Neurosurgery Education and Outreach Network (NEON)

Care and Management of a Patient with a Halo System

Updated 2025

The Neurosurgery Education and Outreach Network (NEON)

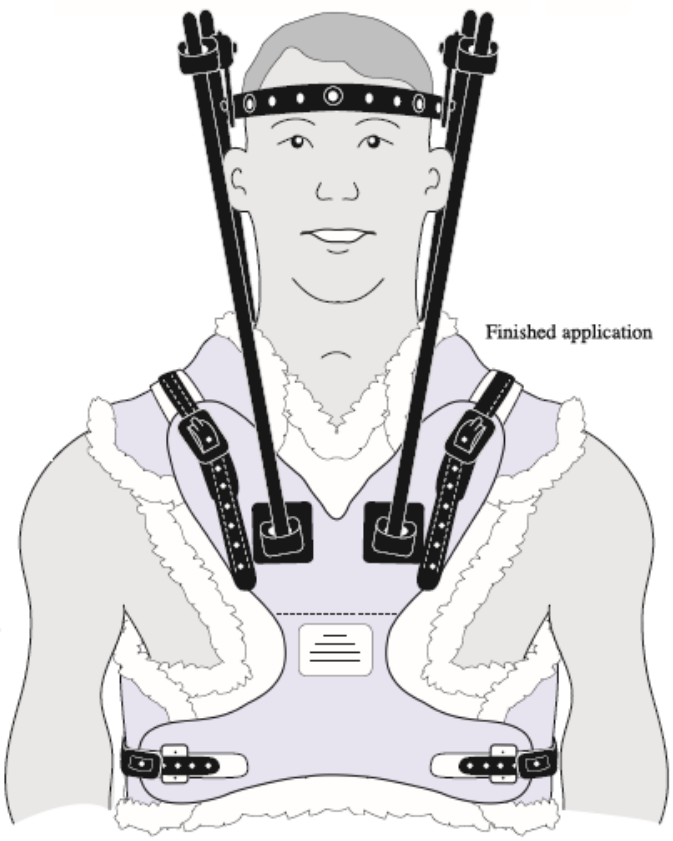
The Neurosurgery Education and Outreach Network (NEON) is comprised of Neurosurgery Nurse Educators, Advanced Practice Practitioners, Clinical Nurse Specialists and Directors from each of the 13 neurosurgery centres.
The mandate of the NEON is to plan and implement neurosurgery system-wide improvements, through education and outreach, to address gaps in skills and knowledge, and improve access and patient flow between neurosurgery and non-neurosurgery centres.

Disclosure Statement

The Neurosurgery Education and Outreach Network (NEON) and Critical Care Services Ontario (CCSO) have no financial interest or affiliation concerning material discussed in this presentation.
This presentation provides direction for how to provide care to patients with a Halo System to ensure consistency within and across organizations. It was developed by a sub-group of clinical neurosurgical nurses and neurosurgical educators for health care professionals (HCPs) across Ontario. This presentation is not meant to be exhaustive, and its contents are recommended, but not mandated for use. HCPs should use their clinical judgment and utilize other assessment parameters if determined necessary. Please note this document is not intended to supersede your hospital's policies and physicians' orders.

Halo System

- Used to immobilize the cervical spine in the treatment of traumatic injuries or for post-operative support.
- Reduces the risk of damage to the patient's spinal column when the vertebrae are unstable due to either a dislocation or fracture of the bones.



