

# NEUROLOGICAL ASSESSMENT USING THE GLASGOW COMA SCALE (GCS)

## Expected Outcome

- The Glasgow Coma Score forms part of the patient's physical assessment and will be assessed and documented during physical assessment.
- Ongoing GCS assessment will occur in patients with neurological compromise or those patients with recognised potential for neurological compromise.
- Medical and nursing staff will perform neurological assessment utilising the GCS accurately and reliably.

## Policy Statement

- Neurological assessment using the Glasgow Coma Scale will be performed by registered nurses accurately and as required by the patient's condition.
- The Glasgow Coma Scale will incorporate assessment of limb strength and pupillary response to light stimulation.
- Assessment of a patient's neurological status, using the GCS, will be accompanied by assessment of the patient's vital signs.
- Changes to the patient's neurological status will be reported immediately to the appropriate medical staff.
- Where required, changes in neurological status will be acted upon immediately.
- If the patient's GCS is less than 15, and then falls by one point, the appropriate medical staff will be informed immediately.
- A MET call is to be initiated when the GCS falls by  $\geq 2$  points.
- Documentation is to occur at all times – even where documentation by exception exists.
- Only appropriate painful/noxious stimulus will be used:
  - ⇒ Peripheral stimuli that may be used include (a) pressure to the side of the finger, next to the nail or (b) pinching of the fine skin over the triceps muscle.
  - ⇒ When using peripheral stimulus, care must be taken to ensure that motor response arises from the brain, not mediated by the spine as a reflex arc. For this reason, central stimulus is advocated as first choice for stimulus.
  - ⇒ Currently, (following literature review) there are NO references to the validity of using nipple twists or genital pain as an appropriate painful stimulus in either the nursing or medical sources. It may be used when other forms of recognised painful stimulus have failed to elicit a response from the patient. It is not to be used as a first line assessment of patient response to stimulus by staff.

## Background

The GCS was developed at Glasgow University and Drs Teasdale and Jennett published its development in 1974. It is a scaled assessment that reviews three areas of neurological functioning and attributes a score to each.

## Purpose

The GCS is a 15-point scoring system designed to objectively assess cortical cerebral function in conjunction with pupillary function and limb strength assessment. It aims to remove both personal interpretations of a patient's condition and confusing descriptors.

After education and assessment, staff will be able to assess a patient's condition in a reproducible manner. Results of the score will be used to establish a baseline then used to assess whether the patient's condition is improving, stable or deteriorating. The GCS is always used in conjunction with a patient history as many conditions and events may result in an abnormal score.

## Assessment

- To assess degrees of coma, three aspects of functioning are considered:
  - ⇒ Eye-opening.
  - ⇒ Verbal response.
  - ⇒ Motor movement.
- These are collectively attributed a score out of 15.
- These areas of assessment correspond to the complex organisation of the sensory/motor cortex, functions of the lobes of the brain and the brainstem

### The assessment is carried out in 3 stages:

EYE OPENING		VERBAL RESPONSE	BEST MOTOR RESPONSE		
spontaneous	4	orientated	5	obeys	6
to speech	3	confused (conversation)	4	localizes	5
to pain	2	inappropriate (words)	3	withdraws	4
nil	1	incomprehensible (sounds)	2	abnormal (spastic) flexion	3
		nil	1	extends	2
				nil	1

### Additional assessment is made of:

- Limb strength
- Pupillary size, equality and reaction
- Haemodynamic status - BP, HR, T, SpO<sub>2</sub> and respiratory rate; end-tidal CO<sub>2</sub> if requested

### Documentation

- To record a response on the ICU flowchart or the Neurological Observations (GCS) Chart CR 166: place a dot in the middle of the box.



### Sequence of Stimulation

- Arousal** - the patient's wakefulness (brainstem).
- Awareness** - the 'thinking' aspect (cerebral cortex).
  - ⇒ Speak, then shout
  - ⇒ Shout and shake
  - ⇒ Use of pain/noxious stimulus
  - ⇒ Score the best response

## EYE OPENING

### 4 - Open spontaneously

The eyes are open without stimulation, indicating that the arousal mechanisms of the reticular activating system (in the brainstem and hypothalamus) are active.

### 3 - To speech

The patient responds to voice by opening their eyes. A normal voice level is used but, if insufficient, greater verbal stimulus may be required. A louder voice must be used for those patients with impaired hearing.

