

# Surgical Site Infections after Median Laparotomy Treated with NPWT and PHMB Gauze

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## Introduction & Aim

After colon operation, wound infection incidence in Europe is 6.4% (6-6.9%) and this occurs usually between the 6th and the 10th day post operatively. In hospital practice the vacuum technique is widely used as a standard treatment for acute or chronic infected wounds. While this technique was first described using gauze as the medium directly in contact with the wound surface and distributing the sub-atmospheric pressure, nowadays foam dressings are widely used. Lately, antimicrobial gauze dressings are experiencing a renaissance, enriching the range of therapeutic options. In our hospital, large postoperative subcutaneous wound infections are treated by a NPWT system\* with PHMB gauze\*\*\*. In our experience, NPWT\* with PHMB interface\*\*\* has many positive effects in wound healing including decontamination, detoxification, internal stabilization of the wound, reduction of wound edema, and induction of new granulation tissue formation leading to quick wound closure. To evaluate the effectiveness of the NPWT system\* in post-operative subcutaneous wound infections after abdominal operations, a prospective single arm controlled study was started, based on the hypothesis that NPWT\* with a PHMB gauze\*\*\* [1, 2, 3] on Surgical Site Infection (SSI) cases followed by secondary sutures for wound closure, provides a comfortable dressing and cosmetically good results.

## Description of Study

All suitable subcutaneous infections after midline incision were treated bedside with NPWT\* and PHMB gauze interface\*\*\* after patient consent. Seven patients with post operative subcutaneous wound infection after median laparotomy (e.g. post colon operation from non-randomized patients) were included. The study application and method is controlled and assessed through the appropriate institutional research bodies and ethical committee. A patient information document was provided to the study subject outlining the study protocol and investigation. Patient data remained anonymous.

## Study Protocol

- Diagnosis of subcutaneous wound infection and exclusion of fascia dehiscence
- (Partial) opening of wound, microbiological swab and debridement, photo documentation
- NPWT\* was applied to wounds with PHMB gauze interface\*\*\*, a round silicone drain and transparent film dressing NPWT system\* was maintained under suction with 200mmHg
- NPWT\* was applied continuously and dressings were changed every 2-4 days. NPWT\* continued until wounds were clean and free of infection
- Secondary suture under local anesthesia plus subcutaneous drainage without suction
- Removal of stitches after 14 days and control of healing after 8 weeks.

## Results

7 patients (4 female, 3 male, age 50 – 80 years, ASA 2 – 4) after median laparotomy were included in the study. All patients voluntarily participated and signed a consent form, no patient rejected, refused or dropped out during therapy. After diagnosis of the SSI, the wounds were opened at bedside by removing the stitches. Wound size was noted and bacterial burden evaluated by a swab. There was an average of 5.3 days from time of infection to the first NPWT\* with PHMB gauze interface\*\*\* dressing. During that period, the wounds were debrided and freed of necrotic and sloughy tissues and PHMB moist to dry gauze dressings without suction were applied. The gauze-based NPWT treatment\* was changed every 2 – 4 days at bedside, while the pain level during each dressing change was recorded as an average of 1.3 on the analog VAS scale. After 2 – 4 NPWT dressing changes, all wounds presented with clean wound bed and without any signs of infection. On an average of 9.1 days after the first NPWT dressing, a secondary suture was applied under local anesthesia. Fourteen days later, the stitches were removed. Thereafter, only one patient showed a wound dehiscence, two patients had small secondary healing wounds due to the persisting drainage canal, which could be managed by minor dressings.

Table 1. Patient data

7 Patients	Gender	Age (years)	ASA score	Operation time (minutes)
MW	3 male	70.14	3.00	169.86
STD	4 female	10.19	0.82	70.77
Range		50 – 80	2 – 4	77 – 280

Table 2. Wound data

	Length (cm)	Width (cm)	Depth (cm)	Volume (cm <sup>3</sup> )
MW	11.00	3.46	7.13	203.20
STD	4.20	1.23	4.69	176.83
range	2.5 – 18	1.2 – 4	3.5 – 10	18 – 468

Table 3. Study data (therapy, dressing changes, pain assessment)

	Infection - 1st INVIA (days)	INVIA dressing changes	Pain level (VAS)	Interval between INVIA changes (d)	Interval 1st INVIA - secondary suture (d)	Extra hospitalisation time (d)
MW	5.29	2.86	1.30	3.36	9.14	7.43
STD	5.82	0.69	1.56	0.28	1.95	6.21
range	1 – 17	2 – 4	0 – 5	1 – 4	6 – 11	0 – 15

ASA score = American Society of Anesthesiologists score

VAS = Visual Analogue Scale

Complications: 1 partial wound dehiscence, 1 secondary healing drainage canal

Wound Swab Microbiology Report:

Microflora found in the wounds:

E. coli, Kleb. Oxytoca, Enterococcus. Faecalis, Enterob. Cloacae, Pseudomonas Aeruginosa, Enter. Sp., Acinetobacter Baumanni, Bact. Fragilis, Candida Glabrata.

