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Review Paper

Simplifying Glasgow Coma Scale Use for Nurses

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Abstract

Glasgow Coma Scale (GCS) was introduced in 1974 as a tool to standardize the assessment of the level of consciousness of patients. Since it was introduced and used, GCS was considered to be the gold standard method for this purpose. Despite plenty of strengths GCS has (i.e. objectivity and easy communication on the results between the health care providers); GCS was considered to be ambiguous and confusing for nurses and infrequent users. Moreover, lack of knowledge and training about GCS might affect the accuracy and inter-rater reliability among health care professionals. The purpose of this paper was to simplify the use of GCS step by step for the beginner health care professionals.
This literature review was done by searching the following search engines: Pubmed, Midline, CINHAL, Ebsco host, and Google Scholar for the key words of: Glasgow Coma Scale (GCS), flow chart, nurses, and consciousness.Types of articles included: original research, literature review and meta-analysis. This review included the following sections:

1) Definition of the related concepts
2) The historical development of the GCS
3) How to score the GCS
4) Recommendation for clinical settings, and
5) Conclusion

Keywords: *Consciousness; Flow Chart; Glasgow Coma Scale; and Nurses.*

1. Definition of the related concepts

1.1. The nervous system

The nervous system is the most highly organized system of the body, with all of its part functioning as an inseparable unit. The nervous system is a unique, complex, and mysterious network of fibers running throughout the body. Anatomically, the central nervous system comprises all the portions of the brain and the spinal cord. The peripheral nervous system comprises of: a) 12 pairs of the cranial nerves, b) 32 pairs of the spinal nerves, and c) peripheral nerves that connect the central nervous system with the body wall (Urdan 2014).
From the physiological point of view, the nervous system is controlling and regulating all body functions and is considered as the executive portion of the body. Nervous system has a plenty of vital functions such as "thought process, emotions, understanding of information, and above all is consciousness." Most activities of the nervous system originated from sensory receptors (i.e. visual, auditory, or tactile) (Urdan 2014).

1.2. Consciousness

A state of general awareness of oneself and the environment and includes the ability to be orientated to time, place and person. It is a dynamic state that is subject to change (Urdan 2014).

1.3. Alertness

Is the state of active attention by high sensory awareness

1.4. Wakefulness

Is a daily recurring brain state of consciousness in which an individual is conscious and engages in coherent cognitive and behavioral responses to the external world (Urdan 2014).

1.5.Arousal

Is a state of "being awake," as observed clinically by external behavior (i.e. body movement, head movement, and eye opening).

1.6. Awareness

Is: state of cognition of the patient about the environment.
The patient is considered fully conscious if he is awake and aware. To be fully oriented, the patient should be oriented to person, time, and place. When the patient is fully conscious and oriented, this reflects that the nervous system is fully intact (Urdan 2014).

1.7 Glasgow coma scale

Is a neurological scale which gives a reliable, objective way of recording the conscious state of a person, for initial as well as subsequent assessment (Batool et al. 2013). GCS consists of three components (eye opening, best verbal response, and best motor response) (table 1). The scale uses the numeric system with a total score ranging from 3 to 15. Patient is considered in a coma if

he/she has GCS score of ≤ 8 (Juliet &Claranne 2001, Urdan 2014).

2. The historical development of the GCS

Before the development of the GCS, there was no standard tool or instrument to assess level of consciousness (Juliet &Claranne 2001). The first instrument used to determine the head injuries called coma index (Juliet &Claranne 2001). This instrument was developed later to be the GCS. The GCS was firstly designed by Teasdale and Jennett in 1974 as a research instrument to study patients' level of consciousness and to assess comatosed patients (Juliet &Claranne 2001).Teasdale and Jennett, 1974 defined the GCS as a practical tool used to assess the level of consciousness/impairment and patients in coma. The first version of the scale has a total score ranging from 3 to 14. Three years later; the scale was adjusted to be from 3 to 15. After this, change was implemented; GCS started to be accepted and used gradually all over Scotland.

