Title:
“Treatment of Postoperative Surgical Complications Following Cytoreductive Surgery and Peri-operative Chemotherapy”.

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E-mail : agomezpor@teleline.es

Institution: Hospital San José. Vitoria. Spain.

Mr. President, Ladies and gentlemen, first of all I would like to give thanks to Dr. Sugarbaker and specially to Dr. Francoise Gilly for giving me the opportunity to participate in this important forum.
I am Dr. Alberto Gómez Portilla Director of the peritoneal carcinomatosis program at Hospital San Jose in Vitoria, Spain. The topic I am going to speak is about the treatment of postoperative surgical complications following cytoreductive surgery and peri-operative chemotherapy. The use of a new therapeutic alternative in the treatment of peritoneal carcinomatosis, involving cytoreductive surgery combined with perioperative intraperitoneal chemotherapy represents a new challenge for the multidisciplinary teams caring for these patients. Their post-operative progress and care needs, apart from differing from those of conventional patients, have not yet been completely defined or protocolized.

Osakidetza; 28/10/2008
Hepatic and Pancreatic Tumors

Optimization of Hyperthermic Intraperitoneal Chemotherapy With Oxaliplatin Plus Irinotecan at 43°C After Complete Resection

Multivisceral Resection Does Not Affect Morbidity and Survival After Cytoreductive Surgery and Chemoperfusion for Carcinomatosis from Colorectal Cancer

Morbidity, Toxicity, and Mortality Classification Systems in the Local Regional Treatment of Peritoneal Surface Malignancy

In these patients there is a summation of risk factors because they suffer of the combined and greater aggression than usual: from the radical cytoreductive surgery, from the application of the intraperitoneal hyperthermia and lastly as a consequence of the intraperitoneal administration of cytostatic drugs.

The application of this new alternative of treatment increases the risk of postoperative complications. In these patients, the imbalance of the risk factors and defense mechanism favors a higher morbid-mortality rate than in usual patients. The goal of cytoreductive surgery in these patients is to remove the last tumor cell, clearing the abdomen and pelvis of disease. This required a series of peritoneectomy procedures and visceral resections.

Osakidetza; 04/12/2007
Cytoreductive Surgery + HIIC + EPIC

• New challenge for teams caring these patients.

• Postoperative progress and care needs not defined.
In these patients there is a summation of risk factors because they suffer of the combined and greater aggression than usual: from the radical cytoreductive surgery, from the application of the intraperitoneal hyperthermia and lastly as a consequence of the intraperitoneal administration of cytostatic drugs.

The application of this new alternative of treatment increases the risk of postoperative complications. In these patients, the imbalance of the risk factors and defense mechanism favors a higher morbid-mortality rate than in usual patients. The goal of cytoreductive surgery in these patients is to remove the last tumor cell, clearing the abdomen and pelvis of disease. This required a series of peritoneectomy procedures and visceral resections.

Osakidetza; 04/12/2007
Topics for this presentation.

- Special characteristics of carcinomatosis patients.
- Physiopathological mechanisms of complications.
- Treatment solutions. Open vacuum abdomen.
- Preventive measures.
In these patients there is a summation of risk factors because they suffer of the combined and greater aggression than usual: from the radical cytoreductive surgery, from the application of the intraperitoneal hyperthermia and lastly as a consequence of the intraperitoneal administration of cytostatic drugs.

The application of this new alternative of treatment increases the risk of postoperative complications. In these patients, the imbalance of the risk factors and defense mechanism favors a higher morbid-mortality rate than in usual patients. The goal of cytoreductive surgery in these patients is to remove the last tumor cell, clearing the abdomen and pelvis of disease. This required a series of peritoneectomy procedures and visceral resections.

Osakidetza; 04/12/2007
Material and Methods.

- Personal experience.
- 110 cytoreductive procedures in 71 patients.
- Previous Surgeries. Median 1,6 (1 to 4).
- Previous Systemic Chemo. Median 1 (0 to 6).
We present our experience with the Open Vacuum abdomen technique in the treatment of these patients. From February 1997 to February 2004, 62 cytoreductive procedures were on 43 patients. In seventeen occasions a reoperation was required because a major abdominal complication. We study these group of patients that need up to 48 open vacuum abdomen techniques before a complete control of the abdominal complication was achieved, with a median of 2,3 procedures for each patient.