- Touch and shake are not listed on the hospital chart but the patient's response to these must be assessed before progressing to the use of painful stimulus.
- Frequently, patients are sleep deprived and will respond to shaking without the use of pain. This may then be scored as 'eyes open to speech'. The need for shaking is noted in the comments section and staff informed of this necessity.
- If the patient's condition then deteriorates and physical pain is used to obtain an eye-opening response, then this deterioration can be accurately assessed/noted/addressed.

## 2 - To pain

If the patient is unable to respond as above, then noxious/painful stimulation must be used to elicit a response. Central pain is used to assess cortical response. Peripheral pain may be used to assess 'eye opening' but is avoided as a first-line assessment as it may elicit a reflex response (spinal), which does not assess cortical (cerebral) function.

## 1 – Nil eye opening

If the patient does not respond to painful stimulation then they are given a score of 1. If the eye is swollen from trauma or surgery then the letter "C" is recorded, denoting 'closed'. If pharmacological paralysis or deep sedation is utilised, "P" or "S" is written in the box or "Paralysed" / "Sedated" is recorded across the 'Coma Scales' area. No score is given.

## 3 Types of Central Stimulus:

- Supra-orbital pressure
- Trapezius pinch
- Sternal rub

**Supra-orbital pain** is applied by placing the thumb parallel to the indentation found on the eyebrow ridge nearest the nose. The supra-orbital nerve plexus is stimulated by strong pressure. This stimulus is inappropriate when there is known or suspected damage to the orbital structure or local facial fractures present. It is not used to assess the 'eye-opening' response, as a normal response to this form of stimulus is to grimace and shut the eye!

**The trapezius pinch** is applied by gathering the fold of skin and muscle above the collarbone (closest to the neck) and squeezing firmly. It is best used on patients who have a defined neck. On patients with a short or very muscular neck/shoulders it may be difficult to apply a strong pressure to elicit a response. When assessing for movement, try both trapezius muscles to obtain the best motor movement, rotate sites between assessments to avoid localised damage.

**The sternal rub** is an effective method of pain stimulus in the event that the above methods are inappropriate. The rub is similar to that of using a mortar and pestle. Duration of stimulus is important, as an initial response may be that of abnormal posturing. Persevering for approximately 20-30 seconds may elicit a better motor movement that accurately reflects the patient's status. It is, however, the least aesthetic method as it frequently results in marked bruising of the patient. It is not appropriate to use this method when there is gross oedema preventing contact with the sternum upon application of pressure.

- If the patient is awake (eyes open) and cooperative (able to follow directions/commands) and is unable to move a limb, there is no need to then use painful stimulus – assess patient for damage to their motor pathways.
- As patient advocates it is imperative that we inform our patients/carers of the necessity for these forms of observations. Use of deep pain to elicit a movement may be unpleasant but accurate assessment is essential.
- Credence must be given to observations that the family may make about the patient's level of consciousness. When a close relative/carer asserts that the patient is "not as good as they were", it is important to investigate their observation.

## Other types of Noxious Stimuli

- Patients may move spontaneously but fail to respond to deep central pain. In these instances, peripheral pain may be used on the upper extremities to elicit movement. Caution must be taken with the elicited response as it may be a reflex and thus bears no relevance to assessing the patient's cerebral function.
- Peripheral stimuli that may be used include (a) pressure to the side of the finger, next to the nail or (b) pinching of the fine skin over the triceps muscle.

- Consideration of what is an appropriate form of noxious, painful stimuli is the concern of the nurse and doctor caring for the patient.
- Currently, (following literature review) there are NO references to the validity of using nipple twists or genital pain as an appropriate painful stimulus in either the nursing or medical sources. It may be used when other forms of recognised painful stimulus have failed to elicit a response from the patient. It is not to be used as a first line assessment of patient response to stimulus by staff.

## VERBAL RESPONSE

Verbal response assesses two key elements:

- Comprehension and transmission of sensory input; verbal or physical.
- Ability to articulate or express a reply.

These areas focus on four aspects of cortical functioning:

- Orientation,
- Attention span,
- Language, and
- Memory.

Deficits involving these areas will result in a decreased GCS – verbal response.

### 5 - Orientated

- The patient is asked questions to assess if they are orientated to time, place and person. They should know what day, month and year it is; where they are and who they are.
- Caution: some cultural groups may not consider age or time as important issues; ask alternate questions. Being able to identify familiar faces or 'known' facts is important.
- It may be necessary to inform the patient of the day and specifically request that they remember the day and date. This will also assess their short-term memory. Known facts are: e.g. Doctors and nurses work in hospitals.