Over the past 40 years since its modification, GCS became a valid, reliable, and highly objective instrument (Siobhan 2014). These characteristics made GCS developed and being used all over the world in multi clinical settings, conditions, especially in the emergencies' situations. Nowadays, GCS is considered the gold standard instrument for health care providers, including nurses to assess the level of consciousness (Siobhan 2014).

3. How to score GCS

3.1. The meaning of the total GCS score

The GCS scores are used to indicate the severity of the head injuries and coma levels as described below:

- If GCS scores ≥ 13, then the patient has mild head injury.
- If GCS score is (9-12), then the patient has moderate head injury.
- GCS score ≤ 8 then the patient has severe head injury, and considered to be in coma (Juliet &Claranne 2001).
- Other classifications give more details as the following:
- If GCS score is 15 with no loss of consciousness or amnesia, then the patient has minimal head injury.
- If GCS score is (14-15) with amnesia or less than 5 minutes loss of consciousness, then the patient has mild head injury.
- If GCS score is (9-13) with more than 5 minutes loss of consciousness or neurological deficit, then the patients has moderate head injury.
- If GCS score is (5-8), then the patient has severe head injury.
- If GCS score is (3-4), then the patient has critical head injury (Juliet &Claranne 2001).

3.2. The flow chart of GCS

The flow chart will promote your assessment and guide you to assess your patient step by step.

3.2.1. Eye opening

Eye opening assessment is important to assess the arousal of patient (the level of wakefulness) which reflects the integrity of reticular activating system of the brain (Hickey 2009). Opening patient eyes doesn't mean that patient is aware about the environment (surroundings) (Kumiko 2014). In some cases, the patient may open his eyes but he is not aware of his surroundings (i.e. Persistent Vegetative State). If the patients' eyes are opened or the patient can open them spontaneously and he is aware, then we say that the patient opens his/her eyes spontaneously and gets a score of four. Nurses should not make any noise or loud voices during assessment of eye opening to avoid voice stimulants at this point (which is the next step).

If the nurse approached the patient and he/she did not open his/her eyes, talk to him/her in normal voice. For example: (Call patient by his/her name, ask patient to open his/her eyes, or ask patient if he/she like to talk cup of juice) (Waterhouse 2009). If the patient opens his/her eyes then we say that the patient opens his/her eyes to speech and gets a score of three.

If patient didn't response to normal voice; make your voice louder and avoid touching the patient to avoid two different stimuli at the same moment. If patient open his/her eyes, we say that the patient opens his/her eyes to speech and gets a score of three.

If patient didn't response to the loud voice, then more stimuli are needed. Start the new stimuli by touching the patient or shaking him/her. This might be enough to open his/her eyes. If the patient opens his/her eyes; we say that the patient opens his/her eyes to pain and he/she gets a score of two.

If this failed, painful stimuli are required. At this point, the nurse should explain to family (if present) about what and why he/she is doing the painful stimuli. The aim of painful stimuli is to assess patient's level of consciousness in an altered state. There is more than one site in the body to apply the painful stimuli.

A peripheral painful stimulus (digital compression) is safer and favored (Kumiko 2014). A pressure is applied with a pen gradually to the second or third finger joint for approximelty10 seconds. The central painful stimulus is performed by gripping and twisting a portion of the trapezius muscle in the patient's shoulder. Pressure to the supraorbital or the jaw angle should be avoided because they might cause grimacing or eye closure (Ihsan et al. 2013). A gain, if the patient opens his/her eyes; we say that the patient opens his/her eyes to pain and he/she gets a score of Two (Figure 1)

If the nurse did all the previous steps and the patient did not open his/her eyes; then we say that the patient does not have any response (No response) and he gets a score of one (figure 2).

Note that there is a special condition when the patients' eyes are closed because of a facial injury or a swilling, then you document (C) and the score cannot be measured for this category.

3.2.2. The Best verbal response

Best verbal response assessment reflects the integrity of higher, cognitive, and interpretive centers of the brain (Waterhouse 2008). The verbal response depends on to language center (Wernicke's speech center) in the temporal lope and (Broca's speech center) in the frontal lobe (Woodward & Waterhouse 2009).

