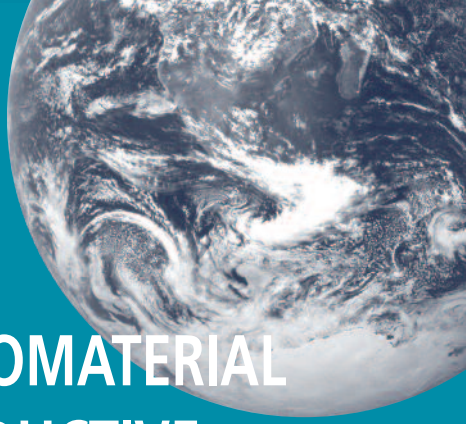
World Cancer Research Journal WCRJ 2014; 1 (2): e250



RESULTS OF LARGE ABDOMINAL WALL RESECTION REPAIRED WITH BIOMATERIAL DURING HIPEC FOLLOWING CYTOREDUCTIVE SURGERY FOR PERITONEAL METASTASES

D. ELIAS, A. CARUSO, F. VITTADELLO, D. GOÉRÉ, F. DUMONT, C. HONORÉ

Department of Surgical Oncology: Gustave Roussy, Cancer Campus, Grand Paris, France

ABSRACT: Background: *Abdominal wall resection is sometimes necessary to achieve complete cytoreductive surgery before using HIPEC to treat malignant peritoneal disease. This surgery is clean-contaminated due to associated digestive wounds contraindicating the use of synthetic mesh to repair the abdominal wall defect and using absorbable polyglactin 910 mesh results in delayed ventral hernias.*

AIM of the study: *To appraise the efficacy of biomesh for the repair of abdominal wall defects occurring during cytoreductive surgery plus HIPEC.*

Materials and methods: *A retrospective analysis of 14 cases in which biomesh was used to repair the abdominal wall defect.*

Results: *Postoperative infection occurred in 29% of cases (not due to the presence of the bomesh), but biomesh removal was not necessary. A delayed ventral hernia occurred in 21% of cases, and no tumor recurrence arose around the biomesh.*

Conclusions: *The use of biomesh can be recommended for the repair of large abdominal wall defects during cytoreductive surgery plus HIPEC.*

KEY WORDS: *Biomesh, Peritoneal metastases, Cytoreductive surgery, HIPEC.*

INTRODUCTION

Complete cytoreductive surgery plus hyperthermic intraperitoneal chemotherapy (CCRS+HIPEC) is on the verge of becoming the gold standard treatment for diffuse peritoneal seeding, for peritoneal pseudomyxoma, peritoneal mesothelioma, and peritoneal carcinomatosis originating from colorectal cancer (when disease is limited in extent)[1-5].

In a few cases, the anterior abdominal wall is widely invaded by tumors and the only way to perform CCRS is to resect the full-thickness of the abdominal wall muscles. This results in a large abdominal wall defect which must be repaired with mesh. Although there is an enormous body of literature devoted to what to do when faced with an operation requiring resection of the abdominal wound, there is virtually nothing when this occurs after CCRS+HIPEC for the treatment of peritoneal carcinomatosis. CCRS comprises digestive resections followed by anastomoses which are "clean-contaminated" actions contraindicating the use of synthetic material. One way to overcome this is to use a recent biomaterial to repair full-thickness abdominal wall defects. Using absorbable polyglactin 910 mesh (Vicryl*, Ethycon Inc.) results in delayed ventral hernias. The aim of this short study was to analyze the results of the use of biomesh to repair large abdominal wall defects during CCRS+HIPEC.

Corresponding Author: Dominique Elias, Ph.D; e-mail: dominique.elias@gustaveroussy.fr

PATIENTS AND METHODS

Patients were retrospectively selected from a prospective verified database comprising 556 CCRS+HIPEC performed in our center between January 2004 and December 2013.

