Guidelines for Basic Adult Neurological Observation
Neurosurgical Patient Flow Model – Urgent/Emergent Cases

Provincial Neurosurgery Ontario system goals and the principle of patient-centred care apply across the continuum

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patient is transported to the hospital and cared for by a team of paramedics</td>
<td>2</td>
<td>Patient arrives to the emergency department</td>
<td>3</td>
<td>Patient is assessed by an emergency department physician</td>
<td>4</td>
<td>Patient is cared for by a team of health professionals who consult with neurosurgeon via CritiCall Ontario</td>
</tr>
<tr>
<td>6</td>
<td>Patient is repatriated to his/her community hospital for post-surgical care</td>
<td>7</td>
<td>Patient is cared for by a team of health professionals prior to rehab/community care</td>
<td>8</td>
<td>Patient receives non-acute care (rehab, complex care or long-term care) or returns home (with or without home care assistance)</td>
<td></td>
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</tr>
</tbody>
</table>
Neurosurgical Centres in Ontario

All neurosurgical centres have been designated as Level 2 or Level 3:

<table>
<thead>
<tr>
<th></th>
<th>Level 2 Neurosurgical Centre</th>
<th>Level 3 Neurosurgical Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services</td>
<td>May not provide certain neurosurgical services (i.e., coil embolization)</td>
<td>Provides all neurosurgical services</td>
</tr>
<tr>
<td>Coverage</td>
<td>Generally do not provide 24/7/365</td>
<td>Provide 24/7/365 coverage</td>
</tr>
</tbody>
</table>

Provincial Neurosurgical and Spine Roster, facilitated by CritiCall Ontario, creates access to neurosurgical services (consult, transfer) for non-neurosurgical sites:

<table>
<thead>
<tr>
<th>Level 2 Centre</th>
<th>Level 3 Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Sciences North</td>
<td>Toronto Collaborative (SMH, SHSC, UHN)</td>
</tr>
<tr>
<td>Kingston General Hospital</td>
<td>The Ottawa Hospital</td>
</tr>
<tr>
<td>Thunder Bay Regional Health Sciences Centre</td>
<td>Hamilton Health Sciences</td>
</tr>
<tr>
<td>Trillium Health Partners</td>
<td>Toronto Collaborative (SMH, SHSC, UHN)</td>
</tr>
<tr>
<td>Windsor Regional Hospital</td>
<td>London Health Sciences Centre</td>
</tr>
</tbody>
</table>
Why Perform a Neurological Assessment?

• The baseline neurological assessment and ongoing assessments are the most sensitive indicators of neurological change

• Early detection is important for successful treatment, management and prognosis
Why Perform a Neurological Assessment?

• Evaluation of the patient’s neurological status
• Record a baseline
• Monitor and detect early changes
• Successfully manage and treat
What is Included

Assessment of the following:

- Level of consciousness (LOC) using the Glasgow Coma Scale (GCS)
- Pupillary response
- Limb movement/ strength
- Vital signs

The administration of continuous sedation of a patient may obscure the neurological assessment and the accuracy of the assessment.
General Approach

- Walk up to patient
- Talk to patient (normal voice)
- Talk to patient (loud voice)
- Light touch
- Painful stimuli
Painful Stimuli

Types Of Stimuli include:

• Peripheral painful stimuli (LOC/eye opening)
• Central painful stimuli (Movement/Motor)

Examples when to Use:

• If patient is not waking and to obey verbal commands
• In the absence of any purposeful spontaneous movements

Examples when NOT to Use:

• Obvious spontaneous movement that are purposeful in nature
• Hemiparesis
Peripheral Painful Stimuli

• Used to elicit an eye-opening response

• The recommended method is an interphalangeal joint pressure (IPJ)
  – Apply pressure with a pen/pencil to the lateral outer aspect of the proximal or distal interphalangeal joint (lateral aspect of the patient’s finger or toe) for **10 to 15 seconds** to elicit a response.

