral jejunojejunal anastomosis was constructed. All anastomoses and stapled duodenum were oversewn with interrupted sutures. In the end, a stoma was constructed as an end-ileostomy. Completeness of cytoreduction was recorded as the principle described by Sugarbaker.⁹ CC-0/1 was considered to be complete cytoreduction.

Postoperative monitoring and care

All patients were closely monitored after surgery. High-energy parenteral nutrition was started from the 3rd/4th postoperative day. One week after operation, an oral gastrointestinal contrast test was carried out to check the esophagojejunal anastomosis. Patients were then placed on a trial liquid diet, which was gradually changed to semi-liquid and soft food. Parenteral nutrition was continued until patients started soft food for 2 weeks without any discomfort. However, for patients with intestinal complications, high-

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