



Preventing Medical Treatment Related Skin and Tissue Injuries in Adults and Children

EVIDENCE INFORMED PRACTICE TOOLS

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PURPOSE AND INTENT

To provide healthcare teams with guidance, information and a consistent approach to prevent medical treatment related skin and tissue injuries in adults and children within the sites of the Winnipeg Regional Health Authority (WRHA) and Shared Health.

1. Practice Outcomes

This guideline will:

1. Identify the risks for skin and tissue injuries specific to medical treatment including those from medical devices, casts and backslabs, medical adhesives and extravasation.
2. Provide a list of medical devices and treatments with greater potential to cause injuries
3. Outline strategies to prevent medical treatment related injuries.
4. Guide clinicians to report to complete occurrence report (RL6 or equivalent) for ALL stages of pressure injury caused by medical treatments

2. Background

2.1 Etiology of Skin and Tissue Injury from Medical Treatments

- Medical Devices

Medical device related skin and tissue injuries occur as devices are often made of rigid materials such as plastic, plaster, fibreglass, rubber or silicone which can cause rubbing or create pressure on the soft tissues¹. The tape or securement devices may cause skin damage particularly where there are fluid shifts and edema develops². Casts and backslabs are also considered medical devices and pose challenges due to the fact that often they cannot be removed. They can also cause thermal injury from the exothermic reaction of plaster.

- Medical Adhesive Related Skin Injury

Medical adhesives can cause traumatic skin damage when the skin-to-adhesive attachment is stronger than the attachment of the epidermis to the dermis. This can cause separation of the epidermal layers or the entire epidermis separating from the dermis. Repeated application and removal of adhesive products causes mechanical trauma and can range from skin stripping to a tension injury or blister or to a skin tear. Irritant or allergic dermatitis may develop under the product, and maceration from trapped moisture or folliculitis can also occur²⁵.

- Extravasation Injury

Extravasation injury to skin and tissue occurs when there is efflux of solutions from a vessel into surrounding tissue spaces during intravenous infusion.

3. Skin and Tissue Injuries

3.1. Medical Device Related Pressure Injuries

Medical devices are used in all healthcare settings and the National Pressure Injury Advisory Panel (NPIAP) defines the etiology of a medical device related pressure injury as follows:

“Medical device-related pressure injuries result from the use of devices designed and applied for diagnostic or therapeutic purposes. The resultant pressure injury generally conforms to the pattern or shape of the device. The injury should be staged using the staging system³. Medical devices can cause mucosal membrane pressure injuries, but due to the anatomy of the mucosal membrane tissue these injuries cannot be staged as unlike skin, mucosa does not have an epithelium, and the base of mucous membrane-covered tissue does not include muscle, tendon, ligaments and bone ^{3, 4, 5}”.

The cause of pressure injuries from medical devices is iatrogenic, that is it is caused inadvertently by medical or surgical treatments or diagnostic procedures. It has been found that medical device-related pressure injuries account for almost one third of serious (Stage 3, 4 and Unstageable) pressure injuries and that half of these were unstageable ⁶. Preventing device related pressure injuries is often much more complex than preventing pressure injuries on bony prominences because the device causing the damage is required as part of the patient’s treatment. Medical co-morbidities, level of consciousness and extremes of age such as the very young and very old may predispose patients to be unable to sense the tissue damage being caused by the device ⁹⁻¹⁰.

3.2 Thermal Injuries with Casts and Backslabs

Plaster has a much higher setting temperature than fiberglass and therefore poses a higher risk for thermal injury (burn) when a cast is applied. Plaster and water react to produce heat through a process known as an exothermic reaction. There are a number of factors during the casting process and the post casting care which is associated with thermal injuries: ^{15, 16}

- Temperature of dip water for wetting plaster >50°C
- Inadequate volume of dip water, as water assists in releasing heat
- Removal of water by aggressive squeezing of plaster
- Increased room temperature
- Cast material >24 ply, considered too thick
- Reinforcing a curing plaster cast with fiberglass as the synthetic overlap prevents heat from effectively dissipating
- Covering the curing cast with blankets
- Supporting the freshly applied cast on a pillow with a plastic cover