**Caution!** A peripheral painful stimulus may elicit a spinal reflex, causing flexion of tested limb. A spinal reflex is not an indication of intact brain function.
Central Painful Stimuli

- Used to elicit a motor response
- Done by stimulating a cranial nerve, thus avoiding the possibility of eliciting a spinal reflex
- Recommended methods are
  - Trapezius twist (Cranial Nerve XI)
  - Supra-orbital pressure (Cranial Nerve V)
  - Jaw margin pressure (Cranial Nerve V)
Central Painful Stimuli

Trapezius twist (Cranial Nerve XI)

• Using the thumb and two fingers as pincers.

• Take hold of about two inches of the muscle located at the angle where the neck and shoulder meet.

• Twist and gradually apply increasing pressure for 10 to 20 seconds to elicit a response.

• Note: High level spinal cord injuries may interfere with assessment using Trapezius twist.

Note: Sternal rub is NOT recommended due to potential for severe bruising and residual pain and discomfort.
Central Painful Stimuli

**Supra-orbital pressure (Cranial Nerve V)**

- Place the flat of the thumb on the supra-orbital ridge (small notch below the inner part of eyebrow), while the hand rests on the head of the patient.

- Apply gradually increasing pressure for **10 to 20 seconds** to elicit a response.

- Note: Supraorbital pressure is **NOT** to be used with orbital, skull, facial fractures, or frontal craniotomies.

*Note: Sternal rub is NOT recommended due to potential for severe bruising and residual pain and discomfort.*
Central Painful Stimuli

Alternative method of applying central pain
Jaw margin pressure (Cranial Nerve V):

- Place the flat of the thumb at the angle of the jaw at the maxilla-mandibular joint.
- Apply gradually increasing pressure for 10 to 20 seconds to elicit a response.
- Note: Apply with caution in patient with increased intracranial pressure (ICP), as this may increase ICP if venous return is compromised due to compression of jugular vein.

Note: Sternal rub is NOT recommended due to potential for severe bruising and residual pain and discomfort.
Level of Consciousness Assessment

- LOC is the most sensitive indicator of neurological condition
- Consciousness consists of two components

**Consciousness:**
“A general awareness of oneself and the surrounding environment”

**Arousal or wakefulness:**
Reflects activity of the reticular activation system (RAS).
Is a brainstem response

**Awareness & cognition:**
Reflects cerebral cortex activity
Activated via the thalamic portion of RAS

(Hickey, 2003)
Glasgow Coma Scale (GCS)

- Most widely used tool to assess Level of Consciousness (LOC)
- Developed in Glasgow 1974
- Provides global measure of depth & duration of impaired consciousness and/or coma

<table>
<thead>
<tr>
<th>Glasgow Coma Scale</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EYE-OPENING RESPONSE</strong></td>
<td></td>
</tr>
<tr>
<td>Spontaneously</td>
<td>4</td>
</tr>
<tr>
<td>To speech</td>
<td>3</td>
</tr>
<tr>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td><strong>BEST VERBAL RESPONSE</strong></td>
<td></td>
</tr>
<tr>
<td>Oriented</td>
<td>5</td>
</tr>
<tr>
<td>Confused</td>
<td>4</td>
</tr>
<tr>
<td>Inappropriate words</td>
<td>3</td>
</tr>
<tr>
<td>Incomprehensible sounds</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td><strong>BEST MOTOR RESPONSE</strong></td>
<td></td>
</tr>
<tr>
<td>Obeys commands</td>
<td>6</td>
</tr>
<tr>
<td>Localizes to pain</td>
<td>5</td>
</tr>
<tr>
<td>Flexion/withdrawal</td>
<td>4</td>
</tr>
<tr>
<td>Abnormal flexion to pain</td>
<td>3</td>
</tr>
<tr>
<td>Extension to pain</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
</tr>
</tbody>
</table>
GCS: Eye Opening Response

