

SECONDARY SUTURE IN COMPLICATION MANAGEMENT OF SUBCUTANEOUS SURGICAL SITE INFECTIONS AFTER COLORECTAL SURGERY: A PROSPECTIVE CASE SERIES USING NPWT WITH A PHMB GAUZE SYSTEM

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Introduction

In our prospective case series, subcutaneous infections after median laparotomy for colorectal surgery were treated by NPWT with a PHMB gauze system [1,2,3,4,5] and finally closed by secondary suture. Our hypothesis was that NPWT provides shorter treatment time, minimal pain as well as cost savings for the total treatment when compared to standard treatment (moist-to-dry) dressing with gauze plus 0.04% PHMB solution. The study was approved by the ethics committee of the medical board, federal state of Baden-Württemberg.

Study Protocol

- Diagnosis of subcutaneous wound infection and exclusion of fascia dehiscence
- 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 -200 mmHg**** using a portable NPWT device**.
- 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.
- None of the patients presented with contraindications such as:

- Malignancy of the wound
- Untreated osteomyelitis or malnutrition
- Non-enteric and unexplored fistula
- Necrotic tissue with eschar present
- The NPWT dressing system was not placed over exposed blood vessels or organs.

Results

16 patients (4 female, 12 male, age 46–83 years, ASA 1–4) after median laparotomy were included. All patients voluntarily participated and signed a consent form, no patient rejected, refused or dropped out during therapy. Validating our patients data by comparison with the literature [6], shows evidence of conformity. Our patients fit into the “normal” class of patients for colon surgery. The mean age of patients undergoing colon surgery in the literature [6] is given as 68 years, in our study we calculated the mean patients age as 68.4 years (standard deviation (STD) = 12.5 years, range 47–83 years). The mean BMI was calculated as 26.3 (STD = 4.7).

After diagnosis of surgical site infection (SSI), the wounds were opened at bedside by removing the sutures. Average wound volume was noted as 203 ml (STD = 174 ml, range 16–488 ml) only at the initial visit, as it remained constant and, all wounds were closed by secondary suture. Bacterial burden was evaluated by a swab, which showed no external contamination.

The treatment times are noted in Table 1:

Table 1: Time intervals in days (d) and pain level (VAS)

All patients	Infection – 1 st NPWT (d)	NPWT dressing changes	Pain level (VAS)	Interval between NPWT changes (d)	Interval 1 st NPWT – secondary suture (d)	Extra hospitalisation time (d)
Mean value	3.2	3.1	1.1	3.1	9.5	4.5
Standard dev.	4.2	0.9	1.6	0.6	3.2	5.3
Range	1 - 18	2 - 5	0 - 5	1 - 5	4 - 15	0 - 15
Median	3	3	1	3	9.5	3

VAS = Visual Analogue Scale

Table 2: Cost calculations NPWT

*Treatment costs were calculated on the basis of German public hospital prices and converted to US\$ (1€ = 1.4 US\$)

Dressing changes/therapy = 3	Canister changes = 4
1 dressing kit (tubing, canisters)	\$78.40 US
1st dressing kit, time nurse/Dr	\$101.26 US
Dressing change, time Nurse	\$86.25 US
Secondary suture, material, Dr	\$124.12 US
Drainage removal	\$7.00 US
3 x 3 days NPWT	\$404.88 US

Table 3: Cost estimation “non NPWT antiseptic wet-to-dry dressing protocol”

Total treatment time = 47.3 days	Dressing changes = 26
Initial 3 days 3 x dressing & time	3 x \$15.40 US (\$46.20 US)
3 x 3 days non NPWT treatment	12 x \$15.40 US (\$184.80 US)
Advanced wound treatment 32.3 days	\$267.79 US
Total treatment cost estimate	> \$498.79 US

* No data were collected with the wet-to-dry dressings, but due to experience in the Ludwigsburg clinic, the estimation for healing would take weeks instead of 15 days (mean average) with the gauze-based NPWT

During the study, after the first 7 patients (group 1) a pre evaluation was done, where the healing rate was found to be lower due to a minor wound from the Easy Drain drainage canal with secondary sutures. In the second group of 9 patients (group 2), the protocol was changed to incorporate a round drain* under suction together with the secondary suture. This method improved the healing rate to 89%.

