NEGATIVE PRESSURE WOUND THERAPY

SELF DIRECTED LEARNING PACKAGE
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**Introduction**

Negative Pressure Wound Therapy (NPWT) is widely used in the management of complex wounds within hospital and community environments. The aim of this self-directed learning package is to increase the theoretical knowledge of community-based health care professionals in NPWT, facilitate the effective utilisation of NPWT for the treatment of complex wounds, and support the client’s journey in the community setting.

KCI Medical (KCI) and Smith & Nephew (S&N) devices are available within the different Health services within Metro North Hospital and Health Services (MNH&HS) and the type of device used in the community setting is determined by the referring hospital. Each brand of device requires the brand specific dressings i.e. S&N device requires S&N NPWT consumables and KCI device requires KCI consumables.

**Objectives**

On completion of this self-directed learning package the clinician will have a sound knowledge of NPWT, its uses, applications and contraindications.

**PLEASE NOTE:**

It is the responsibility of ALL clinicians prior to performing NPWT dressings to ensure competency by completing the Self-Directed Learning Package (SDLP) and the competency tool is reviewed and signed by The Wound Management Nurse or a trained nursing staff member in your clinical area.

**Components of NPWT**

1. Black foam, white gauze, silver foam, white foam
2. Non-adherent interface options
3. Tubing with port
4. S&N and KCI canisters
5. Drape
6. NPWT S&N and KCI devices
1. Foam/gauze to fill cavity:
   - Allows exudate to flow freely into the NPWT tubing
   - Delivers negative pressure evenly over the wound surface
2. Non-adherent interface (if required)
3. Tubing with port
4. Canister with tubing to connect the device to the dressing
5. Semi permeable dressing (Drape): to create an airtight seal, covering all the components
6. NPWT device: Please refer to the device specific user manuals as not all the devices have the same features or require the same guidelines

**How does NPWT work?**

NPWT applies a topical sub-atmospheric controlled negative pressure (vacuum) at the wound surface through a specialised dressing, this assists in drawing the wound edges together, removing wound debris, oedema and bacteria, actively promoting granulation (Carville, 2017; KCI, 2014).

**Clinical Benefits of NPWT**

NPWT promotes healing through multiple actions:
- Increases vascular perfusion
- Reduces excess fluid and localised oedema
- Stimulates formulation of granulation tissue
- Protects from outside contaminants
- Removes barriers to cell migration and proliferation
- Reduces bioburden
- Maintains moisture balance
- Assists in wound contraction

**Indications**

- Need for splinting effect/support to surrounding tissues
- Deep cavities
- Deep tunnelling
- High level of exudate
- Unmanageable with basic dressings
- PICO for shallow or closed incisions still requiring reduced negative pressure (KCI, 2014; S&N, 2013).

**Types of wound indicated for:**

- Acute and chronic wounds
- Post-operative wounds
- Partial-thickness burns
- Dehiscences of surgical wounds
- Pressure ulcers
• Diabetic/neuropathic ulcers
• Traumatic wounds
• Skin flaps/grafts
• Venous ulcers
• Explored fistulae

(Bradley, 2014).

**Contraindications**

- Poorly perfused tissue:
  i.e. clients with severe peripheral arterial disease with an Ankle Brachial Pressure Index (ABPI) readings of $\leq 0.5$. These clients require further investigation and may identify a need for revascularisation
- Untreated osteomyelitis
- Certain tissue types:
  - Necrotic (eschar) tissue - large amounts of necrotic tissue or tissue covered with a dry eschar (best results obtained post-debridement).
  - Malignancy - NPWT may increase mitosis of malignant cells but it can be considered post tumour removal if tissue margins are cleared of malignant cells
  - Exposed arteries, veins or organs
  - Cavity/sinus and unexplored fistulae – Cavities where the origin is not visible
  - Fistulae must be investigated to establish the extent and if there is communication between organs
  - Active bleeding

(Carville, 2017; Mattox, 2017).