- Eye opening assesses the function of the reticular activating system (RAS) extending from the brainstem through the thalamus to the cerebral cortex.
<table>
<thead>
<tr>
<th>Feature</th>
<th>Scale Response</th>
<th>SCORE</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye Opening</td>
<td>Spontaneously</td>
<td>4</td>
<td>Patient’s eyes open <em>spontaneously</em> no prompting from the nurse as he or she approaches the patient.</td>
</tr>
<tr>
<td>Response</td>
<td>To speech</td>
<td>3</td>
<td>Patient’s eyes open to a <em>verbal stimulus</em> only Use normal to louder voice. Consider hearing impairments/medications/status fluctuations</td>
</tr>
<tr>
<td></td>
<td>To pain</td>
<td>2</td>
<td>Patient’s eyes open to a <em>painful stimulus</em> only Use peripheral stimulation Interphalangeal joint pressure is recommended</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>1</td>
<td>Patient’s eyes do not open to any stimuli</td>
</tr>
</tbody>
</table>
GCS: Eye Opening Response

- If eyes are closed due to swelling or surgery and are unable to be opened:
  - Score 1 and indicate with a “1C” or a “C” in the “no response/none” section.

- If one eye is closed
  - Document the response from the functioning eye.
GCS: Best Verbal Response

Helps identify if the patient is orientated

Verify that the patient is able to correctly answer **ALL** the following:

– His/her identity/Name
– Where they are located
– Current year/season/month /date

Person
Place
Time
x3
## GCS: Best Verbal Response

<table>
<thead>
<tr>
<th>Feature</th>
<th>Scale Response</th>
<th>SCORE</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientated</td>
<td>5</td>
<td>Patient correctly answers questions to person, place &amp; time</td>
<td></td>
</tr>
<tr>
<td>Confused</td>
<td>4</td>
<td>Patient incorrectly answers 1 or more questions to person, place &amp; time</td>
<td></td>
</tr>
<tr>
<td>Inappropriate</td>
<td>3</td>
<td>Patient answers to the questions are not relevant. Speech is still intact and understandable.</td>
<td></td>
</tr>
<tr>
<td>Incomprehensible</td>
<td>2</td>
<td>Patient answers by moaning or groaning</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1</td>
<td>No response</td>
<td></td>
</tr>
</tbody>
</table>
GCS: **Best Verbal Response**

- If a patient has an artificial airway, verbal responses cannot be accurately tested:
  - Score 1 and indicate with a “1T” or a “T” in the “no response/none” section.
  - Document in your notes

- If a patient is able to communicate though writing or mouthing of words
  - Describe the response in the notes
  - Still document as 1 - writing does not qualify as orientated verbally.
GCS: Best Motor Response

• Assesses area of brain, which identifies and translates sensory input into a motor response.

• Use central pain if needed to elicit a response & avoid a spinal reflex

• **DO NOT** use pain if patient localizing spontaneously
e.g. attempting to remove tubes or triggers such as suctioning
<table>
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<tr>
<th>Feature</th>
<th>Scale Response</th>
<th>Score</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obey commands</td>
<td></td>
<td>6</td>
<td>Patient understands and obeys verbal/written/gestured commands: stick your tongue out</td>
</tr>
<tr>
<td>Localize pain</td>
<td></td>
<td>5</td>
<td>Purposefully moves limb to locate/remove source of pain: i.e. to chin or across the midline</td>
</tr>
<tr>
<td>Withdrawal</td>
<td></td>
<td>4</td>
<td>Flexes at the elbow/knee with the limb drawn away from the trunk (recoil)</td>
</tr>
<tr>
<td>Flexion to pain</td>
<td></td>
<td>3</td>
<td>Flexes at the elbow with shoulder adduction, wrist flexion and the making of a fist. Slow movement</td>
</tr>
<tr>
<td>Extension to pain</td>
<td></td>
<td>2</td>
<td>Extends limb with shoulder adduction, wrists flexion &amp; fingers either in a fist or extended</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>1</td>
<td>No response or movement</td>
</tr>
</tbody>
</table>
## GCS: Best Motor Response