Macroscopically detectable peritoneal metastases were completely resected with peritonectomy procedures, as described in previous studies[6]. The microscopic residual disease was then treated with HIPEC during the surgical procedure[7]. We used intraperitoneal oxaliplatin (300 mg/m^2) mixed with irinotecan (200 mg/m^2) in 2 L/m^2 of dextrose 5%, over 30 min. at 43°C (in-drains between 45-46°C, and out drains between 42-43°C). Patients received an intravenous infusion of 5-fluorouracil (400 mg/m^2) and leucovorin (20 mg/m^2), one hour before HIPEC.

The abdominal wall resection was performed with the aim of achieving a clear margin of 2 cm around the macroscopic tumor invading the wall. This was a gross examination mainly based on palpation performed by the surgeon.

Biomeshes were acellular animal dermal or pericardial matrices. Placement of the biomesh was the last action of the combined procedure.

No patient was lost to follow-up.

RESULTS

Fourteen patients were eligible. They represent 2.5% of the 556 patients who underwent CCRS+HIPEC during the same period.

There were 12 women and 2 men, with a mean age of 59 years (range: 46-70). In 71% of the cases (n=10), the origin of the primary was colorectal. The lesion was a peritoneal pseudomyxoma in 3 cases and a malignant mesothelioma in one case. The characteristics of the selected patients are reported in Table 1. The median peritoneal cancer index (PCI)[8] which is a reliable yardstick of the extent of the peritoneal disease was 14 (range: 1-35). At least one digestive suture (lateral or circumferential) was performed in all the patients (median: 1.4, range: 1-3). The median duration of surgery was 532 min. and median intraoperative blood loss was 905 ml.

The mean extent of the abdominal wall resection was 145 cm^2 (range: 50-300). Macroscopically, resection of the tumor invading the wall always seemed complete (R0).

Biomeshes, the choice of which changed according to the time period and price, were from diverse manufacturers (Table 1). They were even constructed with bovine pericardium or porcine dermis.

TABLE 1. PRE-, INTRA- AND POST-OPERATIVE PATIENT DATA

Number of patients:	14
Age (median):	58.9 y (46-70)
Sex ratio F/M:	6/1 (12F, 1 M)
Primary:	
• Colorectal	10 (71.4%)
• Pseudomyxoma	3 (21.4%)
• Mesothelioma	1 (7.2%)
PCI (median):	14 (1-35)
Visceral anastomosis/patient (median):	1.4 (1-3)
Extent of wall resection (median):	
Types of prosthesis:	145.4 cm (50-300)
• Protexa*	8 (57%)
• Tutomesh*	5 (36%)
• Strattice*	
Median follow-up:	1 (7%)
24.1 months (6-55)	
Infection rate:	4/14 (29%)
• Simple drainage	3
• Re-laparotomy	1
Prosthesis removed:	0/14 (0%)
Positive margin in the wall:	1/14 (7%)
Delayed ventral hernia:	3/14 (21%)
Wall recurrence:	0/14 (0%)
Overall recurrences:	9/14 (64%)
• Peritoneal	4
• Liver	1
• Lung	1
• Kidney	1
• Multifocal	2
Deceased patients:	3/14 (21%)

Positive margin on the wall

The pathologic examination revealed a positive margin (R1 resection) in one case (7%): the positive margin was irradiated postoperatively (55 Gy).

Postoperative infections

Four patients experienced postoperative abdominal sepsis. Sepsis was not due to the biomesh by itself, but resulted from the miscellaneous digestive resections. Three of the 4 patients had to undergo another surgery to clean and drain an abdominal wall abscess which was in contact with the biomesh. It was however possible to maintain the biomesh in the three cases. Then, in two patients, a superficial infection necessitated prolonged daily local irrigation of the wound which lasted 4 and 6 months respectively. Biomesh removal was never required. The fourth patient developed peritonitis due to perforation of the sigmoid colon. He underwent a Hartman procedure with a terminal stoma and placement of another biomesh.

Delayed ventral ernia

Three patients (21%) developed a delayed ventral abdominal wall hernia which required reoperation and placement of synthetic mesh in two cases and conservative treatment in one case. These abdominal wall hernias occurred after placement of the thin pericardial biomeshes. No peritoneal nor any parietal recurrence was discovered in the re-operated patients.

