*IOSR Journal of Nursing and Health Science (IOSR-JNHS)*
*e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 12, Issue 1 Ser. I (Jan. – Feb. 2023), PP 01-12*
*www.iosrjournals.org*

# Nursing Care of Negative Pressure Wound Therapy in a Patient with Colorectal Cancer: A Case Report

Salha Hamad Rrefaei
*Master of Sciences in Medical –Surgical Nursing*
*Registerd Nurse*
***K**ing Abdullha Medical Complex*
*Jeddah- Saudi Arabia*

***Abstract***
***Background***
*Colorectal cancer has a high disease burden globally, and it has been projected to increase by 60% by the year 2030. In colon cancer patients, colon perforation is uncommon and usually requires emergency surgery. This case report presents a clinical case being treated with negative pressure wound therapy (NPWT) due to the postoperative complication of hematoma. In addition,it analyzes nursing care for colorectal cancer patients with NPWT.*
***Case report*** *A 64-year-old womanpresented to the emergency department because of abdominal pain and constipation. The initial assessment revealed tachycardia and an elevated white blood cell count of 12.29 K/μL. An exploratory laparotomy (Hartmann's procedure) with colostomy was performed.With the complication of hematoma after the surgery, NPWT was applied. The patient was maintained on NPWT for 19 days and discharged after 25 days. Follow-up visits revealed continued improvement in wound healing and no signs or symptoms of infection.*
***Conclusion*** *The role of the nurse is extremely important in optimizing and maintaining care for patients who have colorectal cancer with NPWT.Nurses need to improve their knowledge and expertise by acquiring relevant education and training and gaining insight into evidence-based practices.The discussion of this case expands the literature and offers information for nurses caring for colorectal cancer patients with NPWT.*
***Keywords:*** *Colon perforation, negative pressure wound therapy, nursing care.*

---

Date of Submission: 25-12-2022 Date of Acceptance: 05-01-2023

---

## I. Background

Cancer is responsible for more than 9.6 million deaths in around 185 countries and is the second leading cause of mortality worldwide (Alqahtani et al., 2020).Colorectal cancer has a high disease burden globally, and it has been projected to increase by 60% by the year 2030.In Saudi Arabia, colorectal cancer is the most common cancer type among men and the third most common among women (Al-Zalabani, 2020).

Largebowel perforation may be traumatic or non-traumatic. Several diseases such as colorectal carcinoma, diverticulitis, mesenteric ischemia, and inflammatory bowel disease can cause non-traumatic perforation. The most common reasons for large bowel perforation are colorectal cancer and colonic diverticulitis complications (Song et al., 2016).In colon cancer patients, colon perforation is uncommon and usually requires emergency surgery (Otani et al., 2019). The majority of perforation cases occur in patients with acute obstructiononly in a rare setting of colonic cancer cases due to penetration of the tumor mass through the intestinal wall(Irawan et al., 2020).Colon cancer with perforation comprises 3–10% of the initial presentation of colon cancer, and obstruction comprises 8–40%(Chen et al., 2017).Perforation of the colon tends to occur in older patients, and the most frequent perforation site is the sigmoid colon (Otani et al., 2019).The two types of malignant perforation are perforation of the tumor itself and perforation proximal to the tumor (Song et al., 2016).Two mechanisms exist for perforation of colon cancer: direct necrosis at the tumor site and"blowout" proximal to the tumor. Blowout is defined as a closed-loopobstruction in which the colon cancer causes increased colonic pressure between a competent ileocecal valve and the cancer, leading to a perforation(Kothari et al., 2017).Perforated cancer patients face life-threatening malignant disease conditions along with the sepsis due to peritonitis. The operative mortality rate in perforated colon cancer ranges from 5–52%(Otani et al., 2019).

The surgical wounds heal by primary intention, usually by applying sutures, staples, and adhesive tape. However, various surgical wounds may heal by secondary intention. Surgical wounds healing by secondary intention (SWHSI) presents a management challenge since the wounds remain open for months and need

additional treatment such as infection management, reoperation, and prolonged hospitalization. Sufficient research evidence exists for SWHSI management. Negative pressure wound therapy (NPWT) is a treatment used commonly for SWHSI intervention (Arundel et al., 2016).

The current case study analyzes the nursing care provided to colorectal cancer patientsreceiving NPWT postoperatively. NPWT (vacuum-assisted wound closure) requires suction to remove the drainage and speed up the healing of the wound. During the early 1990s, the Wake Forest University in Winston-Salem, North Carolina, developed NPWT.Sustained negative pressure is generated to promote wound healing, usually from 5 to -125 mmHg in the wound (Mattox, 2017).These systems, which consist of a vacuum source, evacuation tubing, and drainage canister, are used with proprietary or generic wound dressing materials (e.g., gauze, specialized foam) secured with an occlusive dressing, creating negative pressure over the wound bed(Mattox, 2017).The wound is cleaned, andthe foam dressing or gauze is cut according to the wound dimensions. The large occlusive dressing is applied with a small hole over the foam dressing or gauze in which the tube has been attached. The tubing is connected to a pump, which creates negative pressure in the wound bed.

Interprofessional management is needed for patients being treated with these devices to ensure maximum outcomes. Nurses are a vital part of the care team, and they need a level of knowledge and skills inimplementing the modality to ensure optimum wound care. This case report expands the literature and offers information for nurses caring for colorectal cancer patients with NPWT.

**Case Presentation**

**Patient Information**

The patient was a 64-year-old Saudi Arabian woman, homemaker, and widow from the city of Jeddah. She had a medical history of diabetes mellitus for 2 years,treated withmetformin,a surgical history of cholecystectomy 38years ago,and a family history of malignancy (uterine cancer). The patient had for 10 years complained of colitis, but she was not on treatment because she did not like to take medications. For 3 months before admission, she hadexperienced intermittent abdominal pain and loss of appetite; the pain kept worsening, not alleviated by any medication or activity. She came to the emergency department at King Abdulaziz University Hospital on the 12$^{th}$ of September 2020 at 13:26 because of severe abdominal pain for 1 week. The patient had complained of abdominal pain and constipation for 15 days, presenting with a similar complaint 1 week previously at another hospital and being diagnosed with colitis, then discharged. In the emergency department of King Abdulaziz University Hospital, the initial diagnosis was unspecified intestinal obstruction.At that time, an abdominalX-ray and CT were urgently performed, and the patient was admitted to the ICU with an admitting diagnosis of non-traumatic perforation of the intestine.The patient was taken to the OR for an emergency exploratory laparotomy and Hartmann's procedure with end colostomy. On postoperative day 5, the wound was soaked with blood, and the patient was taken to the OR for irrigation and cleaning of clots and blood, then NPWT application.On postoperative day 21, the patient was taken to the OR for a planned wound approximation and vacuum dressing change. On postoperative day 23, the patient was well, and the vacuum was removed.The wound and stoma functioning improved. She was discharged from the hospital 25 days after admission.