Prevention of thermal injuries requires that the plaster must be allowed to cure before setting the casted limb on a support or covering with a blanket or applying fiberglass reinforcement ¹⁷

Suggested solutions:

- Bottled water can be used as dip water as the ambient temperature is in the safe range to activate plaster (thermometer is not needed)
- Prop limb on pillows during the drying period to avoid pressure points
- Ensure that pillows do not have plastic covers

3.3 Medical Adhesive Related Skin Injury

Medical Adhesive Related Skin Injury (MARS) is a traumatic skin injury caused by the removal of adhesives from skin. It is defined as a medical-related skin injury in which erythema and/or other manifestation of skin trauma or reaction including formation of vesicles, bulla, skin erosion, and epidermal tears, persist longer than 30 minutes after removal of the adhesive tape. Other injuries include contact dermatitis and tension injuries from allergy, or tape applied too tightly or stretched over the skin¹⁸. Examples of products with medical adhesives include tape, dressings, ostomy pouches and electrodes. The elderly and neonates are at high risk for MARS ²⁵.

The types of skin injuries caused by medical adhesives include:

- Mechanical trauma
 - Epidermal stripping: Removal of one or more layers of the epidermis following removal of adhesive
 - Tension injury or blister: Injury caused by shear force as a result of distension of skin under an unyielding adhesive tape or dressing
 - Skin tear: Wound caused by shear, friction, and/or blunt force resulting in separation of skin layers; can be partial- or full-thickness wound
- Dermatitis
 - Irritant contact dermatitis: Non-allergic contact dermatitis occurring as a result of a chemical irritant; a well-defined affected area correlates with the area of exposure
 - Allergic dermatitis: Cell-mediated immunologic response to a component of tape adhesive or backing; typically appears as an area of erythematous vesicular, pruritic dermatitis corresponding to the area of exposure and/or beyond
- Other
 - Maceration from trapped moisture: Changes in the skin resulting from moisture being trapped against the skin for a prolonged period; skin appears wrinkled and white/grey in colour
 - Folliculitis: Inflammatory reaction in hair follicle caused by entrapment of bacteria; appears as small inflamed elevations of skin surrounding the hair follicle

MARSI can be prevented by careful selection of adhesive products, correct application and removal.

3.4 Extravasation Injury

Extravasation occurs when a drug is inadvertently administered outside of the vein. Depending on the substance involved, this may lead to tissue necrosis with significant long-term morbidity. Neonates especially premature infants are particularly susceptible to extravasation with up to 70% of children in neonatal intensive care unit having some form of extravasation injury ²⁰. This high prevalence is attributable to the immature vasculature of premature infants, which makes the course of blood vessels less predictable and more vulnerable to damage compared with the blood vessels of adults ²¹. During and after cannulation, the site does not remain fixed, which makes neonates vulnerable to extravasation. If treatment is delayed, surgical debridement, skin grafting, and even amputation may be the unfortunate consequences of such an injury ¹⁹.

Prevention and treatment of extravasation injury is described in Section 7

4. Prescription of Medical Devices

Medical devices are prescribed, non-prescribed, custom made or pre-fabricated. For all medical devices, there **must** be documentation in the chart of:

- Diagnosis necessitating medical device
- Name and type of medical device
- Indications for wear
- Plan for follow-up
- Name of provider responsible for treatment and follow up
- Instructions if device is not removable including contact information of the Prescriber in case of problems with device
 - Communication with patient and family of skin and pressure injury risk posed by device

Daily documentation is required for:

- Skin and pressure injury risk from device
- Presence of skin or pressure injury

Prescribed Medical Devices

Prescribed medical devices usually have specific indications such as a cast, walking boot, urinary catheter, cervical collar or central line. Prescribers can include Physicians, Surgeons and their delegates, Nurses, Occupational Therapists, Physiotherapists, Orthopedic Technologists, Orthotists, and Prosthetists.

Non-prescribed Medical Devices

Non-prescribed medical devices can have specific indications such as a urinary catheter, nasal cannulae, or can be used intermittently use such as a pulse oximeter, wheelchair, bed pan.

