

**Guidelines for a Brief Neurological
Nursing Assessment in Acute Care**
A Literature Review

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Description <p>Every year in Finland approximately 25 000 people suffer from cerebrovascular disorders, such as strokes or transient ischemic attacks. If the prevention of these illnesses is not enhanced, morbidity is predicted to increase. There is an expectation that all nurses, regardless of their specialty, are able to perform a brief neurological assessment, identify the symptoms and, furthermore, respond to these as a medical emergency.</p> <p>The topic was the guidelines for a brief neurological nursing assessment in acute care. The aim was to collect guidelines for a brief neurological nursing assessment of a patient in acute care. The purpose was that nurses would acquire the knowledge of performing a brief evidence-based neurological assessment and that they would thus be able to differentiate abnormalities and arrange appropriate follow-up care.</p> <p>The method of the study was a narrative literature review. The data was collected from the article databases of EBSCO CINAHL, PubMed and Medic. The process consisted of limiting the topic, forming the research question, collecting relevant data, selecting articles, analyzing the data and reporting the findings. Eight (8) studies were selected for the final literature review according to the inclusion and exclusion criteria.</p> <p>The results highlighted six key components deemed most vital in a brief neurological assessment. The key components were as follows: history taking; level of consciousness; orientation, speech and language; pupillary assessment; vital signs; and motor assessment. It is hoped that this study would increase awareness of the topic and that professional competence could be further developed among health care professionals. In the future, it would be beneficial to conduct research on whether nurses are aware of and motivated to utilize newly found evidence-based methods in their work.</p>		
Keywords (<u>subjects</u>) Nursing, guidelines, neurological assessment, acute care		
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Tiivistelmä <p>Suomessa vuosittain noin 25 000 ihmistä kärsii aivoverenkiertohäiriöistä, kuten aivohalvauksista tai ohimenevästä aivoverenkiertohäiriöstä. Mikäli näiden sairauksien ehkäisyä ei tehosteta, sairastavuuden ennustetaan kasvavan. Kaikkien sairaanhoitajien oletetaan, erikoisalasta riippumatta, kykenevän suorittamaan lyhyen neurologisen arvioinnin, tunnistamaan oireet, ja lisäksi reagoimaan näihin hätätilanteena.</p> <p>Tavoitteena oli koota ohjeet lyhyeen sairaanhoitajan toteuttamaan neurologiseen arviointiin akuutissa hoidossa. Tarkoituksena on, että sairaanhoitajat saavat näyttöön perustuvaa tietoa lyhyen neurologisen arvioinnin suorittamisesta ja osaavat siten erottaa poikkeavuudet ja järjestää asianmukaista jatkohoitoa.</p> <p>Menetelmä oli narratiivinen kirjallisuuskatsaus. Aineisto kerättiin tietokannoista EBSCO CINAHL, PubMed ja Medic. Prosessi koostui aiheen rajaamisesta, tutkimuskysymyksen muodostamisesta, relevantin datan kokoamisesta, artikkeleiden valinnasta, datan analysoinnista ja havaintojen raportoinnista. Kahdeksan (8) tutkimusta valittiin lopulliseen kirjallisuuskatsaukseen mukaan poissulkukriteereiden pohjalta.</p> <p>Tulosten mukaan lyhyessä neurologisessa arviossa on kuusi tärkeintä avainkomponenttia, jotka olivat seuraavat: esitietojen kerääminen; tajunnantaso; orientaatio, puhe ja kieli; pupillien arviointi; vitaalit; ja motoriikan arviointi. On toivottavaa, että tietoisuus aiheesta lisääntyisi tutkimuksen kautta ja ammattitaitoa voitaisiin kehittää edelleen terveydenhuollon ammattilaisten keskuudessa. Tulevaisuudessa olisi hyödyllistä tehdä tutkimusta siitä, ovatko sairaanhoitajat tietoisia ja motivoituneita hyödyntämään uusia, näyttöön perustuvia menetelmiä työssään.</p>		
Avainsanat (<u>asiasanat</u>) Hoitotyö, ohjeet, neurologinen arviointi, akuuttihoito		
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1 Introduction

Every year in Finland approximately 25 000 people suffer from cerebrovascular accidents, such as stroke or transient ischemic attack. If the prevention of these illnesses is not enhanced, the morbidity is predicted to increase along the growing middle age of the population. (Aivoliitto 2013.)