Alberto gomez; 07/11/2004
Patients: 71
Women: 41
Men: 30
Mean Age: 52 years

### Cytoreductive Surgery + HIIC + EPIC

#### SUGARBAKER PROTOCOL

<table>
<thead>
<tr>
<th>Intraoperative Drugs</th>
<th>Primary Tumor</th>
<th>Post-operative Drugs</th>
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<tbody>
<tr>
<td>Mitomicin C</td>
<td>Pseudomyxoma</td>
<td>5 - FU</td>
</tr>
<tr>
<td></td>
<td>Colorectal Gastric</td>
<td></td>
</tr>
<tr>
<td>Cisplatin + Adriamicin</td>
<td>Ovary Mesothelioma</td>
<td>Taxol</td>
</tr>
<tr>
<td></td>
<td>Sarcomatosis</td>
<td></td>
</tr>
<tr>
<td>90´ 42ºC</td>
<td>Normothermia. 1º-5º Postop.</td>
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#### ELIAS PROTOCOL

<table>
<thead>
<tr>
<th>Intraoperative Drugs</th>
<th>Primary Tumor</th>
<th>Post-operative Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxaliplatin</td>
<td>Pseudomyxoma</td>
<td>No EPIC.</td>
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<tr>
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<td>Colorectal Gastric</td>
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#### Additional Information

- **Postoperative Systemic Chemotherapy**
## Data Characteristics

<table>
<thead>
<tr>
<th>Affected Areas</th>
<th>Median</th>
<th>Mean</th>
<th>Range</th>
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<tr>
<td>PCI</td>
<td>20,5</td>
<td>19</td>
<td>6-39</td>
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We present our experience with the Open Vacuum abdomen technique in the treatment of these patients. From February 1997 to February 2005, 86 cytoreductive procedures were on 58 patients. In 28 occasions a reoperation was required because a major abdominal complication. We study these group of patients that need up to 65 open vacuum abdomen techniques before a complete control of the abdominal complication was achieved, with a median of 2.3 procedures for each patient.

Alberto Gómez; 25/10/2005
55% > 10 regions affected
Data Characteristics

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<th>Median</th>
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<th>Range</th>
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<td>3.6</td>
<td>3</td>
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<tr>
<td>Nº Resected Viscera</td>
<td>350</td>
<td>3.4</td>
<td>4</td>
</tr>
<tr>
<td>Nº Digestive anastomosis</td>
<td>90</td>
<td>1.3</td>
<td>1</td>
</tr>
<tr>
<td>Time of Surgery (hours)</td>
<td>9.52</td>
<td>9.45</td>
<td>4.15</td>
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</tbody>
</table>
We present our experience with the Open Vacuum abdomen technique in the treatment of these patients. From February 1997 to February 2005, 86 cytoreductive procedures were on 58 patients. In 28 occasions a reoperation was required because a major abdominal complication. We study these group of patients that need up to 65 open vacuum abdomen techniques before a complete control of the abdominal complication was achieved, with a median of 2,3 procedures for each patient.

Alberto gomez; 25/10/2005
The goal of cytoreductive surgery in these patients is the eradication of the last tumor cell, clearing the abdomen and pelvis of disease. This required a series of peritonectomy procedures and visceral resections affected by the disease. Visceral resections may compromise any of the solid or hollow abdominal, digestive or genitourinary viscera. Each one of the visceral resections in itself constitutes a surgical intervention in the normal patient. However these patients submitted to radical oncological cytoreductions may need several of these visceral resections simultaneously.

The most frequent are the performance of a cholecystectomy during the right diaphragmatic peritonectomy, an splenectomy with the left diaphragmatic peritonectomy, an ileo-ceco-appendicular resection at the time of the right lower quadrant peritonectomy, and a rectosigmoid resection, with the uterus and adnexa in women during the pelviperitonectomy.
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Visceral Peritoneum. Risk of unnoticed Serosal tears.

Treatment of the disease in the visceral peritoneum, both in the root of the mesenterium and on the surface of the small and large intestines, generally requires the performance of electroevaporisation of the tumor nodules.

In spite of carrying out these electroevaporisations as we learnt from Dr. Sugarbaker, with an electroscalpel with a 3 mm ball tip in cutting mode at high power, and that we note meticulously each one of the serosal tears which this practice produces on many occasions, it is possible for one of these serosal tears to pass unnoticed and the intestinal wall not to be reinforced with a serous suture on completing the intraoperative chemotherapy. Such serosal tears and the lesions that the diathermy produces are responsible for the most important and the most frequent postoperative complication, which is leakage due to a punctiform intestinal perforation with the corresponding peritonitis and the need for an urgent postoperative surgery.

