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## **Nursing approach to neurological assessment: children and young people**

Abstract - Neurological assessment and observation are important nursing skills. They are founded upon an accurate collection and documentation of information on the function and status of the client's nervous system. Assessing and then monitoring the impact on the client will ensure timely response to any change or deterioration. This article will discuss the main tools used in neurological observation and assessment, as well as consideration given to the vital role of parents and carers within the assessment.

Key words: Neurological observations, Neurological assessment, 'AVPU', Glasgow Coma Scale, Family Centred Care

Nurses completing a structured assessment will consider the neurological status of their client. This is the 'D' for Disability in the ABCDE algorithm taught in professional health settings. That is, issues related to neurological function, which in turn disable the client in some manner. Generally this relates to consciousness, which is the earliest and most sensitive indicator of change in neurological status (Hickey, 2013). If concerns are raised, assessment will include observations that indicate the function and status of a client's nervous system.

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 informed by the condition of the client and reviewed regularly by a registered practitioner (NICE, 2017). Professional knowledge, judgement and policy, will influence the frequency of this assessment, which can be as regular as every 15 minutes (Derbyshire and Hill, 2018). Any neurological deterioration must be reported promptly as support and intervention may be required.

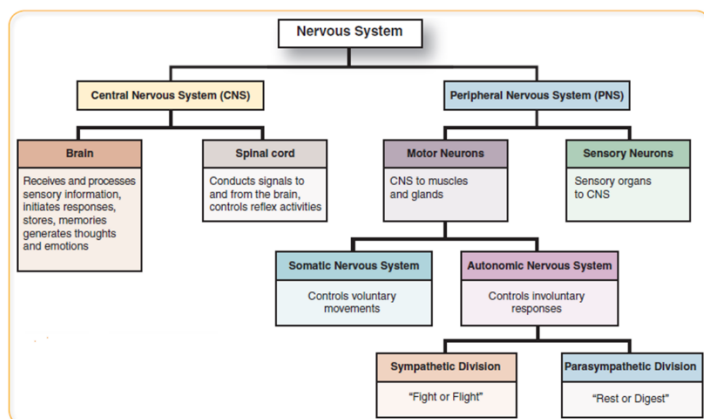
To ensure family centred care and accurate assessment the client and their family should have the need and process of neurological assessment explained (Shields et al., 2012). This should include a rationale for the frequency.

### Neurological structure and function

To understand the elements of a nursing neurological assessment it is necessary to first understand the structure and function of the nervous system. This is because if there is clear understanding of how a system is formed and how it behaves normally we are able to assess and identify change from this. The structure of the brain and spinal cord is complex however a visual overview can be helpful (**See Figure 1 for diagram of the brain and spinal cord**). The MonroKellie hypothesis states that the skull, is filled with non-compressible contents—the brain and interstitial fluid (80%), intravascular blood (10%), and Cerebral Spinal Fluid (10%) (Karakis et al., 2017). These must be constant, or else a pressure change will occur, resulting in complications. However this hypothesis applies only when the skull is fused, usually around the age of 2 years.

The nervous system is divided into the central and peripheral nervous system (See **Figure 2 – the nervous system**). The functions of the nervous system are vast and not yet fully understood by science (Woodward and Mestecky, 2011). They are further complicated by the age and stage of the client being assessed. For example, an individual’s emotional response to hunger differs between a two month old and an 18year old. However if we understand the functioning nervous system at different developmental stages our neurological assessment will be better informed. To expand a nurse who knows the stages of motor development in an infant and child can recognise any impairment to this and clarify with family if the client has reached that developmental mile stone See Figure 3 – motor development.

**Figure 2; something like this**



**Figure 3 – child motor development**

<b>Age</b>	<b>Developmental milestones</b>
0-6 months	<ul style="list-style-type: none"> <li>• Rolls over front to back and back to front</li> <li>• Sits with support and then independently</li> </ul>
6-12 months	<ul style="list-style-type: none"> <li>• Crawls forwards on belly</li> <li>• Assumes a seated position unaided</li> <li>• Creeps on hands and knees</li> <li>• Transitions into different positions</li> <li>• Pulls self to stand</li> <li>• Walks while holding onto furniture</li> <li>• Takes 2-3 steps without support</li> </ul>
18 months	<ul style="list-style-type: none"> <li>• Sits, crawls, walks</li> <li>• Still has wide gait but walking/running is less clumsy</li> </ul>
2 years	<ul style="list-style-type: none"> <li>• Walks smoothly and turns corners</li> <li>• Begins running</li> <li>• Is able to pull or carry a toy while walking</li> <li>• Climbs onto/down from furniture without assistance</li> <li>• Walks up and down steps with support</li> <li>• Picks up toys from the floor without falling over</li> </ul>
3 years	<ul style="list-style-type: none"> <li>• Imitates simple bilateral movements of limbs</li> <li>• Walks up/down stairs alternating feet</li> <li>• Jumps in place with two feet together</li> <li>• Able to walk on tip toes</li> </ul>
4 years	<ul style="list-style-type: none"> <li>• Stands on one foot for up to 5 seconds</li> <li>• Kicks a ball forwards</li> <li>• Throws and catches a ball overarm</li> <li>• Runs around obstacles</li> </ul>