The aging of the population puts pressure on the health care system to meet the changing demands of the community. Nurses' job is becoming more independent and more focused in the concept of Advanced Practise Nursing. The concept gives more responsibility to the nurses to assess and treat the patient on their own. The nurses are expected to be able to implement demanding decision-making and they are given more rights to, for example, prescribe medications. (Sairaanhoitajaliitto 2016.)

Neurological assessment skills are essential for acute care nurses. A nurse is often the first to notice changes in the patient's condition. Nurses should be able to assess a patient immediately during a possible acute neurologic event. The severity of the patient's outcome is affected by the nurse's ability to constantly observe and assimilate the assessment results as well as anticipate potential complications and immediate responses. A good nursing assessment identifies the changes in the patient condition and makes it possible for the nurse to initiate immediate interventions. A neurologic crisis can be prevented by discovering early warning signs and taking urgent action. Any changes are reported to the physician and an individualized care plan is often created in collaboration. (Crimlisk & Grande 2004, 3, 8.)

In Finland, neurological matters are examined and treated everywhere in the healthcare field including health centres, occupational health care, central-, regional- and university hospitals. There are two paths leading to specialized neurological care: in an acute situation by the assessment of paramedics or nurses, and in less emergent situations through referral by one's attending doctor. (Neurologia 2017.)

The objective of the neurological examination in acute care is to identify the neurological disorders that require immediate actions. Moreover, there is a need to find out whether or not there is a problem of neurological nature. Furthermore, neurological assessment is a basis for the patient's neurological monitoring and it also prioritizes the need for patient care and examinations. (Liimatta 2014.)

This thesis focuses on assessing patients who exhibit neurological symptoms and patients with possible neurological problems in acute care. The aim is to gather guidelines for neurological nursing assessment in acute care. The purpose of this thesis is for the nurses to acquire knowledge of performing a brief evidence-based neurological assessment and differentiate abnormalities thus arrange appropriate follow-up care.

2 The main concepts

2.1 Guidelines

Guidelines are statements to aid professionals and patient decisions about appropriate healthcare for specific clinical circumstances. The major benefits of guidelines are to improve the quality of care, health outcomes, consistency of care and the efficiency of health care. Thus, guidelines have the potential to reduce morbidity and mortality and ensure that patients will be cared for in the same manner regardless of location or caregiver. Guidelines can call attention to unrecognized health problems, preventive interventions and high risk groups. Moreover, the health care professionals can utilize guidelines for improving their clinical decision making. Evidence-based guidelines can clarify which interventions are of proved benefit, alert the professionals of unsupported interventions, reinforce the importance and methods of critical appraisal, and point out ineffective or even dangerous or wasteful practices. (Woolf, Grol, Hutchinson, Eccles & Grimshaw 1999, 527-529.)

Despite the benefits of the guidelines, potential harms exist. Inflexible guidelines may leave insufficient room for professionals to tailor the care when considering patient's medical history and individual circumstances. What is best for patients according to recommended guidelines, may be inappropriate for individuals and ignore patient's preferences. If clinical guidelines are flawed and offer inaccurate scientific information, they can end up compromising the quality of care. In addition, guidelines, even if correct, can be experienced time consuming or inconvenient to use by the professionals. (Woolf et al. 1999, 529-530.)

2.2 Nursing and neurological assessment

A nurse can work anywhere in varied areas of health care. However, a common thread uniting their work is the nursing process, which is the essential core of practice for a nurse to deliver holistic and patient-focused care. The first step of the process is the assessment, in which the nurse uses a systematic way to collect and analyse data about a client. The information required does not only concern physiological data, but also psychological, sociocultural, spiritual, economic, and lifestyle factors as well. The following step is nursing diagnosis, which includes nurse's clinical judgment about the client's response to actual or potential health conditions or needs. For instance, the diagnosis reflects not only that the patient is in pain, but that the pain can cause other problems, such as anxiety, poor nutrition or social alienation. Based on the assessment and diagnosis, nurse can plan and set measurable and achievable short- and long-range goals for the patient. The third step is implementing nursing care according to the care plan and physician's orders, in order to ensure the continuity of care for the patient during hospitalization and in preparation for discharge. The last step includes the constant evaluation of the patient's status and the effectiveness of the nursing care. (American Nurses Association 2017.)