**Clinical Findings**

The initial assessment in the emergency department revealed tachycardia and an elevated white blood cell count of 12.29 K/μL. On examination, the abdomen was distended and tender, with no complaint of nausea or vomiting. Baseline vital signs included heart rate 141b/min, blood pressure 117/81mmHg, respirations 21/min, temperature 36.6 °C, oxygen saturation 99%, and blood glucose 230.4 mg/dL.

On postoperative day 18, vital signs were stable, but the patient looked pale.Hemoglobin was 10.3g/dL, with other laboratory findings within normal range. The wound was clean and pink with no odor; the wound bed was healthy pink with no sign of infection (**Figure1**).

**Diagnostic and Therapeutic Intervention**

Abdominal X-rayrevealed diffuse dilatation of the small and large bowel loops with air-fluid levels indicating bowel obstruction (**Figure2**).

A CT scan of the abdomen andpelvis wasarranged urgently. The CT demonstrated features of large bowel obstruction complicated by perforation, with a transition zone at the distal sigmoid, due to an apple-core lesion, likely malignant and associated with lymphadenopathy (**Figure3**).

Carcinoembryonic antigen (CEA) results showed a raised level of 13.55 ng/mL. CA-19-9 was 2IU/mL, and alpha-fetoprotein was 0.46 ng/mL.


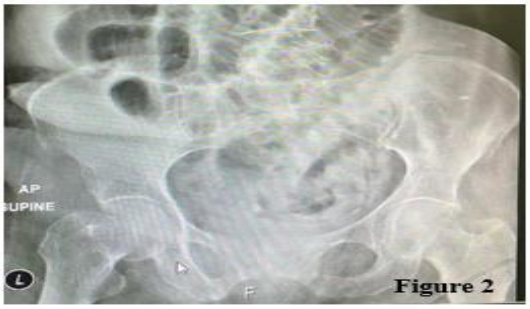



**Figure 2:** Abdominal X-RAY

**Figure 3:** CT scan of the Abdomen and pelvis

The patient underwent emergency surgery on the 13th of September 2020: an exploratory laparotomy and rectosigmoid resection (Hartmann's procedure) with colostomy on the left side. The left ovary and fallopian tube were found attached to the mass and removed, along with specimens from the upper rectum, sigmoid, left adnexa peritoneum, ovary, and omentum for histopathology.

During the surgery, the abdominal cavity was found filled with pus mixed with feces, and an abscess cavity was noted in the left lower quadrant. The abdominal cavity was irrigated with around 12L of NS. These findings were consistent with diffuse peritonitis caused by perforation of the left descending colon by tumor infiltration. Later, histopathological results confirmed the diagnosis of adenocarcinoma, with metastatic carcinoma in three out of 14 lymph nodes. The pathologic stage was pT4b pN2 pM1.The exploratory laparotomy was both diagnostic and therapeutic.

On postoperative day 5, the patient developed a hematoma; she underwent an exploratory laparotomy on the 18th of September 2020.Blood clots were found, and irrigation with warm saline was performed. Fascial dehiscence was found on the lower aspect of the wound. AnNPWT system was applied to the wound, and the patient was moved to the ICU. She experienced considerable improvement in wound status after the NPWT placement. The patient was maintained on the NPWT system for a total of 19 days.

On the 5th of October 2020, the patient was taken to the OR for delayed closure of the granulating abdominal wound. Two sutures were taken to approximate the upper part of the wound, and then the vacuum dressingwas reapplied (**Figure 4**).

**Figure 1**: The wound postoperative day 18.

**Figure 4**: The wound stitches with NPWT.

The patient was received the following medication during her hospitalization:

- antibiotics (ceftriaxone adult infusion, cefuroxime 500 mg tablet, meropenem adult infusion, and vancomycin adult infusion)
- narcotic analgesics (morphine sulfate10 mg/mL ampule and tramadol hydrochloride 100mg/2 mL)
- paracetamol 1000mg/100ml
- enoxaparin sodium 4,000 unit/0.4 mL syringe (Clexane)
- ferrous sulfate 190 mg tablet (60 mg elemental iron)
- folic acid 5 mg tablet
- albumin human 20% vial, 100 mL
- ondansetron hydrochloride 4 mg/2mL ampule
- pantoprazole 20 mg tablet.

**Outcomes and Follow-Up**

The patient was hospitalized for 25 days and then discharged on the 7th of October 2020 with antibiotic and anticoagulation therapy. After 1 month,sheattended the surgical outpatient clinic after follow-up with the dressing clinic once a week showed continued improvement in woundhealing and no signsor symptoms of infection.In subsequent follow-up assessments, the wound looked healthy(**Figure 5**).The patient has not had any inpatient readmissions to the hospital to date.

(1) (2)

**Figure 5.** (1) The wound after one-month (2) after two months from operation date.

A comprehensive discharge plan was established,including the following education given to the patient's daughter before discharge from the hospital.Basic skills and information were provided to manage the ostomy, includingemptying and changing the pouch, how to obtain supplies, potential complications, and managing gas and odor;changingthe dressing aseptically and how to obtain the materials and supplies for dressing; and how to administer Clexaneinjections, as well as the potential side effects.

The follow-up plan for this patient is with the general surgery oncology and dressing clinic. Once a week, the patient is required to visit the dressing clinic for a dressing change.Saline is used to clean the wound and then Sofratolmeshis applied with sterile gauze and covered with a transparent plaster. The caregiver, her daughter, was also given these materials so that the dressing could be done at home twice a week.