**Precautions**

- Clients with neuropathic aetiologies and lack or absence of sensation may predispose the client to not recognising pressure, or a decrease in circulation which has the potential to cause further tissue breakdown
- Untreated or inadequately treated infection
- Ischemia to incision or surrounding area
- Burns are to be debrided prior to the application of NPWT
- Wounds in close proximity to blood vessels, delicate fascia, vital organs or exposed tendons
- Do not apply NPWT to blind or unexplored wound cavities or sinuses
- Sharp edges or bone fragments must be covered to prevent puncturing of organs or vessels
- Clients with a risk of bleeding (long-term anticoagulant therapy, haemophilia, sickle cell disease – see below) or those who are actively bleeding or have irradiated blood vessels/organs
- Sickle cell disease affects the shape of the red blood cell – these change during an acute phase of injury/disease and may cause microcirculation obstructions / blockages which can lead to extreme pain. Clients could require lower pressure settings or therapy to be discontinued due to pain
- Clients with allergies to adhesives and silver products if using silver foam/interface
- Magnetic Resonance Imaging (MRI) and Hyperbaric Oxygen Unit: Do not take the
NPWT device into these environments. The dressings may remain on the client under the direction of the treating radiologist or treating physician

• Children require wound contact layers to reduce adherence of dressings to the wound surface and minimise pain. Pressure levels should be increased or decreased according to tolerance levels and continuous pressure is recommended. KCI recommendation: Neonates and infants 50-75mmHg, children 75-100mmHg and adolescents 75-125mmHg. Care should be taken not to damage the peri-wound skin

• Fluid loss should be closely monitored especially in neonates and infants, considering the volume in both the tubing and the canister (Bradley, 2014; KCI, 2014; S&N, 2013).

**Client and Wound Considerations**

Prior to application and during treatment:

• Holistic assessment of the client and wound to ensure the NPWT is suitable


• Undertake assessment of the wound type and tissue involved as this will affect the choice of product and therapeutic negative pressure level required

• Actively engage clients in their NPWT treatment and encourage them to provide feedback on their experience

• Assess the home environment: ensure the client/family/caregiver can read and understand the safety information, respond to device alarms, charge the unit from mains electricity supply, and follow instructions for use,

• NPWT discontinuation will be largely dependent on client compliance / tolerance and information gained from a comprehensive wound assessment

• Provide client with out of hours contact number for NPWT company in case of issues

• It is expected that the wound will display signs of improvement after two dressing changes

• Weekly wound measurements and photographs should be attended to compare previous dimensions and appearances as this will provide evidence of healing

• Measurement of the exudate volume at each dressing change (note: fluid/balance/monitoring is vital in infants and young children), a decrease in exudate level is an expected outcome of NPWT (Bradley, 2014; MNH&HS, 2018).

**Consider discontinuation when the following occurs:**

• Frank blood or pus is evident in the canister and/or dressing

• Haematoma is evident underneath the dressing

• Granulation tissue is level with the surrounding skin

• When there is no demonstrated benefit or improvement to the wound (Mattox, 2017).

*Note: Prior to ceasing NPWT ensure the treating consultant is advised and agreeable to cease therapy.*
Allergies

If signs of an allergic reaction develop (redness, swelling, urticaria, rash) discontinue use and contact the treating team/ wound management nurse for alternative management (S&N, 2013).

Pain Management

Assess pain at each dressing change – the client should be referred to their GP, or have their referring consultant contacted, to discuss if there are concerns.

The following should be considered at dressing changes to reduce pain and maximise client comfort:

- Advise and educate client to turn device off 20-30 minutes prior to appointment, this will alleviate discomfort on dressing removal
- Educate the client to ensure analgesia is taken 30 minutes prior to dressing changes and as prescribed
- Consider a non-adherent wound interface underneath the wound filler to reduce pain and trauma to the wound bed upon removal of dressings. Discuss this with the Wound CN as granulation can be impacted
- Consider using gauze filler or white foam if black foam filler is causing discomfort
- Ensure use of remove wipes and instil warmed saline into the dressing prior to removal (KCI 2014; Mattox, 2017; S&N, 2013).

NPWT Settings

- The most common pressure level is -120mmHg (S&N) and -125mmHg (KCI). This may be raised or decreased in increments of 10mmHg with S&N devices and 25mmHg with the KCI devices
- Pressure levels should only be adjusted in consultation with the treating consultant or qualified wound clinicians, ensuring pressure settings are aligned with clinical guidelines for wound aetiology, pain, age, risk of bleeding and poor nutritional status
- Target pressure for white foam (KCI) requires a pressure of -150mmHg – -175mmHg due to density of the foam
- PICO delivers approx. -80mmHg (+/- 20mmHg)
- Please refer to clinical guidelines to ensure appropriate settings are utilised:
  (KCI 2014; S&N, 2013).

Frequency of dressing changes

- If there is heavy exudate or increased bioburden increase frequency of dressing change, maximum of every second day
- If the client is comfortable and the wound is progressing with low to moderate exudate, dressing changes should occur approximately two to three times per week
- If foam dressing is being used and requiring twice weekly changes make sure the foam
fills the cavity and consider using interface to minimise client discomfort and trauma to the wound bed

- If using a PICO dressing these are indicated for low to moderate exudate and wounds requiring dressing changes weekly or twice a week (KCI, 2014; S&N, 2013).