### 4 - Confused

- The patient is unable to correctly identify one or more of the above areas despite correcting the wrong response. If the patient has a pre-existing dementia then they are still scored as confused. Obvious reasons for confusion, such as hypoxia, are addressed immediately.
- The confused person speaks in sentences. They may be able to respond in a conversational manner but responses are incorrect.

### 3 - Inappropriate

- The patient responds to the spoken word (and possibly to their environment) inappropriately. They are often unable to hold a conversation or will respond to questions in an unrelated manner - e.g. "Who is the Prime Minister?" may be answered with "I did the shopping". Often words rather than sentences are used and these may be obscenities.

### 2 - Incomprehensible

- Words are unable to be distinguished from sounds made in response to questions or to painful stimuli. Moaning or groaning is heard.

### 1 - No verbal response

- There is no verbal response. If a patient is intubated or has a cuffed tracheostomy tube insitu preventing speech, then a "T" is recorded in the 'No Response' area. This is still scored as one point.

## Non-English Speaking Background (NESB) Patients

- If the patient is from a NESB then an interpreter should be utilised to assist with accurate assessment. It is insufficient to record a patient as having followed a non-verbalised directive. Language barriers make it difficult to obtain continuing assessment data.
- If unable to accurately assess if the patient is orientated, (by assessing correct verbal responses), then the patient's best response is that of 'confused'. The nurse will need to observe the patient carefully as the ability to accurately assess the patient is reduced.

## BEST MOTOR RESPONSE

### 6 - Obeys Commands

- The patient is able to follow verbal or signalled direction by moving their limbs in a purposeful manner. Questions such as "Lift your arm/leg off the bed" are useful because they can differentiate from coincidental movement.
- If the patient has a known gross limb weakness/paresis/plegia then ask the patient to poke their tongue out. Wriggling fingers/toes is a useful request for patients with generalised weakness. In the severely compromised patient, they may be able to open or shut their eyes to command. Instructions such as "squeeze my hand" risk assessing a grasp reflex as a conscious response.

### 5 - Localises

- If the patient is unable to obey commands then the assessor must use a central stimulus to elicit a response. The best response is then recorded. e.g. if the arms flex and the legs extend, then flexion is the best response. Arms are usually capable of better responses.
- Whilst the central pain/noxious stimulus is applied, the assessor watches for the patient to attempt to locate and remove the stimulus (a 'localizing' or purposeful response). If the patient attempts to remove the stimulus ineffectively but is able to move their arm(s) at or above the nipple line, it is still classified as a localizing response - albeit a poor one.

### 4 - Withdraws (Normal Flexion)

- The patient responds to painful stimulus by trying to withdraw away from the source of the pain. It is termed a 'withdrawal flexion' and differs from "spastic" abnormal flexion. Withdrawal response is characterised as a normal flexion of the elbow with the arm moving away from the body. There is no purposeful movement to remove stimuli. There is no stiffness associated with the movement and it may be accompanied by a grimace or frown. Occasionally the patient's body may attempt to move away from the source of pain.

### 3 - Abnormal Flexion (Spastic Flexion)

- There is increased tone with a reflex-like response to pain. Movement is generally slow, the forearm and hand are held close into the body. The elbow flexes rigidly. This form of movement can result in increased expenditure of energy due to the muscle spasm/rigidity. Legs are not assessed for 'flexing' as bending the knees and flexing are indistinguishable.

### 2 - Extension

- This indicates a brainstem (poor) response. The arms, if extending, will be close to the body and rigidly straightened with fists rotating into the body. Legs are straightened with the feet pointing downwards. This posture expends much energy, increasing body temperature and oxygen consumption. It will increase intracranial pressure (ICP) in compromised patients and if it persists, must be treated.

### 1 - No movement

- There is no visible trace of muscle movement or contraction in response to deep central pain (nor to peripheral stimulus).

### Paralysis and/or Sedation:

- An initial assessment is made prior to induction of paralysis and/or sedation.
- The GCS is not scored during paralysis. "Paralysis" is written across the GCS chart.
- At all times, the paralysed patient must receive a form of analgesia and sedation to decrease awareness of the paralysis.
- During deep sedation only, the GCS will still be assessed.
- Pupillary reaction to light and possibly ICP/EEG monitoring may be used to assess the patient's condition.

## LIMB STRENGTH

**Limb strength** assessment is based upon the medical model of muscle contractility:

- **normal strength** - full movement against both gravity and resistance.
- **mild weakness** - limb moves against gravity but not against resistance (no push/pull).
- **severe weakness** – limb is able to move but unable to lift against gravity.
  
