

CERVICAL SPINE (SUSPECTED) INJURY: PATIENT MANAGEMENT

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

Quick reference [C-Spine Management FLOWCHART](#)

- An injured paediatric patient needs a mechanism of injury and clinical findings consistent with a neck injury to be considered at risk of cervical spine(C-spine) injury.
- The potential for cervical spine injury **must be considered** in all head injured patients. The majority of patients can be cleared with history and examination, and when indicated, plain x-ray.
- If the patient is considered at risk of a c-spine injury, all relevant expert clinical advisory groups* **no longer recommend** rigid cervical collar use and support the use of foam cervical collars in initial cervical spine immobilisation, which are used to highlight the need for caution.
- All patients that are admitted require the Spinal Precaution Order form to be completed to determine their c-spine management status. This form can be found in eMR tab chart → Ad Hoc Charting → Orthopaedic Service → Spinal Precautions Orders.
- Infants & children arriving with a rigid C-collar insitu may either be clinically cleared and collar removed as per the [C-spine management flow sheet](#), or changed to a [foam cervical collar](#) if there is a high index of suspicion of c-spine injury or prolonged time to clearance is anticipated.
- [Alternate semi-rigid collars](#) may be requested by the spine team and are still available at both sites.

* ANZCOR, ILCOR and ITIM, through ACI, State Spinal Cord Injury Service (SSCIS), Intensive Care NSW (ICNSW) Spinal surgeons of NSW (RNSH & POW)

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy Procedure and Guideline Committee	
Date Effective:	1 st April 2023	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Trauma (CHW & SCH)

CHANGE SUMMARY

- Changes to the flow of the document have been made throughout, including moving information to appendices. Suggest rereading to become familiar with this version.
- Added a link to the CHW [PICU Procedure Cervical Spine Immobilisation for Intubated Patients in PICU – CHW](#).

READ ACKNOWLEDGEMENT

- Clinical staff caring for patients with (suspected) spinal injuries should read and acknowledge they understand the contents of this document.

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Introduction

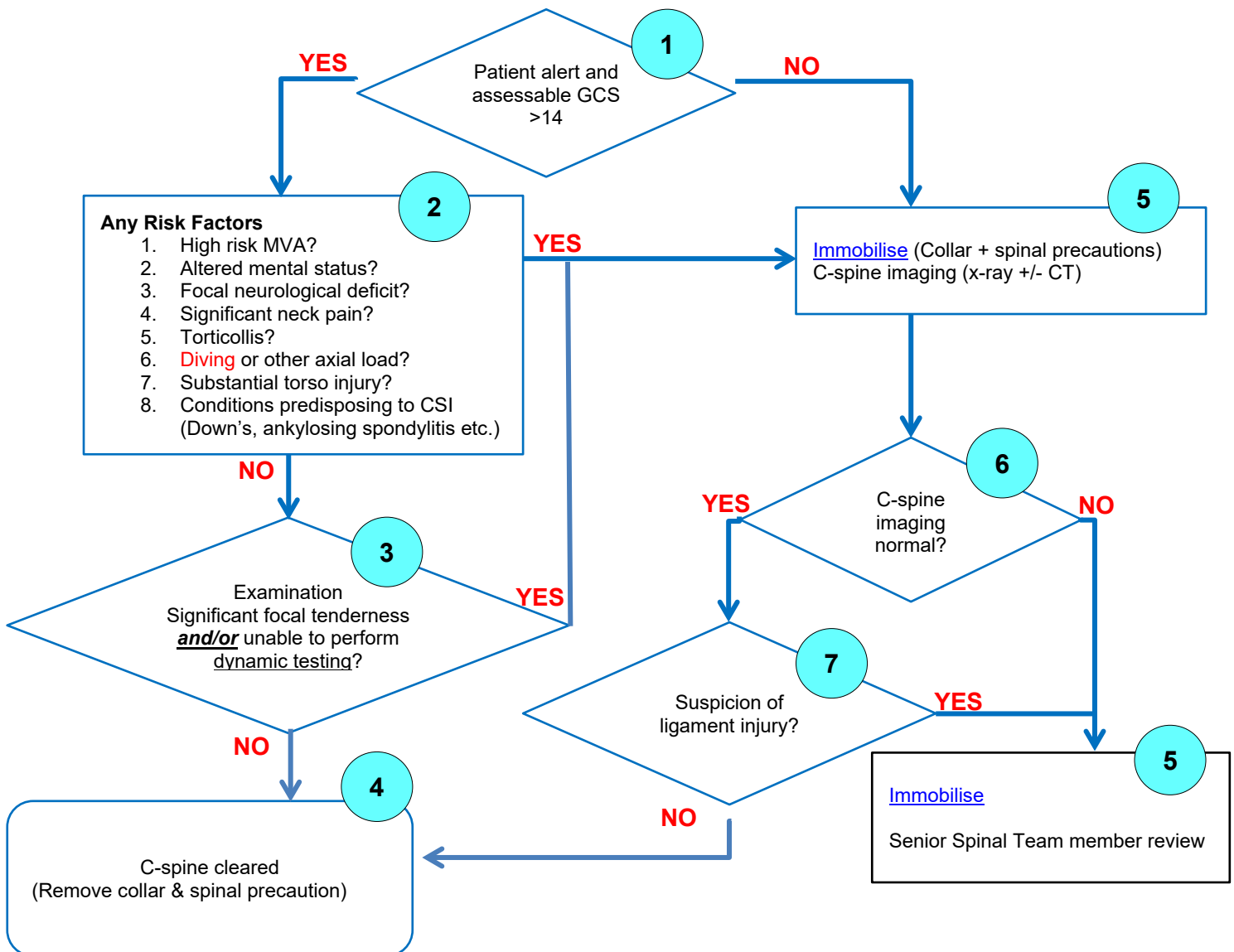
Significant cervical spine injury (CSI) following blunt trauma in children is uncommon, occurring in approximately 1% of all paediatric blunt trauma (1). Of this 1%, the majority are stable injuries, with only 20% requiring bracing or operative fixation (2; 3). Identification of this small group of patients with clinically significant spinal injuries is difficult, but important given the potential morbidity these injuries may cause.