**Types of available therapy**

- **Continuous** therapy applies consistent negative pressure to the wound
- **Intermittent** therapy is where the NPWT device is programmed to turn on and off throughout the treatment
- **Instillation** therapy is where fluids such as normal saline is injected into the wound through a port to optimise healing
- The treating medical team and/or Wound CN will advise of required therapy settings to be used. For further information regarding the different treatment settings, please refer to the clinical guidelines (S&N and KCI link above)
- **PICO** is a single use NPWT system consisting of a pump and two sterile dressing kits which the exudate is absorbed into (KCI, 2014; Panayi et al., 2017).

**Hints and Tips**

**Foam/Gauze:**

- Foam is appropriate for deep open wounds with minimal tracking and higher exudate
- Gauze is appropriate for irregular shaped wounds with undermining and lower exudate
- Only use from sterile and unopened packets
- Should fill the cavity and leave no open voids
- When more than one piece of foam is used, all foam should stay in contact with each other
- Document in the wound management plan the number of foam/gauze dressings used, particularly in cavity dressings
- Do not over pack a wound as this may inhibit wound progression
- Ensure the foam/gauze does not come into contact with the peri wound as it could cause tissue breakdown
- Do not cut foam/gauze over the top of the wound as fibres can fall into the wound bed
- Ensure the foam/gauze is larger than the port but not protruding over the wound frame onto the unprotected peri wound
- Ensure there is sufficient filler to allow for foam/gauze shrinkage once pressure is applied, filler needs to be level with surrounding skin and level with wound edges once pressure is engaged
- Moisten the gauze filler with saline before applying to the wound which ensures the entire wound surface is in contact with the gauze
- The gauze contains 0.2% PHMB for 72 hours of antimicrobial effectiveness (Carville, 2017; KCI, 2014; S&N, 2013).
**PICO:**

- Do not cut the dressing as this may lead to loss of NPWT application
- Ensure the edges are secured with supplied drape strips, without covering any of the PICO pad
- Do not use occlusive dressings over the pad as this will affect the efficacity of the device
- Educate clients on trouble-shooting, leakages and monitoring the indicator lights on the device

Refer to S&N PICO clinical guidelines (link on p7) for further information (S&N, 2013).

**Drape:**

- Should cover 3-5cms beyond the wound edge
- Ensure peri wound is dry prior to application, use skin prep to protect peri wound
- Application is easier when using strips of drape that are smaller and are more manageable
- Do not stretch the drape on application
- Make a hole in the drape for the port (50 cent piece size for KCI sensor track)
- Keep excess/leftover drape as clients can use this if any leaks develop between dressing changes (KCI, 2014; S&N, 2013).

**Port:**

- Position the port over the cut hole in the drape
- Ensure tubing is positioned on a flat surface away from bony prominences and pressure areas. (See Bridging Procedure in KCI and S&N clinical guidelines)
- Loosely secure the tubing with an additional piece of drape or tape a few centimetres away from the wound, this prevents pulling of the tube which can potentially tear the port away from the dressing.
- When dealing with lower limbs or areas with sensitive skin ensure padding is applied under tubing to prevent shearing and pressure injuries
- Ensure adequate filler applied under port to prevent pressure injury
- When using PICO position the dressing centrally over the wound, and ensure the port is positioned uppermost on intact skin and does not extend over the wound to reduce risk of collection of fluid around the port and blocking the suction (KCI, 2014; S&N, 2013).
**Canister:**

- Change a minimum of once per week to control odour or when it is full (alarm will sound)
- If a leak is detected check canister and tubing for damage (KCI, 2014).

**Maintaining a seal:**

To avoid seal issues, ensure the following:

- Prepare the peri wound and surrounding area with skin prep to ensure skin is dry and free from residual oil-based substances used in adhesive removers
- Frame the wound with hydrocolloid or drape. In difficult areas (around toes) cohesive seals, Renasys or KCI gel strips can be used to assist with sealing (KCI, 2014).

**Disconnecting the NPWT:**

- Disconnection from the unit should be avoided, however, if necessary for not more than two hours. If disconnected for longer than two hours the dressing requires changing
- If disconnected for more than two hours please remove the dressing, cleanse the wound and re-apply either NPWT as plan or a conventional dressing (KCI, 2014; S&N, 2013).