Custom-made Medical Devices

As per the Canadian Medical Device Regulations ¹⁴, a custom-made device is one which is: (a) manufactured in accordance with a HCP's written direction giving its design characteristics or made by the HCP; (b) differs from medical devices generally available for sale and (c) is for the sole use of a particular patient. Custom-made medical devices include casts, back slabs, braces and splints.

Pre-fabricated Medical Device

A Pre-fabricated Medical Device is generally available for sale and is mass-produced. Examples of pre-fabricated medical devices are walking boots, urinary catheters, compression stockings and cervical collars.

5. Skin Surveillance

5.1 Skin Surveillance under Removable Medical Devices

Assess patients at risk for skin breakdown using a risk assessment such as the Braden Scale for Predicting Pressure Ulcer Risk, The Braden Q Scale or Pressure Ulcer Risk Scale (PURS).

Prevention of skin breakdown under medical devices is device removal with inspection of the skin under adequate light. Unless otherwise indicated, device should be removed and skin surveillance completed once a shift (at least every 8 hours) for hospitalized patients and personal care home residents ¹¹. Skin inspection under medical devices should always be noted on rounds, patient handovers and transfers.

Early skin breakdown is heralded by non-blanchable erythema, which is a Stage I pressure injury. Stage 1 pressure injuries can be difficult to detect in dark skinned persons, and should be augmented with palpation for warmth and induration (firmness).

- Check the fit of devices, by ensuring that device conforms to the patient's anatomy comfortably and only the areas of the device that are intended to have contact with skin do so.
- Lift or move the medical device to examine the skin underneath and other areas vulnerable to pressure ulcers from medical devices (e.g., openings of the nose, inside the mouth). If the patient is obese, examine between any skin folds to ensure the medical device is not hidden from view ¹².

- Apply dressings, as needed, to redistribute pressure and absorb moisture from body areas in contact with a medical device or tubing. Remove and reapply the dressings during skin assessments to check the skin ¹².
- Reposition the medical device at routine intervals ¹³.
- Check the tension of any tape or straps holding a medical device or tube in place to ensure it does not create more pressure from the device against the skin¹³.
- Examine the patient for any swelling that could aggravate skin breakdown from a medical device. Tape and straps holding a medical device in place could tighten against the device and skin with swelling ¹².
- Evaluate the patient's need to continue with a medical device to eliminate unnecessary use of the device.

5.2. Skin Surveillance under Non-Removable Medical Devices

Signs and symptoms of problems under a non-removable device include:

- Pain beyond what would be considered normal (burning, stinging etc.)
- Foul odour
- Complaint of pressure point, rubbing etc.
- Moisture in device (i.e. wet cast)
- Intense pressure from swelling i.e. fracture blisters
- Body fluid leaking through device

If the device is non-removable and there is risk of a pressure injury developing or a pressure injury or thermal injury is suspected, contact the prescribing physician and/or the department that applied the device.

6. Prevention and Management of Medical Adhesive Related Skin Injury

Prevent Medical Adhesive Related Skin Injury ²² by:

- Identifying patients at elevated risk and implementing interventions before skin injury occurs
- Apply skin preparation prior to application of tape or dressings (unless dressing is silicone)
- Using silicone dressings, tape or tape which has less adhesion
- Using adhesive remover to remove heavy tape, tube securement devices, and ostomy pouches
- Keeping skin well moisturized
- Using protective devices such as skin sleeves to keep at-risk areas covered (also protects from skin tears)
- Changing devices that are adhered to the skin (ostomy pouches, tube securement devices) on a routine basis.