A cervical collar is applied to minimise unnecessary movement of the cervical spine, mitigate further injury or to highlight the potential existence of a cervical spine injury. However, **no available cervical collars will provide complete immobilisation but they may lead to significant complications and morbidity**. There is lack of evidence for the efficacy for spinal immobilisation in the prevention of spinal cord injury (SCI). Also, as with all mechanical trauma to the skeleton, deformations causing SCI or ischaemia occur at the time of the initial injury resulting in massive angulating/displacing forces, and are unlikely to be reproduced during normal handling. Furthermore, **there is evidence that rigid collars can lead to potential complications including:**

- Patient discomfort & distress
- Pressure areas
- Increased intracranial pressure
- Increased neck pain
- Can cause/worsen SCI (e.g. ankylosing spondylitis)
- Impaired ventilation
- Aspiration risk
- Masking of neck/occipital injuries

As **foam cervical collars mitigate some of these issues**, whilst still acting as a warning of the potential existence of a CSI, they are now the **PREFERRED DEVICE** for application in children with a **suspected CSI**.

Flowchart – Suspected Cervical Spine Injury



Consultants, Fellows and Senior Registrars in the fields of Emergency Medicine, Orthopaedics, Trauma and Neurosurgery, with appropriate training and experience, may be designated as a Senior Spinal Team Clinician and have the responsibility of ultimate decisions for cervical spine clearance. These same senior clinicians are responsible for signing the spinal precaution form indicating that the C-spine has been cleared once this has been determined.

Key for Flowchart

- 1** The cervical spine is immobilised as part of airway assessment with cervical spine control. Examination includes a careful neurologic examination including motor, sensory, reflex examination of the peripheral nervous system. Assessment requires patient to be:
- alert and cooperative,
 - not significantly affected by alcohol or recreational drugs
 - be developmentally able to engage in assessment process
 - distracting injuries need to be considered where appropriate

The majority of children with a **clinically significant CSI will be symptomatic**.

There must be a relevant mechanism and appropriate clinical suspicion for cervical spine injury to need exclusion. **Children at risk of cervical spine injury who are unconscious, unco-operative, intoxicated, GCS < 14 or have received significant opiate analgesia are unsafe to assess for spinal injury and thus un-assessable.**

- 2** Determining the risk for SCI in the paediatric trauma patient requires synthesising the history, presentation, and physical examination. The Paediatric Emergency Care Applied Research Network (PECARN) has identified these 8 risk factors for CSI in children after blunt trauma with an associated 98% sensitivity for these risk factors.

Any child demonstrating any of these risk factors should have strong consideration of cervical spine immobilisation (using a foam collar) and radiographic evaluation. Their absence does not exclude cervical spine injury. Complaints of neck pain are more reliable than detection of midline neck tenderness and thus midline neck tenderness may not be a concerning risk factor.

- 3** Provide reassurance and analgesia. Whilst minimising neck movement, gently palpate the posterior midline of the neck. Feel from the nuchal ridge to the 1st thoracic vertebra. The most prominent spinal process arises from the C7 vertebra. Repeat the process lateral to the midline on both side. Tenderness may indicate vertebral or soft tissue injury

Generalised midline or paraspinal tenderness is consistent with mild ligament or muscle strains. Significant focal tenderness in an area covering 1-2 vertebrae is more suspicious for a fracture or significant ligament injury.

Dynamic testing is performed after palpation and involves rotation of head left and right 45 degrees and if this is achieved, an attempt to extend the head and then flex to lift head off bed. **Stop immediately if this causes pain or paraesthesia with movement of the cervical spine & remain in foam cervical collar.**

- 4** A degree of mild tenderness or mild discomfort is acceptable for clearance, as would happen with a minor strain of any other joint. If there is no significant tenderness and no abnormal neurology and these movement do not cause significant pain or neurological symptoms the cervical spine may be clinically cleared.