According to Shah (1999) nurses and doctors execute neurological assessment for different reasons. Doctors primarily use the neurological assessment for discovering the site of the central nervous system problem, establishing a diagnosis or

determining the course of treatment. However, nurses utilize the assessment to: determine whether the patient has a neurological problem; establish the impact of a neurological condition on the patient's everyday life and independence; establish a baseline assessment of a patient's neurological function; determine any changes in the patient's neurological condition over some period of time; detect life-threatening situations and the ones that require medical intervention. A comprehensive neurological assessment is often the responsibility of a doctor. (Shah 1999.)

Neurological assessment is a method of obtaining specific information related to the function of a patient's nervous system. Neurologic observations allow monitoring and evaluation of changes in the nervous system that later on aid in the diagnosis and treatment, which impact patient prognosis and rehabilitation. (Restrepo 2013, 96.)

The neurological assessment is a key component in the care of the neurological patient and it can help the health care professional detect the presence of neurological disease or injury and monitor its progression. It will also aid the person conducting the assessment determine the type of care to be provided, and gauge the patient's response to those interventions. The initial assessment should be a comprehensive exam covering several critical areas, while also establishing a baseline data with which to compare subsequent assessment findings. Once a thorough exam is done on admission or at the beginning of each shift, the next control assessments should be problem-focused, zeroing in on the parts of the nervous system affected by the patient's neurological condition. The patient's diagnosis will determine how extensive the subsequent assessments will be and how frequently they'll need to be conducted. (Noah 2004, 18-19.) Rechecking the neuro exam at periodic intervals with any patient that has a neurological deficit is essential (Constantine 2014, 5).

Specific signs and symptoms manifested by the patient are associated with specific areas of the brain and nurses observe for these signs and symptoms that may be abnormal and link them to general areas of the nervous system that may be causing the disturbance. One must also recognize when further neurological injury is

manifesting and intervene appropriately, and notify the physician in charge for a change in plans regarding the patient. It might not be necessary to perform a complete neurological exam on a patient with no suspicion of neurological disorders, while a complete baseline neurological examination should be conducted on any patient that has verbalized neurological concerns in their history. (ibid., 5.) No matter how brief or extensive the neurological assessments are, comparing new findings to those of previous exams is crucial (Noah 2004, 20).

2.3 Acute care

Acute care can be defined as a way to treat patients with urgent injuries or illnesses which usually are sudden and unexpected. They can have a risk of leading to a disability or even death without fast intervention. A variety of clinical health care functions are included in the term acute care. These functions include, for instance, prehospital emergency care, trauma care, emergency medicine and acute care surgery as well as critical care. (Calvello, Hirshon, Narayan, O'neill, Risko, Stewart de Ramirez & Theodosis 2013.) The goal of acute care is to discharge patients as soon as they are healthy and stable (Acute Care 2017). In this thesis, the focus is on patients in acute care anywhere in the healthcare sector, for example, in acute primary care, as well as acute secondary care. There, the patients who exhibit neurological symptoms and thus need a neurological assessment are the focus of this thesis.

3 The nervous system

Neurology is a specialty that considers normal functioning, examination, treatment and rehabilitation of the disorders of the nervous system (Tortora & Derrickson 2011, 447; Neurologia 2017). The nervous system regulates body activities by responding rapidly using nerve impulses. Moreover, the nervous system is responsible for our perceptions, memories, behaviour and initiating all voluntary movement. The nervous system is one of the smallest and yet the most complex of the 11 body systems. This sophisticated network consisting of billions of neurons and even more

neuroglia is organized into two major subdivisions that are the central nervous system (CNS) and the peripheral nervous system (PNS). (See Figure 1.) (Tortora & Derrickson 2011, 447-448.)

The central nervous system is composed of the brain and spinal cord. The brain is located in the skull and includes about 100 billion neurons. The spinal cord includes about 100 million neurons and is connected to the brain through the foramen magnum of the occipital bone. The spinal cord is encircled by the bones of the vertebral column. (ibid., 448.)

The peripheral nervous system is composed of all nervous tissue outside of the central nervous system. The components include nerves, ganglia, enteric plexuses and sensory receptors. The peripheral nervous system is organized into somatic nervous system (SNS), autonomic nervous system (ANS) and enteric nervous system (ENS). (See Figure 2.) (ibid., 448.)

