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ORIGINAL ARTICLE

Negative pressure wound therapy in gynecological oncology

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ABSTRACT

Objective: The aim of this study was to describe the clinical and surgical characteristics of patients who underwent surgery for gynecological cancer and were applied with negative pressure wound therapy (NPWT) for wound failure that developed post-operatively, and to investigate the effect of NPWT on wound healing.

Material and Methods: A retrospective analysis was made of patients treated with NPWT for wound failure at a single academic institution between 2010 and 2019. Patient demographic data, pre-operative and intraoperative information, and outcomes were extracted from the registry. The primary outcome was the effect of NPWT on complete wound healing.

Results: The study included 20 patients who had undergone laparotomy for a gynecological malignancy and received NPWT due to wound failure. NPWT was applied to all patients in the post-operative period, to 10 after primary surgery, and to 10 patients after secondary laparotomy. The mean time to wound failure was 25±22 days and the mean duration of vacuum therapy was 18.9±17.2 days. NPWT was used in an outpatient setting for 4 (20%) patients. Complete wound recovery was obtained in 18 (90%) patients. No complications related to the use of NPWT were observed in any patient.

Conclusion: In the post-operative period, NPWT can be used to accelerate wound healing and shorten the post-operative recovery time.

Keywords: Gynecological oncology, negative pressure wound therapy, post-operative wound failure.

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INTRODUCTION

Wound complications are an important cause of post-operative morbidity and often require a longer length of stay in hospital, and cause a possible delay in adjuvant therapy in gynecological oncology.[1] A balance between providing optimal surgical treatment and decreasing post-operative morbidity and mortality must be achieved in this patient group. Due to the high incidence of coexisting medical comorbidities (diabetes, malignancy, obesity, long operation time, etc.) in these patients, post-operative complication rates are high and this prolongs recovery and the time to start adjuvant therapy.

Despite improvements in minimally invasive oncological surgery, some patients still remain candidates for laparotomy.[2] The wound complication rate in patients undergoing gynecological oncology surgery has been reported to be 34%. The high prevalence of obesity in the gynecological oncology population poses a risk for wound failure.[3]

Numerous new treatment modalities have been developed for the management of wound failure.[4] Negative pressure wound therapy (NPWT) is one of the most important types of treatment used in modern wound management. NPWT promotes wound healing by increasing blood perfusion to the wound, providing a moist environment, accelerating the formation of granulation tissue and removing excess exudate from the site of the injury and lowering bacterial counts, and decreasing tension on wound edges.[5]

The aim of this study was to investigate the effect of using NPWT in gynecological oncology patients who developed complex wound failure in the post-operative period.

MATERIAL AND METHODS

All patients who underwent laparotomy due to suspected or confirmed gynecological malignancy between 2010 and 2019 at the gynecological oncology clinic of our hospital were retrospectively identified. A total of 20 patients treated with NPWT for post-operative wound failure were included in the study.

The clinical, surgical, and pathological data of the patients were collected from the gynecological oncology department electronic database system and patient files. The study was approved by the Institutional Review Board of our hospital. (Approval Date: 10.10.2019 Number: 2019/14). All reported researches involving "human beings" were conducted in accordance with the principles set forth in the Helsinki Declaration 2008.[6]

In our clinic, the clinical approach of "wet-dry" dressing is applied as a primary treatment for patients who develop complex wound failure in the post-operative period. In addition, antibiotherapy is administered in the presence of clinical suspicion for bacteria or other organisms or a positive wound culture. In wet-dry dressing, after debridement of the necrotic tissue, the wound site is cleaned with saline and excess liquid is removed with gauze, then moist gauze is placed in or over the wound, allowed to dry, and then removed. This procedure, which functions as mechanical debridement, is usually applied 1–4 times a day.

NPWT is applied to patients with wound failure despite "wet-dry" dressing. Before application, the wound is debrided using a scalpel and cutting the wound edges at 1 cm for removing of devitalized tissue in the operating room. After the wound area is cleaned with saline, NPWT is applied by an experienced NPWT nurse in sterile conditions. Depending on the size of the wound, sterile polyurethane foam is cut and placed in the wound, and an evacuation tube is inserted into the foam, then an adhesive dressing is applied over this to maintain the air seal (Fig. 1). The evacuation tube is connected to the NPWT device and pressure starting from 50 mmHg can be increased up to 125 mmHg depending on the tolerance of the patient (Fig. 2). Negative pressure dressings are changed every 48 h by an experienced wound care specialist. When adequate wound healing and granulation tissue are observed, the NPWT is terminated provided that it is possible to close the wound edges (Fig. 3a, b). The incision is then sutured with absorbable polydiaxonone monofilament suture in the operating room.