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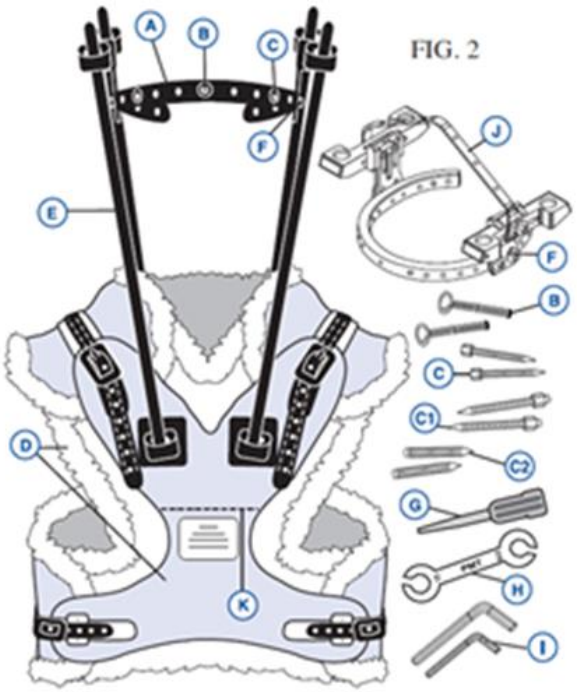
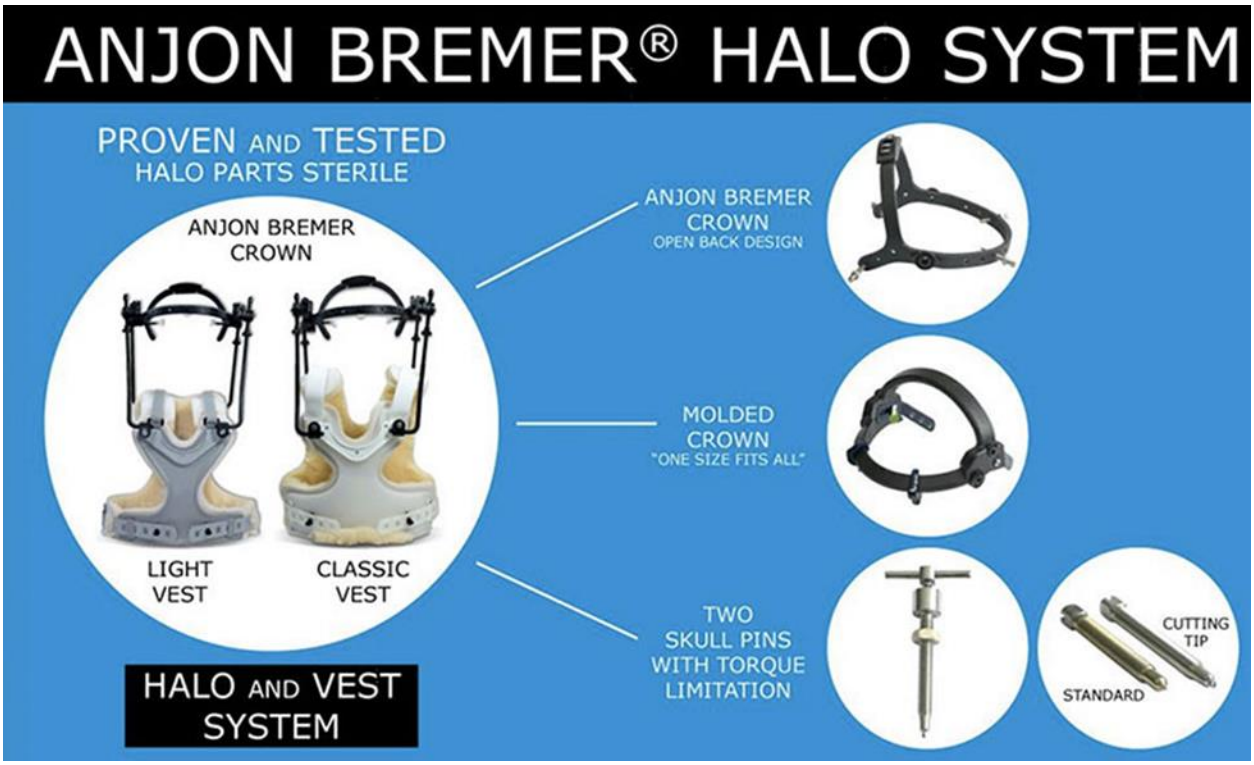
The PMT® Halo System



PART	QTY.	DESCRIPTION
A	1	Halo Ring
B	3	Positioning Pins
C	5	Head Pins (Standard Ring) OR
C1 C2	2 2	Spring Loaded Head Pins and Solid Head Pins (Traction Ring)
D	1	Vest with Liner
E	4	Graphite Rods
F	2	Head Blocks
G	1	Small Screwdriver (standard superstructure only)
H	1	7/16" – 1/2" Combination Wrench for locking head pins
I	2	Allen Wrenches (1 large and 1 small) NOTE: For emergency use only. (PMT recommends a torque driver for tightening head pins and superstructure.)
J	1	Traction Bail Assembly (Depending on the circumstances, you may decide to apply traction prior to vest application. Apply the vest and put the patient into traction. The traction bail assembly easily attaches to the head blocks.)
K	(feature)	Cardiac Crease

Image used with permission from PMT. PMT Halo System 1200 Series Instruction Manual (2020). *PMT Corporation*

Combination Wrench and Allen Wrench taped to the front of the halo vest.
Photo provided courtesy of the NEON Images Library. (2024)



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Description of the Parts of a Halo System

Halo: A graphite ring attached to the skull with a minimum of four stabilizing skull pins (anteriorly and posteriorly), which are threaded through the holes in the ring. The pins are inserted into the outer layer of the skull, 1 mm into the periosteum. The ring is attached by metal or carbon fiber rods to a jacket vest around the patient's chest.