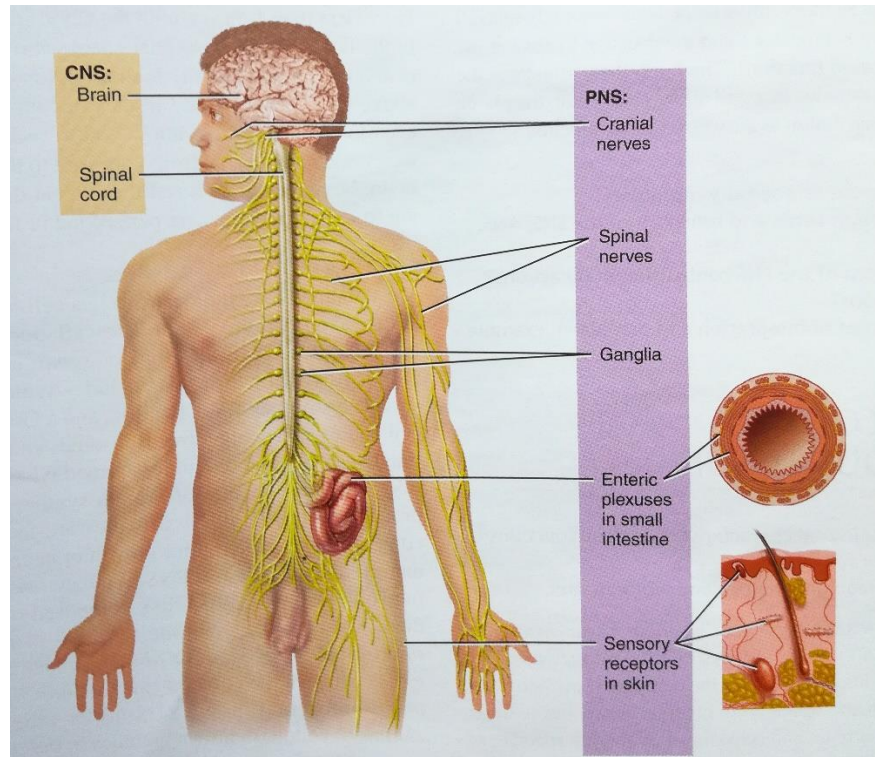


Figure 1. Subdivisions of the nervous system (Tortora & Derrickson 2011, 449)

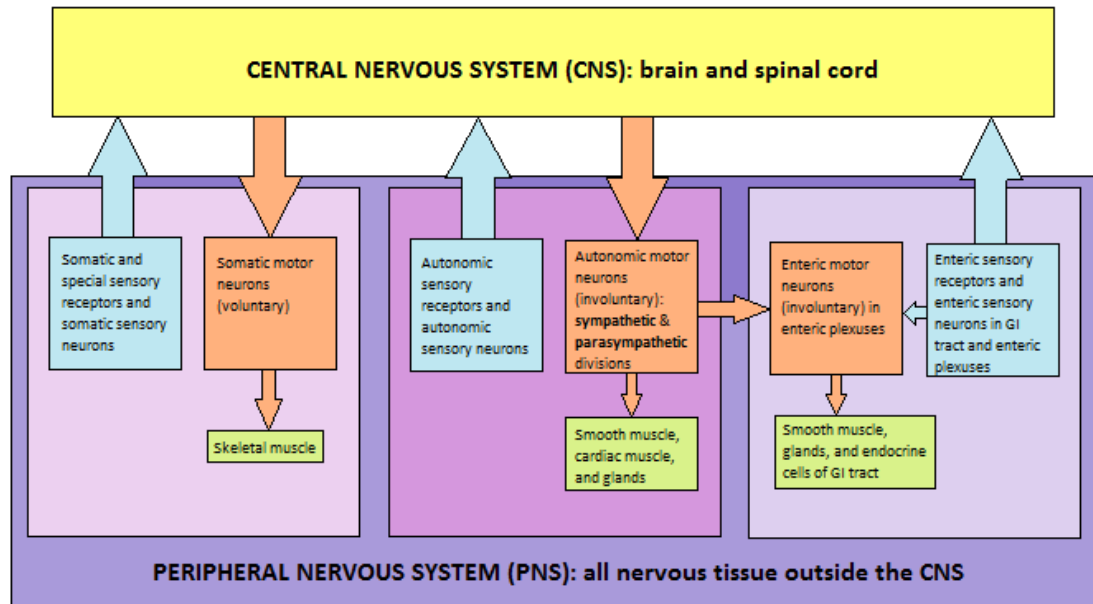


Figure 2. Nervous system organizational chart (Tortora & Derrickson 2011, 449)