	<ul style="list-style-type: none"> <li>• Able to walk on a line</li> <li>• Able to hop on one foot</li> </ul>
5 years	<ul style="list-style-type: none"> <li>• Able to walk up stairs while holding an object</li> <li>• Walks backward toe-heel</li> <li>• Jumps forward 10 times without falling</li> <li>• Skips forwards after demonstration</li> </ul>
6 years	<ul style="list-style-type: none"> <li>• Runs lightly on toes</li> <li>• Able to walk on a balance beam</li> <li>• Able to skip using a skipping rope</li> <li>• Can cover 2 metres when hopping</li> <li>• Demonstrates mature throwing and catching patterns</li> </ul>

Neurological assessment in children and young people may be required for a range of reasons (please see Box 1 for examples). It is a necessary skill for all children and young people's nurses. If we consider head injuries alone it is estimated around 30,000 children are admitted to hospitals every year (Great Ormond Street Hospital, 2015).

Box 1 contents;

Increased brain volume caused by: Brain lesions, Brain tumours, Brain abscess, Intracranial haematoma, Cerebral oedema, Encephalitis, Meningitis, Traumatic brain injury, Stroke

Increase in cerebrospinal fluid volume caused by: Hydrocephalus

Increased blood volume caused by: Vascular malformations, Cerebral thrombosis, Meningitis, encephalitis

Increased or decreased brain activity caused by: Epilepsy, Intoxication

Neurological assessment may include the following forms of nursing observation;

- AVPU and Glasgow Coma Scale (GCS)
- Pupillary response and limb power
- Vital signs

'AVPU'

AVPU is a quick and common way to assess a client's nervous system (American College of Surgeons, 1977). You will begin by waking the child. If a child or young person is fully alert and talking to you, they are 'A'. For an infant this may be presented as a coo or a babble. Essentially the client presents how they normally would. This is where the role of the parents or carers is vital in allowing a comparison to client's usual state.

If the patient is not fully alert, check they respond to your voice. Then your client is a 'V'. This may require a gentle touch. A response may be as simple as opening their eyes to look at the nurse.

If the patient does not respond to voice or touch, the health professional may need to apply painful stimulus (trapezius squeeze see Figure 3) - if there is a response of any kind, they are 'P' for responding to pain.

Those clients who do not respond at all are 'U' for unresponsive. If any concerns are highlighted they must be escalated rapidly.

A more detailed assessment is needed then a nurse may assess using the Glasgow Coma Scale.

### The Glasgow Coma Scale (GCS)

The GCS was developed in 1974 in Glasgow and is seen as a standardised tool for assessment of consciousness level (Teasdale, 2014). Various adaptations have been produced including paediatric guidelines which allow for the developmental age of the individual child. The scale is divided into three subscales; eyes, voice and movement (See example in Box 2 – GCS chart, British Paediatric Neurological Association, [BPAS] 2001). Each of these subscales is given a score that is added together to give an overall score of between 3 and 15. For example, a client with a score of 15 would be fully alert whereas a client with a score of 3 is indicative of deep coma (Hickey, 2013). However, the assessing nurse should not focus on the overall score alone. Any change in the clients presentation is important to identify and escalate accordingly.

#### Box 2 – GCS chart example (BPAS, 2001)

	Score	All children	Older than 5 years	Under 5 years
Eyes	E4 E3 E2 E1 C	Spontaneous To voice To pain None Eyes closed (by swelling or bandage)		
Verbal	V5  V4  V3  V2  V1  T		Orientated (in person or place or address)  Confused  Inappropriate words  Incomprehensible sounds	Alert, babbles, coos, words or sentences to usual ability (normal)  Less than usual ability, irritable cry  Cries to pain  Moans to pain
		No response to pain		
		Intubated		

Motor	M6		Obeys commands	Normal spontaneous movement
	M5	Localises to supraorbital pain (>9 months of age) or withdraws to touch		
	M4	Withdraws from nailbed pain		
	M3	Flexion to supraorbital pain (decorticate)		
	M2	Extension to supraorbital pain (decerebrate)		
	M1	No response to supraorbital pain (flaccid)		

The process of completing a GCS and scoring is guided by the structure of the documentation. A nurse must select the relevant tool for the age of the child. However it is important to understand the relevance of each aspect. The three key areas of the GCS are: eye opening (scoring between 1-4), verbal response (scoring 1-5) and motor response (scoring 1-6). Eye opening is an assessment of arousal rather than awareness. The client's verbal response is used to assess awareness and higher cerebral function.