Vest: The plastic jacket vest is typically lined with a soft synthetic *sheepskin. It has shoulder and thoracic straps. The vest holds the halo ring in place with the upright and transverse attachment bars and distributes the weight of the patient's head to their chest.

***Throughout the rest of this document, the term "sheepskin" will be referred to as "liner".**
**** "Trained delegate" may include physician assistant, nurse practitioner, orthotic technician.**

Halo System Wrench/Allen Wrench: Only a ****surgeon/trained delegate*** in halo system application and maintenance can adjust the skull pins.

- PMT Halo System: The "Combination Wrench" is used to adjust the nuts that thread onto the skull pins. The "Allen Wrench" is used for everything else – i.e., to adjust the skull pins, the rod connection points, and the bolts that secure the nylon joints.

- Bremer Halo System: A 7/16” wrench is supplied with the vest. It is used to tighten or loosen vest bolts.

The Wrench and/or Allen Wrench (Bremer Halos – wrench ONLY; PMT Halos – Combination Wrench AND Allen Wrench) ***must ALWAYS be attached*** to the front of the vest for:

- CPR – may be accessed by any member of the health care team
- Any required adjustments – done by the surgeon/trained delegate

*****The Halo system is MRI compatible *****

Assessment of the Halo System

Integrity & Function

- Examine the halo system for stability, secure connections, and positioning.
- Inspect each skull pin/bolt for loosening - ensure they are secure and tight; report loosened skull pins to the surgeon/trained delegate.
    - *Signs that a skull pin may be loose:*
        - Redness, swelling or discharge at the pin site.
        - Clicking noise that only the patient can hear. If there is a noise the caregiver can hear, the external pieces may need to be tightened by a trained delegate.

    - Pain at the pin site.

- Ensure that the wrench and/or Allen Wrench is fastened to the vest for emergency intervention.
- Check the fit of the vest.
    - With the patient in a supine position, you should be able to insert two fingers under the vest at the shoulder and chest. If the vest is too loose/too tight, inform the surgeon/trained delegate.
- Ensure that the liner is clean and dry.
- Check the halo system for loose straps or screws, dirt, odour, or evidence of the need to repair the vest.
- Never use any part of the halo system (e.g., rods, ring, vest) to lift or reposition the patient.

Documentation

- Document as per your hospital policy.

Patient Assessment & Nursing Interventions

Neurological and Spinal Cord Assessment

Changes in the neurological and spinal cord assessment could indicate spinal cord trauma, which would require immediate intervention.

- Follow the:

  CCSO Guidelines for Basic Adult Neurological Observation
  CCSO Guidelines for Basic Paediatric Neurological Observation
  CCSO Provincial Guidelines for Adult Spinal Cord Assessment

Identify neurologic deficits:

- Assess if the patient's neurological function is intact, if mobility and sensation are maintained, and if the patient will be able to ambulate in the halo system.
- Notify the most responsible provider (MRP) immediately when there is a decrease or loss of motor function or sensation. The nurse should increase frequency of assessment while acute changes are happening.

Respiratory Assessment

The vest limits chest expansion, which could lead to complications or alterations in respiratory function, such as reduced vital capacity, respiratory distress, atelectasis, and pneumonia.

  - Respiratory complications are more common in the elderly population.