The diverse activities of the nervous system can be gathered into three basic functions: sensory (input), integrative (process) and motor (output). Sensory receptors detect internal or external stimuli and the information is then carried into the brain and spinal cord through cranial and spinal nerves. By analysing and making decisions for appropriate responses, in other words integrating, the nervous system processes the sensory information. After integrating the information, the nervous system may elicit an appropriate motor response by activating effectors through cranial and spinal nerves. When the effectors are stimulated, it causes the muscles to contract. (ibid., 448.)

Cranial nerves are part of the peripheral nervous system and they create a direct connection between the body and the brain (Farley, Hendry, Johnstone & McLafferty 2014, 46). There are 12 cranial nerves and all of them have their own principal function. The brainstem is the origin of ten of the 12 cranial nerves whereas the other two originate from the cerebrum. The cranial nerves can be affected by problems such as head injuries. A systematic approach should be used in the examination of the cranial nerves and all findings should be documented, whether they are normal or not. Abnormalities in the results help in the determination of further investigations and tests. The patient history may help in the decision making

of which nerves to examine. In acute care settings, obtaining a full cranial nerve assessment is often impossible due to the expeditious nature of the assessments. A more precise cranial nerve assessment by a physician is often done in secondary care. (Cox, Boswell, McGrath, Reynolds & Cole 2004, 14-15; Polikliinisesti tutkittavat oireet ja sairaudet 2017.)

Neurological disorders include the nervous system disorders, in other words, the brain, spinal cord and peripheral disorders and neuromuscular disorders (Alanen, Jormakka, Kosonen & Saikko 2016, 104). Injuries of the brain are classified as focal or diffuse. Focal damage can be the result of contact injury resulting in, for example, contusion, laceration or intracranial haemorrhage. Diffuse damage is due to acceleration or deceleration injury types that result in diffuse axonal injury or brain swelling. (Werner & Engelhard 2007, 4.)

Moreover, the outcome of the brain injury can be divided into two categories; primary damage and secondary damage. Primary damage includes mechanical damage which occurs at the moment of impact and the treatment is entirely sensitive to preventive but not therapeutic measures. Secondary damage includes delayed non-mechanical damage, and represents processes initiated at the moment of injury with a delayed clinical presentation, for example, cerebral ischaemia and intracranial hypertension. The treatment is sensitive to therapeutic interventions. (ibid., 4.)

4 Neurological symptoms

Neurological symptoms arise from the central nervous system or the peripheral nervous system. The most common neurological symptoms include headache, paralysis or muscle weakness, dizziness, tremors, numbness and paraesthesia. Neurological diseases can also cause loss of perception, logical thinking, production of speech or understanding as well as disturbances in recognition of matters and memory. Moreover, seizure-like symptoms, such as changes in vision, hearing and

loss of consciousness as well as convulsion seizures are included in the spectrum of neurological symptoms. (See Table 1.) Neurological symptoms are caused by a wide variety of conditions, such as neurological diseases. They may also be associated with other conditions, such as back problems and diabetes. (Neurologia 2017; Soinila, Katse & Somer 2006, 144.)

Table 1. (Neurologia 2017; Soinila, Katse & Somer 2006, 144)

Neurological symptoms

<i>Headache</i>
<i>Dizziness</i>
<i>Seizures and tremors</i>
<i>Paralysis or muscle weakness</i>
<i>Numbness and paraesthesia</i>
<i>Changes in mood and sleep pattern</i>
<i>Syncope and loss of consciousness</i>
<i>Disturbances in recognition and memory</i>
<i>Disturbances in logicity and understanding</i>
<i>Changes in vision</i>
<i>Changes in hearing</i>
<i>Changes in speech</i>

Most commonly figuring out the cause of the symptoms, such as disturbances in memory, tremors and numbness, starts in health care centres or in occupational health care. Even though neurological symptoms and diseases can be acute, many of them do not necessarily need immediate neurological care. For example, examination and treatment of chronic headache, such as tension headache or migraine, is carried out in primary health care. Doctors refer the patient to the regional neurology polyclinic when the diagnose or follow up care requires a consultation of a neurologist. (Neurologia 2017.)