Start the best verbal response by the following questions:

- Who are you?
- Where are you?
- Why are you here?, and
- Ask patient about current month, year, and season.

To be oriented, the patient must be oriented to time, place, and person.The examiner should avoid: a) close ended questions (Kumiko 2014), b) questions about a day of the week; because they are easily mistaken, c) questions about relative name to assess patient orientation. If the patients answered all question correctly (Kumiko 2014), then we say that the patient is oriented and he/she gets a score of five.

Usually, Orientation to time usually lost first (Kumiko 2014). Therefore, if the patient answered one or more of the above-mentioned questions wrong, but he/she still able to talk in sentences, then we say that the patient is confused, and he/she gets a score of four. In this state, the patient knows the question, but he does not know the answer.

We say that the patient is using inappropriate words, and he/she gets a score of three if the patient is trying to answer the questions, but he/she cannot talk in sentences. In this case, the patient does not know the question and does not know the answer. Instead, he uses random words or repeats phrases (i.e. calling relatives' names). If the patient is only groaning, moaning, or mumbling (non-intelligible words); then we say that the patient is using incomprehensible sounds and score two.

If the patient cannot produce any sound; he/she is on the no verbal response category and scores One (figure 3).

Note that there are special cases where the patient is with endotracheal/ tracheotomy tube and unable to respond verbally. In such cases we have document (T) on GCS chart. However, some cases with tracheotomy are still able to response verbally (Kumiko 2014). Language barrier and hearing problem must be considered in this step.

3.2.3. Best motor response

It is the final step in the GCS. The motor response checks the function ability of the cerebral cortex (Hickey 2009, Waterhouse2009). In this assessment, the patient has to understand the commands and performs the movement accordingly. Best motor response is the most difficult and important portion of the GCS assessment (Heron et al. 2001, Barlow 2012).

During this step we assess the upper extremities by simple orders because they are more reliable than the lower extremities (Waterhouse 2009). We start this assessment by asking the patient to do the verbal instructions as:

- Elevate your left arm
- Open your mouth
- Squeeze on my hand
- Leave my hand

If the patient follows the verbal instructions, then we say that the patient is obeying commands, and gets a score of six.

The next step will start if the patient doesn't follow your verbal instructions. Usually, the presence of nasogastric tube (NGT) or oxygen mask is irritant to the patients. Therefore, if the patient has an NGT or on oxygen, and he can move his hand above the chin level and tries to remove NGT or the oxygen mask, we consider that he/she is localizing to pain even if we did not introduce the stimulus. In this case, the patient will have a score of Five (Waterhouse 2009).

If the patient doesn't follow verbal instructions or doesn't try to remove the irritation (pain) source, then next step is to apply the painful stimuli. Again, we have to explain to the family (if present) what and why we are doing that before performing the painful stimuli. Published studies (Palmer & Knight 2006, Woodward 2007, Waterhouse 2009) about the use of GCS reported a big debate about which is the best way to apply the painful stimuli. In our study, we will adopt the central painful stimulus as recommended by the National Neuroscience Benchmarking Group (Waterhouse 2009).

There are two ways to perform this stimulus.

a) Squeeze the trapezes: it is the first and the most appropriate method used. This methods works by stimulating the cranial nerve XI (spinal accessory nerve). Done by grasping approximately 3 cm of the muscle between the thumb and forefingers and twisting for up to 30 seconds (Kumiko 2014)
b) Supraorbital pressure: done by gradually applying pressure for 10-20 seconds in the supraorbital area. This method works by stimulating the trigeminal nerve (Urdan 2014). It is contraindicated in orbital damage, skull fracture, glaucoma (Urdan 2014) and in patients with reduced awareness because of high risk to injure their eyes (Urdan 2014).

If the patient locates the pain source and try to remove it; then we say that the patient is localizing pain and he score Five. Note that the patients' hand should cross the midline of the body or above chin level to remove the pain sources (Fairley & Pearce 2006, Waterhouse 2009).