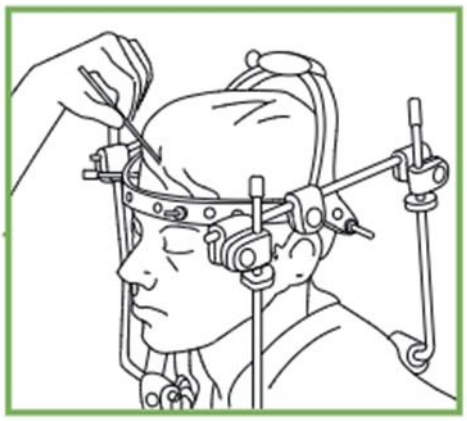
  - The elderly are at higher risk for respiratory failure and cardiovascular collapse.
- Encourage deep breathing, coughing, and the use of an incentive spirometer.
- Pulmonary embolus (PE) is a common complication associated with spinal cord injury.
  - Implement interventions such as mobilization, medication, sequential compression devices (SCD) or anti-embolism stockings to decrease the possibility of thrombus or embolus formation.
  - Identify signs and symptoms of PE so that treatment can be initiated.
- Identify a patient at high risk for aspiration and the need to modify oral intake.
  - Assess for difficulty swallowing and risk for aspiration. Difficulty swallowing is usually due to placement of the head and neck in hyperextension. Readjustment of the halo device may solve swallowing difficulties.
  - If activity order permits, keep patient in upright position for meals.

Integumentary Assessment

Patients with a halo system are at risk of developing skin breakdown/pressure injuries under the vest and infection at the skull pin sites.

Skull Pin sites

- Monitor and assess pin sites as per your organization's policy/MRP orders, for redness, pain, tenting of the skin, edema, and prolonged or purulent drainage. Monitor body temperature.
- Provide thorough pin site care. Pin site care and management as per your organization's policy/MRP orders. For example, daily pin site care, may use a sterile applicator (gauze) dipped in Normal Saline.



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Vest

- Assess the skin at the edges of the vest; inspect around and under the vest for redness or abrasions, especially over bony prominences. Keep all areas of skin dry. May use a flashlight to thoroughly inspect under the vest and around the skull pin sites.

- A transparent, hydrocolloid or foam dressing may be applied to prevent skin breakdown on vulnerable and/or prominent body areas, such as the shoulder.

Musculoskeletal System

Ambulation & Positioning

The system can affect a patient's balance, coordination, and centre of gravity, thereby decreasing their range of motion (ROM) and ability to ambulate. It is important to encourage ambulation, promote proper body alignment, and implement measures to prevent injury. A physiotherapist (PT) consult is recommended.

- Repositioning is required every 2 hours. Assistance may be needed initially. Teach your patients to turn slowly, in small increments, to avoid losing their balance.
- ROM exercises for all extremities is encouraged.
- Initially, patients will need assistance to get out of bed. When patients are stable and independent, they can get out of bed on their own.
    - In these instances, patients should not do a "sit up" from a position laying on their back. Instead, patients should roll onto their side, swing their legs over the edge of the bed, and use their arms as levers in assisting them to sit up.



Photos provided courtesy of the NEON Images Library. (2024)

- Remind patients to avoid bending forward because the extra weight of the halo system could cause them to fall. Have them bend at the knees rather than at the waist.
- Instruct patient to scan environment for any hazards prior to ambulating.
- Assess patients when ambulating. The weight of the halo alters a patient's balance.

Activity Level

- Resume activity as indicated by the MRP.
- If able to resume full activity, patients should avoid heavy lifting (i.e., no weight lifting) or pulling oneself up by the waist.

- Patients cannot drive a vehicle.
- To get into a vehicle (as a passenger), patients should sit first, then lean forward and swing their legs into the car.
- To compensate for restricted head and neck movement during ambulating, the patient will need to rely on ocular movement or trunk rotation.

Activities of Daily Living (ADL) with the Halo System

Hygiene

Skin Care and Bathing

Wash the patient's chest and back daily, while avoiding putting stress on the halo system.