The patient may be discharged with minor tenderness and/or discomfort, taking as needed regular NSAIDS and simple analgesia, but with instructions to return if any concerns and to avoid high contact activity/sport until repeat medical review in 5-7 days.

- 5** Keeping the cervical spine in an age appropriate, neutral, but comfortable position. The aim of immobilisation is to avoid any unnecessary movement. In the unconscious child, appropriate attention to this relationship is needed for transfers and logrolls.

It needs to be noted that immobilisation has not been shown to prevent deterioration or progression of a cervical spine injury. Enforced immobilisation in the young or unco-operative may aggravate injury.

Prolonged immobilisation in firm collars can result in respiratory embarrassment, raised ICP, pressure sores and a stiff neck. Foam collars are best for the alert, assessable child awaiting clearance. Children with high suspicion or proven cervical spine injuries may require a specific immobilisation device – seek senior advice.

6 Cervical spine imaging principles

a) Radiation and prolonged immobilisation are not without risk and need to be considered whilst weighing up the choice of imaging and degree, duration and type of interim immobilisation.

b) Cervical spine x-rays involve a lateral (if urgent and able prior to intubation, surgery etc.), AP and odontoid (only if > 5yrs). Interpretation can be difficult as ossification centres, physiological variants etc. may need specialist radiological interpretation with senior clinical correlation.

If you are ordering an X-ray, it should be that the clinical risk is low and any findings of mild pain, tenderness and dysfunction are acceptable, and will allow clearance, if the x-ray is normal.

A normal x-ray does not mean that a patient's signs and symptoms miraculously disappear, as this would not occur with a sprain or contusion of any other body part.

If you do not feel comfortable clearing the cervical spine despite a normal x-ray, speak to a senior doctor. Trial of analgesia, application of a foam collar and follow up or further imaging are possible options for consideration in this circumstance

c) CT is best for those with high clinical suspicion of fracture/dislocation with inadequate or abnormal X-ray. CT may be considered if there is a need for cervical spine imaging in a child having another body part imaged with CT (in this case omit any c-spine x-ray). Very few children should need CT and most can be cleared once the CT is reported as having no evidence of injury.

d) MRI is best if there are neurological findings suggestive of cord or nerve root injury or high suspicion of significant/unstable ligament injury. In such cases proceeding directly to MRI and omitting CT is suggested, but will depend on MRI availability, the need to sedate and length of time in immobilisation device.

- 7** Children of any age exposed to significant or unusual force may need consideration of ligamentous injury even if initial bony imaging appears normal. Unconscious, unco-operative, intoxicated patients usually need to return to an assessable status before the neck can be cleared of potential ligamentous injury. In the assessable child, ligamentous injury may be suspected at the point of dynamic testing with reluctance to move or significant tenderness. A number of age related anatomical variances such as shallow facet joints and lax ligaments can allow ligamentous stretch in an AP and/or caudocranial axis without bony injury. These can be real with the right MOI and clinical findings or false, such as pseudosubluxation detected on plain or flex/ext xray. Seek senior advice in interpretation and the consideration of any further imaging.

- 8** Consultants, Fellows and Senior registrars in the fields of Emergency Medicine, Orthopaedics, Trauma and Neurosurgery, with appropriate training and experience, may be designated as a Senior Spinal Team Clinician and have the responsibility of ultimate decisions for cervical spine clearance. These same senior clinicians are responsible for signing the spinal precaution form indicating that the C-spine has been cleared once this has been determined. All patients that are admitted require the Spinal Precaution Order form to be completed to determine their c-spine management status. This form can be found in eMR tab chart → Ad Hoc Charting → Orthopaedic Service → Spinal Precautions Orders. This needs to be reviewed and updated daily.

Management (Spinal Immobilisation and Log Roll)

Spinal immobilisation

In those children who are identified as at risk of CSI, **initial immobilisation preference includes [application of a foam cervical collar](#)**. If tolerated, and deemed necessary, this can be supplemented with:

- in line manual immobilisation (always required when log rolling or intubating)
- sand or fluid bags alongside the head

It may also be necessary to provide additional padding to achieve a [neutral neck position](#).

[Sizing and fitting of foam collars](#)

- Correct sizing is important for patient comfort.
- The head is to be maintained in a neutral position (in-line immobilisation).
- Refer to the appropriate sizing chart & select foam collar based on the closest match to the measurement taken, if between two sizes, select the smaller of the two sizes or cut along the lower edge to ensure snug fit under the chin.
- Following placement of a foam collar, ensure the patient's neck is in correct alignment & sandbags are re-positioned.

Transferring patients and Log rolling

Transfer from one bed to another of patients at high risk of a CSI needs to take place carefully to minimise spinal movement.

- PAT slides, whilst providing in line immobilisation and maintaining body alignment, is acceptable and should be used within the ward environments inclusive of medical imaging and theatres.
- Log roll procedure is used to maintain correct anatomical alignment in patients with suspected or confirmed CSI and to prevent the possibility of further neurologic injury.