If the patient cannot locate the pain, however, he/she flexes his/her or her arm towards pain source, but he/she cannot remove the source, we say that the patient either having normal flexion or withdrawal from pain, and he/she scores four. If the patient flexes his/her or her arm at the elbow and rotates the wrist, then we say that the patient is having abnormal flexion and scores three, indicating damage to the corticospinal tract (Hickey 2009).

The extension to pain is considered when the patient straight his arms and rotates them inwards. In this case, the patient's score is two indicating that he/she has damage in the dencephalon midbrain, or pons (Hickey 2009). This sign is considered very serious with poor prognosis. Finally, if the pain applied to the patient was adequate and no movement noticed, then the score is One (no motor response) (Figure 4).

Note: Adequacy of the pain is important to differentiate if the cause of the no response is pharmacologically or pathologically (Middleton 2012, Kumiko 2014).

4. Recommendation for clinical settings

- For better understanding, it is recommended to state each component score rather than the total score of the GCS (i.e. Eye opening 2, best verbal 3, best motor 3).
- The staff member assigned to care for the patient should carry out all assessment during the shift to decrease inter-rater disturbances and ensure reliability.
- To maintain permanence and steadiness, the two nurses doing the handover should do one assessment together.
- Ask for second opinion when you are in doubt.
- When you are going to perform painful stimuli, explain to the family what and why you are going to do.
- Immediately report any drop in the motor response to the medical team because it is of highly clinical significance.
- Do not omit the assessment assuming that the patient is sleeping.
- Continue GCS assessment till it is discontinued by the medical team.

5. Conclusion

Early detection of any neurological status change is highly important. This might decrease the morbidity, mortality and improve patients' outcomes. Contrary, failure to do so can lead to irreversible and devastating consequences. Nurses are the frontline health care professionals working with patients 24/7. Therefore, they should be knowledgeable and confident in GCS assessment. Dissemination of simplified knowledge and benchmarks among nurses and health care professionals is essential. We hope that nurses find this review helpful.

6. Acknowledgment

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Table 1: Glasgow Coma Scale and Score

Feature	Response	Score
Eye opening	Spontaneous (when approached)	4
	To speech (normal or loud voice)	3
	To pain (Touch or gently shake patient, or painful stimuli)	2
	No response	1
Best verbal response	Oriented (time, place and person)	5
	Confused (some incorrect answers, still able to talk in sentences	4
	Inappropriate words (no complete sentences, repeat words only)	3
	Incomprehensible sounds (no clear words, only moans or groans)	2
	No response	1
Best motor response	Obeys commands (follows simple commands)	6
	Localizes to pain (tries to locate towards the stimulus in an attempt to remove the source of the pain.)	5
	Withdrawal from pain/normal flexion (arm withdraws to pain, shoulder abducts)	4
	Abnormal flexion (flexes the arm and rotates the wrist)	3
	Extension (shoulder adducted and forearm internally rotated)	2
	No response	1