During an average of 3.2 days, the wounds were debrided and freed of necrotic and sloughy tissue, and then the first NPWT was applied. During those 3 days, a PHMB moist-to-dry gauze dressings without suction was applied. The NPWT with gauze was changed on average every 3.1 (2–4) days at bedside, while the pain level during each dressing change was recorded as an average of 1.1 (0–5) on the analog VAS scale, where extra oral analgesics were administered on demand in 2 of the patients. After an average of 3.1 (2–4) NPWT changes, the wounds presented without signs of infection showing clean granulation tissue. Thereafter, a secondary suture was made under local anesthesia. Thus, we calculated an average of 9 days for the total treatment time with 3 dressing changes every 3 days, plus 3 days after secondary suture (until removal of drainage).

As an example, Pictures 1–5 show a 46 year old female patient (ASA 2, BMI = 34.6), who was operated on sigmoid resection (08/29/2009) for perforated diverticulitis with left tubo-ovarian abscess. Post operation, she developed a subcutaneous SSI which was treated according to our NPWT protocol. Initially, the wound measured 13 x 5 x 7.5 cm (5.12 x 1.97 x 2.95 inch) with a subcutaneous pocket of 7 cm (2.76 inch) depth (Picture 2). First NPWT was done on the 09/08/2009 (Picture 3) and changed after 2 days.

Picture 1: Deep surgical site infection (08/09/2009)



Picture 2: NPWT on 08/09/2009



During the course of NPWT, the deep wound still showed signs of infection with pseudomonas aeruginosa after 3 cycles and a 4th cycle of NPWT was initiated. Secondary suture was performed when the wound was completely clean on the 9/23/2009 with a subcutaneous drainage (Picture 4), which was removed 3 days later.

Total treatment costs and work related expenses were calculated on the basis of German public hospital prices and salaries (currency was converted accordingly, 1€ = 1.4 US\$). With our cases, on average 3 dressing changes every 3 days were performed, leading to a total of \$404.88 US for the whole treatment (see Table 2). Keeping in mind that the average amount of wound exudate per NPWT change as 90 ml, a change of the canisters and tubing would not be necessary in normal hospital practice. This would lead to lower total treatment costs.

Comparing this procedure to standard antiseptic dressing with PHMB solution, every standard dressing change will consume one pack of 5 sterile gauze pieces 5 x 5 cm + PHMB + sterile cover + fixation + 15 minutes nurse and doctor, giving a total of \$15.40 US. Calculating 12 treatment days, a total of \$184.80 US was calculated (see Table 3).