Abdominal wall and overall recurrences

After a median follow-up of 24.6 months, no abdominal wall recurrence was detected. No tumor recurrence arose on the preserved skin covering the biomesh. Nine (64%) patients developed a recurrence (peritoneum: 4, liver: 1, lung: 1, kidney: 1, multifocal: 2), and reoperation was possible with a curative intent in 3 cases. Three patients (21%) died of cancer.

DISCUSSION

This short series shows that biomeshes appear to be useful and reliable to replace large abdominal wall defects occurring during CCRS+HIPEC aimed at curative treatment of diffuse tumor deposits in the peritoneum. Importantly, biomeshes seem to tolerate a low degree of sepsis, as is the case when surgery is clean, but during which a segment of the digestive tract is open. To our knowledge, this is the second study devoted to this subject.

HIPEC is used to treat occult residual intraperitoneal tumor deposits, and only once has CCRS resected all the visible malignant lesions[8]. If there is tumor extension inside the abdominal wall, it must also be resected to maintain a curatively intended approach.

Extensive tumor involvement of the abdominal wall is rare (2.5% in this series), and occurs more frequently in the case of colorectal cancer than in that of pseudomyxomas or peritoneal mesotheliomas (respectively 71%, 21%, and 7%). It occurs via direct contiguous tumor invasion upward towards the surface, or along the postoperative abdominal drains. Large abdominal wall involvement after resection results in a far greater defect. After many years, experience has taught us that every time we make an incision in the wall (and its muscles) close to the tumor, without tumor rupture and perform a macroscopically complete excision, this frequently results in an R1 resection at the pathologic examination. Microscopic tumor foci are observed inside the striated muscle around the tumor. Consequently, we adopted the rule to cut at approximately 2 cm beyond the visible and palpable tumor. This allowed us to obtain an R0 resection in 13 of the 14 cases (93%) in this series.

In this series, the median surface of the abdominal wall defect was 145 cm^2 (i.e. 12 cm x 12 cm). Direct suture of the abdominal wall was not possible. When there is no abdominal wall replacement (only the closure of the skin) or when absorbable polyglactin 910 mesh is used, a large ventral hernia occurs. It is dangerous to use synthetic mesh due to the high risk of infection related to very frequent opening of the digestive tract during CCRS+HIPEC. The other possibility would be to use the component separation technique described by Ramirez et al. This technique allows one to cover only midline defects (and not lateral defects) with a fasciotomy lateral to the rectus abdominis muscle followed by dissection along the plane between the external and internal oblique muscle[9]. So far, we have not used this technique, but it would be good to compare it to the use of biomesh when we are faced with a midline defect.

Biomesh is reputed to have the capacity to tolerate infection[10], but this is based exclusively on case series and case reports which provide the lowest level of evidence. At this point in time, there is no real proof that biologic mesh is better than synthetic mesh in contaminated conditions[11] and neither the FDA nor the EU (European Union) have approved its usefulness in this setting. However, in our study, the question is different because it concerns only clean-contaminated surgery, and not dirty-infected surgery.

The degree of microbial contamination of surgery was classified as early as 1964 into four classes: clean (I), clean-contaminated (II), contaminated (III), and dirty (IV)[12]. This classification continues to be used worldwide[13]. All of our patients belong to the clean-contaminated class, due to the operative wound of the alimentary tract. In addition they underwent extensive cytoreductive surgery and HIPEC, resulting in major physiological aggression which promotes immunosuppression and infection[14]. For this particular type of combined treatment, using biomesh to repair abdominal wall defects seems to result in 29% of mesh infection (secondary to an initial deep-seated infection), without mesh removal and with 21% of delayed wall dehiscence. This result appears favorable and acceptable given the complexity of the pathology. Before us, Boutros et al. reported early results of biomaterial also used during CCRS+HIPEC in 8 patients[15]. Only one patient developed complications (enterocutaneous fistula and incisional hernia). However, the peritoneal disease was less extensive in their series (median peritoneal cancer index was 8 versus 14 in our series), and more than half of their patients did not have bowel resection with anastomosis (versus 100% of our patients). In addition, the HIPEC protocol was different with

the use of only one compound (mitomycin C). Finally, their better results are also in favor of using biomesh under such conditions.