The patient is log rolled with the cervical collar in place and the spine is assessed for tenderness, swelling or bruising and visible or palpable signs of step deformity. **If indicated the** tone of the anus is inspected – with a patulous anus suggesting spinal injury.

When the child is in this position it enables for assessment for posterior hidden injuries. Inclusive of:

- Back of the head.
- The renal angles are examined for tenderness or bruising.
- Perineal and rectal examination is performed if there is suspicion of a major pelvic injury with bowel involvement (for blood) or urethral injury in males (position of prostate in adolescents).

Log rolling is also used for removal of clothes and debris, cleansing and prevention of pressure injuries.

For non-intubated patients:

A log roll is performed by minimum 5 people & is usually done away from the side of major injury to reduce pain: (see pictures below).

- 1x holding the head to minimise neck movement
- 3x holding the shoulders, hips and legs respectively
- 1x examining



For Intubated patients:

ALL intubated patients require:

- 1x extra person to be solely responsible for the security of the ETT. This person's role is dedicated to ensuring the ETT remains patent and secure during the log roll.
- Patients in **CICU at SCH** with suspected/confirmed Spinal Cord Injury are to have log rolling undertaken as per [Log Rolling Patients In CICU With Suspected/Confirmed Spinal Cord Injury – SCH procedure.](#)
- Intubated patients in **PICU at CHW** requiring spine immobilisation should follow the [Cervical Spine Immobilisation for Intubated Patients in PICU – CHW Procedure.](#)

Disposition

Unstable patients, patients with altered conscious state, and patients with specific focal neurological deficits suspicious of CSI require admission with spinal immobilisation and spinal precautions.

Patients who have been clinically cleared, with or without C-spine imaging, are considered at low risk of CSI and may be discharged with appropriate advice regarding analgesia and expected recovery.

Accepting the patient in the ward

The transferring nurse and the accepting ward nurse must review the Spinal precautions order form in patient's eMR for:

- clearance status
- Collar requirements
- sitting/ mobilising restrictions
- further investigations required

If this is unclear or incomplete the patient is nursed with full spinal precautions and the surgical or spinal team is contacted to clarify the situation.

On discharge, if the patient is going home with a cervical collar, Spine/Ortho team are to complete *spinal collar discharge instructions template* (wearing routine, duration, sports/level of activity, school attendance & follow up plan) in patient's eMR progress notes by typing .orthospinalcollar discharge

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Appendix 1: C-Spine Injury Risk Factors

Determining the risk for SCI in the paediatric trauma patient requires synthesising the history, presentation, and physical examination. The Paediatric Emergency Care Applied Research Network (PECARN) has identified 8 risk factors for CSI in children after blunt trauma with an associated 98% sensitivity for these risk factors (2). Any child demonstrating any of these risk factors must have cervical spine immobilisation (using a foam collar) and radiographic evaluation as per flowchart.

C-Spine Injury risk factors

- **Altered conscious state** – decreased GCS, history of head trauma, intoxication
- **Focal neurological deficits** – abnormal reflexes, strength or sensation; paraesthesia
- **Neck pain** – which differs from midline tenderness on palpation, and is a common symptom in low risk paediatric CSI. PECARN found patient initiated complaint of posterior neck pain to be a significant risk factor for true paediatric spinal cord injury.
- **Torticollis**
- **Substantial torso injury** (associated with risk of thoraco-lumbar injury)
- Children with **pre-existing disorders** that predispose them to CSI – Down syndrome, ankylosing spondylitis (common in adults)
- **Diving and sporting injuries**– axial load to head or neck, also consider fall from a height and forced hyperflexion such as can occur in a rugby scrum collapse
- **High risk motor vehicle accident (MVA)** – head on collision, rollover, ejected from vehicle, death in same crash, or speed greater than 60km/hr

Appendix 2: Neutral Neck Position

Fig 1. - Achieving a neutral neck position in an infant

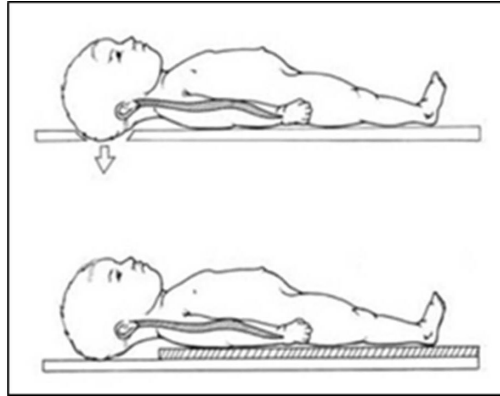


Fig 2. Achieving neutral neck position in a child



Fig 3. Achieving neutral neck position in an older child/adolescent



Appendix 3: Fitting and Sizing a Collar

Procedure – Cervical collar

1. Gently align the patient's head to a neutral anatomical position or position of greatest comfort.

2. Measure the distance between the base of the chin and the suprasternal notch.



3. Select the appropriate size collar by comparing the patient's neck measurement to the width of soft collar's chin support.