- Removing tape and/or device in the direction that the hair is growing

7. Prevention and Management of Extravasation

Neonates: Refer to Management of Peripheral IV Access Devices and Extravasation Injuries in Neonates: <http://www.wrha.mb.ca/extranet/eipt/files/EIPT-035-23.pdf>

Health Sciences Centre – Cytotoxic Medication (Chemotherapy): Management of Extravasation of Antineoplastic Vesicant and Irritant Drugs
https://policies.sharedhealthmb.ca/wp-admin/admin-ajax.php?juwppfisadmin=false&action=wpfd&task=file.download&wpfd_category_id=60&wpfd_file_id=291&token=cfdb900c8d8fe796346a7bb788ffc592&preview=1

Health Sciences Centre: Infusion therapy: Standards of Practice.
<https://policies.sharedhealthmb.ca/document/64/management-of-patient-services-patient-care/370/350-140-124-cpg-hsc-infusion-therapy-central-peripheral-subcutaneous-intraosseous>.

Nursing Skills On-Line: Refer to Intravenous Therapy: Prevention and Management of Extravasations

Prevention: The patency of the catheter and vein should be assessed frequently so that extravasation can be prevented. Before administering each dose of medication, the nurse should visually inspect and palpate the site, checking for vein cording, edema, skin temperature, and tenderness or discomfort. Check for a positive blood return ^{19, 20, 21}.

Suggested Extravasation Interventions ^{19, 20, 21}

- **STOP** the infusion immediately. **DO NOT flush if extravasation is suspected as this would inject additional fluid into the tissues.**
- **Notify *Prescriber/ Primary Care Providers immediately**
- **Consult Pharmacy immediately** for further treatment direction, including antidote information and application of heat or cold.
- Disconnect the IV tubing from the catheter hub and carefully aspirate any remaining vesicant using a 3-5 ml syringe with a gentle technique.
- **NOTE:** Do not remove Vascular Access Device (VAD) until antidote requirement is determined. Certain antidotes must be given through the existing VAD to ensure delivery into the affected tissue

- When VAD can be removed, apply a dressing to achieve hemostasis and elevate the extremity. **NEVER apply pressure to a site where extravasation is suspected.**
- In collaboration with the prescriber, consider facilitation of consultation with other specialists as needed (ex. PICC Services, Wound Care CNS, Vascular Surgeon, Plastic Surgeon, PT/OT, pain specialist).
- Mark the affected area with a skin marker, continue to monitor. This is due to increased risk of tissue necrosis and risk of loss of limb.
- **Document** ^{19,20, 21}
 - Date and time of occurrence
 - Site of administration, condition of the vein, and age of the IV site
 - Method of administration and equipment used with administration
 - Patient and family discussion including symptoms, pain
 - Suspected agent and any other medications administered or procedures completed around the same time period
 - Treatment interventions
 - Notification of *Prescriber/Primary Care Providers
 - Plan for follow-up care
- **Patient safety**

Report as an occurrence in RL6 or other site specific system

* Prescriber/Primary Care Providers can be physicians, nurse practitioners, & physician assistants

8. Commonly Used Medical Devices and Causative Factors for Skin and Tissue Injury

Location	Device	Issues
All	Adhesive	Removal of adhesive can cause skin tears, blisters, and adhesive can cause dermatitis. Maceration and folliculitis can occur under adhered products
All	Extravasation	Accidental infiltration of a vesicant or chemotherapeutic drug into the surrounding IV site. Mild to severe tissue damage including necrosis can occur.
Arms	Arterial Lines	Edema post fluid resuscitation causes pressure on skin from tubing and securement devices
Arms	Backslab	Hard edges, limb swelling, thermal injury