Osakidetza; 04/12/2007
HIIC. OPEN COLISEUM TECHNIC.
Once the cytoreduction is completed, if a cytoreduction score CC0-CC1 has been obtained, and before any anastomosis for reconstruction of the gastrointestinal tract has been made, HIIC is applied up to a temperature of 42-43°C intraperitoneally through an abdominal circuit by continuous perfusion. The application of intraoperative intraperitoneal chemotherapy modulated by hyperthermia constitutes an aggression that increases the risk of postoperative complications. With the open technique, known as the "coliseum technique," which is the one we use, enables verification of the localization of the Tecnkhoff catheter throughout the period of application of the intraoperative chemotherapy. This involves the periodic changing of the situation of the catheter from one abdominal area or quadrant to another, which we carry out every 5 minutes, thus avoiding direct lesions from heat on intestinal surfaces. We think that the possible risk of local burns with direct lesions of the intestine can only happen with the closed technique.

Osakidetza; 04/12/2007
Cytoreductive Surgery + HIIC + EPIC

benefits

risks

mortality

morbidity

In these patients there is a summation of risk factors because they suffer of the combined and greater aggression than usual: from the radical cytoreductive surgery, from the application of the intraperitoneal hyperthermia and lastly as a consequence of the intraperitoneal administration of cytostatic drugs.

The application of this new alternative of treatment increases the risk of postoperative complications. In these patients, the imbalance of the risk factors and defense mechanism favors a higher morbid-mortality rate than in usual patients. The goal of cytoreductive surgery in these patients is to remove the last tumor cell, clearing the abdomen and pelvis of disease. This required a series of peritonectomy procedures and visceral resections.

Osakidetza; 04/12/2007
# CARCINOMATOSIS Versus CONVENTIONAL PATIENTS.

<table>
<thead>
<tr>
<th></th>
<th>Conventional Patients</th>
<th>Cytoreduction Patients</th>
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<tr>
<td>Previous Surgeries</td>
<td>0</td>
<td>&gt; 1</td>
</tr>
<tr>
<td>Previous Chemotherapy</td>
<td>0</td>
<td>&gt; 1</td>
</tr>
<tr>
<td>Parietal Peritoneum</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Greater and lesser omentum</td>
<td>Present / Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Parietal Peritonectomies</td>
<td>0</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Visceral resections</td>
<td>1</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Bowel anastomosis</td>
<td>1 or 2</td>
<td>&gt; 2</td>
</tr>
<tr>
<td>Serosal Tears</td>
<td>Unusual</td>
<td>Frequent</td>
</tr>
<tr>
<td>HIIC + EPIC</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Empty cavity. Dead space.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Severe Sepsis or C.I.D.</td>
<td>Unusual</td>
<td>Frequent</td>
</tr>
<tr>
<td>Abdominal Compartment Syndrome</td>
<td>Unusual</td>
<td>Frequent</td>
</tr>
</tbody>
</table>

The main difficulty in the management of these patients lies in that the complete elimination of the causative focus of coagulopathy or infection is a prerequisite before clousing of the abdominal cavity, and often it is difficult to get the situation under control in only one reoperation. These are patients whose parietal peritoneum and greater omentum have been previously resected, with many surgical resections and who have received intraperitoneal chemotherapy. As a consequence of that, they have not any locoregional protection and suffer from an empty cavity with a big dead space. And finally we must avoid that these patients develop an abdominal compartment syndrome. For all these reasons they need a temporary abdominal wall closure.
# MORBIDITY. National Cancer Institute´s common toxicity criteria.

- **Complications**
  - Medullary Aplasia: 17 (22.9%)
  - Genitourinary: 7 (9.4%)
  - Cardiovascular: 0 (0.0%)
  - Pleuropulmonar: 7 (9.4%)
  - Central Line Sepsis: 7 (9.4%)
  - Gastrointestinal: 27 (36.4%)
  - Infections: 8 (10.8%)
  - Neurologic: 1 (1.3%)

- **No Complications**

Bowel perforations. A sidewall perforation of the bowel produced by electroevaporation of tumor nodules with the ball tip was responsible most of the times in these septic cases. The abdominal septic problems appeared later during the second postoperative week. Up to ten abdominal revisions were necessary in one of the patients before clousing his abdomen.

Alberto Gomez; 07/11/2004
Complications.

30% 70%

42.8% Reop

Bowell perforations.
A sidewall perforation of the bowel produced by electroevaporation of tumor nodules with the ball tip was responsible most of the times in these septic cases.
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Alberto gomez; 07/11/2004

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Unnoticed Serosal tears.

Complications.

- 30% Complications
- 70% No Complications

- 42.8% Reop
- 23.9% OVA

Bowell perforations.
A sidewall perforation of the bowel produced by electroevaporation of tumor nodules with the ball tip was responsible most of the times in these septic cases.
The abdominal septic problems appeared later during the second postoperative week.
Up to ten abdominal revisions were necessary in one of the patients before clousing his abdomen.

