

(RESEARCH ARTICLE)



## Readmissions after cytoreductive surgery and HIPEC

John Spiliotis<sup>1,2\*</sup>, George Dadoudis<sup>3</sup>, Christos Koupanis<sup>3</sup>, Mary Gianniri<sup>2</sup>, Pinelopi Stefanopoulou<sup>3</sup>, Dimitrios Farmakis<sup>1</sup>, Apostolos Raptis<sup>2</sup> and Dimitrios Vaikos<sup>1</sup>

<sup>1</sup> Department of Surgery/Surg. Oncology European Interbalkan Medical Center, Thessaloniki, Greece.

<sup>2</sup> Athens Medical Center, Marousi, Greece.

<sup>3</sup> I.C.U, European Interbalkan Medical Center, Thessaloniki, Greece.

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### Abstract

Cytoreductive Surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) results in significant morbidity and mortality and readmission. Previous studies have been limited with numbers or lack of tumor details. We analyzed a 15 year experience a total 730 Hipec procedures and the postoperative morbidity was 22.3% and mortality was 3.6% for the first month after initial operation.

Complications with Dindo classification reached 39% in the first 90 postoperative days. The most common cause of delayed complications which demands re-admission was bowel obstruction and the second is rectovaginal fistulas and pulmonary embolism.

**Keywords:** Cytoreductive Surgery; Peritoneal Metastasis; Hyperthermic Intraperitoneal Chemotherapy (HIPEC); Cytoreductive Surgery (CRS)

### 1. Introduction

The management of Peritoneal Metastasis (PM) has proven to be a challenge for both medical and surgical oncologists.

In the past, the presence of diffuse implants in the peritoneal cavity denoted terminal stage disease, however current therapeutic approaches are in a position to improve patient outcome. If left untreated the median overall survival with PM ranges between 3 to 6 months [1, 2]. The last 20 years many centers have developed procedures involving cytoreductive surgery and intraperitoneal hyperthermic chemotherapy with loco-regional high-dose drugs [3].

This approach can improve the disease locally and minimize the systemic toxicity, providing promising results in the survival of patients with PM. CRS plus HIPEC have been associated with high morbidity and mortality rates [4, 5]. Some complications present after the patients hospital discharge. Despite this the frequency of and reasons for re-admissions after CRS and HIPEC have been poorly investigated. The aim of our study was to analyze retrospectively the incidence of readmissions in a national HIPEC center in Greece.

### 2. Material and methods

From August 2005 until August 2020, 730 patients underwent CRS plus HIPEC procedure. All patients' readmissions were retrieved, from the first HIPEC treatment discharge and until 6 months post operatively. No patients included in

\* Corresponding author: Spiliotis J  
Department of Surgery/Surg. Oncology European Interbalkan Medical Center Thessaloniki Greece.

this study underwent second HIPEC within 6 months after index HIPEC. All demographic information was registered from each hospital admission.

### 3. Results

The last 15 years a total of 730 HIPEC procedures was performed and the post-operative morbidity was 22, 3 % and mortality was 3, 6 % for the first month after the initial operation. Complications grade III-IV according to the Clavien-Dindo classification reached 39% in the first 90 post-operative days. Respiratory complications were the most frequent (24%) followed by surgical complications (22%). Reoperation was required in 10% of the above-mentioned patients. In our study, three months re-admissions were 64 patients (6, 8%) and the 6 months readmissions were 28 patients (3, 4%). The most common cause in the early -1<sup>st</sup> month- postoperative complication were enterocutaneous fistulas 33 cases and bleeding in 18 cases, in which nine of them demands reoperation, pulmonary embolism in 10 patients, bowel dysfunction in 26 (delayed bowel movements) intra-abdominal collections in patients and 63 cases of catheter related sepsis and 3 cases of pancreatitis (table 1).