<table>
<thead>
<tr>
<th>Feature</th>
<th>Scale Response</th>
<th>Score</th>
<th>Score Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obey commands</td>
<td>6</td>
<td>Patient understands and obeys verbal/written/gestured commands: stick your tongue out.</td>
<td></td>
</tr>
<tr>
<td>Localize pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Withdrawal</td>
<td></td>
<td></td>
<td>If unable to obey commands:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Place the patient in a supine position</td>
</tr>
<tr>
<td>Flexion to pain</td>
<td></td>
<td></td>
<td>• Hands at the groin area, if possible</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Apply a central painful stimulus</td>
</tr>
<tr>
<td>Extension to pain</td>
<td></td>
<td></td>
<td>If applicable, loosen any limb restraints while performing assessment.</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GCS – Best Motor Response
Localizes Pain: Score of 5

- The patient purposefully moves a limb in an attempt to locate and remove the source of the applied central painful stimulus.

- The hand must move toward the source in an attempt to remove the painful/noxious stimulus i.e. to the chin or across the midline of the body.
The patient withdraws the limb in response to a central painful stimulus by flexing at the elbow/knee with the limb drawn away from the trunk (recoil). There is no direct attempt to remove the source of the painful stimuli.
GCS – Best Motor Response

Abnormal Flexion to Pain: Score of 3

- The patient flexes the limb at the elbow in response to central painful stimuli.
- Accompanying this movement is shoulder adduction, wrist flexion and the making of a fist.
- Flexion to pain is usually a slow movement, with no attempt to remove the painful stimuli.
GCS – Best Motor Response
Extension to Pain: Score of 2

- The patient extends the limb at the elbow in response to central painful stimuli.

- Accompanying this movement is adduction of the shoulder; flexion of the wrist while the fingers either make a fist or extend.
GCS: Best Motor Response

- Flexion withdrawal
- Abnormal flexion to pain
- Abnormal extension to pain
GCS – Best Motor Response
None: Score of 1

No movement of the limbs occurs in response to painful central stimuli
Components of a Basic Neuro Assessment

• Level of consciousness (LOC)
  - using the Glasgow Coma Scale (GCS)

• **Pupillary response**

• Limb movement/ strength

• Vital signs
Pupil Assessment

Shape

Size

Reaction
Why Assess Pupil Shape?

• Many neurosurgical patients are at risk of increased ICP.

• Early detection of the signs and symptoms may make interventions more effective.

• The baseline neurological assessment and ongoing assessments are the best indicators of changing ICP.

• Subtle neurological changes, such as changes in pupil shape, may indicate rising ICP.
Pupil Assessment: WHY?

- Indication of changes in ICP:
  - Compression of the oculomotor nerve results in changes in pupillary size, shape and reaction to light
  - May be related to increasing intracranial pressure (ICP) brainstem damage, cerebral anoxia, cerebral ischemia or oculomotor nerve compression.

- Monitor & detect for early changes to allow for early management or treatment of the cause

<table>
<thead>
<tr>
<th>PUPIL</th>
<th>Rt. Size</th>
<th>Rt. Reaction</th>
<th>Lt. Size</th>
<th>Lt. Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupil</td>
<td>3</td>
<td>+</td>
<td>3</td>
<td>+</td>
</tr>
<tr>
<td>Pupil</td>
<td>3</td>
<td>+</td>
<td>3</td>
<td>+</td>
</tr>
</tbody>
</table>
Pupil Assessment: Size

- Assess size after the eyes have opened & the pupils have accommodated to room light
- Size is documented in mm with normal range from 2-6 mm
- A difference of 1.5 mm between pupils should be reported to MD
Size of the pupil can denote changes in neurological status. Sizes can be described as:

- Pinpoint
- Small
- Mid-position
- Large
- Dilated

**NOTE:** Pupil changes in size may be LATE sign of rising intracranial pressure and neurological deterioration
Elderly patients may have irregular margins

- May indicate ↑ ICP
- Usually same side (ipsilateral)
- Sign of impending brain herniation

