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original article

Negative pressure wound therapy (NPWT) after cytoreductive surgery (CRS) and intraperitoneal chemotherapy (HIPEC) for peritoneal surface malignancies: preliminary report

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SUMMARY: **Negative pressure wound therapy (NPWT) after cytoreductive surgery (CRS) and intraperitoneal chemotherapy (HIPEC) for peritoneal surface malignancies: preliminary report.**

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Aim. *Surgical site (SSI) infection is a common complication that occurs in the post-operative period because it still has a decisive impact on the morbidity and mortality of patients and the costs associated with therapy and prolongation of hospitalization. In recent years, therefore, several authors have published their experience in the use of negative pressure prevention systems (NPWT) for the management of surgical wounds.*

Few authors in the literature have discussed the use of NPWT in patients undergoing cytoreductive surgery (CRS) for peritoneal surface malignancies associated with hyperthermic intraperitoneal chemotherapy (HIPEC).

Patients and methods. *Nineteen patients undergoing open surgery, of which 15 underwent CRS+HIPEC operations; in 2 cases the dressing was applied to patients undergoing colon surgery, 1 case after emergency laparotomy for intestinal occlusion in a patient with a BMI of 29 and 1 case after gastric surgery for a tumour.*

At the and of the surgery, NPWT was placed on the surgical site; the therapy includes a closed and sealed system which maintains a negative pressure between at -125 mmHg on the surgical wound and which remains in place for five days.

Results. *The rationale for using an NPWT is to determine a barrier between the wound and external contamination, reducing wound tension and reducing the formation of seroma and hematoma. Moreover, during the HIPEC, several litres of water are used to wash the patient's abdominal cavity and then the patient is sutured again without the peritoneum, losing the function of protection from external microorganism and also of reabsorbing the intra-abdominal serum.*

A recent Cochrane collaboration about the application of NPWT demonstrates that it may reduce the rate of SSI compared with SSD, even if there is no sure evidence about the reduction of complications like seromas or dehiscence.

Conclusion. *After the analysis of the preliminary data, we confirm the possibility to start with a randomised clinical trial, as suggested by the literature.*

KEY WORDS: Negative pressure wound therapy (NPWT) - Surgical site infection (SSI) - Surgical oncology.

Background

Surgical site (SSI) infection is a common complication that occurs in the post-operative period because it still has a decisive impact on the morbidity and mortality of patients and the costs associated with therapy and prolongation of hospitalization (1); in the United States it has been calculated that the increase in hospitalization costs in the case of SSI is about $ 20,000 (2).

In Italy, the rate of SSI reported by surveillance of surgical site infections was 2.6%, about 1628 cases, of which the most important percentages concerned colon and rectum surgery (5,2%) (3, 4). Also, SSIs are responsible for the emergence of antibiotic resistance.

The risk of developing complications in a surgical wound is linked to multiple risk factors, including some behavioral (diabetes, high BMI, cigarette smoking), others related to correct clinical practice

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(correct antibiotic prophylaxis, correct surgical technique, duration of the intervention), and others related to medical cancer or radiotherapy, as in the case of advanced oncological diseases (5, 6).

Several protocols have therefore been developed for the prevention of the onset of SSI; the latest guidelines have reiterated some already consolidated evidence, but as far as the indication for the use of advanced dressings is concerned there is still no strong recommendation (7).

In recent years, therefore, several authors have published their experience in the use of negative pressure prevention systems (NPWT) for the management of surgical wounds closed by the first intention with a high risk of complications.

Few authors in the literature have discussed the use of NPWT in patients undergoing cytoreductive surgery (CRS) for peritoneal surface malignancies associated with hyperthermic intraperitoneal chemotherapy (HIPEC). The first case series was published in 2013 into an observational study and subsequently in phase II clinical trial (RCT) that included laparotomies for different types of abdominal tumours. In phase II clinical trial (RCT), a sample of 67 patients underwent CRS+HIPEC plus NPWT was investigated compared to a group of 68 patients in which a standard surgical dressing (SSD) was applicated (8, 9).

The objective of our observation was to evaluate whether, in a selected group of patients, the use of NPWT could lead a reduction of SSI in oncological abdominal surgery and if these results could suggest starting with a randomised clinical trial.