## Discussion

Patients in the hospital suffering from post operative infections have highly complex polymicrobial wounds and require costly treatments and extended lengths of stay. Early in the usage of NPWT, sterile gauze was used as a standard interface for delivery of NPWT. Foam-based NPWT has become the standard management solution for the treatment of these types of challenging wounds. We selected a proprietary NPWT system\* with PHMB gauze interface\*\*\* to use in the current clinical study. Sub atmospheric pressure of 200 mmHg was applied to the system, to aid in the removal of high exudate and also to decrease clotting. The first NPWT dressing was applied 1 – 17 days after the diagnosis of infection, due to long hospitalization of patients in severe condition on the ICU. The bacteria found in the wounds reflected the common intestinal flora. Although the possibility of instilling PHMB solution into the NPWT system\* in a pain free manner was included in the protocol to treat severe infections of the abdominal wall, this technique had not been used due to the excellent antimicrobial effect of the applied PHMB gauze\*\*\*. The dressing system was changed 2 – 4 times every 1 – 4 days until the wounds were free of infection, showing good granulation tissue. All procedures could be done bedside without further anesthesia. The pain level on the analog VAS scale at each dressing change was acceptable with an average of 1.3, and oral pain medication was applied when necessary. 6 – 11 days after the first application of the NPWT system\*, the wounds presented with clean tissue and were closed by secondary sutures under local anesthesia. A drainage was placed in the wounds without suction. As only 3 patients showed complications (2 minor complications), the total treatment time was reduced by the NPWT system\* with PHMB gauze interface\*\*\*.

## Conclusions

Preliminary findings from the current prospective single armed controlled study have yielded positive results. As well as the standard treatment for infected abdominal wounds, the NPWT system\* with PHMB gauze interface\*\*\* has also been established as a standard in the Ludwigsburg Hospital. Evidence is accumulating of the system's effectiveness, particularly in areas where patient comfort is a concern, since there are less dressing changes with this system. Additionally, secondary stitches can be applied, supporting secondary closure of the wound and excellent aesthetic results. The study was performed based on the assumption that NPWT with PHMB gauze\*\*\* lowers duration of treatment and therefore lowering medical costs. However, it should be noted that final conclusive evidence can only be made through randomized controlled studies. The existing study only serves to evaluate the effectiveness of the NPWT system\* with PHMB gauze interface\*\*\* in these described cases. In conclusion, the NPWT system\* with PHMB gauze interface\*\*\* proved to be a powerful tool for treating SSI, showing good cosmetic results and low overall treatment time. All patients were satisfied with the treatment and results.

Notes:

\* Invia® Wound Therapy for NPWT, Medela Inc., Chicago, U.S.A.

\*\* Invia® Liberty, Medela Inc., Chicago, U.S.A.

\*\*\* AMD™ is a trademark of Tyco Healthcare Group, LP.

Patient de-identification is implemented in all photographs.

- These authors contributed equally to the study

Although the manufacturer's instructions for use with the NPWT pump\* recommends pressure of 60-80mmHg, the primary researcher in this study has been investigating sub atmospheric pressure settings in the management of wounds and has experience with higher pressure settings in the management of wounds and therefore applied pressures commiserate with this experience.

## Literature

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Figure 1 Patient 1; Subcutaneous wound infection: Before and after pictures comparing visual characteristics of the wounds before and prior to initiation of NPWT\* with PHMB gauze interface\*\*\*



A) Day 1, Initiation of gauze-based NPWT\*

C) Day 6 (Secondary sutures placed with NPWT\* and PHMB gauze\*\*\* and a round silicone drain at 200 mmHg)



B) Day 6 (Post wound cleansing and gauze-based NPWT\* dressing change)

D) Day 15 (Gauze-based NPWT\* discontinued)

Figure 2 Patient 2; Subcutaneous wound infection: Before and after pictures comparing visual characteristics of the wounds before and prior to initiation of gauze-based NPWT (Invia® Wound Therapy System\*)



A) Day 1, Initiation of gauze-based NPWT\*

C) Patient follow up: Post operative wound infection was treated successfully through gauze-based NPWT\*.



B) Day 21, gauze-based NPWT\* discontinued.

Figure 3 Patient 3; Before and after pictures comparing visual characteristics of the wounds before and prior to initiation of gauze-based NPWT (Invia® Wound Therapy System\*)



A) Day 1, Initiation of therapy

C) Day 7, (New gauze-based NPWT\* dressing in situ)



B) Day 4, (Post wound cleansing and gauze-based NPWT\* dressing change)



D) Patient follow up: Post operative wound infection was treated successfully through gauze-based NPWT\*.