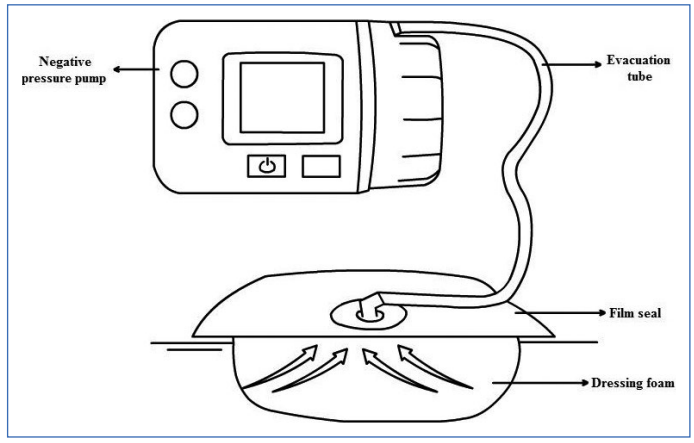

Figure 1: Negative pressure wound therapy device.

Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 23.0 software (IBM Corp., Armonk, NY, USA). Patient demographic data and disease characteristics were evaluated with descriptive statistics. Continuous variables were presented as median, minimum-maximum values, and categorical variables as number (n) and percentage.

RESULTS

Retrospective evaluation was made of 20 patients who underwent surgery for gynecological malignancy and were applied NPWT due to wound failure.

Five patients had endometrial cancer, two patients had squamous cervical cancer, nine patients ovarian cancer, two patients had uterine sarcoma, one patient vulvar squamous carcinoma, and one patient was operated on for adnexal mass and a gastrointestinal tumor was detected. In this cohort, three patients were operated on for recurrence.

The mean age of the patients was 59±6.7 years. The mean body mass index (BMI) was 32.5±5.3 kg/m^2. The pre-operative mean hemoglobin and albumin levels were 11.6±1.7 g/dl and 3.2±0.7 g/dl, respectively. In the post-operative period, 11 patients (55%) received a red blood transfusion, mean 2±1 units.

All but five patients had at least one comorbidity that could compromise wound failure, and four patients had two or more. Comorbid diseases included BMI ≥30 kg/m^2 (14 patients), diabetes (6 patients),

Figure 2: How the negative pressure wound therapy device is applied to the patient.

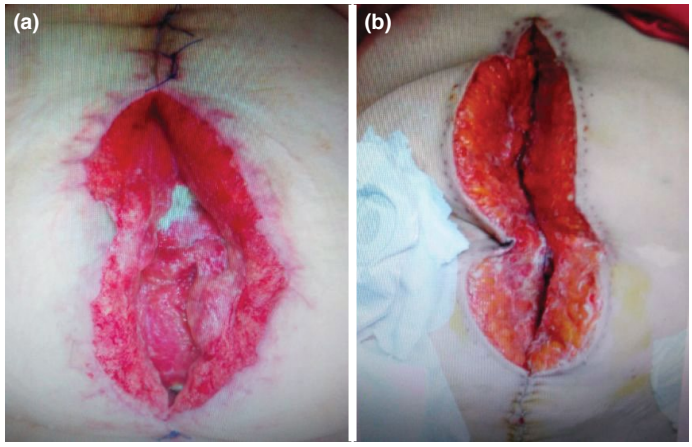

Figure 3: (a, b) Granulation tissue before and after negative pressure wound therapy.

smoking (1 patient), hypertension (7 patients), radiation history to operative site (1 patient), chronic myeloid leukemia (1 patient) and hypothyroidism (5 patients). All but seven patients had at least one previous abdominal surgery, and six patients had undergone two or more. The general features of the patients and primary diagnoses are shown in Table 1.

When wound failure was detected, the infection was identified in 16 patients at the incision site, and while 14 had a positive result for the wound culture, two had a negative result. Appropriate antibiotic treatment was applied.

The post-operative mean wound failure time was 25±22 days. The mean NPWT usage time was 18.9±17.2 days; NPWT was used in an outpatient setting for 4 (20%) patients.

No complication related to NPWT usage developed in any patient. Complete wound recovery was obtained in 18 (90%) patients, while the remaining two patients died due to early progression of disease.