4. Slide the collar under the patient's neck (right to left) until the adhesive Velcro strap is clearly visible.



6. Ensure the patient's chin rests on top of the collar and they are able to open their mouth.

5. Mould the soft collar around patient's neck and secure the Velcro tabs.



Measure A. height of your neck from chin to the top of your shoulder, and B. circumference of your neck

Sizing Guide			
Model #	Height	Length	Size
CX23	2"	12"	Toddler
CX46	2"	15"	Juvenile
CX712	2 ½"	19"	Child
CX1316	2 ½"	21"	Adolescent



If needed, foam collars can be cut along the lower edge to ensure a snug fit under the chin. A tube grip can be used to cover the cut collar, ensure the C-spine not cleared sign is still visible.

Appendix 4: Alternative C-Spine Collars: Sizing and Fitting

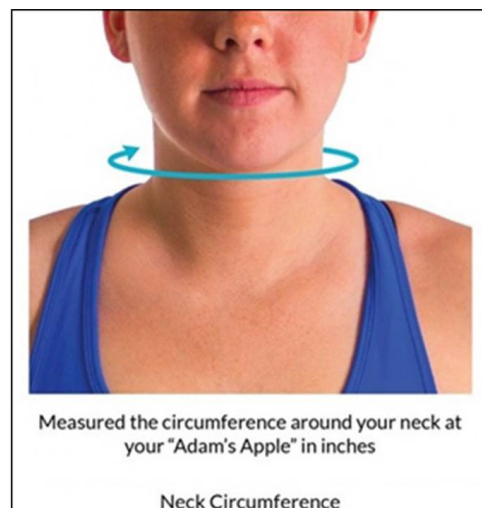
Please note, that although the preference is for a soft collar, even if a cervical SCI is suspected, a member of the Spinal Care Team may order the application of an alternative (rigid, two piece) collar. The following are those commonly utilised within the SCHN.

Philadelphia Collars

Collar height measurement: Measure (in inches) from the tip of the patient's chin to the top of the sternum in a straight line (as represented by A below).



Circumference measurement: Measure (in inches) around the child's neck



1. Take the piece labelled 'back'. Ensure arrow is pointing upwards. Gently slide the back of the collar in place under the patients neck (press gently on the mattress to create room to manoeuvre the collar)
2. Apply the 'front' piece of the collar with the chin centred in the recess, with the arrow pointing upwards. The front piece should overlap the back piece.
3. Fasten the Velcro straps firmly



Philadelphia Collar Sizing Chart

Size	Circumference	Height
Infant	6 – 8 inches	2 inches
Paediatric / Child	8 – 11 inches	2 ¼ inches
Small	10 – 13 inches	2 ¼ inches
		3 ¼ inches
		4 ¼ inches
		5 ¼ inches
Medium	13 – 16 inches	2 ¼ inches
		3 ¼ inches
		4 ¼ inches
		5 ¼ inches
Large	16 – 19 inches	2 ¼ inches
		3 ¼ inches
		4 ¼ inches
		5 ¼ inches
Extra Large	More than 19 inches	2 ¼ inches
		3 ¼ inches
		4 ¼ inches
		5 ¼ inches

Aspen (CHW preferred)

- Place sizing guide on the highest point of the shoulder muscle (trapezius) and flat against the side of the head.
- Draw an imaginary line from the bottom of the chin back to the sizing guide and select the proper size collar.
- Pre form the collar by rolling the back panel and the front panel like a hand towel-sides inward.
- The second nurse maintains neutral neck alignment and immobilizes the cervical spine while the collar is being applied.
- Apply the posterior section first, pushing down on the back panel with one hand and pull with the other hand until the back panel is centred between the ear and the top of the shoulder muscle.
- The end of the Velcro strap should reach the same position on both sides (confirms that the collar is level) and should be centred between the ear and the top of the shoulder muscle.
- Flare the sides of the front panel outward.
- Place the chin piece directly under the chin (the chin should not extend beyond the edge of the plastic).
- Hold firmly, push sides of front panel up over the shoulder muscles and around the neck
- While holding the collar front panel with one hand, centre the back panel and attach both sides to the front
- To ensure all slack is removed undo one Velcro strap at a time, and pull the strap laterally until all slack is removed
- The patient's chin should be flush with the collar and the inner trach bar should not be touching the thyroid cartilage (Adams apple).
- All slack should be removed from the collar back and the back panel should be centred (identified by symmetrical Velcro straps).