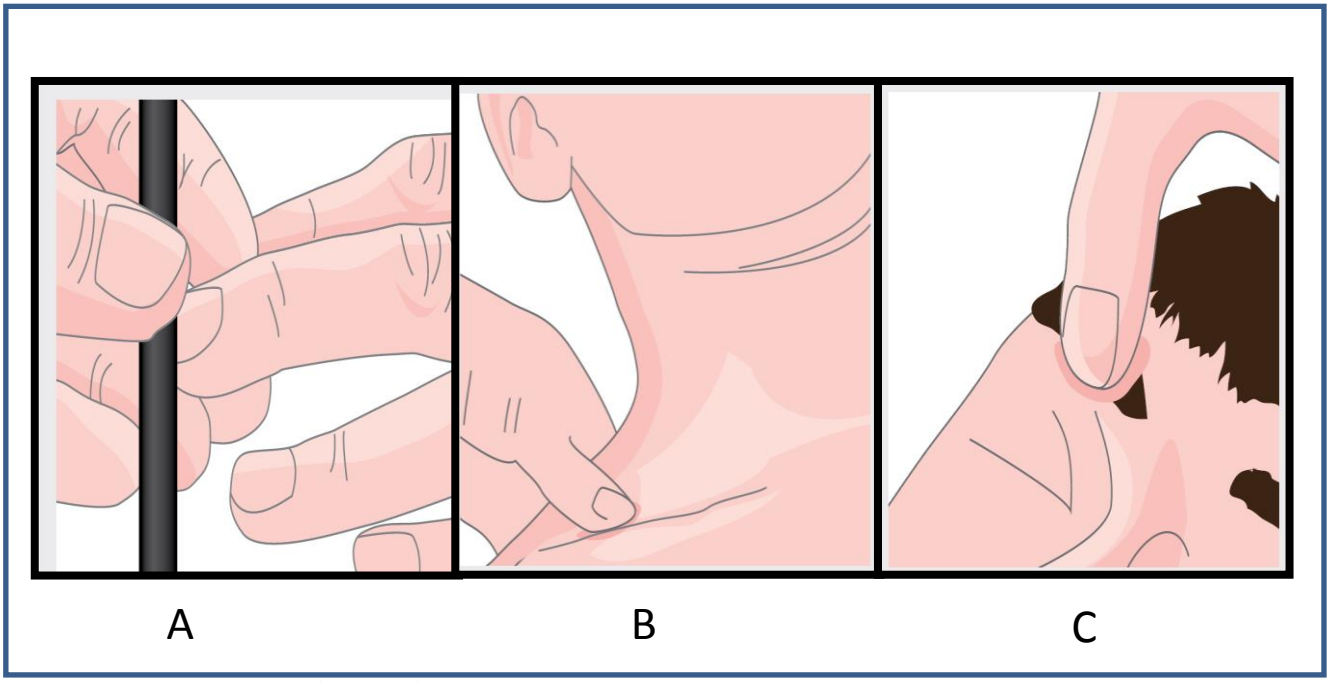

Fig. 1: Painful Stimuli for GCS. A: Digital Compression, B: Trapezius Squeeze, C: Supraorbital Pressure