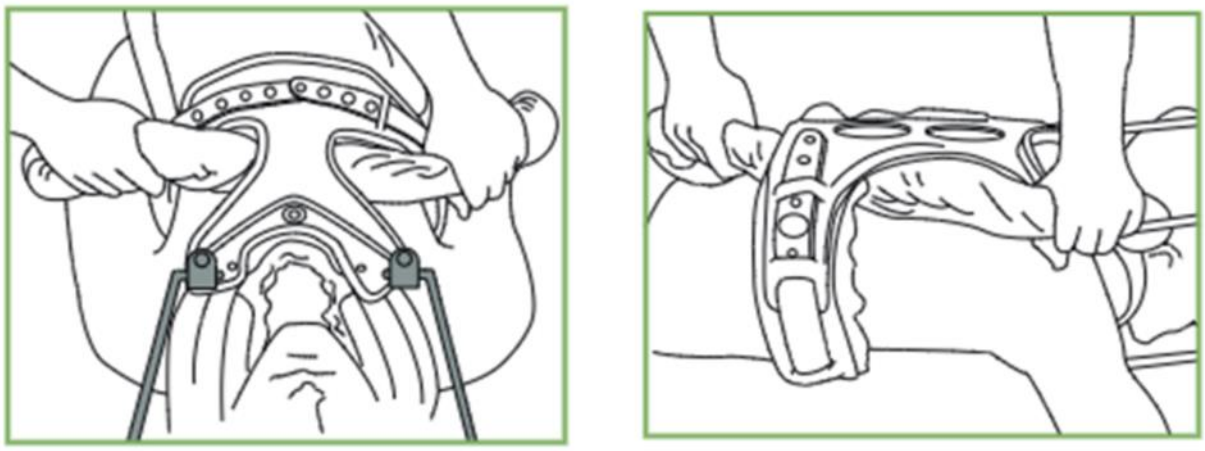
- This will require the assistance of another person.
- Position patient flat on their side in good alignment (**patient must not move**).
- Undo one side strap of the vest**- only if approved by MRP** - (one side should always be securely buckled).

Note: If the buckle position on the straps have not been marked, mark them before you undo them.

- Inspect skin integrity.
- Place an incontinent pad/towel against the liner to prevent it from getting wet, then with a damp washcloth, wash the torso.
- Dry the skin thoroughly. **Do not apply lotions or powders under the vest.**
- Reconnect the strap to the proper notch **(if permitted)**, then turn the patient to the other side and repeat the procedure.

Note: If it is very difficult to pass a towel between the vest and skin, the surgeon/trained delegate should be notified to reassess fit.

- Some organizations/MRP may not allow nursing to undo the strap/buckle of the vest.
- In this case, nursing would need to continue the washing/bathing procedure with the buckle(s) intact, as shown in the pictures below.



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- Remind the patient to avoid scratching under the vest. Doing so may disrupt skin integrity.

Clinical Alert: *Avoid the use of lotions or powders underneath the vest. A cotton pillowcase or undershirt can be placed under the vest for comfort and absorption of perspiration; change this item daily.*

Washing Hair

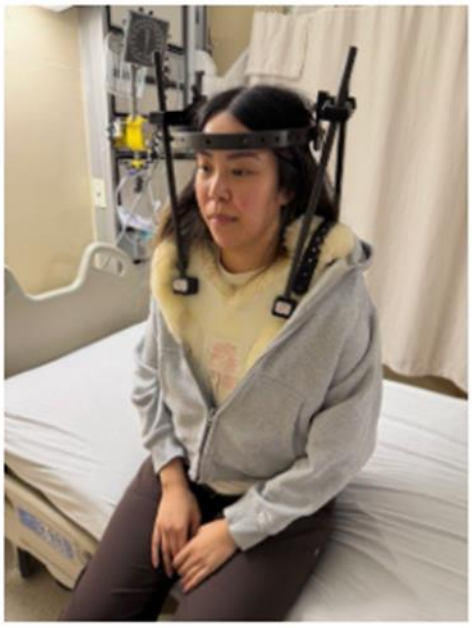
- Wash the patient's hair regularly using mild shampoo.
- The patient may be supine in bed with an incontinent pad/towel along the back and shoulders of the halo system to protect the liner from getting wet. When activity order allows and patient is able to tolerate, patient may be placed in a sitting position bending forward/backwards on top of a sink (see pictures below).

- The halo, skull pins, and bars can all safely get wet.
- If skull bars, pins get wet – ensure they are dried with no remaining soap residue.

Photos provided courtesy of the NEON Images Library. (2024)

Clothing and Dressing

- Alterations to the patient's clothes may be necessary.
- Dress patient in a sitting position.
- T-shirts can be put on by helping the patient step into them (if able), following some alterations to the shoulder area.
- It is easier for patients to wear loose fitting clothing over the halo system (e.g., sweatshirts, hoodies, v-neck t-shirts).
- A cotton undershirt may be worn under the halo device lining to absorb moisture.



