**Performing neurological observations**

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**ABSTRACT**

Trauma to the brain from injury or illness can cause sustained, raised intracranial pressure. In such patients, neurological observations are a fundamental aspect of nursing care and the ability to make and record such observations accurately is an essential nursing skill. Neurological observations are a collection of information on the function and integrity of a patient’s central nervous system—the brain and spinal cord. This article will discuss the tools used in their observation, including the Glasgow Coma Score tool, pupillary response, and limb power observations, and provide a ‘how-to’ guide on neurological observations

**Key words:** Neurological observations ■ Neurological nursing ■ Intracranial

Pressure ■ Glasgow Coma Scale

Neurological observations are the collection of information that indicate the function and integrity of a patient’s central nervous system (brain and spinal cord). Neurological observations should only be performed by appropriately competent staff and must be recorded accurately (National Institute for Health and Care Excellence (NICE), 2017). The frequency of neurological observations will be dictated by the condition of the patient and reviewed regularly by a registered practitioner (NICE, 2017). Their professional knowledge and judgement, and following NICE guidance, will prescribe the frequency of this assessment, which can be as regular as every 15 minutes, depending on the patient’s clinical condition. Any neurological deterioration must be reported promptly as the sooner changes are recognised, the less chance of permanent secondary damage to the brain.

**Brain pressure**

Intracranial pressure is determined by the pressure within the cranium. The cranium is made up of brain matter, blood and cerebrospinal fluid (CSF). Under normal conditions, intracranial pressure (ICP) is determined by changes in the intracranial blood volume and in the pressure exerted by the CSF that circulates around the brain and spinal cord and within the cerebral ventricles.

It is difficult to establish a universal ‘normal value’ for ICP because it will depend on age, body posture, and clinical conditions. In the horizontal position, the normal ICP in healthy adult subjects was reported to be within the range of 7–15 mmHg (Czosnyka and Pickard, 2004). In the vertical position it is negative with a mean of around −10 mmHg, but not exceeding −15 mmHg (Czosnyka and Pickard, 2004). Karakis et al (2017) stated that abrupt changes in ICP from a stable level in response to activity causing increased or decreased heart rate, or a change in blood volume, such as being overloaded or underfilled, bleeding and sepsis, is called transient increased ICP. With cerebral trauma or neurological disease, the normal homeostatic mechanism controlling ICP may be disrupted, resulting in a sustained high ICP. The Monro- Kellie hypothesis states that the skull, a rigid compartment, is filled with essentially non-compressible contents—the brain and interstitial fluid (80%), intravascular blood (10%), and CSF (in the ventricles and subarachnoid space) (10%). These must be constant, or else a pressure change will occur, affecting autoregulation, blood flow and result in content shifts within

the fixed skull. This hypothesis applies only when the skull is fused (i.e. a closed box). Common causes of raised intracranial pressure are listed in *Box 1*.

Is should be noted that, as intracranial pressure rises, the blood flow within the cerebrum is reduced, affecting the medulla oblongata. This can lead to increased blood pressure and a slow pulse, known as the Cushing reflex, and is a late and grave sign (Bickley, 2017).

Neurological observations

Neurological observations are undertaken in three key areas:

■■ Glasgow Coma Scale (GCS) results

■■ Focal signs: pupillary response and limb power

■■ Vital signs.

The Glasgow Coma Scale

The GCS was developed in 1974 by neurosurgeons Brian Jennett and Graham Teasdale in Glasgow and was quickly adopted internationally as a standardised tool for assessment of consciousness level (Teasdale, 2014). The scale is divided into three subscales with each subscale given a score that is added together to give an overall score of between 3 and 15. The three key areas of the GCS are: eye opening (1-4), verbal response (1-5) and motor response (1-6). Eye opening is a measure of arousal rather than awareness and is assessed as shown in Table 1. Factors influencing the score but not necessarily indicating lack of arousal include deafness in a patient or if a patient’s eyes are closed by swelling. In this instance a ‘C’ will be documented.