However, all of the neurological symptoms can be a sign of an acute problem and need to be assessed properly. Most common symptoms considered to be severe

include, for example, lopsided paraesthesia, difficulties in speech or prolonged epileptic seizures. In acute cases, the patient is transferred to an emergency unit where proper assessment of the patient's neurological status can be made without delay. (Päivystyksenä hoidettavat neurologiset oireet ja sairaudet 2017.)

5 Aim and purpose

The aim of this thesis is to gather guidelines for a brief neurological nursing assessment of a patient in acute care.

The purpose of this thesis is for the nurses to acquire knowledge of performing a brief evidence-based neurological assessment and differentiate abnormalities thus arrange appropriate follow-up care.

Research question:

1. How to implement a brief evidence-based neurological assessment of a patient in acute care as a nurse?

6 Methodology

6.1 Literature review

A literature review is an account of what has been published on a certain topic by accredited scholars and researchers. The purpose of a literature review is to convey the knowledge and ideas which have been established on a topic to the reader, and what their weaknesses and strengths are. A literature review must be defined by a guiding concept, for example the issue being discussed or the research objective. Writing a literature review lets the author demonstrate their information seeking

ability, as well as their critical appraisal: the ability to apply the principles of an analysis in order to identify unbiased and valid studies. A literature review must be organized around and related directly to the thesis or the research question being developed as well as synthesize the results into a summary of what is and is not known. Moreover, the review must identify areas of controversy in the literature and formulate questions that need further research. (Taylor 2012.)

The method utilized in this thesis is a narrative literature review. It is one of the most often used types of literature review and can be described as an overview without strict rules. The studied phenomenon can still be illustrated thoroughly. The purpose of a narrative literature review is to concisely and consistently synthesize previously conducted studies. Narrative literature review helps to update research data but is sometimes at fault of subtle leading as well as being biased. (Salminen 2011, 7.)

Using a literature review is rational in this case, as many studies have already been conducted on the topic of neurological patient assessment. Using this previous knowledge and information collected to make a clarifying compaction seemed like the most beneficial method of looking into the matter at hand. Moreover, the results of the data analysis would be helpful in identifying and explaining the possible contradictions or gaps in knowledge concerning the topic.

6.2 Literature search

The data for this literature review was collected from the article databases of EBSCO CINAHL, PubMed and Medic. Different combinations of relevant keywords were tested prior to the data search. The best results were obtained by combining the following words: *nursing, neurological, neurologic, examination, assessment, acute care, neurology* and *neurologinen*. The discovered data was glanced through and on the basis of relevant titles the abstracts were read. On the basis of the abstracts, the suitable articles were selected. After reading through these studies, the final selection was made based on the predetermined inclusion criteria. (See Table 2.) The criteria were selected in order to find relevant, high quality and current research material. Matters limiting the search were lack of knowledge in languages other than

English or Finnish, and lack of financial resources and funding. Articles that did not follow the inclusion criteria, such as studies that did not answer the research question, were excluded from the data for this study.

Table 2. Inclusion criteria

Inclusion criteria

<i>Responds to the research question</i>
<i>Study in English or Finnish</i>
<i>Scientific publication</i>
<i>Full text access through JAMK provided databases</i>
<i>Published between the years 2007 and 2017</i>
<i>Studies considering neurological nursing assessment/examination in acute care</i>

The data search was conducted in January 2017. The search yielded 13 relevant articles, and after excluding the duplicates, 8 relevant articles were left for reviewing for this study. (See Table 3.) Appendix 1 presents the chosen articles by their authors, year of publication, place of study, titles, aims, type of the study/article, and how the article/study answers the research question.