As a surgical procedure, midline vertical incision was performed in 19 patients. Radical vulvectomy and bilateral inguinofemoral lymph node dissection were performed in one patient who was operated on for vulvar cancer. Total abdominal hysterectomy and pelvic±para-aortic lymphadenectomy were performed in 14 (70%) patients. Radical parametrectomy + lymphadenectomy was performed in two patients

Table 1: The general features of the patients and primary diagnosis

	Median	Range	n (%)
Age	58	48–71	
BMI (kg/m^2)	34.5	21.3–40	
>2 comorbidities			5 (25)
≥2 abdominal surgeries			6 (30)
Radiotherapy history+smoking			1 (5)
Preoperative hemoglobin (g/dl)	10.9	9.6–14.9	
Preoperative albumin (g/dl)	3.2	2–5	
Diagnosis			
Ovarian Carcinoma			9 (45)
Cervical Carcinoma			2 (10)
Endometrial Carcinoma			5 (25)
Vulvar Carcinoma			1 (5)
Carcinosarcoma			1 (5)
Leiomyosarcoma			1 (5)
Gastrointestinal tumor			1 (5)

BMI: Body Mass Index.

who had previously undergone hysterectomy in an external center and had a diagnosis of cervical cancer. Tumor resection±bridectomy±herniography±intestinal surgery was performed in three patients who underwent surgery for recurrence. A total of 11 patients underwent bowel surgery during these operations, nine patients underwent colon resection, anastomosis was applied to four, colostomy to five, and small intestine surgery was applied to two patients. The surgical procedures and NPWT usage are shown in Table 2.

NPWT was applied to 10 patients in the post-operative period after primary surgery. The remaining 10 patients underwent a secondary laparotomy for various reasons (anastomosis leakage, bleeding, ureter complication, recurrence, and interval debulking) after the

Table 2: Surgical procedures and NPWT usage

Type of surgery	n (%)
TAH+BSO±PPLNDD	14 (70%)
Vulvectomy+Inguinofemoral LND	1 (5%)
Tumor resection±Bridectomy±	
Herniography±Intestinal surgery	3 (20%)
Radical parametrectomy+Lymphadenectomy	2 (10%)
Additional intestinal surgery	
Colon resection+Anastomosis	4 (20%)
Colon resection+Colostomy	5 (25%)
Small intestine surgery	2 (10%)
Wound failure – NPWT	Mean
Wound failure days	25±22
NPWT days	18.9±17.2

NPWT: Negative pressure wound therapy; LND: Lymph node dissection; TAH: Total abdominal hysterectomy; BSO: Bilateral salpingo-oophorectomy; PPLNDD: Pelvic-para-aortic lymph node dissection.

primary operation. NPWT was applied to these patients due to wound failure in the post-operative period following the second operation.

One patient who was operated on for endometrial cancer was a smoker with a history of external beam radiotherapy and brachytherapy 13 years ago for advanced-stage cervical cancer. After surgery, wound failure developed in the radiotherapy application area.

In another patient who underwent vulvectomy and bilateral inguinal lymphadenectomy due to vulvar cancer, wound failure developed in the left inguinal operation site on the 26th post-operative day.

After complete wound healing, none of the patients in this study developed wound failure during the follow-up period. Although not measured objectively, the wound volume was observed to markedly decrease during NPWT.

DISCUSSION

Wound complications are common problems in gynecological oncology patients. Concomitant patient or surgery-related factors can delay wound healing, which may also be complicated by surgical site infections (SSI).[3] As a result of developing wound complications, patients often require a longer length of hospital stay, additional healthcare costs, a possible delay in adjuvant therapy, and adverse psychological effects can diminish quality of life for the patient.[2] Surgical wounds in obstetrics and gynecology practice are classified as clean contaminated according to Centers for Disease Control and Prevention.[7] The wound complication rate has been reported as 1.8–12.2% for abdominal hysterectomy, 45.4% for vulvectomy with or without inguinal lymphadenectomy, and 40% for patients with BMI ≥30 operated on for gynecological malignancy.[3,8]

In recent years, many new techniques have evolved for the management of abnormal healing and infected wounds. New treatment agents such as growth factors, NPWT, and silver dressings for the treatment of post-operative wounds that are difficult to heal in obstetrics and gynecology have been evaluated in many studies.[1,9–11] It has been shown that in the ideal technique, the dressing should not only play a protective role or provide appropriately moist conditions, but also directly stimulate cellular regeneration.[5]

Morykwas et al.[12] first reported the use of negative pressure to promote the healing of chronic pressure wounds by increasing the rate of granulation tissue formation. Subsequently, various studies have evaluated the use of NPWT in many surgical disciplines, including general surgery, plastic surgery, and orthopedic surgery.[5,13]

The first use of NPWT in patients with gynecological malignancies was reported by Argenta et al.[14] Although NPWT has been used in the treatment of complicated wound failures in many disciplines, there are very few studies on the use of NPWT in the treatment of gynecological oncological wound failure.