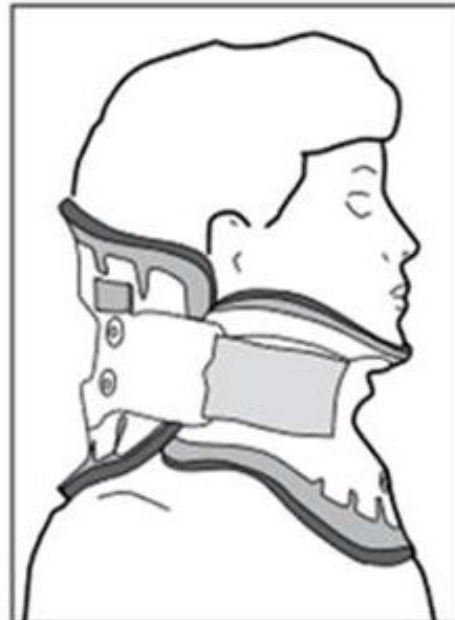
Aspen Collar care

In patients who are on bedrest, collar care needs to occur 4/24, and pressure area surveillance should occur at the same time. In mobile patients collar care & pressure surveillance should occur at least once a day. Collars are to be cleaned & foam inserts changed at the time of collar care if moist or soiled. You will need a second nurse to assist you to ensure/maintain spinal alignment. You should also inform the patient of the procedure

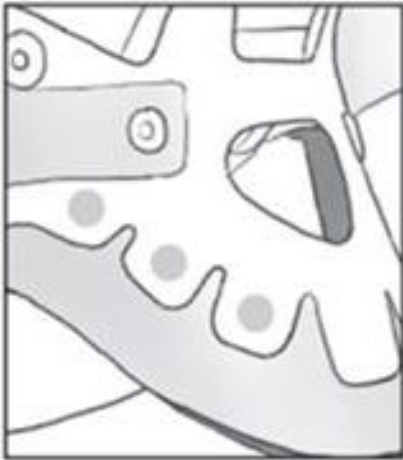
Pressure, moisture, heat, and dirt can all lead to skin redness and sores. To avoid this, keep your skin clean, dry, and cool. At least once a day, remove the collar and wash your neck and face. At this time, moist or dirty pads should be changed. Check with your doctor or nurse on how to keep your head and neck still while the collar is off. If you notice any skin redness or sores, call your doctor or nurse.

Instructions for Removal, Skin Care, and Re-Application

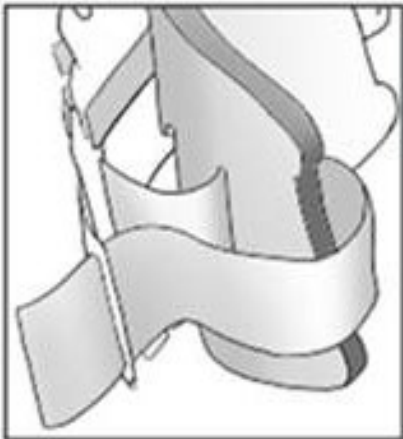
- Before taking off your collar, gather the supplies you will need: soap, wash cloth, towel, and pads.
- Stand or sit in front of a sink with a mirror. Release the strap on one side. Remove the collar and set it aside.
- Keep your head and neck straight and still. Use a wash cloth to clean your face and neck.
- Rinse away soap and gently dry your skin.
- Remove moist and/or dirty pads. If needed, clean and towel dry the plastic and straps. Attach the clean pads.
- Place the front of the collar so your chin comes to the front edge of the chin piece.
- Place the back panel behind your neck.
- Connect the straps on both sides and tighten.
- *Tighten the Support Strap until secure and comfortable (Aspen only).*



Pad Replacement



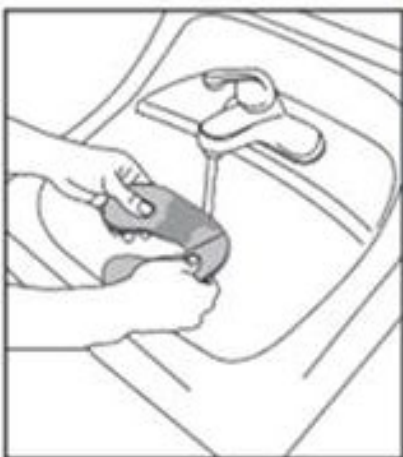
Adjust the pads so grey/green color material side grips the hook dots. The pads must cover all edges of the plastic to avoid touching skin.



To change the back pad, push the hookstraps through the slits in the pad, and then through the slots in the outer edge of the plastic.

NOTE: The padding on the Cervical Collar has a notable white cotton side and a notable gray or green side that covers the foam. The white cotton will always face out and have contact with the skin. Adjust the pads as needed to make sure no plastic touches the skin.

