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Hospital readmission rates and risk factors for readmission following cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) for peritoneal surface malignancies

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ABSTRACT

Background: Cytoreductive surgery and Hyperthermic intra-peritoneal chemotherapy (CRS/HIPEC) for peritoneal surface malignancies is associated with high morbidity. The increased numbers of patients undergoing CRS/HIPEC in recent years mandates risk analysis and quality assurance. However, only scarce data exist regarding causative parameters for readmission.

The aim of this study was to assess readmission rates and risk factors associated with readmission.

Methods: A retrospective-cohort study including patients from two high-volume centers who underwent CRS/HIPEC surgery between the years 2007–2016 was performed. Patients' demographics, peri-operative data and readmission rates were recorded.

Results: 223 patients were included in the study. The 7 and 30-day readmission rates were 3.5% (n = 8) and 11% (n = 25), respectively. Late readmission rates (up to 90 days) were 11% (n = 25). The most common causes of readmission were surgical related infections (35%), small bowel obstruction (17.5%) and dehydration (14%). Post-operative complications were associated with higher readmission rates (p = 0.0001). PCI score was not associated with higher rates of readmission.

Conclusion: Readmissions following CRS/HIPEC occur mainly due to infectious complications and dehydrations. Patients following CRS/HIPEC should be discharged after careful investigation to a community based continuing care with access for IV fluid replacement or antibiotics administration when required.

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Introduction

Readmissions following surgical procedures carry high economic burden on healthcare systems worldwide.[1] Understanding the factors leading to readmission may contribute in reducing those costs. Therefore, healthcare providers as well as payers invested considerable resources in reducing readmission rates. Clinical research as well as tight monitoring may lead to better understanding of the factors contributing to readmissions. In the USA, for example, there is a penalty scheme that proposes a reduction in the total reimbursements for hospital with excessive readmissions.

Since all parties involved including patients, healthcare providers and health care systems in the national level, may benefit from a substantial reduction in readmission rates, much research has been conducted in order to identify the rates and causes of hospital readmission. Readmission rates following complex surgical procedures such as Whipple's procedure (pancreaticoduodenectomy) can range from 12% to 20%[2–4] Sadot et al.[5] recently concluded that the most common cause for 30-day readmission following whipple's procedure was procedure-related infection, while the most common cause for 31–90 day readmission reason was failure to thrive and chemotherapy related symptoms.

Cytoreductive surgery and Hyperthermic intra-peritoneal chemotherapy (CRS/HIPEC) is a complicated surgical procedure that often combines multiple organ resections, intestinal anastomoses in all areas of the abdomen and pelvis combined with intra-operative hyperthermic chemotherapy.

CRS/HIPEC is associated with high rates of major morbidity[6] that can range between 24% and 35%[7,9] in large series. Most of the complications occur early, during the first hospitalization while in some cases complications will occur at a later stage and will require readmission.

The intra-operative administration of chemotherapy delays wound healing and impairs the immune system's function leading, perhaps, to higher rate of late complications [Bhagwandin et al.,[10]] occurring after discharge from the hospital. Lately, Martin et al.[14]), described a 21% rate of readmission following CRS/HIPEC in 90 days. However, Scarce literature exists regarding readmission rates and factors that are associated with readmission.

The aim of the present study was to evaluate the readmission rate following CRS/HIPEC and identify associated factors associated with hospital readmission.

Methods

This is a retrospective study based on a prospectively maintained database of patients with peritoneal surface malignancies treated in two tertiary centers. All patients who underwent CRS/HIPEC between 2007 and 2016 were included. Based on the data recorded in the database, Patient demographics, primary diagnosis, the number and type of intestinal anastomosis, Peritoneal cancer index (PCI), operating time, estimated blood loss, duration of HIPEC, length of hospital stay and post-operative complications. The electronic medical records were searched for readmission within 7, 30 and up to 90 days after discharge from the hospital. The PCI index was calculated at the time of CRS/HIPEC for each patient according to standard parameters.[8]

Statistical analysis was performed using Fisher exact test and chi-square to evaluate differences between qualitative variables and t-test to compare quantitative variables. A P value of <0.05 was considered significant.

Results

Demographics

Between April 2007 and April 2016, a total of 223 patients underwent CRS/HIPEC. Fifty-eight (58) patients were readmitted. The mean age was 56.4 years. Most of the patients underwent CRS/HIPEC due to metastatic colon cancer (70%) followed by appendiceal neoplasms (18.4%) as shown in Table 1 above.

CRS/HIPEC protocol

Following cytoreduction the abdominal cavity was temporarily closed and chemotherapy was administered according to the patients' pathology. Patients with colon cancer received intraperitoneal (IP) mitomycin C and intravenous 5 fluorouracil and leukovorin. Patients with mucinous tumor of the appendix were treated with IP mitomycin C and mesothelioma and ovary patients with cisplatin and doxorubicin.

Perioperative characteristics

Postoperative complications were recorded in more than half of the patients (51.5%).

Surgical complications leading to post-operative mortality (grade V) occurred in 4 patients (1.7%). Causes for post-operative mortality were septic shock that led to multi-organ failure ($n = 1$), pulmonary failure and ARDS ($n = 1$), gastric necrosis leading to sepsis and death ($n = 1$) and liver failure ($n = 1$). Major complications (Grade 3 and 4 according to the clavien dindo classification) were documented in 30% of the patients and did not differ in both the readmission and the non-readmission group.

Complete cytoreduction (CC0-1) was achieved in 84% of the patients ($n = 188$), while CC2 and CC3 were achieved in 16% ($n = 35$).

The average mean length of hospital stay was 19.9 days ($SD = 19.45$). The average length of stay for patients who were afterwards re-admitted was 21.3 ($SD = 11.47$) versus 19.1 days ($SD = 20.1$) for the non-readmitted patients ($p = 0.45$).

Hospital readmission rates

Early readmissions occurring in patients readmitted to the hospital within 7 days ($n = 8$, 3.5%) were mainly due to surgical site infections ($n = 3$) and anastomotic leak ($n = 2$).

The 30-days readmission-rate was 11% ($n = 25$) and late readmission-rate (post-operative days 30–90) was 11% as well ($n = 25$). In the first 30 days following hospitalization, patients were readmitted mainly due to infectious complications

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