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Comparative analysis of the incidence of surgical site infections in patients with liver resection for colorectal hepatic metastases after neoadjuvant chemotherapy

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ABSTRACT

Background: The aim of this study was to identify the incidence of surgical site infections (SSIs) and postoperative complications, as defined by the Clavien–Dindo classification, after hepatic resection for metastatic colorectal cancer in patients with and without associated neoadjuvant chemotherapy.

Methods: A total of 181 patients were studied retrospectively. Patients were divided into two groups: the first group comprised patients with associated neoadjuvant chemotherapeutic treatment for liver metastases with a latency time <8 wk and the second group comprised patients without associated neoadjuvant chemotherapy.

Results: Variables of duration of liver surgery, length of total hospital stay, and length of postoperative hospital stay seem to be correlated with SSIs and postoperative complications, $P < 0.005$ and $P < 0.0001$, respectively. Duration of surgery is a risk factor for SSIs, with an odds ratio of 1.15, and for complications according to the Clavien–Dindo classification, with an odds ratio of 1.35.

Conclusions: Neoadjuvant chemotherapy was not a significant risk factor for SSIs, whereas the total length of hospital stay, length of postoperative hospital stay, and duration of surgery were independent predictors of SSIs and complications according to the Clavien–Dindo classification.

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1. Introduction

Postoperative infections are frequent complications and have a significant impact on the length of hospital stay, morbidity, and mortality [1]. Surgical site infections (SSIs) are the most common hospital-acquired infections among surgical patients, with a significant impact on both patient morbidity and health care costs according to the U.S. Centers for Disease Control and Prevention through the National Nosocomial Infections Surveillance program [2].

An SSI is defined as an infection either with incisional involvement of the skin alone or with the involvement of deep tissues or organs. The criteria for defining SSIs are as follows: superficial incisional SSI if only the skin and subcutaneous tissue are involved; deep incisional SSI with the involvement of deep soft tissues, such as fascia and muscles; and organ-space SSI when the organ or space is involved [3]. In recent years, a decreasing incidence of perioperative septic complications has been reported, the result of advances in surgical techniques, new suturing materials, better perioperative management, and the implementation of infection surveillance [4]. Neoadjuvant chemotherapy for colorectal cancer seems to enhance the risk of surgical complications and infections [1], suppressing the hematopoietic system, and causing neutropenia. It is also associated with the risk of life-threatening infections [5].

The aim of this study was to identify the incidence of SSIs and postoperative complications according to the Clavien–Dindo classification, (Table 1) [6], after hepatic resection for metastatic colorectal cancer in patients with and without associated neoadjuvant chemotherapy. The latter are increasingly being used to enlarge the cohort of patients who can be offered hepatic resection for malignancy.

Modern management of colorectal liver metastases is multimodal and incorporates open and laparoscopic surgery, ablative therapies such as radio frequency ablation or microwave ablation, and (neo)adjuvant chemotherapy. Most patients with hepatic metastases should be considered for resectional surgery if all the tumor(s) can be resected, as this offers the only opportunity for prolonged survival.

However, the real impact of these agents on clinical outcomes after hepatic resection remains unclear.

2. Materials and methods

A total of 181 patients who had undergone hepatic surgery for metastatic colorectal cancer in three surgical units, the Mediterranean Institute for Transplantation and Advanced Specialized Therapies (ISMETT), Palermo, Italy, Azienda Ospedaliero-Universitaria Policlinico-Vittorio Emanuele, and Humanitas Centro Catanese di Oncologia, Catania, Italy, between January 2006 and December 2011 were investigated retrospectively. Data were collected on patient age, gender, comorbidities, site of primary tumor, type of hepatic resection, duration of surgery, and the total length of hospital stay and the length of postoperative stay and are reported in Table 2. Patients were divided into two groups: the first group comprised patients who had undergone hepatic resection for metastatic colorectal cancer after a latency time <8 wk since the end of the neoadjuvant chemotherapy and the second group comprised patients who had undergone hepatic resection without associated neoadjuvant chemotherapy [7]. The two groups differed in the volume of type of resection. Patients with significant progression of metastatic disease and-or the development of new lesions during neoadjuvant chemotherapy were not included in this series.

In the first group, patients were assigned to six cycles of FOLFOX4 (Folinic acid, Fluorouracil, Oxaliplatin) before surgery; each cycle of chemotherapy lasted 14 d, with the subsequent cycle set to start on day 15, as previously described by Nordlinger *et al.* [8,20]. The incidence of SSIs classified as superficial, deep incisional, and organ/space, and all other infectious complications were evaluated in the two groups. We also used the Clavien–Dindo classification for postoperative complications.

A comparison of means for quantitative variables was done using the Student *t*-test at a $P = 0.05$ significance level using Analyse-it for Microsoft Excel (version 3.0; Analyse-it Software, Ltd, http://www.analyse-it.com/; Leeds, United Kingdom 2012). Univariate contingency table analysis was

Table 1 – Clavien–Dindo classification of postoperative surgical complications.

Grades	Definitions
I	Any deviation from the normal postoperative course without the need of pharmacologic treatment or surgical, endoscopic, and radiologic interventions. Allowed therapeutic regimens are drugs as antiemetic, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy. This grade also includes the wound infections opened at the bedside
II	Requiring pharmacologic treatment with drugs other than such allowed for grade I complications: blood transfusions and parenteral nutrition are also included
III	Requiring surgical, endoscopic, and radiologic interventions: a. Intervention not under general anesthesia b. Intervention under general anesthesia
IV	Life-threatening complication (including CNS complications)* requiring IC-ICU management: a. Single organ dysfunction (including dialysis) b. Multiorgan dysfunction
V	Death of the patient

CNS = central venous system; IC = intermediate care; ICU = intensive care unit.
* Brain hemorrhage, ischemic stroke, subarachnoid bleeding, but excluding transient ischemic stroke.