NPWT promotes wound healing by increasing blood perfusion to the wound, providing a moist environment, accelerating the formation of granulation tissue and removing excess exudate from the site of the injury, lowering bacterial counts, and decreasing tension on wound edges.[5]

In the literature, the use of NPWT on surgical wounds is controversial. In some studies, the use of NPWT in gynecological oncology patients has been found to reduce wound failure and SSI.[1,9,15] Lynam et al.[1] showed that prophylactic use of NPWT has a potentially therapeutic benefit in obese gynecological oncology patients for the reduction of wound complications. Stannard et al.[15] suggested the prophylactic use of NPWT directly after the surgery to prevent wound infection and breakdown in morbidly obese patients subjected to abdominal hysterectomy.

In a study that evaluated the use of NPWT in gastrointestinal, pancreatic, or peritoneal surface malignancies, NPWT was not found to significantly reduce incisional SSI rates.[16]

In the current study cohort, 55% of patients underwent additional intestinal surgery and most were complicated with anastomotic leakage, bleeding, or other complications and had to undergo secondary surgery. In 30% of the patients, there was a history of more than 2 previous laparotomies and 20% of patients had more than 2 comorbidities. With the use of NPWT, wound healing was achieved in 90% of the current study patients. These results emphasize that NPWT is effective in complex wound failures.

Due to the high cost of NPWT in Turkey (100 USD/dressing), it cannot be used prophylactically in patients with a high risk of wound complications. Although NPWT seems to be quite expensive, Lewis et al.[17] reported that the cost of wound care was lower for NPWT than for standard wound care in patients who underwent surgery for endometrial cancer.

The previous studies have suggested the use of NPWT for the treatment of abdominal sepsis and abdominal compartment syndrome. Perez et al.[18] suggested the use of NPWT for open abdomen treatment and reported that complete fascia closure was achieved in 70% of patients.

Although rare, some adverse events including necrosis, pain, bleeding, and fistula formation have been reported with the use of NPWT.[15] In some reports, NPWT has been shown to help close the fistula tract and protect the wound from intestinal fluid.[19] In the

current study, although most of the patients had additional intestinal surgery with primary debulking, no adverse effects were observed.

In addition to abdominal complex wound failures in gynecological oncology, NPWT is also used for vulvar cancer surgeries. Most inguinofemoral incisions are at risk of wound failure due to SSI, seroma, and increased wound tension. Wound healing in the vulva is poor due to the moist environment and adjacent rectal and urinary structures. In a study by Narducci et al.,[20] it was confirmed that post-operative use of NPWT in vulvectomy was effective for shortening the time to complete healing of the wound.Wound complications after inguinal lymphadenectomy are common problems in vulvar, penile, and urethral cancers. Tauber et al.[21] found that post-operative epidermal NPWT was associated with lower rates of lymphoceles, lymphorrhea, and lymphedema of the lower extremity and wound complications. In the current cohort, one patient who underwent vulvectomy and bilateral inguinofemoral lymphadenectomy was treated with NPWT for the left inguinal wound failure on the 26th day postoperatively and wound closure was obtained after 12 days.

The main limitation of this study was the small cohort, and lack of a control group only treated with wet-dry dressing. However, despite these limitations, this study provides a treatment algorithm for post-operative wound failures. There are few published studies on the use of vacuum therapy in gynecological oncology. Therefore, this study can be considered to make significant contributions to the literature by reflecting real-life data of patients.

Due to high concomitant comorbidities of gynecological oncology patients, post-operative wound complication rates are high, and this often leads to long-term hospital stay and causes disruption to the timing of adjuvant therapy. Therefore, effective methods for wound complications are warranted in these patients.

CONCLUSION

NPWT provides faster and more comfortable treatment in addition the advantages of local treatment in complex wound care. As a result of these properties, it seems to be a safe option compared to traditional wound care methods, especially in patients with many comorbidities. Nevertheless, there is a need for large prospective studies in the field of gynecological oncology in respect of the prophylactic use of this method after surgery.

Statement

Ethics Committee Approval: The Etlik Zübeyde Hanım Women's Health Training and Research Hospital Ethics Committee granted approval for this study (date: 10.10.2019, number: 90057706-799).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – DY, CMA; Design – DY, CMA; Supervision – FK, TT, NB, SK; Data Collection and/or Processing – CMA, DY, CÇ, ÇK, GKC; Analysis and/or Interpretation – GKC, TT; Literature Search – DY, ÇK, GKC; Writing – DY; Critical Reviews – DY, FK, TT, SK.

Conflict of Interest: The authors have no conflict of interest to declare.

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