Every month, general surgery checks andassesses the status of the wound and colostomy wound. Until the wound is closed, follow-up with general surgery will be continual. Physical assessments will be made every 3 to 6 months by the oncology clinic, along with CEA testing for 2 years at each follow-up visit. The patient will visit the home care service every month to obtain colostomy care supplies.

Several recommendations are associated with the guidelines for follow-up care of colorectal cancer patients (Jorgensen et al., 2015). A summary of the recommendations from the National Comprehensive Cancer Network is outlined in (**Table 1**).A history and physical examination are recommended at regular intervals to identify symptoms that may indicate reoccurrence of cancer,including digital rectal assessment for rectal cancer patients. CEA testing is recommended at each follow-up visit (Jorgensen et al., 2015).

Colonoscopy, proctoscopy, or rectosigmoidoscopy can help visualize metachronouscolorectal canceror polyps and anastomotic recurrence. Toidentify synchronous tumors, a colonoscopy should be performed preoperatively if it has not been done earlier due to obstruction (Jorgensen et al., 2015).Distant metastatic disease inthe liver or lung is detected by CT scans of the chest, abdomen, and pelvis. This also detects locoregional pelvic recurrence in rectal cancer patients. Positron emission tomography and fecal occult blood testing are not recommended (Jorgensen et al., 2015).Care coordination is associated with discharge care in which the community physician or nurse presents the treatment summary or surveillance plan (Jorgensen et al., 2015).Other recommendations are long or late influences on bowel function monitoring. The patients should be counseled regarding preventive health measures such as healthy weight, physical activity, and diet(Jorgensen et

al., 2015).Evidence suggests that asymptomatic recurrence is detected through CEA testing, colonoscopy, and CT imaging and is associated with a higher surgery recurrence rate (Fahy, 2014). Most of the guidelines mention "intensive" follow-up considering an association with surveillance strategies (Jorgensen et al., 2015).

## II. Discussion

Based on the literature,emergency surgery is typically required for perforation of colon cancer (Otani et al., 2019).For right-sided colon cancer perforation, the strategy usually used is emergency resection and primary ileocolic anastomosis, even in the presence of peritonitis. For left-sided colon cancer perforation, a discontinuity resection is used, such as Hartmann's procedure (Otani et al., 2019).The surgical approach to perforated colon cancer must be oncologically curative if the cancer is uncomplicated.According to Otani (as cited in Lee et al., 2007), the complicated and uncomplicated cancer pathwaysare similar. An aggressive oncological surgical approach should be applied for perforated colon cancers.

Irawan et al.(2020) reported the case of a 34-year-old man who presented to hospital due to worsening pain in his whole abdomen over1 day.The signs and symptoms exhibited were similar to peritonitis. An emergency laparotomy was done, showingperforation ofthe descending colon, due to the infiltration of a tumor. Therefore, an emergency left hemicolectomy and stoma were performed.

The World Society of Emergency Surgery(WSES)guidelines for colorectal emergencies in the case of perforation and obstruction caused by an infiltrating tumor is to first control the source of sepsis; prompt medical treatment is advised.Keeping in mind the associated warnings for treating patients with colon perforation, the main priority is the patient's safety,so controlling the source of sepsis and treating sepsis status is to be performed first (Pisano et al., 2018); see **Appendix1**).The procedure of choice in left-sided obstruction is Hartmann's procedure, but severely unstable patients should be treated with loop transverse colostomy.If an open abdomen must be considered, thestoma creation should be delayed(Pisano et al., 2018).

Acute and chronic wounds are a major cause of morbidity and impaired quality of life.Complications arising postoperatively are common for open abdominal surgery.These can include surgical site infection, hematoma, wound dehiscence, and seroma (Sahebally et al., 2018).For large and deep clean wounds, open abdominal wounds, skin grafts, open fractures, pressure ulcers, and clean wounds in obese patients, NPWT has shown good results in reducing the chances of wound complications (Gologorsky et al., 2020).The treatment of large wounds is a serious concern for clinicians, and for this purpose, the use of NPWT is paramount because it is a fast-working method for the healing of wounds. The advantages of NPWT are that it is a safe and cost-effective clinical intervention that provides very good results in healing rates and reducing hospital admissions,length of stay, and mortality rates, especially in casesof infection, openabdomen, trauma,or open fractures (Hunt, 2016).

The exact mechanism by which NPWT helps the process of wound healing is unclear.One suggestion is that it reduces edema and exudate, increases granulation tissue formation, decreases bacteria burden on the wounds, increases blood circulation via the process of angiogenesis, and provides a moist wound healing environment, all adding up to supporting wound healing for open acute and chronic wounds(Itani, 2015).The benefitsof NPWT includeincreased blood flow to the wound bed and surrounding tissues, reduction of edema through removal and containment of excess fluids, stimulation of new cells forming granulation tissue, stimulation of cell proliferation and therefore wound reduction, removal of soluble healing inhibitors from the wound bed, reduced bacterial load and infection risk, and wound edges being drawn closer together(Hunt, 2016).

The US Food and Drug Administration has given a series of warnings to all healthcare providers and identified bleeding, infection, and retained dressing material as three life-threatening complications that can arise due to complications of NPWT (Mattox, 2017).No conclusive evidence has shown that NPWT independently increases a patient's risk of bleeding or directly causes more bleeding events compared to other wound management therapies.However, there is a need to understand and be aware of bleeding events that have occurred in patients with NPWT and prevention.Therapy-specific detection and recovery strategies might help reduce the risk of injury to the patient (Mattox, 2017).**Table 2** outlines the strategies that reduce patient harm secondary to bleeding while on NPWT therapy.

No definitive studies have been conducted on the relationship between NPWT and wound infections. Some examples have shown the benefits of NPWT in reducing risk infections, but these studies are limited.Nonetheless, they have shown NPWT as an innovative treatment that can be useful in specific infections (Mattox, 2017).Several strategies, described in **Table3**, can be used in the detection, prevention, and recovery from harm that might arise due to NPWT-associated infections.