Table 3. Data search

Database	Key terms	Results	Chosen on the basis of title	Chosen on the basis of abstract	Relevant studies
<i>EBSCO Cinahl</i>	“neurologic* assessment” AND Nursing	10	7	5	3
<i>EBSCO Cinahl</i>	“nursing assessment” AND “neurologic* examination”	17	14	11	5
<i>EBSCO Cinahl</i>	“acute care” AND neurologic* AND assessment	17	10	5	1
<i>EBSCO Cinahl</i>	neurology AND assessment AND nursing	8	4	0	0
<i>Medic</i>	“neurologic examination”	9	8	4	2
<i>Medic</i>	neurologinen	23	15	8	2
<i>PubMed</i>	neurologic assessment AND nursing	25	8	5	0
<i>PubMed</i>	neurological AND examination AND nursing	48	10	6	0
<i>PubMed</i>	neurological assessment AND acute care AND nursing	45	10	6	0

6.3 Analysis and synthesis of data

In a narrative literature review qualitative or quantitative content analysis can be used. The purpose of the analysis is to compare the studies based on the results, as well as forming larger conclusions. In narrative literature review the researcher can decide what to use to arouse the interest of the reader in the content analysis.

(Kangasniemi, Utriainen, Ahonen, Pietilä, Jääskeläinen & Liikanen 2013, 296-297.)

There can be different types of content analysis. A content analysis is valuable for categorizing the substantive focus of published research and for providing a parsimonious perspective on the discussed topic and insight into what is viewed as important to the field of relevance. (Eby, Casper, Lockwood, Bordeaux & Brinleya 2005, 125.)

The chosen method for this thesis was thematic analysis. Thematic analysis is a qualitative analytic method to analyse, identify and report patterns within the data. It can minimally describe and organize the data set in proper detail. Moreover, it can often go further and interpret various aspects of the research topic. (Braun & Clarke 2006, 79.)

All chosen eight articles were read by all four researchers multiple times in different stages of the analysis. The articles were printed, read and highlighted for parts answering to the research question. This was first done individually, then following group meetings where articles and highlighted parts were glanced through together to confirm and agree the relevance of the same parts. The highlighted parts were further searched for subcategories and themes relating to the same, more detailed, matters and subjects that were concurrent and repetitive in the chosen articles. (See Figure 3.) After finding the themes as a group, they were shaped into components of performing a brief neurological nursing assessment. The components were equally assigned to between the researchers for deeper observation. Each researcher read the articles individually again and onward to obtain comprehensive data for their result components. Further component-focused highlighting was performed individually, and on the basis of these parts the result chapters were written. Consulting the other member of this thesis group, helped the researcher in constructing an image of what are the main contents of each theme and final component. The result chapters were reviewed and discussed inside the thesis group, and with a mutual decision adaptations and editing was performed in order to reach the final format.

HOW TO IMPLEMENT A BRIEF EVIDENCE-BASED NEUROLOGICAL ASSESSMENT OF A PATIENT IN ACUTE CARE AS A NURSE?

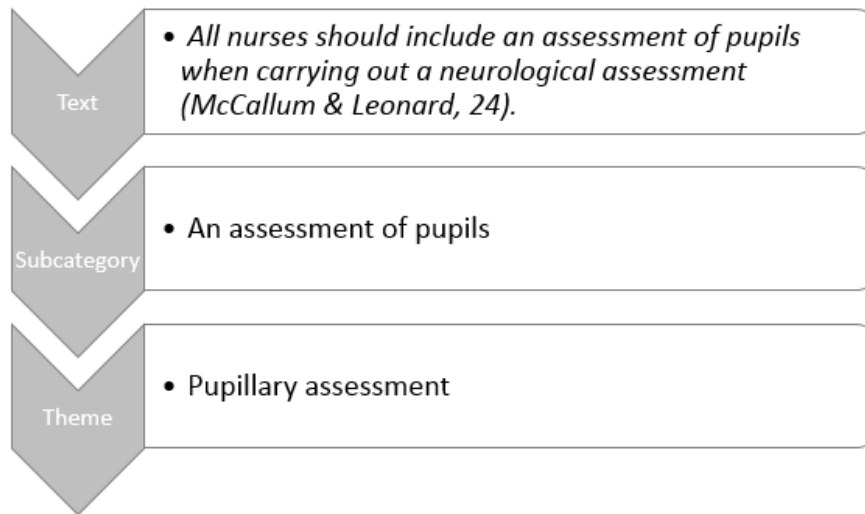


Figure 3. An example of implementing thematic analysis

7 Results

7.1 Components of neurological assessment

The results show that there is no clear consensus among experts regarding the optimal order of performing components of neurological examination and that the practices can vary widely between health care institutions or even colleagues on a given unit. (Gocan & Fisher, 2008, 32.) Components of a neurological assessment presented in the reviewed articles were similar yet differentiating to some extent. Six components were chosen as a result based on their incidence in the reviewed articles.