Alberto Gomez; 07/11/2004
# Techniques of temporary abdominal closure

**Table 2. Techniques for Temporary Closure**

<table>
<thead>
<tr>
<th></th>
<th>Packing</th>
<th>Fascial Closure</th>
<th>Skin Closure</th>
<th>Synthetic Biomaterial</th>
<th>Vacuum Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contains viscera</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Protects viscera</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Prevents fluid loss</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Prevents contamination</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Ease of use</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Nursing care</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Prevents high intra-abdominal pressure</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Preserves fascial edges</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
</tr>
</tbody>
</table>

It is the optimal temporary closure.

*Brock WB et al. Am Surg. 61: 30-35. 1995*

Temporary Closure of Open Abdominal Wounds: The Vacuum Pack

W. Bradford Brock, M.D., Donald E. Barker, M.D., F.A.C.S., R. Phillip Burns, M.D., F.A.C.S.

From the Department of Surgery, Chattanooga Umt. University of Tennessee College of Medicine, Chattanooga, Tennessee.

Temporary closure of abdominal surgical wounds is occasionally required when conditions of the abdominal wall or peritoneal cavity prevent closure or when early re-exploitation is planned. The optimal temporary closure should contain and protect the contents of the peritoneal cavity from external contamination and injury; preserve the integrity of the abdominal wall; be simple to perform and maintain; provide ease of feeling; and have minimal adverse physiological effects. Based on these criteria, a method of temporary abdominal wound closure (termed the "vacuum pack") has been designed and evaluated. The operative technique includes: 1) placement of a fenestrated polyethylene sheet between the abdominal visera and anterior parietal peritoneum; 2) placement of a moist, sterile laparotomy towel over the polyethylene sheet; 3) placement of two closed suction drains over the towel; 4) placement of an adhesive-backed drape over the entire wound, including a wide margin of surrounding skin; and 5) suctioning applied to the drains, creating a vacuum and rigid compression of the layers of closure material. This creates a tight, external seal of the adhesive-backed drape and facilitates drainage of the peritoneal cavity. From April 1992-December 1993, 110 temporary abdominal wound closures were performed 26 times in 28 patients, ages 6-78 years, for periods of 1-11 days. The procedure was used in 17 trauma patients and 11 non-trauma patients. Indications for use included increased intra-abdominal pressure, in situ mandatory re-exploration in 10, and a combination of these indications in nine patients. No intra- and postoperative airway and systemic blood pressures were affected by this closure. All closures remained intact until removed, and there was no extravasation or abdominal wall injury. Overall manual mortality was 37.5%, none related to the vacuum pack. Twenty-one patients underwent either primary fascial closure (n = 14), or staged closure (n = 7). The vacuum pack has proven useful for temporary closure of abdominal wounds.

A MAJOR COMPONENT in completion of most open intra-abdominal surgical procedures is wound closure of the abdominal wall. However, under certain circumstances, immediate tension-free approximation of the abdominal wall (i.e., primary fascial closure) may be impossible. Such circumstances occur in patients with major tissue loss secondary to trauma or abdominal wall infections requiring radical debridement, and in patients when visceral edema, retroperitoneal hematoma, or packing of the peritoneal cavity results in increased intra-abdominal volume beyond the capacity of the closed peritoneal cavity. Forced abdominal closure under tension may result in fascial laceration, necrosis, and lead to infection and dehiscence. In addition, forced closure may adversely affect pulmonary, cardiac, and renal function. Other circumstances negate the necessity of immediate primary closure, even when possible. These conditions include planned re-exploration for intra-abdominal sepsis, compromised bowel viability, or following "damage control" procedures when physiologic instability of the patient has necessitated performance of incomplete procedures.

A variety of techniques for temporary abdominal wall closure have been described over the past decade. Although the techniques are similar in surgical principles and allow for sequential abdominal reexploration and debridement, they each have inherent flaws making them less than ideal.

We describe a technique of temporary abdominal wall closure and review its use in our surgical patient population.

Materials and Methods

The technique of closure which we have designated as the "vacuum pack" consists of a three-layered, sutureless, occlusive dressing that is stabilized by a continuous vacuum seal. The first layer is a polyethylene sheet (10-10, 3M), the second a moist sterile...
Cross sectional diagram of open vacuum abdomen pack

Adhesive backed plastic drape

Abdominal wall

Surgical towels

Multiperforated plastic drape

Sump drain

Peritoneal cavity

Sump drain


We have chosen the Open Vacuum Abdomen technique, described by Brock et al 10 years ago, as the elective temporary closure in these difficult situations.
The technique consists of a three-layered sutureless occlusive dressing stabilized by a continuous vacuum seal.
The inner layer is a fenestrated polyethylene sheet between the viscera and the abdominal wall.
two closed suction drains plus two sterile laparotomy towels, provide a filter for exudative material.
For the outer layer an adhesive drape over the entire wound is applied (Ioban, 3M).