The patient’s verbal response is used to assess higher cerebral function, including awareness of time, place and person and is assessed as shown in Table 2. Factors influencing the score but not necessarily indicating

lack of awareness or cognitive function would be dysphasia (difficulties with speech) recorded as ‘D’, or the presence of a tracheostomy, which can be documented as ‘T’. Assessment of the motor response (Table 3) is recognised as the most significant component of the GCS in predicting patient outcome and is the most difficult to assess accurately (Woodward and Mestecky, 2011). When assessing motor response, the nurse will assess the patient’s ability to understand language and simple commands. This indicates the integrity of the motor cortex. If the patient does not simply obey commands (scoring 6), the best response should be recorded—only one limb needs to respond for a score of 5 or less. Factors influencing motor response include sedatives and muscle relaxants. Once the GCS is completed the information is plotted on a recording chart using dots to represent a visual perspective of the deterioration, improvement or stability of the patient. Based on the score, health professionals can determine the severity of the condition or the level of consciousness. For example, a patient with a score of 15 would be fully alert and oriented, whereas a patient with a score of 3 is indicative of deep coma (Hickey, 2013).

Box 1. Common causes of raised intracranial pressure

■■ Increased brain volume caused by:

–– Intracranial space-occupying lesions

–– Brain tumours

–– Brain abscess

–– Intracranial haematoma

–– Intracranial vascular malformation

–– Cerebral oedema

–– Encephalitis (viral, inflammatory)

–– Meningitis

–– Hypoxic ischaemic encephalopathy

–– Traumatic brain injury

–– Hepatic encephalopathy

–– Reye’s syndrome

–– Stroke

■■ Increase in cerebrospinal fluid volume caused by:

–– Hydrocephalus

–– Choroid plexus papilloma

■■ Increased blood volume caused by:

–– Vascular malformations

–– Cerebral venous thrombosis

–– Meningitis, encephalitis

**Focal signs**

**Pupillary response**

Careful examination of the pupil size and reactivity to light is an important part of the neurological assessment and assesses the third cranial nerve (occulomotor) function. Normal function of the third cranial nerve is indicated if the pupils constrict briskly with an equal size of 2 mm-5 mm. The pupils are assessed using a bright pen torch and pupillary size is compared with the scale printed on the torch or the neurological observation chart before and after the light source is shone into the eye (see Figure 1). When recording the pupil size it is important that each pupil is assessed separately with the light applied from the side of the eye being assessed, as this overcomes the accommodation response in which pupils constrict to a nearing object (Iggulden, 2006). Pupil size should be recorded in millimetres and the reaction recorded as positive (+) for a brisk response, sluggish (S) for a slow reaction and negative (-) for no reaction or fixed pupil If one pupil is fixed, dilated and unreactive to light this could indicate injury or pressure on one side of the brain; however, it is more serious if both pupils are fixed and dilated. Factors influencing abnormal pupillary size, shape and reactions, in the absence of raised intracranial pressure, include previous eye surgery, medication and hormonal disorders, which is why it is important to observe the pupils first before applying the light source (Waterhouse, 2005). Within the clinical setting the phrase ‘pupils are equal, round, and reactive to light and accommodation’ (PERRLA) is often used to help assess pupils.

**Limb power**

Assessment of limb power and movement is an important indicator of motor response and may give clues to the location and extent of the neurological dysfunction. Each limb is assessed separately for its strength, starting with the upper limbs. They are assessed as shown in *Table 4*, with each limb assessed individually as each side of the brain controls the opposite limbs so are recorded using left (L) and right (R).

**Vital signs**

Vital signs are also an important aspect of the neurological assessment, with Dougherty and Lister (2015) recommending that respirations are recorded first as they give the clearest indication of how the brain is functioning, followed by temperature (T), blood pressure (BP) and pulse (P). Recording of rate, depth and rhythm of respiration is important as any deterioration or abnormal patterns can indicate poor functioning of the vital centres of the brain. A raised temperature may indicate infection, but it can also indicate hypothalamic damage, because of its role in temperature regulation (Hickey, 2013). A slow pulse and rising blood pressure are indicative of raised intracranial pressure in patients with conditions that may cause the pressure inside the skull to rise. This may be indicative of brain herniation and is known as the ‘Cushing reflex’ (Bickley, 2017). While routine observation of vital signs is important for all patients, abnormal changes in respiration, blood pressure and pulse are late signs in the neurological patient and often occur after the patient’s consciousness level has deteriorated. *Table 5a* and *Table 5b p*rovide a ‘how-to’ guide to recording neurological observations.

