



## Care of the Open Abdomen After Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy for Peritoneal Surface Malignancies

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A patient with a mucinous appendiceal cancer presents to the surgeon complaining of abdominal discomfort and nausea. Having undergone a prior right hemicolectomy, the patient has been disease free and on surveillance with clinical and carcinogenic antigen (CEA) monitoring. The CEA was noted to be elevated and a computed tomography scan revealed peritoneal nodules throughout the abdomen with a presumptive diagnosis of pseudomyxoma peritonei (progressive peritoneal implants from a mucinous primary). Several therapeutic options were offered and the patient selected to undergo cytoreductive surgery (CRS) with the potential to receive hyperthermic interoperative chemotherapy (HIPEC). Extensive resection was performed, including removal of the entire greater omentum, partial gastrectomy, and total pelvic exenteration with end colostomy and ileal conduit. Reassessment of the peritoneal cavity after the resections revealed almost complete cytoreduction. HIPEC was performed with mitomycin C and, after drainage and abdominal washing, the intestinal segments were anastomosed and the abdominal wall closed. Seven days postoperatively, an acute abdomen with septic shock developed as a result of a leak from the ileocolonic anastomosis. The patient returned to the operating room and an exploratory laparotomy, a small bowel resection, a resection of the ileocolonic anastomosis, and an abdominal washout were performed. Edema of the bowel caused by peritonitis resulting from the anastomotic leak necessitated delayed closure of the abdominal wall. A temporary abdominal closure using the ABThera™ Open Abdomen Negative Pressure Therapy

system was applied and the abdomen was eventually closed.

Selected patients with extensive intraperitoneal malignancies such as gastrointestinal or gynecologic cancers or sarcomas may be candidates for a radical surgical intervention consisting of CRS with HIPEC. These diagnoses have a dismal prognosis with high recurrence rates after traditional surgical debulking and systemic chemotherapy. Although no data are available from randomized clinical trials, evidence suggests that this aggressive approach is associated with improved survival when compared to systemic chemotherapy (de Bree & Helm, 2012; Elias et al., 2009; Gonzalez-Moreno, Gonzalez-Bayon, & Ortega-Perez, 2012; Helm, 2012; Yan, Black, Savady & Sugarbaker, 2006). In fact, for selected patients, CRS and HIPEC provide the only chance for long-term survival (Gonzalez-Moreno, Gonzalez-Bayon, & Ortega-Perez, 2010).

### Rationale

The rationale for using intraperitoneal therapy is to expose residual and microscopic disease to the direct cytotoxic effects of chemotherapy and hyperthermia. Intraperitoneal chemotherapy provides a high concentration of drug regionally while avoiding high systemic blood levels. Clearance of the drug from the peritoneum is slowed by the peritoneal plasma barrier, which maintains a constant high gradient between the peritoneal cavity and the plasma compartment. In addition, the molecular weight and affinity for water (hydrophilicity) of the chemotherapy further slow the passage of drugs through this barrier. The portal vein drains blood from the peritoneal surface directly to the liver for metabolism (first

pass, detoxifying effect) and, therefore, systemic drug exposure is reduced even more. First pass metabolism also increases exposure of any hepatic metastases to the chemotherapy (de Bree & Helm, 2012; Gonzalez-Moreno et al., 2010).

A disadvantage to HIPEC is that the chemotherapy can only penetrate tissues to a depth of 3–5 mm. Therefore, cytoreduction must be completed prior to installation of the chemotherapy. All visible disease must be removed. The largest amount of residual tumor diameter acceptable is 2.5 mm, which is considered the threshold of eligibility for HIPEC (Gonzalez-Moreno et al., 2010).

Hyperthermia (in the range of 41°C–43°C) has cytotoxic activity on malignant cells. Hyperthermia decreases blood flow (at times to the point of vascular stasis) and decreases or inhibits oxidative metabolism. That limits tumor growth and results in accumulation of lactic acid. The acidotic environment increases lysosomal activity, which further increases the sensitivity of mitochondrial membranes to the chemotherapy. The increased cell membrane permeability and improved membrane transport allows increased drug penetration. When hyperthermia is combined with cytotoxic drugs, the effect is synergistic and cytotoxicity is greater than what would be expected from additive effects alone (Gonzalez-Moreno et al., 2010).

### Preoperative Considerations and Technique

CRS with HIPEC is a high-risk procedure. Morbidity has been reported to be

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