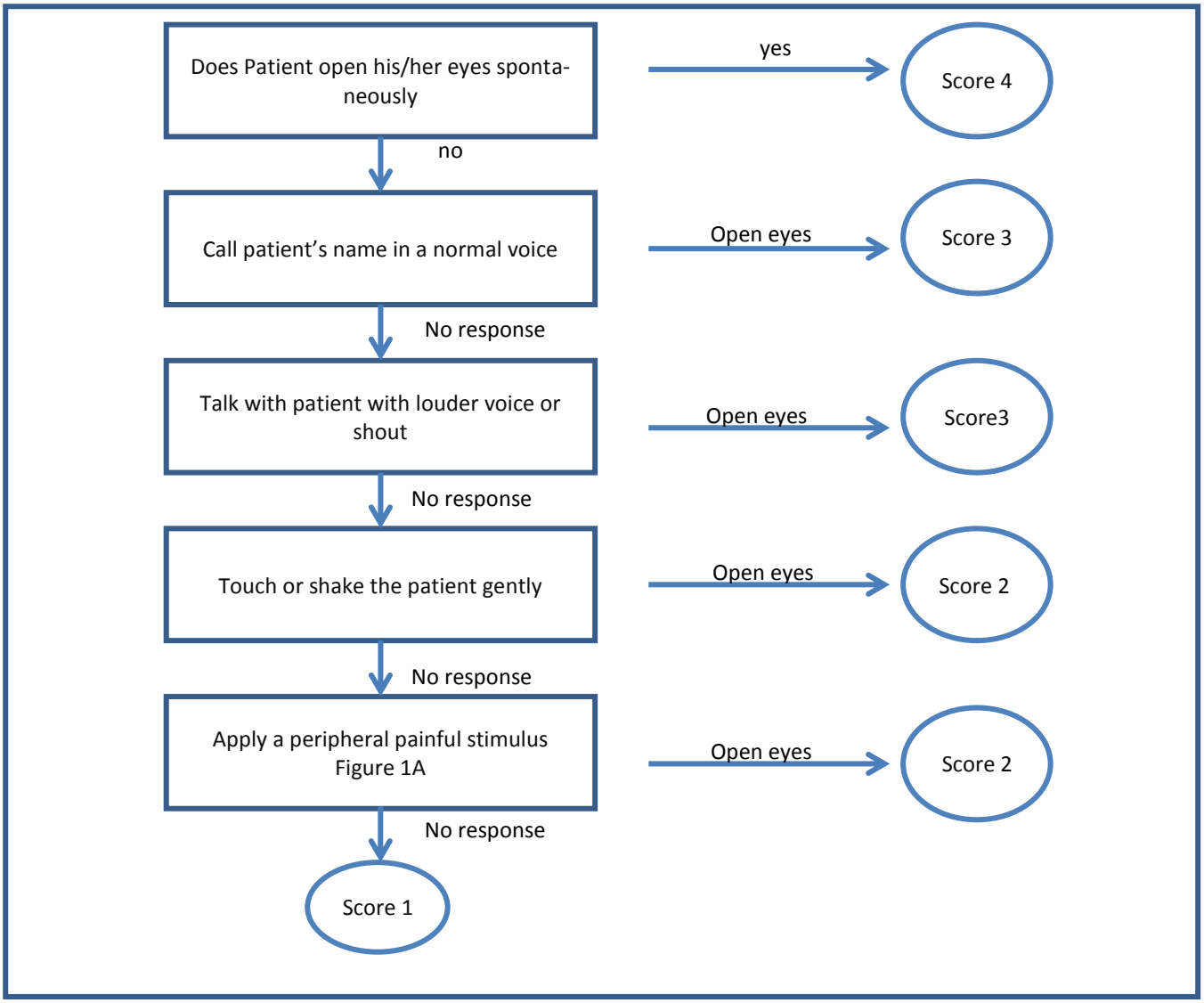

Fig. 2: Eye Opening Flow Chart

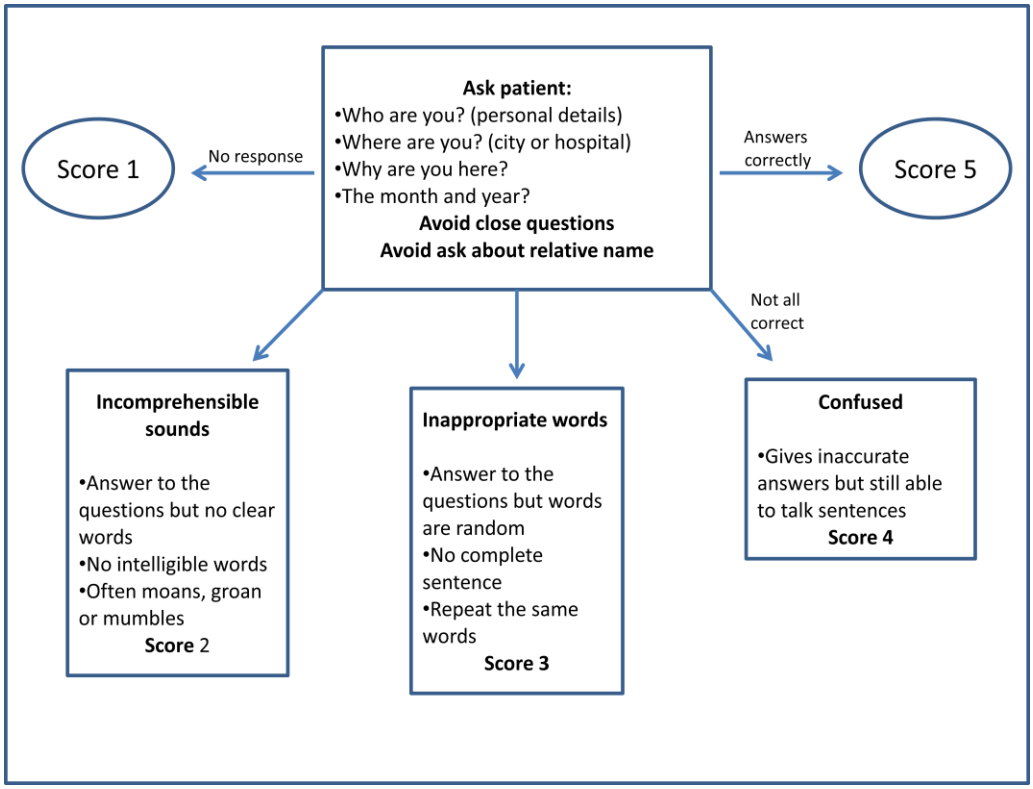

Fig. 3: Best Verbal Response Flow Chart