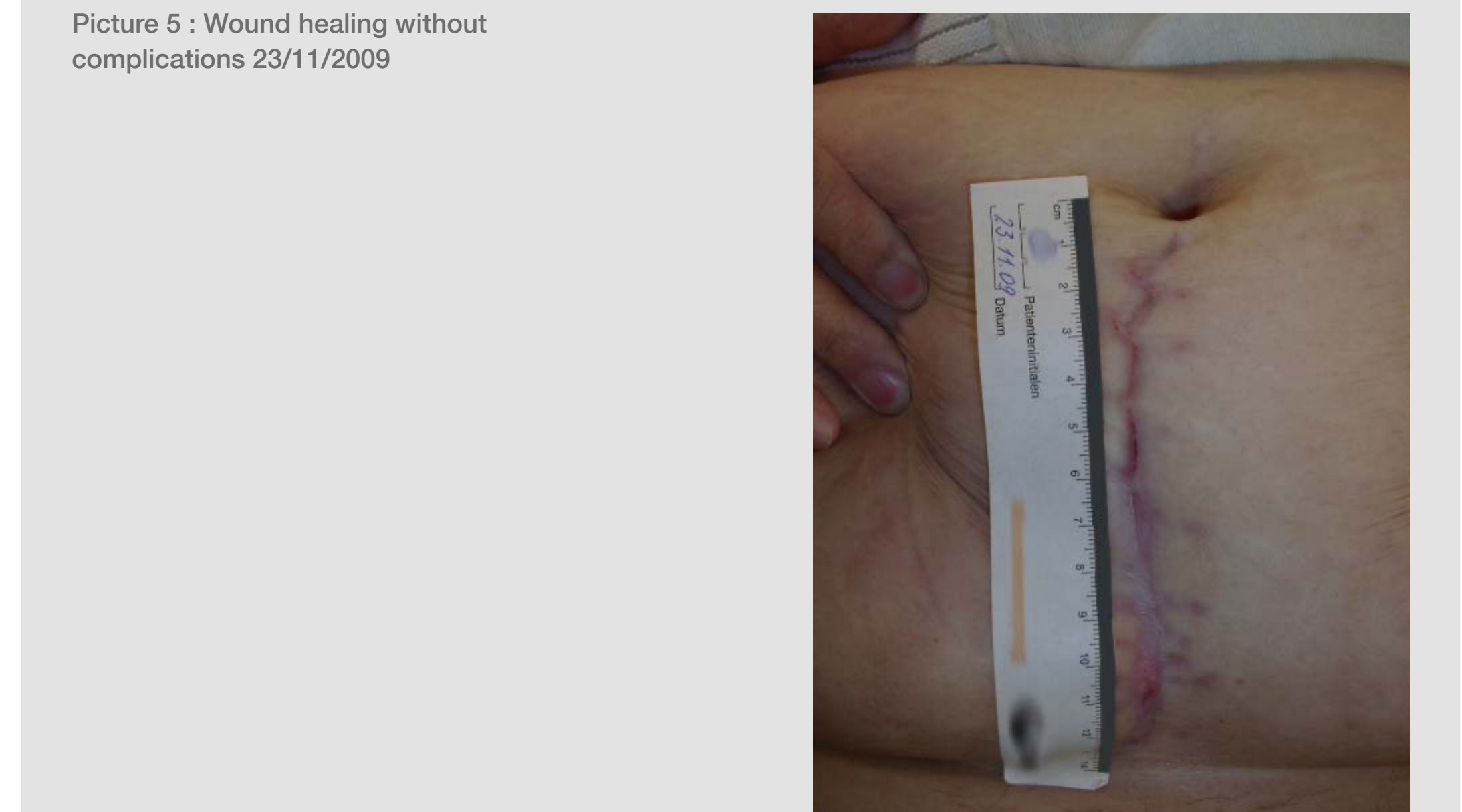


The wound healed without complications.

Picture 4 :



Picture 5 : Wound healing without complications 23/11/2009



In our patients with complications, additional wound therapy was necessary on an average of 32.3 days (STD = 22.2 d, range 6–69 d). Moreover, this non NPWT protocol was estimated to 15 initial days of antiseptic wet-to-dry gauze dressings (15 x \$15.40 US), changed a minimum of once a day leading to more pain and discomfort and higher work load for the hospital staff. This may be followed by applying a modern wound therapy for 32.3 days, with a dressing change every 3 days, leading to an estimated sum of \$267.79 US. The overall estimated treatment costs would finally add up to a total of \$498.79 US.

By NPWT in our regimen, total treatment costs were lowered in the case that only one canister is used for the entire treatment. The savings calculated for the whole treatment time (hospital plus ambulant) will be higher in reality. Extra costs for medical home-care providers must be taken into account too, leading to even higher savings.

The low level of pain during dressing changes made bed side treatment possible in all patients. All treating surgeons and nurses were comfortable with the study protocol. Staff work load was lower, especially when the study team performed the dressing changes. As the NPWT system is a closed system, even wounds with high exudate levels avoided contamination of the patients' environment leading to good hygienic conditions and less frequent changes of bed linen and gowns.

Conclusions

All patients were satisfied with the treatment and NPWT results. In the second group, a healing rate of almost 89% could be achieved using subcutaneous drainage with a suction protocol of 3 days after secondary suture.

Compared to standard wet-to-dry gauze dressings with PHMB solution, the NPWT treatment provides an inexpensive method for lowering total treatment costs. PHMB gauze under NPWT proved to be a powerful system for treating SSI, providing a comfortable dressing that was noted to be in a “minimal pain level range” during dressing changes, and lowered overall treatment time and costs. Finally, our NPWT 3 x 3 day protocol is recommended for subcutaneous infections of median laparotomies after abdominal surgery and has since become a standard treatment for SSI in our hospital.

Notes:

Product notation:
* Invia® Wound Therapy for NPWT, Medela AG, Baar, Switzerland
** Invia® Liberty, Medela AG, Baar, Switzerland
*** AMD™ is a trademark of Tyco Healthcare Group, LP.
Patient de-identification is implemented in all photographs.

Preliminary data were previously presented in SAWC Spring 2011. The manuscript is submitted for publication in a surgical journal.

**** Although the manufacturer's instructions for use with the NPWT pump* recommends pressure of 60-80mmHg (or as directed by the physician), 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 commensurate with this experience.

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