Abnormal variations in pupil shapes may be related to:
- Cataracts and cataract surgery may distort pupil shape
- Disease processes: glaucoma
- Trauma or iris inflammation
- Congenital defects

- Fixed + dilated
- Signs of ↑ ICP
- Cranial Nerve 3 compression
- Brain herniation and brain death
Pupil Assessment: Reaction

- Inform patient to look forward & dim room lights
- Move a concentrated light source from the outer aspect of the eye inwards:
  - Direct constriction: pupil with light source constricts
    - Repeat for other eye
  - Consensual constriction: Pupil constricts in response to light directed in opposite eye
- Record a “+” symbol if the pupil reacts, a “−” symbol if the pupil does not react

If eyes closed by swelling, open gently otherwise record a “C”
Pupil Assessment: Reaction

Pupil response can be described as:
- Brisk
- Sluggish
- Nonreactive
- Fixed
- Dilated
Pupil Assessment Steps

1. Note pupil size and shape in ambient lighting
2. Sweep light onto the pupil, note reaction of the pupil the light is on
3. Repeat action noting the reaction of pupil the light is not shining on
   • This is the consensual reaction … IT’S IMPORTANT TOO!
4. Repeat for the other eye
5. Document your assessment
   • Alert team if concerned
Changes from baseline pupil assessment size shape and/or reaction

**Early signs – interventions may still be effective**
- Decreased briskness to light (sluggish or no response)
- Changes in size or shape of one pupil (or both)
- Round to ovoid pupils

**Late signs – may be too late for effective interventions**
- Fully dilated
- Nonreactive to light
- Bilaterally fixed and fully dilated
Limb Movement and Strength

- Test legs and arms
- Compare left and right sides
- Can’t obey or non-compliant?
  - Observe spontaneous movement or central pain response
- Grade the movement and strength 0 to 5
- Abnormal flexion ‘F’
- Extension to pain ‘E’

NOTE: Assessing Limb movement & strength as part of a Neurological Assessment is NOT considered a replacement for Spinal Cord Assessment in a patient with a suspected Spinal Cord Injury.
<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>What the movement means</th>
<th>What the movement looks like</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Limb moves against full resistance</td>
<td>Normal Power</td>
<td>The patient has normal limb power</td>
</tr>
<tr>
<td>4</td>
<td>Limb moves against moderate resistance, but strength is diminished</td>
<td>Contraction- against Gravity and Resistance</td>
<td>The patient is able to lift the limb off the bed (against gravity and resistance) but is not normal limb power</td>
</tr>
<tr>
<td>3</td>
<td>Limb may move against minimal resistance or gravity. E.g., If the patient lifts the arm off a surface and it immediately drops back down</td>
<td>Contraction- against Gravity</td>
<td>The patient is able to lift the limb off the bed (against gravity)</td>
</tr>
<tr>
<td>2</td>
<td>Limb moves on a horizontal surface with the inability to lift against gravity</td>
<td>Contraction- Gravity eliminated</td>
<td>The patient is able to move the limb but cannot lift it off the bed</td>
</tr>
<tr>
<td>1</td>
<td>Limb or muscle flickers</td>
<td>Flicker of muscle contraction</td>
<td>The patient is attempting to move the limb</td>
</tr>
<tr>
<td>0</td>
<td>No movement is observed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Not Applicable for:

- Spinal Cord Pathology – Use ASIA scoring or facility specific policy and procedure and associated documentation

- If unable to assess limb movement/strength due to limb Fractures/Limb Traction. Document not applicable on patient care record, and document reason in interdisciplinary notes
Some Examples of Applying Gravity and Resistance

1. Resistance

Flex up; pull in

2. Resistance

Push down

Lift up

3. Resistance

Bring Limb off surface for gravity - then apply counter resistance

Lift up
Vital Signs

• Increasing fluctuations in vital signs including blood pressure, heart rate and respiratory rate coupled with a deteriorating GCS and Neurological status can indicate rising intracranial pressure.

• This can be a emergency and should be communicated and addressed IMMEDIATELY by a physician.
Questions and Answers

THANK YOU!