Arms	Casts	Sharp edges, limb swelling, poor fit, thermal injury
Arms	Identification tags	Hard plastic securing buttons
Arms	IVs	Hard plastic ports, locks, flow controllers, and tubing can cause pressure on skin, extravasation
Arms	PICC line	Hard plastic clips and ports
Arms	Restraints	Straps can cause friction and shearing as patient moves
Arms	Splints	Hard plastic and straps, heat and humidity
Ear	Oxygen tubing	Sidelying causes pressure on pinna of ear, tubing tightened to hold tubing on face, ear cartilage is thin
Ear	Pillow	Sidelying causes pressure on pinna of ear, cartilage is thin
Ear lobe	Pulse Oximetry	High pressure from device clip on small area, ear cartilage is thin. In infants and young children probes wrapped around digits, hands, wrists and feet can constrict blood flow. Cables from both pulse oximetry and cardiorespiratory leads can rest under patient similar to IV tubing. Light from pediatric and infant probes can cause burns
Ear	Glasses	Hard plastic/metal can cause pressure on ear lobes, ear cartilage is thin
Face	CPAP/BiPAP	Urgently placed and secured tightly on thin skin on the bridge of nose, face can cause edema. Incorrect sizing of CPAP/BiPAP or difficulty with sizing due to patients being "in between" sizes especially in pediatrics.
Head ⁷	Rigid Cervical Collar	Urgently placed and secured tightly in trauma and extraction situations. Plastic components, high heat and humidity under collar. Incorrect sizing of cervical collars or difficulty with sizing due to patients being "in between" sizes especially in pediatrics
Head	Soft Cervical collar	High heat and humidity, pressure from collar edge or plastic reinforcement
Head	EEG leads	Metal buttons cause pressure injury. Glued in place when used long term.
Neck ⁸	Tracheostomy	High pressures occur with the skin/tracheostomy interface, as tracheostomy is sutured to secure airway; securement straps can cause skin injury; pressure from hard plastic flange and tube
Nose	Nasal Cannula	Tightened in place to prevent slippage from nares causing pressure on ears. Mucosal membrane injury from nasal cannula

Nose	Nasogastric tubes	Secured with tape to prevent migration. Mucosal membrane injury from tube
Nose	Glasses	Hard plastic/metal can cause pressure on sides of nose
Mouth	Endotracheal tube	Secured to prevent extubation; hard plastic can cause mucosal membrane pressure injury
Mouth	Bite Block	Hard plastic can cause mucosal membrane pressure injury
Chest Scapula/Sternum	Halo traction	Hard plastic and metal components
Chest Scapula. Spine	Wheelchair	Wheelchair and seating component sizing, plastic and metal on wheelchair and seating system. Seating components incorrectly inserted
Head/chest	CTO	Hard plastic and metal components
Chest/Hips	TSLO	Hard plastic and metal components
Abdomen	GT tubes	Stoma can enlarge and leak stomach acid on abdomen
Abdomen	Ostomy	Stomas can enlarge leaking hydrochloric acid onto skin of abdomen
Hips	Hip Spica	Children tend to put items into the cast, food falls into cast, thermal injury, sharp edges, limb swelling, poor fit
Hips	Wheelchairs	Wheelchair and seating component sizing, plastic and metal on wheelchair and seating system. Seating components incorrectly inserted
Perineal area Mucosa	Urinary catheters	Indwelling catheters can cause urethral erosion in men if not secured correctly
Perineal area	Urinary catheters	Aspiration and balloon inflation ports cause pressure on skin
Perineal area	Bed pans	Rigid plastic or metal
Perineal area	Fecal containment devices	Tubing can rest under patient; ports become hidden in skin folds or under scrotum
Legs	Backslab	Hard edges, limb swelling, thermal injury
Legs	Casts	Sharp edges, limb swelling, poor fit, thermal injury
Legs	IVs	Hard plastic ports, locks, flow controllers, and tubing can cause pressure on skin, extravasation
Legs	Compression	Can be applied too tight, fluid shifts, edema
Legs	Splints	Hard plastic and straps, heat and humidity
Legs	Tensors/TEDs	Fluid shifts, edema cause tourniquet effect
Feet	Walking boots	Can be applied too tight, fluid shifts, edema

9. Critical Incidents

Manitoba's legislation defines a critical incident as "an unintended event that occurs when health services are provided to an individual and results in a consequence to him or her that is serious and undesired."

Upon discovery of a pressure injury, regardless of stage, an occurrence report (RL6 or equivalent) must be completed.

Stage 3 and 4 pressure ulcers (injuries) are considered potential critical incidents and in WRHA Unstageable Pressure Injuries are also considered potential critical incidents as when debrided they are usually Stage 3 or 4. Serious injury associated with the use of devices also forms part of the criteria.

See the following links for further details:

<https://www.gov.mb.ca/health/patientsafety/ci/guidelines.html>

<https://www.gov.mb.ca/health/patientsafety/docs/guidelines.pdf>

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