Materials and methods

In our surgical unit for two years, we placed the NPWT to patients who undergo CRS+HIPEC or who had high-risk factors in developing SSI, such as some obese patients and diabetics undergoing major surgery.

Nineteen patients undergoing open surgery, of which 15 underwent CRS+HIPEC operations; in 2 cases the dressing was applied to patients undergoing colon surgery, 1 case after emergency laparotomy for intestinal occlusion in a patient with a BMI of 29 and 1 case after gastric surgery for a tumour.

At the end of the surgical procedure, the negative pressure dressing system, of the length of the surgical wound, was positioned above the median wound closed by the first intention. The therapy includes a closed and sealed system which maintains a negative pressure between at -125 mmHg on the surgical wound and which remains in place for five days. The indication, however weak, is for those wounds at high risk of developing SSI, such as wounds with poor tissue perfusion, wide dead space, wound contamination.

The therapy helps to reduce the formation of seromas or hematomas thanks to better drainage of the fluids and the isolation of the wound from the entry of microorganisms from the surrounding environment.

The dressing was removed in the fifth day, except in one case where the removal took place on the first day due to infiltration of the wound by enteric material from the adjacent ileostomy, without providing for repositioning; this case is not considered in this series.

Results

Preliminary data showed that patients undergoing CRS+HIPEC have a higher average age than the other groups, 70% of them have an ASA score of III and an average BMI of 22; 80% of them had a neo-adjuvant chemotherapy treatment, and the duration of the intervention was on average 695 minutes with a range of 810-405 min.

In the other groups, as shown in Table 1, the average age was lower, and the BMI average was higher than 29, with a significantly lower duration of surgery.

The complications observed after dressing removing were four. In one case a dehiscence of 2 cm was found in the distal third of the laparotomy in the absence of SSI in the CRS+HIPEC group; in the other three cases the presence of SSI in subcutaneous tracts of about 2-3 cm associated with fever was observed; 1 of this in the exploratory laparotomy and the remaining 2 complications in the colic surgery group.

SSI was treated with antibiotic-therapy aimed at wound culture tests and traditional manual dressings,

TABLE 1 - TYPE OF PROCEDURES, AGE, ASA SCORE AND BMI OF THE PATIENTS.

PROCEDURES	AGE (mean)	ASA SCORE III (%)	BMI (mean)
CRS+HIPEC	62	69	22.01
COLON RESECTION	56	33	30.3
EXPLORATORY LAPAROTOMY	38	0	29
GASTRECTOMY	54	100	36

also performed in outpatient post-hospitalisation, still leading to complete resolution of the complication in 3 weeks. In no case, we observed the formation of hematomas or seromas.

The NPWT applications are shown visually in Figure 1; the lighter portion indicates a complication. The curve shows the average duration of surgery, much greater for CRS+HIPEC.

Discussion

Patients subjected to CRS+HIPEC undergo surgical procedures of high duration, with the removal of the parietal peritoneum (a natural barrier that reduces the translocation of bacteria from the most superficial layers of the wall and the abdominal cavity) and subjected the effects of acquired immunosuppression after several cycles of neoadjuvant chemotherapy (Table 2).

Not only, but they are also often ill-nourished patients, who need intravenous nutritional support and may have risk factors for SSI related to common risk factors such as diabetes, high BMI values and high ASA scores (10). The rationale for using an NPWT is to determine a barrier between the wound and external contamination, reducing wound tension and reducing the formation of seroma and hematoma. Moreover, during the HIPEC, several litres of water are used to wash the patient's abdominal cavity and then the patient is sutured again without the peritoneum, losing the function of protection from external microorganism and also of reabsorbing the intra-abdominal serum (11).