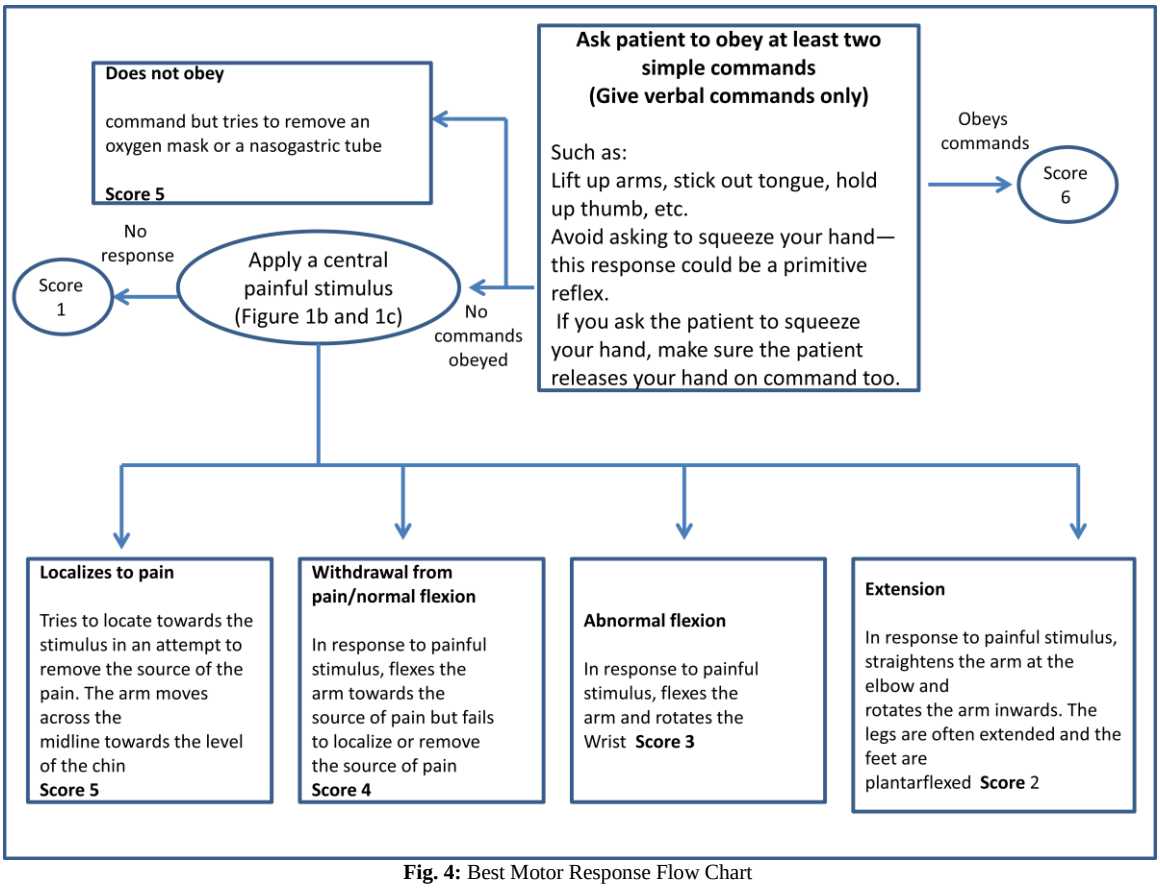

Fig. 4: Best Motor Response Flow Chart

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