Dressing materials such as foam and gauze, when left unattended on wounds, may cause tissue to grow on the material, resulting in the wounds becoming more prone to bleeding and infections at the site. Materials used for dressing in NPWT are not bioabsorbable, which inadvertently causes an inflammatory response,increases the chances of an infection at the site, and decreases the healing rate (Mattox,

2017).Following the practices defined in **Table4**,can reduce the harm that may arise due to retained dressing material.Such complications are not uniquely related to NPWT. They can cause serious patient injury or death in some cases. Clinicians using NPWT should be knowledgeable about the complications that may arise and be prepared to prevent, detect, and reduce harm to the patient if they arise (Mattox, 2017).

A risk assessment tool for the use of NPWT can help clinicians to detect and identify adult patients who are at high risk for developing surgical site complications and determine their ability to sustain NPWT(PEART, 2019). NPWT is recommended for adult patients who are assessed at level 1 or 2 risk **(Table 5)**. A consensus document by the Wound Union of Wound Healing Societies (2016) recommended using NPWT depending on the risk factors involved for each individual and the types of surgeries being performed. Most importantly, it highlighted that patients undergoing delayed primary closure, high-risk surgery such as transplantation or left ventricular assist device implantation,or emergency surgery have a higher risk of surgical site complications (PEART, 2019).

NPWT applicationrequires two pairs of hands and is time-consuming but straightforward. The wound bed is debrided and cleaned with saline. According to the shape of the wound, the black foam is cut and placed over the wound and sealed hermetically with a transparent drape. A connector is inserted inside the drape by cutting a small hole in the drape; the other end of the connector is connected to a vacuum machine initially working at 125mmHg of suction. The suction provides a visible shrinkage of the foam and the fluids are sucked into the canister. Keypoints for application of NPWT are described in **Table 6**(Schreiber, 2016).

The best possible wound care for the patient is the professional responsibility of the nurse and can only be given when the nurse has complete and current knowledge of the cause of the wounds, management options, and expected outcomes (Benbow, 2016). The role of the nurse is extremely important in optimizing and maintaining care for patients who have colorectal cancer with open woundsusing the NPWT system. Specially trained nurses are responsible for the direct care of patients from the time the NPWT is applied until theyare discharged and the device is removed. Nurses in critical care units will most likely see the patients with open abdominal wounds on which NPWT has been used. The discussion in the case report includes specific nursing interventions that are paramount in the management of patients using NPWT.

**Wound Assessment and Management**: In continuous monitoring of the wounds for abnormalities, complications, and signs of healing,the nurse should inspect for:

- wound width, depth, and length; characteristics of the wound bed;the extent of granulation of tissue; and wound edge characteristics at each dressing change
- wound bed bleeding, purulent drainage or exudate, wound enlargement, color, and odor
- maceration, drainage, bleeding, redness,or tenderness of the skin surrounding the wound.

The photographs taken of the site at the first dressing change on each calendar day should be uploaded and the maintenance of negative pressure verified at every shift (Mattox, 2017).The maintenance and assessment of the NPWT system by the nurse is to check the integrity, effluent drainage, and vascular supply of the wound and new areas of intestinal fluid leakage that may arise (Fitzpatrick, 2017).

**Drainage Assessment**: At the time of checking the postsurgical abdominal drains, healthcare providers should address the following questions.What type of drain was placed?What is the volume of fluid obtained?Is there a dressing on the drain, and if so, does the dressing contain any drainage fluid?How does the skin look around the drain(Orth,2018)?

**Maintaining Drain Patency**:Postsurgical abdominal drains are placed near the anastomosis, which is at risk for leakage, to evacuate postsurgical fluid. The reason for evacuating fluids before collection is to decrease the leakage incidences that may occur at the at-risk sites for anastomosis, thereby preventing infection. The techniques used to maintain patency are performing sterile flushes, making sure that continuous pressure from the negative pressure device is applied, stripping the tubing, and preventing kinks in the drainage tubes attached (Orth, 2018).

**Emptying the Drainage Reservoir**: Completely emptying the contents of a drainage reservoir in a negative pressure system is imperative every time before refilling it or at least after each shift. The process of emptying the closed drainage reservoir requires a measuring device and an alcohol swab. The reservoir must be held firmly while opening the emptying cap. The reservoir is then inverted to allow the contents to pour out into a clear container. The contents drained from the reservoir are measured, observed, and their consistency, color, and smell checked.A significant increase in output, darkening color, and increasing odor are concerning findings to discuss with the provider. The alcohol swab is used to wipe the mouth of the securement port, and the drainage device is squeezed before placement of the cap (Orth, 2018).Each shift, the nurse should monitor and document theamount and characteristicsof the drainage (Mattox, 2017).

**Management of Pain and Anxiety**:For patients with NWPT, treatment providers must ensure comfort and reduce stress and tension. The nurse must assess the level of pain the patient is experiencing and strive to control pain and anxiety. Patients may be provided relief by different anxiolytic drugs through continuous infusion or intermittent dosing. Duringtreatment, they may be given analgesics and sedatives if required to prevent

discomfort and pain, and the rate of infusion of continuous drugs may be adjusted. After the administration of analgesics and sedatives, their effectiveness on patient outcomes is evaluated. Any inadequacy of analgesia or sedation is immediately reported. This practice of regular assessment allows medical personnel to identify the right time to stop these medications to prevent overuse. Deep sedation can be used to suppress abdominal muscle retraction, helping in delayed primary closure. Medical personnel must discuss with the patient their condition, ask them about the pain, and tell them about the treatment plan(Fitzpatrick, 2017).

**Prevention of Infection**: The risk of developing an infection exists because of intra-abdominal sepsis, exposure of the wound to the air, or the use of invasive catheters and tubes.

**Standard Precautions**:The spread of infection may be prevented by hand hygiene. For maintaining hand hygiene, various cleaning agents including soap and water or alcoholic solutions may be used to clean hands before and after interactions with patients. The same precautions must be taken when dealing with patients' bodily fluids or other infectious material. The use of gloves is also highly recommended. Frequent changing of gloves prevents the spread of pathogens to other body parts. Thorough handwashing with soap is preferred if the hands are visibly dirty. When the caretaker is directly in contact with a patient's blood or secretions, personal protective equipment is recommended to avoid infection, including gloves, surgical face masks, overalls, and goggles (Orth, 2018). The nurse must regularly assess patients for signs and symptoms of infection. For this purpose, the patient's body temperature must be monitoredregularly, and all the essential lab tests must be performed and their results examined. The wound must also be checked for any signs of inflammation or infection. Antibiotics should be administered as ordered to prevent infection; however, any adverse effects of antibiotics must also be closely observed(Fitzpatrick, 2017).