In conclusion, the use of biomesh can be recommended for the repair of large abdominal wall defects during cytoreductive surgery plus HIPEC.

The authors thank Ms Lorna Saint Ange for editing.

Conflict of Interests:
The Authors declare that they have no conflict of interests.

References

1. Elias D, Goéré D, Dumont F, Honoré C, Dartigues P, Stoclin A, Malka D, Boige V, Ducreux M. Role of hyperthermic intraoperative peritoneal chemotherapy in the management of peritoneal in the management of peritoneal metastases. Eur J Cancer 2014; 50: 332-340.
2. Chua T, Moran B, Sugarbaker P, Levine, E, Glehen O, Gilly F, Baratti D, et al. Early and long-term outcome data on 2298 patients with pseudomyxoma peritonei of appendiceal origin treated by a strategy of cytoreductive surgery and hyperthermic intraperitoneal chemotherapy. J Clin Oncol 2012; 30: 2449-2456.
3. Yan TD, Deraco M, Baratti D, Kusamara S, Elias D, Glehen O, et al. Cytoreductive surgery and hyperthermic intraperitoneal chemotherapy for malignant peritoneal mesothelioma: multi-institutional experience. J Clin Oncol 2009; 27: 6237-6242.
4. Chua T, Esquivel J, Pelz J, Morris D. Summary of current therapeutic options for peritoneal metastases from colorectal cancer. J Surg Oncol 2013; 107: 566-573.
5. Elias D, Gilly F, Boutitie F, et al. Peritoneal colorectal carcinomatosis treated with surgery and perioperative intraperitoneal chemotherapy: retrospective analysis of 523 patients from a multicentric French study. J Clin Oncol 2010; 28: 63-68.
6. Elias D, Blot F, El Otmany A, et al. Curative treatment of peritoneal carcinomatosis arising from colorectal cancer by complete resection and intraperitoneal chemotherapy. Cancer 2001; 92: 71-76.
7. Elias D, Lefevre JH, Chevalier J, Brouquet A, Marchal F, Classe JM, Ferron G, Guilloit JM, Meeus P, Goéré D, Bonastre J. Complete cytoreductive surgery plus intraperitoneal chemohyperthermia with oxaliplatin for peritoneal carcinomatosis of colorectal origin. J Clin Oncol 2009; 27: 681-685.
8. Sugarbaker PH, Cunliffe WJ, Beliveau JF, de Bruin E, Graves T. Rationale for perioperative intraperitoneal chemotherapy as a surgical adjuvant for gastrointestinal malignancy. Reg Cancer Treatment 1988; 1: 66-79.
9. Ramirez OM, Ruas E, Dellon AL. "Components separation" method for closure of abdominal-wall defects: an anatomic and clinical study. Plast Reconstr Surg 1990; 86: 519-526.
10. Rosen MJ, Krpata DM, Ermlich B, Blatnik JA. A 5-ear clinical experience with single-staged repairs of infected and contaminated abdominal wall defects utilizing biologic mash. Ann Surg 2013; 257: 991-996.
11. Primus FE, Harris HW. A critical review of biologic mesh use in ventral hernia repairs under contaminated conditions. Hernia 2013; 17: 21-30.
12. Hart D, Postlethwaith RW, Brown IW et al. Postoperative wound infections: a further report on ultraviolet irradiation with comment on the recent (1964) national research council cooperative study reports. Ann Surg 1968; 167: 728-743.
13. American College of Surgeons. ACS data collection, analysis, and reporting [internet]. Chicago, IL: American college of surgeons; 2013 [cited 2012 Aug 31]. Available from: https//site.acsnsqip.org/programspecifics/data-collection-analysis-and-reporting/
14. Slade NS, Simmons RL, Yunis E. Immunodepression after major surgery in normal patients. Surgery 1975; 78: 363-372.
15. Boutros C, Somasundar P, Espat N. Early results on the use of biomaterials as adjuvant to abdominal wall closure following cytoreduction and hyperthermic intraperitoneal chemotherapy. World J Surg Oncol 2010; 8: 72-78.