Pad Cleaning

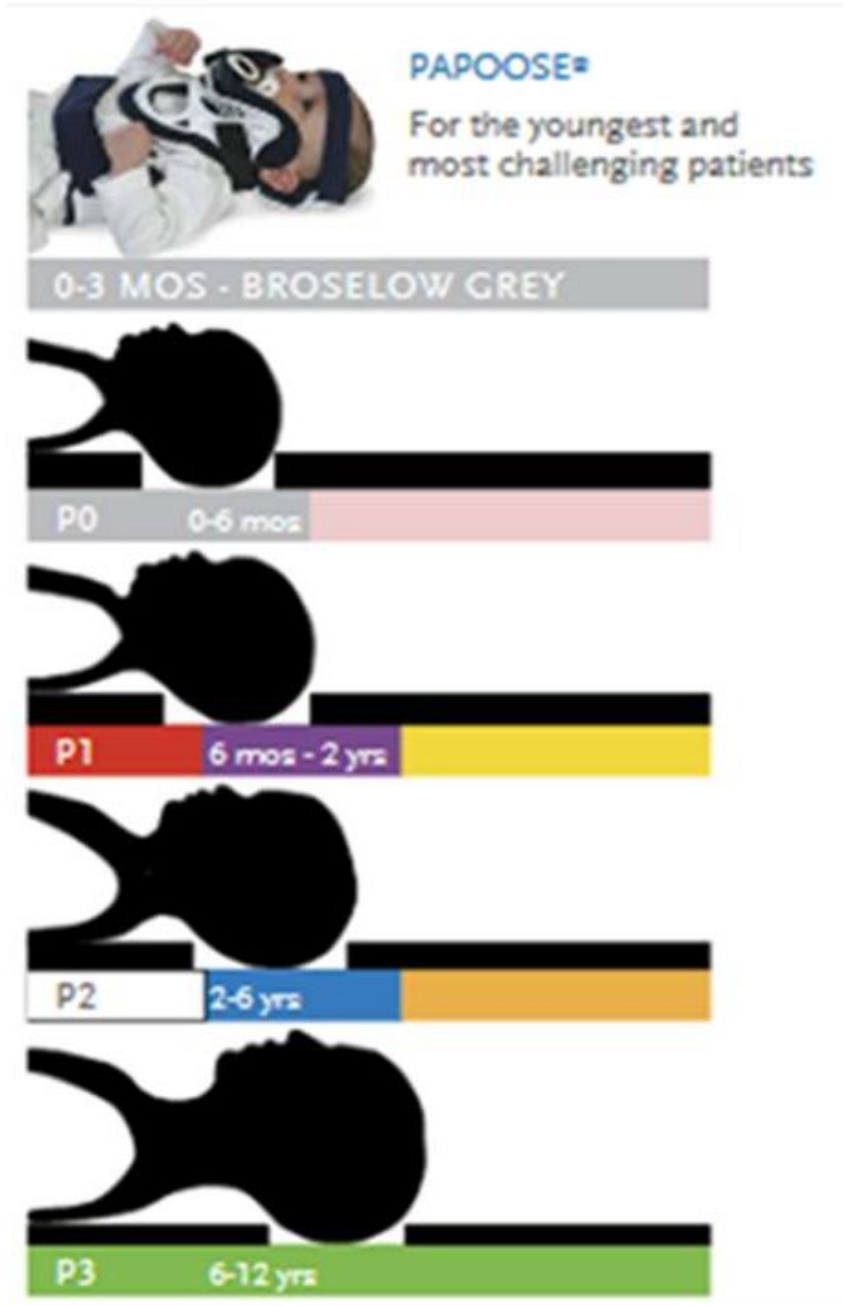


Hand wash the pads with soap and water. Rinse out all soap. Gently squeeze out excess water. Allow to air dry (6 to 8 hours). **Do not place pads in a washer or dryer.**