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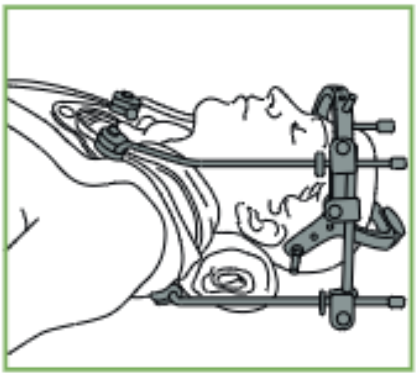
- For female patients, it may be easier to wear a tube top, bikini top with neck drawstring, or strapless bra.
- Patients should wear slip on shoes that are supportive, with no heels, and have rubber soles.

Sleeping

- Patients can sleep on their back or in a side lying position that is comfortable for them.
- Patients can sleep with or without a pillow under their head.

- A small pillow, rolled up towel, or a wedge of foam between the patient's head and the surface of the bed can be placed for more support.



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Eating

- Have the patient eat in an upright position.
- Use a towel to protect the top part of the halo system, to prevent the dropping of food/liquids into the vest.
- Ensure the patient's meal is within easy access; assist with meal prep as necessary.
- Encourage the patient to take smaller bites and chew food thoroughly.
- Assess diet as tolerated (DAT) – it may be easier for the patient to eat soft/liquid foods while wearing a halo system.

***Clinical Alert:** Contact MRP if chewing and/or swallowing becomes painful and if pain persists. A speech-language pathologist (SLP) consult may be required.*

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Summary of Complications

Complications associated with use of a halo system include:

- Skull pin loosening.
- Skull pin-site bleeding.
- Skull pin-site infection.
- Discomfort secondary to skull pins.

- Scars after skull pin removal.
- Dysphagia.
- Dural puncture (following trauma to the halo ring).
- Skin breakdown - pressure sores secondary to vest irritation.
- Reduced vital capacity.
- Psychological trauma.

Cardiopulmonary Resuscitation (CPR)

CPR Considerations:

- ✓ No hyperextension of the neck - use the jaw thrust maneuver to open the patient's airway.
- ✓ Two person bagging technique with jaw thrust.
- ✓ Ensure that the cervical spine (c-spine) is manually stabilized. This may mean applying a temporary (extrication) collar.
- ✓ The back portion of the vest will act as a crash board or backboard during CPR.
- ✓ The vest needs to be replaced following CPR.

NOTE: Some halo system may have CPR instructions written directly on the vest. Instructions may differ depending on the brand of halo system used.
CPR instructions for the PMT® and Anjon Bremer® systems will be discussed in this document. If your organization uses a different halo system, please refer to the manufacturer's instruction manual for CPR.

PMT® Halo System

Performing CPR With Adult Patient

To perform CPR on an adult patient, follow this procedure (see Fig. 19):

5.2.1.1. Step 1 **The patient should be supine on the posterior portion of the vest.**

Step 2 **Loosen and release waist and shoulder buckles.**

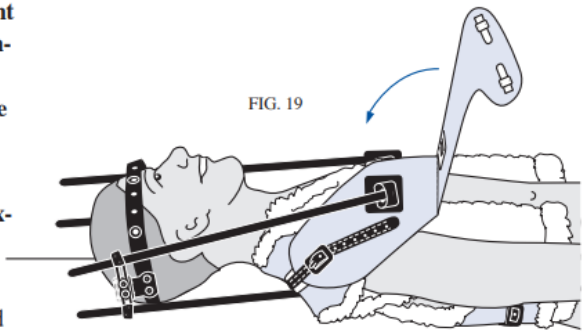
Step 3 **Use large allen wrench that is kept with the patient or guardian for emergency access to loosen the anterior rod connection points of the head blocks. These should be loose enough so the rods can slide out.**

Step 4 **Pull the entire anterior portion of the vest shell with the anterior rods away from the patient to expose the chest.**

NOTE: After performing CPR on an adult patient, you will need to order a new vest. The vest has been damaged and will not provide the correct support for the patient.

Please refer to the PMT *Patient Care Guide for the PMT Halo System* for additional information on patient care. A copy of the *Patient Care Guide for the PMT Halo System* should be provided and reviewed with each patient prior to discharge from the hospital.