**Table 1. Eye opening**

4 Spontaneously: eyes are open when approaching the patient

3 To speech: the eyes open in response to verbal stimuli/speech

2 To pain: the eyes open in response to painful stimuli e.g. trapezius squeeze or pinch or pressure to the side of the fingernail (not the nail bed)

1 None: no eye opening

**Table 2. Verbal response**

5 Oriented to time, place and person: questions might include who they are, where they are, the month and year

4 Confusion: the patient gives incorrect answers to any of the above questions but is able to speak in sentences

3 Inappropriate words: the patient is able to speak words but not in a coherent way or in response to questions asked

2 Incomprehensible sounds: the patient moans or groans with no clear words, more in response to stimulus

1 None: no verbal response

**Table 5b.** A how-to guide to neurological observations (continued)

**Pupillary response**

16. Both pupils must be assessed for size, shape, equality and reaction to light using a pen torch. Each eye is assessed separately. It is important to observe the pupil size before shining the pen torch into each eye and assessing the patient for any history that may affect pupil reactions e.g. cataracts, Holmes- Adie syndrome, or medication. Using a pen torch, shine the light from the side of both eyes moving to the inner aspect of the eye using a quick movement. Observe the pupil size, using the pupillary size guide on the neurological observation chart or on the pen torch (size 1-8) and the reaction to light (the pupil should constrict). This will be recorded for each eye as a brisk reaction (+), sluggish (S) or no reaction (-). If either eye is closed by swelling or trauma and it is inappropriate to open the patient’s eye to check the pupil, then this should be recorded as ‘C’

**Limb power**

17. To assess limb power, it is important that each limb is assessed separately for strength, which often begins with the upper limbs. To assess the strength of each arm the patient is asked to close their eyes and hold their arms out in front of them. The patient is also often asked to squeeze the hands or pull/ push against the health professional’s hands, so the strength and grip of each arm can be assessed. If both arms are the same, then they will both be recorded as normal power. If one or both of the arms drift away, or they cannot maintain the position or there is weakness in the power of either arm then it should be recorded as mild weakness

18. If the patient is unable to lift their arm but can make some movement then it should be recorded as severe weakness. It is important that each arm is assessed separately

19. If there is no movement of the arm, the trapezius squeeze is used. If there is no response, apply peripheral stimuli using a pencil or pen to the side of the

nail bed of each hand and record the response, which may be abnormal flexion, extension or no response as shown earlier in the assessment of the best motor response

20. To assess leg strength, ask the patient to raise both legs off the bed. Or the health professional can stand at the bottom of the bed and place their hands on the soles of each foot and ask the patient to push against their hand. Then the health professional can place their hands on the tops of each foot and ask the patient to try to pull their leg away. The strength of each leg should be assessed to determine whether it is normal power or mild weakness, and this needs to be recorded for each leg. If the patient is unable to raise their legs and there is limited movement then this should be recorded as severe weakness. As with the arms it is then important to apply central stimulus using the trapezius squeeze to assess for a response, if no response apply peripheral stimuli using the side of the nail-bed for each limb and record as extension to pain or no response.

**Vital signs**

21. Vital signs (temperature, blood pressure, pulse) will also be recorded on the neurological observations chart and should be performed with all the other neurological observations

22. Document the patient’s details carefully, remembering to ensure that you have included your signature, designation and date

**Conclusion**

Accurate assessment and recording of neurological observations are essential to establish the patient’s neurological status. Nurses play a vital role in detecting and reporting these changes

and concerns to doctors so that prompt treatment can be provided. Prompt and accurate neurological observations may consequently reduce the chance of permanent secondary brain damage—nurses’ recognition, reporting and early treatment of symptomatic patients is essential.

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