**Options for treating multiple wounds**

**Y-Connector:**

- To be used for more than one wound if the wounds are highly exudating or over 25cm apart so unable to be bridged
- Ensure Y-connector is changed weekly with canister
- Do not use a Y-connector to connect infected with non-infected wounds
- When using more than one port blockages are not detected in the port unless both are blocked (KCI, 2014; S&N, 2013).
The Bridging technique:
https://www.youtube.com/watch?v=vSLON_cqLSs

- Recommended for wounds within close proximity (within 25cm of each other) and of similar pathologies. Do not bridge wounds of different aetiologies or bridge an infected wound to a non-infected wound
- Protect the skin between the wounds with a hydrocolloid or film dressing connecting the wounds
- Connect the two wounds with wound filler (gauze/foam) ensuring that each piece is in contact with each other
- Apply the port centrally over the wound bridge to ensure that exudate from one wound is not drawn across to another
- This technique can also be used to move the port/drain to a non-weight bearing area e.g. wounds to the plantar surface or heel of the foot
- When bridging the track pad to the dorsum of the foot consider vascular status of patient and ensure padding is applied under the tubing to prevent pressure

Note: appropriate off-loading of the foot is essential to maximise the therapeutic benefits of NPWT (KCI, 2014; S&N, 2013).

Wound with undermining:

- Continuous therapy is recommended in the presence of undermining
- White foam or Kerlix gauze to be used in all undermined areas, beginning at the distal end ensuring not to tightly pack into undermined areas, continue filling the entire wound to fill the defect to skin level allowing for shrinkage when negative pressure is applied
- Foam can be gently placed in undermined areas all the way to the distal part of the wound - gently pull the foam out 1-2cm leaving some foam in the wound to communicate with the foam in the wound bed. This will allow the wound cavity edges to granulate from the distal portion of the wound (KCI, 2014; S&N, 2013).

Wounds that tunnel:

- Do not place filler material into blind or unexplored tunnels
- Document in the notes and mark on the dressing the exact number of wound filling material placed into all aspects of the wound to ensure that all pieces are removed during dressing changes. Adjunct dressings such as non-adherent contact layers or silver dressings should also be noted
- V.A.C. White foam is recommended by KCI to be used with their NPWT system in tunnelled or undermined wounds. Always cut the foam wider for the opening. This will ensure that the opening of the tunnel remains open until the distal portion of the tunnel has closed. In the initial application cut the foam to a size that accommodates the tunnel’s dimensions, plus 1-2cm. into the wound bed. Gently put the foam into the tunnel all the way to the distal portion. The foam in the tunnel should be in contact with the foam in the wound (KCI, 2014; S&N, 2013).

Refer to clinical guidelines when attending to wounds with undermining or tunnelling.
Body cavity wounds:

Underlying structures must be covered by natural tissues or synthetic materials that form a complete barrier between the underlying structures and the wound filler.

- **Exposed tendons**: Healthy exposed tendons should be protected against trauma and desiccation by covering them with fascia or muscle or a non-adherent contact layer such as atrauman or cuticerin.

- **Exposed nerves and blood vessels**: Exposed nerves and tendons should be protected by moving available fascia or muscle over them (surgery) or one or more layers of a non-adherent contact layer. (KCI, 2014; S&N, 2013).

Wounds at risk of infection:

- Assess for wound infection (culture/ biopsy if necessary). Signs of possible infection include fevers, tenderness, redness, swelling, rash, increase in temperature around the wound, purulent discharge and a strong odour. Systemic infection may cause an increase in temperature, headache, nausea, vomiting, dizziness, fainting, orthostatic/refractory hypotension, sore throat with swelling of the mucus membranes and erythroderma (sunburn like rash).

- Effective debridement of devitalised tissue prior to NPWT application will reduce bacterial load and infection risks

- Applying foam over slough or devitalised tissue can increase infection risks due to bacteria clogging up foam pores

- Untreated infection will make NPWT ineffective

- Monitor for progression of local infection or systemic signs of infection

- Where infection is suspected consider undertaking a wound swab in liaison with GP as antibiotics may need to be commenced

- Increase dressing changes to reduce bacterial burden on the wound

- Use of silver-based interface that allows free movement of fluid (e.g. Acticoat flex) or the KCI Granufoam Silver (with KCI devices) can help reduce infection

- Bleeding can occur as a result of infection or intergrowth of retained materials

- but should not replace systemic therapy or infection treatment regimens

- Undertake standard infection control techniques

- Check pressure settings as they may need to be adjusted

Short Assessment

1. Provide three examples of the clinical benefits of NPWT.
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

2. When is NPWT contraindicated?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

3. What steps would you take if the client complained of pain?
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4. On removal of the NPWT an odour is noted to the wound, how do you manage this?
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5. You receive a phone call from a client stating the machine has been turned off for five hours what do you do?
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References