FIG. 19



Performing CPR With Pediactric Vest

To perform CPR on a pediactric patient, follow this procedure (see Fig. 20):

Step 1 **The patient should be supine on the posterior portion of the vest.**

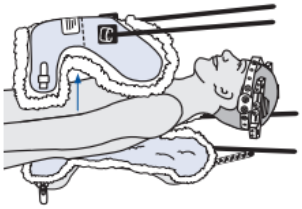
Step 2 **Loosen and release waist and shoulder buckles.**

Step 3 **Use large allen wrench that is kept with the patient or guardian for emergency access to loosen the anterior rod connection points of the head blocks. These should be loose enough so the rods can slide out.**

Step 4 **Pull the entire anterior portion of the vest shell with the anterior rods away from the patient to expose the chest.**

Step 5: **Using the posterior portion of the vest as a "crash board," perform CPR as necessary.**

Please refer to the PMT *Patient Care Guide for the PMT Halo System* for additional information on patient care. A copy of the *Patient Care Guide for the PMT Halo System* should be provided and reviewed with each patient prior to discharge from the hospital.



Step 5: After performing CPR on a pediactric patient, you can replace the anterior portion of the vest, once the patient is stable. The anterior shell and rods should only be replaced by a trained surgeon or orthotist, familiar with the PMT halo system.

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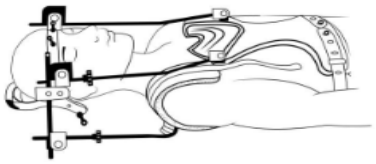
Anjon Bremer® Halo System

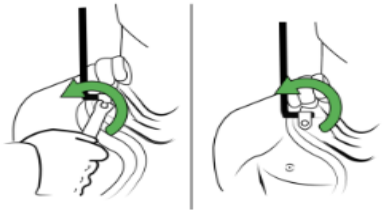
Exposing The Chest For CPR And Life Support

Note: The Wrench supplied with the Vest should be attached to the Vest superstructure, or patient's bed at all times.

1. Place patient supine on posterior portion of the Vest.



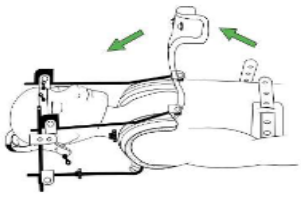
2. Loosen the two anterior Vest bolts using the 7/16" (11mm) wrench.



3. Release the thoracic bands by turning the locking posts and pull the bands out of theway.

Note: If plastic cable ties are in place, cut them with scissors and remove prior to turning the locking posts.

4. Rotate the anterior shell of the Vest away from the body exposing the chest.



5. Using the posterior Vest shell as a "crashboard" perform CPR and/or Life Support as necessary.

Note: Some stability of the cervical spine is maintained as long as the patient's body remains on the posterior Vest shell, the posterior Vest uprights are secure, and the transverse bars remain firmly attached to the Anjon Bremer Halo Crown/Adjustable Ring.

6. Defibrillation of the patient may be performed without removing the Anjon Bremer Halo Crown or Anjon Bremer Adjustable Ring.

Recommendation

Manufacturer suggests the entire nursing care team practice this procedure using an Anjon Bremer Classic Vest/Anjon Bremer Light Vest on a resuscitation dummy.

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Do's and Don'ts

Do's	Don'ts
Halo wrench and/or Allen Wrench must be affixed to the front of the vest at all times in the event that CPR must be performed.	Do not tighten the skull pins if loose; only the surgeon/trained delegate can do so. If loose, contact the MRP immediately.
Log roll the patient when in bed until spine stability has been confirmed by the surgeon.	Do not grab the rods when turning or moving the patient.
Keep the liner dry.	Do not get the liner wet.
May use soap to wash the skin, but rinse and dry well.	Do not use lotions or powders under the vest.

Length of Time a Halo System is Worn

- Most patients wear the halo system for about 12 weeks.
- The surgeon will determine the length of time that the halo system must be worn.

- The patient will have imaging performed before the halo system is removed to assess spinal healing.
- It is a quick procedure to remove the halo system and causes very little discomfort.
- The patient may be fitted with a cervical collar once the halo system is removed.

Follow-Up

- The patient will have regular follow-up with the surgeon.
- The surgeon should be contacted if:
  - Patient has pain at a skull pin site that lasts more than two days.
  - Patient feels that they can move their neck.
  - Patient has changes in sensation or movement on any of their four limbs.
  - Patient has rattling sounds from their halo system.
  - Liner is soiled.
  - Skull pin sites look infected.
  - Skull pins are loose.

- Patient develops skin breakdown under the vest.
- Patient develops a severe headache.
- Changes in neurological status.

Documentation

- Document as per your hospital policy.

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