- Testing the upper then lower limbs simultaneously assesses equality of movement. Patients are asked if their limb movements feel equal.
- When a person is unable to obey commands but moves limbs to pain, then limb strength is based upon the degree of movement as specified above.
- If the patient is able to obey commands but cannot move a limb – do not use painful stimulus to effect a movement. Investigate for causes of hemiparesis/hemiplegia; inform the medical officer urgently if a new finding.

### **Pronator Drift is another means to assess for arm weakness**

The patient is requested to close their eyes and stretch their arms out as in holding a bowl of soup. Closing the eyes is imperative to prevent visual correction of the arm's position.

Weakness (or an inattention to that side of the body) is evidenced by:

- Arm trembling
- Hand pronating (turning downwards)
- The arm drifting down towards the body

## PUPILLARY OBSERVATION

Assesses the size, equality, reaction to light and consensuality of pupil response.

- **Size** - pupils are assessed for size against a uniform scale in millimetres. Differences are noted between the pupils.
- **Equality** - an unequal pupil may indicate increasing pressure on the Oculomotor nerve (unilateral side) or indicate ischaemia of the brainstem. One in five people have naturally occurring unequal pupils. Therefore, it is essential to evaluate the GCS in conjunction with assessment of the pupils.
- **Reaction** - direct a small, bright torch from the side of the face to shine into the eye. Pupillary response is recorded as brisk, sluggish or non-reactive. If the response is difficult to see the surroundings should be dimmed. Changes are significant when accompanied by a decrease in the patient's neurological response. Reactions are recorded as: "+" for a brisk response; "o" for a sluggish response and "-" for no response.
- **Consensuality** - when testing pupillary response in the cooperative patient, a light shone into one eye should stimulate both pupils to constrict.

### **Issues in Pupillary Assessment:**

- Lack of reaction or decreased response may be due to increased ICP, hypoxia or drug therapies.
- Narcotics such as morphine or fentanyl will constrict the pupil, atropine will dilate the pupil and barbiturates such as thiopentone will make the response sluggish; in high doses the response will disappear.
- Vigilance in assessment of the pupils in conjunction with the Glasgow Coma Score will alert the assessor to neurological deterioration.

## ASSESSMENT OF FOCAL DEFICITS

A focal (neurologic) deficit is a loss of movement, sensation or function of a nerve in a specific location; the loss is related to dysfunction in the brain or peripheral nervous system. There may be no decrease in the level of consciousness.

- Focal neurologic deficits may affect the left or right side of the face, arms or legs or be related to a specific region within the brain e.g. speech may be affected but not the ability to write.
- Sensation changes include paraesthesia (abnormal sensations), decrease in sensation or numbness.
- Movement changes include paralysis, weakness, loss of muscle control, increased or decreased muscle tone. The terms paresis and plegia are used to describe severe weakness and lack of movement.

### Other types of focal deficit:

- Speech or language changes may occur, such as aphasia or dysarthria (impaired speech and language skills), poor enunciation, poor understanding of speech, impaired writing, impaired ability to read or to understand writing, inability to name objects (anomia).
- Vision changes such as reduced vision, decreased visual fields, sudden vision loss, double vision (diplopia) or homonymous hemianopia (loss of a visual sector in one eye) may occur.
- Neglect or inattention to the surroundings on one side of the body - see "Pronator Drift".
- Loss of coordination, fine motor control, or ability to perform complex movements.
- Horner's syndrome: one-sided eyelid drooping (ptosis), absent sweating on one side of the face, and retraction of one eye into the socket, poor gag reflex, swallowing difficulty, and frequent choking.

### Comments

- It is important to note the rhythm of the person's speech, whether it is clear or slurred and whether they correct mistakes they have made or are oblivious to them.
- Sometimes a patient, when asked, "what is this?" (watch), will say, "it tells time". They must then be asked, "what is it called" to fully assess the language and memory centres.
- Confabulation (where the patient fills in memory gaps without realizing their statements are fabricated) may occur and careful questioning is required to assess whether the patient is orientated or confused.
- If the person is dysphasic this will affect their score and the dysphasia is noted in the comments section of the Neurological Observations' chart.

**The cardinal rule when assessing a patient for NEUROLOGICAL DETERIORATION is:**  
**Report any decrease in the level of consciousness.**  
Assess for speech changes, restlessness or sudden quiet behaviour,  
a change in the motor response or evidence of pronator drift and pupillary response changes.

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