**Nutrition**:The help of a nutritionist is required immediately after surgery to prepare an enteral nutrition plan for the patient. It is important to devise a nutritional plan based on the patient's weight and nutritional factors including prealbumin and albumin levels, CRP, and urea nitrogen levels in the patient's urine. Monitoring the patient's weight regularly is important (Fitzpatrick, 2017).

**Monitoring for Complications**:The patient must be assessed for any changes in serum protein levels and electrolyte balance because of fluids losses from the wound. Coagulation or blood clotting tests must be performed to check platelet count, partial thromboplastin time, and prothrombin time.

**Patient Education**:Patient education is focused on four principles of patient communication: engagement, empathy, education, and enlistment. Before taking the patient's consent to begin NPWT, all the details about the treatment, its mechanism, and its consequences must be clearly conveyed to the patient to enhance their knowledge of it; this is essential for effective functioning of the NPWT system (Benbow, 2016).Patient education also involves follow-up and taking into account the patient's concerns such as improved quality of life, daily life activities, and pain management and control.Various pain management techniques may be needed forthe colorectal cancer patient who has undergone Hartmann's procedure followed by the complication of hematoma leading to the application of NPWT for an open abdominal wound. Following medical interventions, the patient will likely experience several complications and difficulties besides the underlying illness after gaining consciousness and a stable physiological state. After surviving the perforation, the patient and relatives now look forward to the restoration of health and the ability to live a normal life. At this stage, the patient is in dire need of the emotional support and care offered by the critical care team, specifically the critical care nurses. Also important are considering the patient and family, informing them about the treatment plan, and involving them while preparing the discharge plan and resource plan. Critical care nurses are responsible for all these functions with the gradual recovery of the patient.

This case report describes the nursing interventions for patients treated with NPWT. It makes a significant contribution and adds value to the existing base of nursing knowledge because only limited studies have shed light on how to care for patients using NPWT following Hartmann's surgery. Despite the abundance of literature on nursing interventions for wound management, there is a dearth of studies aimed at exploring nursing interventions in the context of NPWT. Hence, studies are imperative to highlight nursing interventions in this context to achieve conclusive results about the role of nurses in the effective application of NPWT systems and the consequent improvement in patient outcomes. Nurses involved in NPWT application can enhance their knowledge and expertise throughrelevant education and training and gaining insight into evidence-based practices. A recent study found that nurses were usually equipped with an appropriate understanding of NPWT before they participated in any education program (Mohamed et al., 2019). However, the study also revealed that an education program could enhance their existing skills and knowledge. Nurses must also encourage their patients (particularly elderly patients with comorbid conditions) to attend regular testing and medical examinations by informing them about the importance of these.

## III. Conclusion

The current case report is about a colorectal cancer patient who underwent Hartmann's procedure followed by a complication of hematoma. NPWT was applied to treat the open abdominal wound. The NPWT was continued for 19 days. The patient stayed at the hospital for 25 days, after which she was discharged. At the 1-month follow-up after surgery, the patient indicated gradual wound healing with no signs of infection. Since then, no inpatient readmission of this patient to the hospital has been reported.

NPWT is an extensively used technique for treating open abdominal wounds. Many studies in the literature support its application. The open abdominal wound in this case report was effectively treated with NPWT. Despite the lack of randomized controlled trials investigating the effectiveness of NPWT for wound healing, extensive clinical evidence indicates the effectiveness of this therapy for better patient outcomes without affecting quality of life. The role of nurses in enhancing the effectiveness of the NPWT device is significant and can lead to a reduced risk of complications and better and faster wound healing. In addition, healthcare institutes must keep abreast of advancements in technology and accordingly upgrade their devices and techniques for wound management.