**Table 1** 1st month postoperative complications after CRS + HIPEC

	NO	%
Complications	160/730	(22.6%)
Bleeding	18*/730	(2.46%)
Enterocutaneous fistulas	33/730	(4.5%)
Pulmonary embolism	10/730	(1.3%)
Bowel dysfunction	26/730	(3.6%)
Intra-abdominal collections	9/730	(1.2%)
Catheter related sepsis	63/730	(8.6%)

\*Nine demands re-operation

**Table 2** 3<sup>rd</sup> month re-admissions (delayed complications) after CRS + HIPEC

	NO	%
Re-admissions	64/730	(8.8%)
Bowel obstruction	10/64	(15.6%)
Ureteral stricture	4/64	(6.2%)
Fulmonony embolism	3/64	(4.7%)
Rectovaginal fistulas	10/64	(15.6%)
Malnutrition	18*/64	(28.2%)

\*Demands Home Parenteral Nutrition (HPN) for more than 2 days/week

**Table 3** 6<sup>th</sup> month re-admissions (delayed complications) after CRS + HIPEC

	NO	%
Re-admissions	43/730	5.9%
Bowel obstruction	7/43	(16.3%)
Malnutrition	25/43	(58.1%)
Enterocutaneous fistulas	9/43	(20.9%)
Scotrum necrosis	2/43	(4.6%)

The 3 months delayed complications which demands re-admission were bowel obstruction in 10 cases, ureteral stricture in 4 cases, pulmonary embolism 3 cases, rectovaginal fistulas in 10 cases malnutrition in 18 cases (table 2). The 6 months delayed complications are bowel obstruction in 7 cases malnutrition in 25 cases, demands Home parenteral nutrition for more than 2 days per week in 30% of cases. Enterocutaneous fistulas in 9 cases and a rare complication of 2 scotrum necrosis (table 3).

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#### 4. Discussion

The results of re-admissions demands careful follow-up after the patients discharge from the hospital, on issue that has not been investigated thoroughly and may have serious impact on the post-operative quality of life [6]. In a recent study from Dreznik et. al [3] in the 90 days admissions rates were 11% and the most common cause were surgical related infections in 35%, small bowel obstruction in 17, 5% and dehydration in 14%. In the Danichnikov study [1] which is the first national comprehensive re-admissions and mortality study, in the 519 patients within 6 months 150 re-admissions for adverse events were adserved in 129 patients (25%). These results were higher than expected. The main bias at this study is that the management of almost 50% of this patient occurring outside of a specialized HIPEC center. The most important finding in this study was the number of operations occurring in the referral hospital during a HIPEC-readmission. In total 46% of all patients requiring on intervention in the first 6 months which did not received at a HIPEC center. Our study and others most recent studies confirms that preoperative functional status, individual cytoreductive surgery procedures, early postoperative complications, adjuvant chemotherapy after CRS and HIPEC and the possible role of intraperitoneal oxaliplatin during HIPEC were associated with higher readmissions rates. On the other hand the PCS score is not related with delayed complication [7, 8]. Another important observation in our study and from other investigators is the important role of centralization and oncologic training in cytoreductive surgery and logo-regional chemotherapy. In low-volume centers patients were with a significantly higher comorbidity and less aggressive management with inadequate patient selection. In high volume centers the failure to rescue after cytoreductive surgery and HIPEC was twice as low versus meter is an indicator of a surgical team expertise and performance in controlling postoperative complications [9, 10]. In conclusion patients with these risk factors or early postoperative complications may benefit from closer postoperative discharge monitoring and we would like to highlight the need of further cooperation between centers of excellence in the HIPEC files in other to further clarify its role of delayed complications and possible measures to avoid them.

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#### 5. Conclusion

In our study to date examining readmissions after CRS-HIPEC. Tumor factors failed to predict readmissions whereas preoperative performance status along with individual cytoreductive procedures predicated readmission. Patient with these risk factors or postoperative complications may benefit from closer post-discharge monitoring.

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#### Compliance with ethical standards

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##### *Disclosure of conflict of interest*

No conflict of interest.

##### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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