Alberto Gomez; 07/11/2004
Diagram of open vacuum abdomen pack completed

Continuous suction

Abdominal wall

Jackson Pratt Sump drains

Adhesive backed plastic drape


The application of the open vacuum abdomen is relatively simple, and takes only minutes to perform. All vacuum changes were performed in the operating room following an intraperitoneal abdominal exploration. This technique prevents peritoneal contamination, protects viscera and...
All clousures remained intact until removed, and there were no eviscerations or abdominal wall injuries. A single vacuum pack was never left in place longer than 2 days.

A new enteric fistula occurred in only one patient during abdominal explorations.
Causes of Open vacuum abdomen. OVA.

17 patients (23.9%) need an OVA.

The coagulopathy problems aroused during the first five postoperative days. The diaphragmatic and the pelvi peritonectomies, were responsible of the reoperations for coagulopathy reasons. In those cases only one vacuum abdomen was need to control the hemorrhage and we close the cavity 24 hours later, after a second reoperation with complete revision of the hemostatic situation of the whole cavity.

Alberto Gomez; 28/11/2004
Anastomotic dehiscence
A colo-rectal anastomotic dehiscence was found in only three occasions.

We also control the sepsis in case of anastomotic disruption, in one or two sessions, because we use a derivative colostomy in these patients. So we could close the abdomen in 48 hours.

The situation was completely different in cases of leakage from bowel lacerations, because although we close the enterotomies primary the edema, ileus and luminal pressure prevents the control of the problem many times, requiring up to 10 different reoperations in one of our patients.

Alberto gomez; 07/11/2004
Unnoticed Serosal tears.
Bowell perforations.
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Alberto gomez; 07/11/2004
<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>No. Of patients</th>
<th>Operation duration (hours)</th>
<th>Hospital stay (days)</th>
<th>Mortality (%)</th>
<th>Morbidity (%)</th>
<th>Hematological toxicity (%)</th>
<th>Reoperation (%)</th>
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<tbody>
<tr>
<td>Piso et al</td>
<td>2001</td>
<td>28</td>
<td>6</td>
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<td>7</td>
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<td>Butterworth et al</td>
<td>2002</td>
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<td>Glehen O et al</td>
<td>2003</td>
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<td>Kusamura et al</td>
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<td>Loggie et al</td>
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<td>Sugarbaker et al</td>
<td>2006</td>
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<td>Smeenk et al</td>
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<td>Elias et al</td>
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<td>Franko et al</td>
<td>2008</td>
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<td>1,4</td>
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<td>33</td>
<td>9,8</td>
<td>70</td>
<td>22,9</td>
<td>42</td>
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</table>

Differences in the method of grading toxicity make it difficult to compare these reports.

The main difficulty in the management of these patients lies in that the complete elimination of the causative focus of coagulopathy or infection is a prerequisite before clousing of the abdominal cavity, and often it is difficult to get the situation under control in only one reoperation. These are patients whose parietal peritoneum and greater omentum have been previously resected, and who have received intraperitoneal chemotherapy.
And finally we must avoid that these patients develop an abdominal compartment syndrome.
For all these reasons they need a temporary abdominal wall closure.
The Common terminology criteria for adverse events (CTCAE) version 3.0 of the NIH criteria, was adopted in Milan by the panel of experts as the unique classification system to be used for reporting complications related to CRS + HIPEC.

It is a very complete and extensive guide regrouping 310 types of complications within 28 categories based on the anatomy and/or pathophysiology of the complication.
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Conclusions.

In our experience the open vacuum abdomen is an optimal technique useful for temporary closure of the abdominal cavity in patients suffering abdominal complications after cytoreductive surgery.

A primary fascial closure was possible in 2/3 of the cases. 1 patient died. 2 enteric fistula.

All but one patients were discharged alive from the Hospital.

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**Conclusions. Preventive measures.**

Right diaphragmatic peritonectomy with glisectomy FIRST.

Avoid cytoreductions of more than 10 hours duration.

Although a colo-anal anastomosis is always performed, opt for an excluding derivative ostomy from the outset in case of more than two anastomoses.

Prompt reintervention when fistulas or the dehiscence of sutures are suspected or reveal themselves, and even in unidentified septic processes.

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