**Appendix 1**

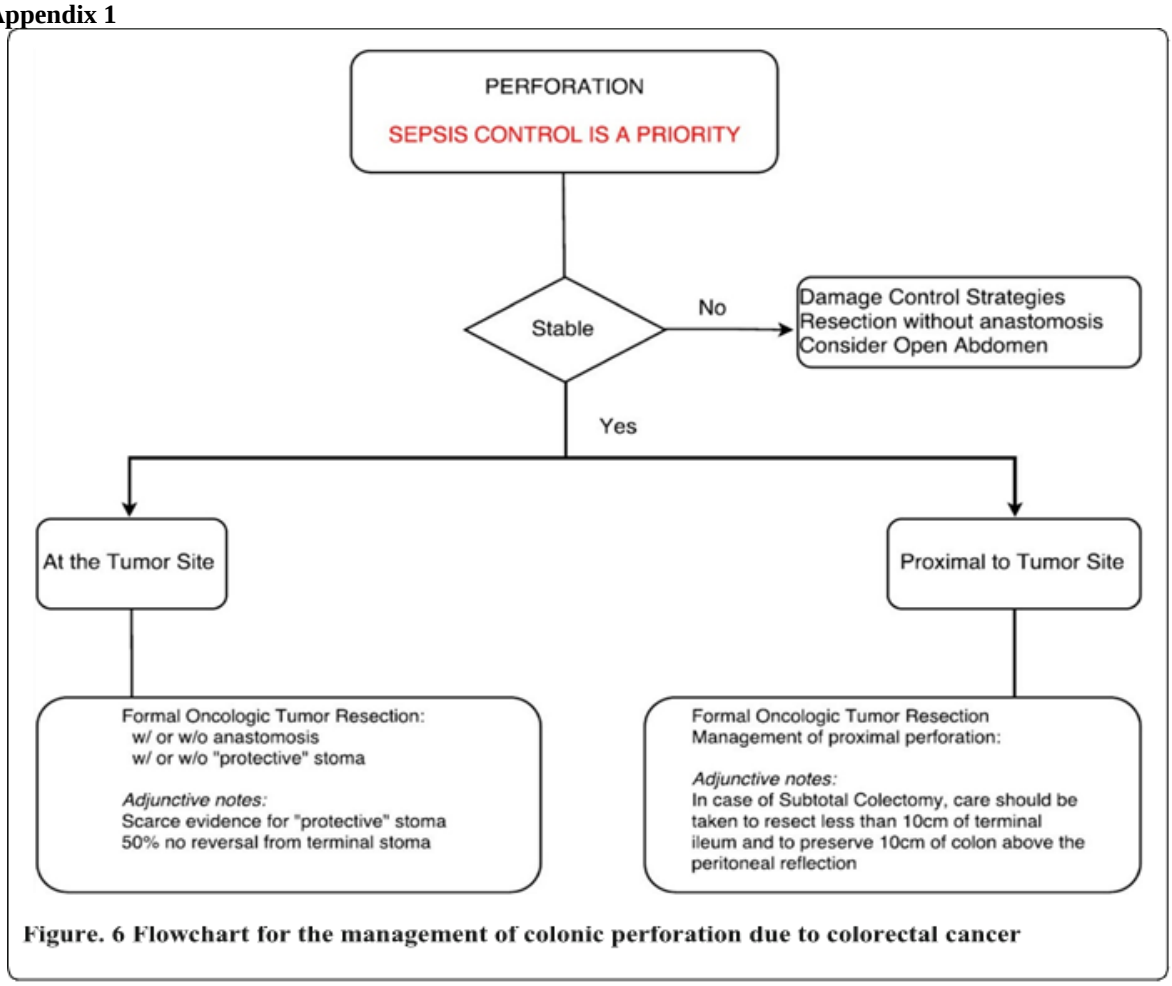


**Figure. 6 Flowchart for the management of colonic perforation due to colorectal cancer**

**Table**1. Summary recommendations from National Comprehensive Cancer Network on the follow-up care of patients with CRC

| **National Comprehensive Cancer Network®(NCCN®)** | |
|---|---|
| **History and physical examination.** | 3–6 m for 2 y, then 6 m till 5 y. |
| **Serum carcinoembryonic antigen measurement.** | 3–6 m for 2 y, then 6 m till 5 y. |
| **Colonoscopy.** | @ 12 m or @ 3–6 m post resection if not preoperatively, then @ 3 y, then 5 y if normal. |
| **Proctoscopy/ rectosigmoidoscopy for rectal cancer.** | Not recommended |
| **Abdominal and chest CT.** | 12 m for up to 5 y if high risk. 3–6 m for 2 y, then 6–12 m till 5 y (stage IV colon). |

| | |
|---|---|
| **Pelvic CT.** | 12 m for up to 5 y if high risk 3–6 m for 2 y, then 6–12 m till 5 y (stage IV colon). |
| **Care coordination.** | Recommends prescription for survivorship and transfer of care to primary care physician. |
| **Other recommendations.** | Monitor and manage bowel and urogenital late effects; Counsel for healthy lifestyle; Cancer screening (breast, prostate) as average risk; Additional health monitoring and immunizations as indicated; PET scans not recommended |

**Table 2.**Strategies for reducing patient harm secondary to bleeding during negative-pressure wound therapy (NPWT)

| **Prevention** | **Detection** | **Recovery** |
|---|---|---|
| Adhere to manufacturer's guidelines for use of NPWT systems, including pressure settings and wound management technique. | Monitor NPWT output at regular intervals as ordered | If bleeding occurs, disconnect the vacuum and use direct pressure and/or compression to control the bleeding |
| Prepare the wound bed appropriately, including removing necrotic tissue. | When documenting NPWT, describe output characteristics | If bleeding occurs, do not remove dressing until treatment clinician or surgeon is consulted. |
| Complete medication reconciliation before NPWT initiation, with careful attention to anticoagulants; use caution when patients are receiving or have recently received anticoagulants and monitor anticoagulants status. | Fully visualize NPWT output to identify increased or unexpected sanguineous drainage | After a bleeding event, consider waiting at least 24 hours before restarting NPWT |
| Identify patients with coagulopathies or at risk for developing coagulopathies, including those with malignancies or intrinsic coagulation disorders. | Do not conceal NPWT canisters with bedding or behind furniture. | Identify and resolve coagulopathies |
| Review patient's medical history for risk factors for friable or weakened tissues and vasculature, including radiation therapy, infected vascular tissues, and adjacent trauma. | Consider bleeding as a potential cause for hypotension, tachycardia, and other signs of hypovolemia in a patient receiving NPWT | Initiate prompt resuscitation measures as ordered, including volume and blood product administration |
| Do not tightly pack material into wounds; this practice may result in undesirable ingrowth of tissue into dressing materials and promote bleeding | Do not disable alarms designed to identify high output conditions | Quantify blood loss and communicate to responsible clinician. |
| Use extreme caution in wounds with active bleeding or difficult hemostasis. | Respond to device alarms and verify if bleeding is a cause of a high output alarm. | |
| Use lower pressures for patients at risk for bleeding. | | |
| Use continuous (vs. intermittent) pressure for patients at risk for bleeding. | | |
| Do not use large-volume (e.g. 800-1000 mL) vacuum containers for patients at risk for bleeding. | | |
| Identify and communicate local or systemic signs of infection; local infection increases risk for bleeding. | | |
| Maintain awareness of anatomical structures and hardware adjacent to wounds:<br>•Collaborate with surgical team members to identify underlying structures (e.g. ventricle, muscle, granulation tissue).<br>•Use visual tools (e.g. diagrams, photographs as permitted by your organization) to identify and communicate underlying structures and promote early identification of significant changes in underlying strata<br>•Promote continuity of care wherein providers and family members regularly see the wound and can identify changes over time | | |
| •In high-risk situations and when logistically possible, conduct dressing changes when emergency resources (e.g., surgical team) are readily available. | | |
| •Do not place NPWT directly over exposed vessels, anastomotic sites, or organs. | | |
| •When an adequate layer of natural tissue is not present‘ artificial barriers may reduce (but not wholly eliminate) the likelihood of erosion and bleeding.<br>•Protective layers should completely cover the underlying organ and tissues and may be secured (e.g., by suturing) to prevent shifting and dislodgement. | | |
| Take steps to reduce the likelihood of retained dressing materials. | | |

| |
|---|
| When a deep wound is present, dressings should be performed or directly supervised by a lead clinician or surgeon. |