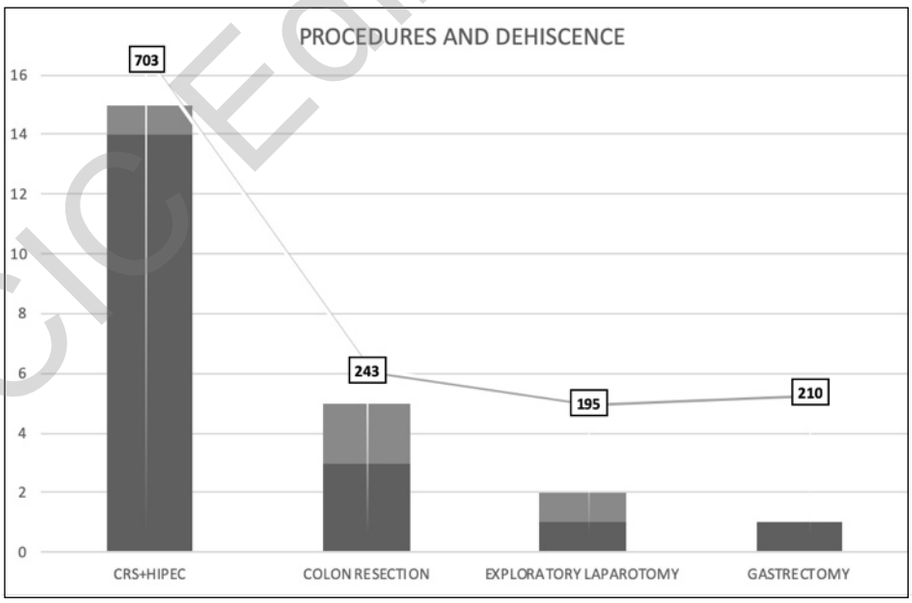

Figure 1 - The column describes the type of procedures; in dark grey the number of patients treated, in light grey the complications noted. Into the square the mean time of surgery for each procedure.

TABLE 2 - NUMBER OF PROCEDURES (N) AND WOUND COMPLICATIONS (WC).

PROCEDURES (N)	CW (N)(%)
CRS+HIPEC (14)	1 (7,14)
COLON RESECTION (3)	2 (66)
EXPLORATORY LAPAROTOMY (1)	1 (100)
GASTRECTOMY (1)	0
TOT (19)	4

The authors hypothesise that negative pressure can keep the laparotomy dry, reducing the risk of evisceration.

Furthermore, it is necessary that the postoperative course of these patients is free of complications to allow the recovery of subsequent cancer treatments as soon as possible and with good performance status.

The estimated cost of a negative pressure therapy is about $ 500; however, it has been calculated that the overall costs of a hospital stay complicated by SSI are greater than $ 15,000 (5).

The limit of this study is the reduced number of included cases; they are preliminary data that analyse a small number of patients subjected to CRS+HIPEC; in literature, however, there is only the sample of 67 patients present in the phase II trial of Shen and Blackham regarding CRS+HIPEC (9).

In this trial, the authors conclude that the use of NPWT does not decrease the risk of wound complication if compared to the application of SSD. Not only but they point out that in retrospective observational studies, there seems to be a benefit that is lost in the prospective study, which however is also unique RCT in literature at the moment (8).

A recent meta-analysis, moreover, appears to demonstrate the efficacy of NPWT in wall reconstruction in high-risk patients; in the meta-analysis, the RCT aforementioned is also considered itself (12, 13).

In both cases, the authors conclude, it is necessary to produce new prospective randomised clinical trials.

Moreover, a recent Cochrane collaboration about the application of NPWT demonstrates that it may reduce the rate of SSI compared with SSD, even if there is no sure evidence about the reduction of complications like seromas or dehiscence (14).

Our experience suggests that in selected patients, such as oncological patients underwent to CRS+HIPEC, the use of NPWT could help reduce the occurrence of SSI and improve post-operative recovery, allowing to resume post-operative oncological therapies as soon as possible.

Conclusion

Starting from these considerations, we evaluated the application of NPWT to a selected group of patients and, after the analysis of the preliminary data, we confirm the possibility to start with a randomised clinical trial, as suggested by the literature.

The use of NPWT did not delay the discharge of the patient for SSI.

Additional RCTs are needed to validate the use of NPWT in patients undergoing CRS+HIPEC.

Disclosure statement

The Authors have nothing to disclose.

Consent to the processing of data for scientific purposes is requested and signed at the time of admission and kept in the medical record.

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