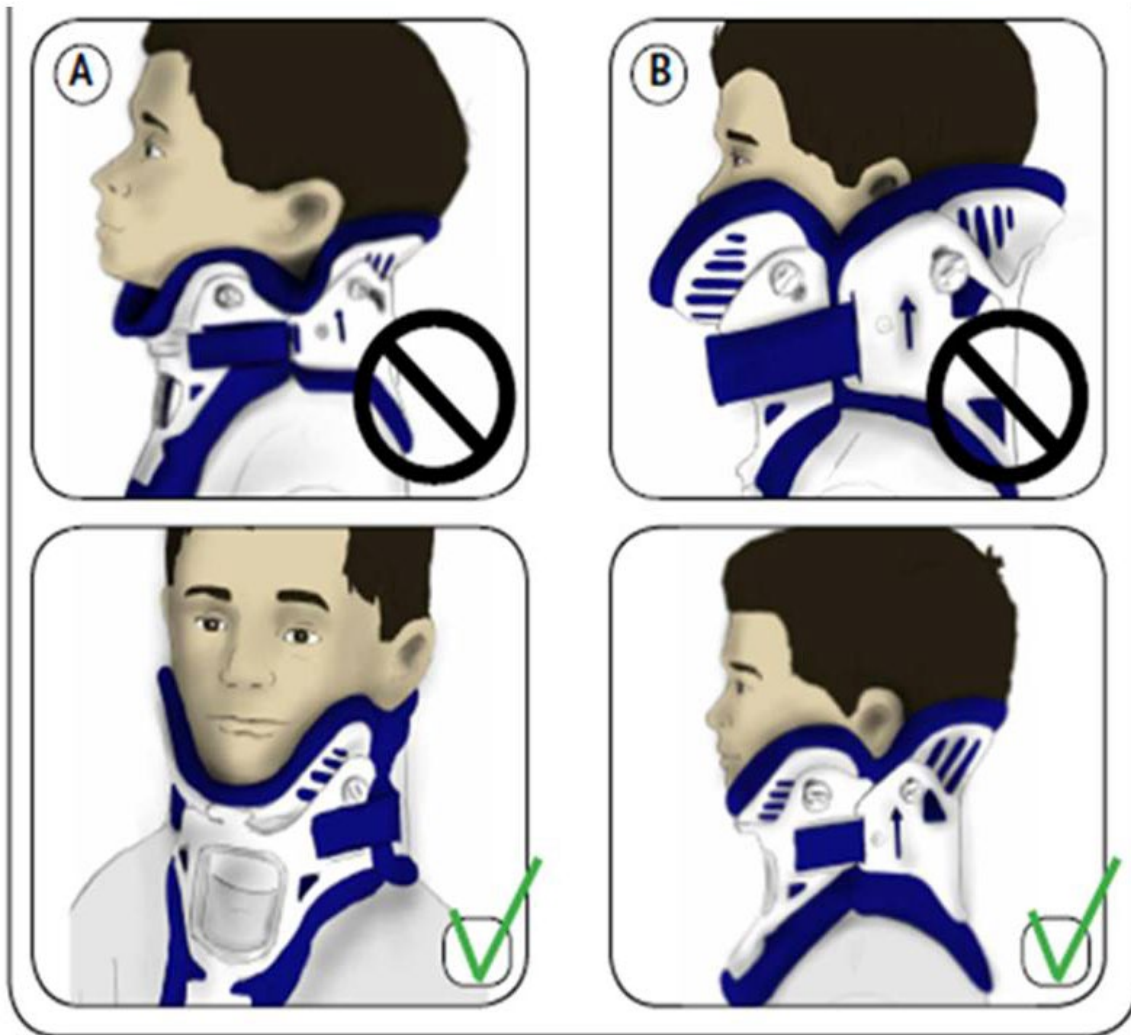
Miami J (SCH preferred)

Note: At SCH the Miami J collar is sized & fitted by orthotics, which needs to be ordered through EMR. Orthotics are on call if this is required out of hours. Orthotics are also available to troubleshoot concerns, such as patient discomfort and/or pressure area associated with the collar, and inadequate alignment.

Sizes Available



Confirming a properly fitted Miami J Collar



Miami J Collar Care

In patients who are on bedrest, collar care needs to occur 4/24, and pressure area surveillance should occur at the same time. In mobile patients collar care & pressure surveillance should occur at least once a day. Collars are to be cleaned & foam inserts changed at the time of collar care if moist or soiled. **You will need a second nurse to assist you to ensure/maintain spinal alignment.** You should also inform the patient of the procedure and seek cooperation to assist with remaining still if able.

Removing the Collar

- Position patient with arms to the side, shoulders down and head aligned centrally (Fig. 1).
- Have one staff member perform a head hold.
- Undo the Velcro straps.
- Remove the Back of the Collar – To do this push the collar down into the mattress and slide out from beneath the neck (Fig. 2).
- Remove the front of the collar (Fig. 3)



Figure 1: Correct Patient Position



Figure 2:
Sliding out
back section
of collar



Figure 3:
Removing
front of collar

Skin Care

- Wash front and back of neck with mild facial soap and water and completely dry the skin.
- Observe for any redness or irritation under the collar, especially over bony areas like the chin, clavicles, or back of the head.
- Redness beneath the chin may indicate improper use of a pillow. If permitted, pillows must always be placed behind the head and shoulders.
- If redness does not resolve or there are any areas of concern please contact the Orthotics Department.
- After cleaning the patient's neck, clean the front and back of the collar and replace the soiled pads with clean ones as directed below.

Pad Care and Replacement

- Peel the soiled blue pads off.
- Look carefully at the shape as you remove them so that you can reposition the clean pads properly.
- Wash the pads with mild facial soap and water. DO NOT use bleach or harsh detergents.
- Thoroughly rinse the pads with clean water. Wring out the excess water and squeeze in a towel.
- Lay the pads out flat to air dry. It should take less than 60 minutes for them to dry.
- Wipe the white plastic collar shell clean with mild soap and water.
- Attach the replacement pads. Fold the pads in half with the dull side facing the Velcro (the shiny side goes against the skin); then centre the pad in the white shell.
- Adjust pads as needed to make sure no plastic touches the skin.



Reapplying the Collar

- Pressing down into the mattress, slide the back carefully behind the patient's neck.
- Make sure it is centred evenly.
- Flare the sides of the front out, slide it up the chest wall and 'scoop' it up under the chin.
- While holding the front securely, curl sides of the back section snugly against the patient's neck.
- Fasten the Velcro straps.
- Once fastened alternately tighten the straps, one at a time, until they are fastened firmly and symmetrically and oriented 'blue on blue' with the front Velcro.