**Table 3.**Strategies for reducing patient harm secondary to infection during negative-pressure wound therapy (NPWT).

| Prevention | Detection | Recovery |
|---|---|---|
| Debride nonviable and necrotic tissue beforeNPWT initiation. | Monitor patients for signs and symptoms of local and systemic infection. | Promptly notify responsible providerforsuspectednewlocal or systemicinfection |
| Adhere to clean or sterile technique,depending on wound designation, during wound care. | Document wound drainage and wound bed characteristics in the medical record to allow for longitudinal comparisons; use photographs if permitted by yourorganization. | Obtain blood and wound cultures (if indicated) before initiation of antimicrobial therapy |
| When using NPWT with a colonized or infected wound, monitor for progression of local infection or systemic signs of infection. | | |
| Do not use NPWT over infected blood vessels. | | |
| Take actions to prevent retained dressing materials. | | |

**Table 4**.Strategies for reducing patient harm caused by retained dressing material during negative-pressurewound therapy (NPWT)

| Prevention | Detection | Recovery |
|---|---|---|
| Consistently document the number of pieces of dressing material in the wound; strategies may depend on the complexity of the wound and include annotating and documenting the number of dressing material pieces or the occlusive dressing in the medical record and providing a diagram of the number, size, and shape of materials. | Examine removed dressing materials for integrity | |
| Attempt to use the largest single piece of material in the wound bed; avoid using >1 piece of material whenever possible. | Correlate counts of removed material with documented counts from prior changes | |
| Trim dressing material away from the wound and the patient to reduce the risk for fragments in the wound or linens. | Resolve discrepancies in counts immediately through wound exploration and imaging strategies (most materials are poorly visualized on radiographs) | Base recovery strategies on the presence of complications of retained materials (e.g., bleeding, infection) |
| Clear bedding and clutter from the local area during wound care to prevent inadvertently shifting materials into the wound. | | |
| Ensure that patients are comfortable and can remain relatively during wound care; pre medicate for pain or anxiety if appropriate. | | |
| Avoid trimming materials in a manner that promotes fragmentation upon removal (e.g., very thin connections between sections of material) | | |
| Do not use materials that can shed fibers into the wound. | | |
| Use a table, tray, or other solid surface to rest dressing materials (do not rest loose materials on a drape where they can be deposited into the wound by patient movement). | | |
| Consult the team if wound characteristics change in a manner that may result in fragmentation of dressing materials (e.g., exposed bone ends, excessive dryness) | | |
| Establish a facility standard regarding counting and documenting the number of pieces of dressing material.<br>•Identify where the count should be documented (e.g.in the medical record, on the dressing in a manner that remains visible over time).<br>•Ensure that all persons who manage the wound (e.g. physicians, wound care specialists, family members) adhere to the standard. | | |
| Remove adherent material carefully; if necessary, apply sterile water or saline into the material, wait 15-30 minutes, and reattempt removal. | | |
| Prevent adherence of material to wound beds by using non-adherent dressings. | | |
| Review manufacturer guidelines or consult wound specialists for recommendations regarding dressing materials that may reduce adherence (some proprietary materials are less likely to adhere in some clinical scenarios, according to manufacturer guidelines). | | |
| Do not tightly pack materials into wounds; this practice may result in adherence and fragmentation of materials. | | |

**Table 5.** Risk assessment tool for the use of NPWT

| Level of risk | Individual patient risk factors | Intra operative risk factors | Procedure-related risk factors |
|---|---|---|---|
| **Level 1:** presence of 1risk factor =consider INPWT | BMI ≥40 kg<br>Uncontrolled diabetes<br>Severe left ventricular ejection failure<br>End-stage renal disease undergoing regularly scheduled dialysis | Extended duration of surgery* | **Transplantation surgery /extensive surgery Previous surgery at the site /multiple incisions.**<br>**Emergency surgery.**<br>**Cardiothoracic surgery:**<br>Left ventricular assist device<br>Bilateral internal mammary artery harvesting<br>Delayed primary closure<br>**Abdominal surgery:**<br>Delayed primary closure |
| **Level 2:** presence of 2risk factor =consider INPWT | ASA physical status ≥II†<br>Age >65 years<br>BMI 30–39.9 kg<br>Diabetes mellitus<br>Hypertension<br>Chronic heart failure<br>Chronic obstructive pulmonary disease<br>Renal insufficiency<br>Immunosuppression<br>Steroids for a chronic condition<br>Chemotherapy<br>Smoking<br>Serum albumin <3.5 g/dl and Malnutrition Universal Screening Tool score = 2<br>Peripheral vascular disease | Blood transfusion<br>Blood loss > 1 liter<br>Cardiopulmonary bypass time extended | **Abdominal surgery:**<br>Crohn's disease<br>Presence of malignancy<br>Previous radiotherapy<br>**Orthopaedic surgery**:<br>Rheumatoid arthritis<br>Implant/prosthesis<br>**Obstetric surgery:**<br>Chorioamnionitis<br>Pre-eclampsia<br>**Vascular surgery**<br>Groin incision |
| *****Defined as >T (hours) which is dependent on the type of surgical proceduree.g. small bowel surgery has a T of 3 hours and caesarean section has a T of 1 hour (Culver et al, 199)<br>†American Society of Anesthesiologists (ASA) Pre-operative Assessment Score (ASA, 2014). | | | |