Accurate assessment of the motor response is challenging, particularly with children, but is recognised as the most significant component of the GCS in predicting client outcome (Woodward and Mestecky, 2011). When assessing motor response, the nurse will assess the patient's ability to understand and respond to simple commands. For example, can you place both hands against my palms and push me away? Conversely in infants observing their movement should give an indication of tone and strength (Great Ormond Street Hospital, 2015). Assessment of limb power and movement is not part of the GCS but is an accepted measure in neurological assessment. It is an important indicator as to the location and extent of the neurological difficulty (Derbyshire and Hill, 2018). Each limb is assessed individually as each side of the brain controls the opposite limbs.

### Pupillary response

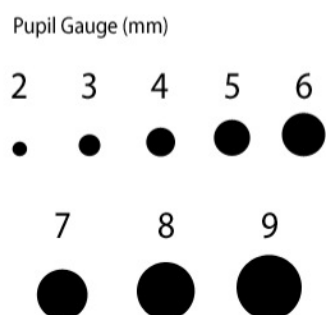
A brief assessment of the eyes allows information to be gained beyond if the client is rousable. By observing pupil size and response to light a nurse is able to consider the cranial nerve function (Derbyshire and Hill, 2018). Normal function is indicated if both pupils are an equal size and reacting when a pen torch is shone. The size is compared with a printed scale on the neurological assessment chart or the pen torch itself (See

Figure 4 – pupil size). When recording the pupil size it is important that each pupil is assessed separately. If assessing the right eye; the pen torch should begin from the right side of the face, moving the beam into the pupil and then away in the direction it came. This will be repeated with the left eye. 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 (Derbyshire and Hill, 2018). This process is challenging with children and young people particularly if you are asked to repeat observation throughout the night. Good explanation and distraction become essential techniques.

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. The nurse must consider factors which may influence pupil size or response; eye surgery, medication, a normal difference in pupil size and hormonal disorders (Waterhouse, 2005).

Figure 4 – pupil size chart (something like this)



## Vital signs

Vital signs are also an important aspect of the neurological assessment. Accurate recording of respiration is important as any deterioration or unusual patterns can indicate poor functioning of the vital centres of the brain. A raised temperature may indicate infection, but it can also indicate damage to the brain, because of its role in temperature regulation (Hickey, 2013). A slow pulse and rising blood pressure can indicate raised intracranial pressure.

With infants and young children there are some additional signs which indicate raised intracranial pressure; tense or bulging anterior fontanelle in infants, sun setting pupils in infants, high pitched cry, irritability or lethargy, vomiting and headaches (Great Ormond Street Hospital, 2015).

Factors that may influence the score of a child or young person

There are many factors to consider when assessing the neurological function of a child or young person. Having a family centred approach to care will be necessary to address or negate these factors. The input of family is vital in the assessment process. If they are not able to stay with the child then accurately recording their feedback regarding their child's presentation is key. The following is a list of suggestions to consider due to range of age and developmental stages of children;

- Cognitive function
- Verbal development or speech difficulties
- Tracheostomy
- Both medication and illegal substances which have a sedative or muscle relaxant affect
- Motor development
- Distress due to hospitalisation
- Over stimulation in a hospital setting
- Pain
- Change in routine affecting tired, hunger etc.
- Refusal to follow commands

The child or young person will usually benefit from having their parent or carer remaining with them during the period of assessment and observation. This is because they are most likely to respond to them but also being comforted by their presence. The child and their family, in hospital, should be nursed in an environment which is as calm as possible but also where consistent access and monitoring can occur. This is because too much stimulation can cause distress, however if the child or young person deteriorates it needs to be identified quickly.

## LEARNING OUTCOMES

- Understand the importance of accurate neurological assessment and the need to involve parents/carers
- Develop an understanding of the neurological observations which should influence your assessment

## Conclusion

Accurate assessment and recording of neurological assessment and observations are essential to establish the status of the client's nervous system. Nurses play a vital role in monitoring, detecting and reporting any concerns so that prompt treatment can be provided. The role of family is of great importance in forming an accurate assessment of a child or young person.

Declaration of interest: none

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