**Table 6.** Key Points for Application of NPWT

| Nursing process | Key Nursing Points |
|---|---|
| **Assessment** | Verify the order.<br>Wound bed cleaning and preparation<br>Device to be used<br>Filler products to be used(foam/gauze)<br>Pressure and cycle settings<br>Dressing change frequency<br>Ensure proper patient positioning.<br>Assess and treat pain before application.<br>Inspect wound for abnormalities.<br>–Wound bed: color، odor، bleeding،purulent drainage/exudate.<br>Skin surrounding wound: redness, tenderness, firmness, edema, maceration,drainage, or bleeding. |
| **Nursing Diagnosis** | Impaired Skin integrity. Acute pain. |
| **Planning** | Gather needed supplies<br>Request an assistance to help.<br>Communicate with the patient and family.<br>Mentally prepare for the task.<br>Wear appropriate personal protective equipment. |
| **Implementation** | • Prepare wound bed; cleanse per order.<br>• Prepare periwound area; cleanse per order and dry periwound area.<br>• Prepare wound filler and pack wound. Cut foam to fit wound areaand pack wound with foam/gauze per doctor's order. Do not overfill.<br>• Apply a skin-prep barrier to the periwound area.<br>• Apply adhesive drape to cover the wound and periwound area.<br>-To avoid periwound damage, do not stretch the transparent drape tight.<br>-When sealing is challenged: A hydrocolloid dressing can be used around the wound edges to reduce tension. A stoma adhesive can be used to fill creases.<br>• Cut hole in adhesive drape, secure tubing port and connective tubing.<br>- Position tubing away from periwound area.<br>-Do not secure over pressure areas, bony prominences, or skin creases.<br>-Anchor tubing to prevent tension.<br>• Set device with ordered suction pressure and cycle settings. Then Start device.<br>• Observe drainage to ensure proper flow.<br>• Assist patient to comfortable position. |
| **Evaluation** | • Ask following questions regarding the patient's condition:<br>▪ Has device been applied properly?<br>-Is wound filled completely with foam/gauze filler?<br>-What is condition of periwound skin?<br>▪ Is device set at appropriate suction and cycle type? |

- Does occlusive drape have complete seal?
- Did sponge collapse when device was started?
- Any potential seal complications to consider?
- How did patient tolerate procedure?

-Is patient comfortable? Any complaints of pain?

## References


[1]. Al-Zalabani, A. (2020). Preventability of colorectal cancer in Saudi Arabia: Fraction of cases attributable to modifiable risk factors in 2015–2040. *International Journal of Environmental Research and Public Health*, *17*(1), 320.

[2]. Alqahtani, W. S., Almufareh, N. A., Domiaty, D. M., Albasher, G., Alduwish, M. A., Alkhalaf, H., Almuzzaini, B., Al-Marshidy, S. S., Alfraihi, R., & Elasbali, A. M. (2020). Epidemiology of cancer in Saudi Arabia thru 2010–2019: A systematic review with constrained meta-analysis. *AIMS Public Health*, *7*(3), 679.

[3]. Benbow, M. (2016). Understanding safe practice in the use of negative pressure wound therapy in the community. *British Journal of Community Nursing*, *21*(Sup12), S32–S34.

[4]. Chen, T.-M., Huang, Y.-T., & Wang, G.-C. (2017). Outcome of colon cancer initially presenting as colon perforation and obstruction. *World Journal of Surgical Oncology*, *15*(1), 164.

[5]. Fahy, B. N. (2014). Follow-up after curative resection of colorectal cancer. *Annals of Surgical Oncology*, *21*(3), 738–746.

[6]. Fitzpatrick, E. R. (2017). Open abdomen in trauma and critical care. *Critical Care Nurse*, *37*(5), 22–45.

[7]. Gologorsky, R., Arora, S., & Dua, A. (2020). Negative-pressure wound therapy to reduce wound complications after abdominoperineal resection. *The Permanente Journal*, *24*.

[8]. Hunt, S. (2016). Negative pressure wound therapy: An update. *British Journal of Nursing*, *25*(20), S6–S8.

[9]. Irawan, A., Adeline, A., & Linggo, M. H. P. (2020). Perforation of descending colon caused by tumor infiltration: A case report. *Medicinus*, *7*(3), 90–93.

[10]. Itani, H. E. (2015). Reviewing the benefits and harm of NPWT in the management of closed surgical incisions. *British Journal of Community Nursing*, *20*(Sup6), S28–S34.

[11]. Jorgensen, M. L., Young, J. M., & Solomon, M. J. (2015). Optimal delivery of colorectal cancer follow-up care: Improving patient outcomes. *Patient Related Outcome Measures*, *6*, 127.

[12]. Kothari, K., Friedman, B., Grimaldi, G. M., & Hines, J. J. (2017). Nontraumatic large bowel perforation: Spectrum of etiologies and CT findings. *Abdominal Radiology*, *42*(11), 2597–2608.

[13]. Mattox, E. A. (2017). Reducing risks associated with negative-pressure wound therapy: Strategies for clinical practice. *Critical Care Nurse*, *37*(5), 67–77.

[14]. Mohamed, E., Elmoniem, A. E., & Zaki, H. M. Effect of training program on performance of nurses caring for patient with negative pressure wound therapy.

[15]. Orth, K. (2018). Preventing surgical site infections related to abdominal drains in the intensive care unit. *Critical Care Nurse*, *38*(4), 20–26.

[16]. Otani, K., Kawai, K., Hata, K., Tanaka, T., Nishikawa, T., Sasaki, K., Kaneko, M., Murono, K., Emoto, S., & Nozawa, H. (2019). Colon cancer with perforation. *Surgery Today*, *49*(1), 15–20.

[17]. Ousey, K., &Milne, J. (2014). Exploring portable negative pressure wound therapy devices in the community. *British Journal of Community Nursing*, *19*(Sup1), S14–S20.

[18]. Peart, J. (2019). A tool to assess the risk of surgical site complications and suitability for incisional negative pressure wound therapy. *Wounds UK*, *15*(1).

[19]. Pisano, M., Zorcolo, L., Merli, C., Cimbanassi, S., Poiasina, E., Ceresoli, M., Agresta, F., Allievi, N., Bellanova, G., & Coccolini, F. (2018). 2017 WSES guidelines on colon and rectal cancer emergencies: Obstruction and perforation. *World Journal of Emergency Surgery*, *13*(1), 1–27.

[20]. Sahebally, S. M., McKevitt, K., Stephens, I., Fitzpatrick, F., Deasy, J., Burke, J. P., & McNamara, D. (2018). Negative pressure wound therapy for closed laparotomy incisions in general and colorectal surgery: A systematic review and meta-analysis. *JAMA Surgery*, *153*(11), e183467–e183467.

[21]. Schreiber, M. L. (2016). Negative pressure wound therapy. *MedSurg Nursing*, *25*(6), 425–429.

[22]. Song, P., Qin, K., Chu, X., & Li, S. (2016). Different site, different clinical outcomes in perforated colorectal cancer? *International Journal of Colorectal Disease*, *31*(8), 1517–1518.


Salha Hamad Rrefaei. "Nursing Care of Negative Pressure Wound Therapy in a Patient with Colorectal Cancer: A Case Report." *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 12(1), 2023, pp. 01-12.