According to Cox (2008), neurological assessment starts with taking the patient's history to highlight or discount possible causes of any symptoms. In case the patient is showing signs of disorientation, amnesia or loss of consciousness, it is advisable to gather information about the patient's condition and health status from the family and friends (Mogensen 2008, 817-819; Sojila 2014, 413).

Assessing the patient's level of consciousness was one of the components of the neurological nursing assessment and was considered as the formal first step (Adoni & McNett 2007, 191; Cox 2008; Gocan & Fisher 2008, 34; Kallela, Häppölä & Eriksson 2014, 374; McCallum & Leonard 2013, 22; Mogensen 2008, 817; Soinila 2014, 416; Steen 2010, 50). Assessing a patient's conscious level is crucial and may occur informally during history taking (Cox 2008).

Assessing the patient's speech and language was specified as one of the main components of neurological assessment (Cox 2008; Gocan & Fisher 2008, 34; McCallum & Leonard 2013, 22; Mogensen 2008, 817; Soinila 2014, 416; Steen 2010, 50) as well as assessing the orientation of the patient (Gocan & Fisher 2008, 34; McCallum & Leonard 2013, 22; Mogensen 2008, 817; Soinila 2014, 416). McCallum and Leonard (2013) combined the assessment of orientation, speech and language due to convenience of performing the assessment of these three simultaneously while taking the patient's history.

One of the key components of a neurological assessment was specified to be the pupillary examination as it is one of the few neurologic signs that can be assessed in an unconscious patient (Cox 2008; Gocan & Fisher 2008, 34; McCallum & Leonard 2013, 22; Soinila 2014, 416; Steen 2010, 50). The more functional parts of examination were related to the motor assessment, which should include testing the patient's balance, pronator drift, strength, coordination, facial motor symmetry and sensory perception, (Cox 2008; Gocan & Fisher 2008, 34; McCallum & Leonard 2013, 22; Mogensen 2008, 817; Soinila 2014, 416; Steen 2010, 50) and monitoring the patient's vital signs (Cox 2008; Gocan & Fisher 2008, 34; Kallela, Häppölä & Eriksson 2014, 374; McCallum & Leonard 2013, 22; Steen 2010, 50). In addition to the monitoring of the vital signs, it is suggested that checking the patient's blood glucose levels should be included as well (Gocan & Fisher 2008, 34; McCallum & Leonard 2013, 22; Steen 2010, 50). Moreover, Cox (2008) expressed that neurological assessment should be augmented by the use of blood tests, as some symptoms may be the result of metabolic disturbances, such as renal impairment, diabetes or thyroid disorders, or of vitamin deficiency. (Cox 2008.)

There is an expectation that all nurses, regardless of specialty, are able to perform a brief neurological assessment, can identify the symptoms, and furthermore respond to these as a medical emergency (McCallum & Leonard 2013, 20). A brief neurological examination enables identification of any abnormalities that might be present. Nurses are in a capital position to notice and alert the appropriate medical professionals to a potentially critical deterioration in the patient's condition. (Cox 2008; McCallum & Leonard 2013, 21-22; Adoni & McNett 2007, 196.) Any neurological changes or deficits in patient's condition should be documented accurately and a physician should be notified immediately to ensure a more profound neurological assessment and proper follow-up care. (Cox 2008; McCallum & Leonard 2013, 21-22; Gocan & Fisher 2008, 35).

7.1.1 History taking

Neurological assessment starts with taking the patient's history. To ascertain the possible causes of the symptoms the patient is having and to determine whether they are neurological symptoms, it is vital to take a detailed history. Cox (2008) defines questions, which should be inquired in the initial assessment of the patient. (See Table 4.) (Cox 2008.)

Table 4. Questions for initial assessment (Cox 2008)

Questions for initial assessment

When did the problem start?

What exactly happens?

How often does it happen?

Are things getting better, worse, or staying the same?

Are the symptoms interfering with normal daily activities or with sleep?

Are the symptoms intermittent (if so, how often do they occur and for how long) or constant?

In addition to history of the presenting complaint, a full medical history should be taken. This should include details of any medication patient is having, including prescribed drugs, drugs bought over the counter, recreational drugs - both legal and illicit - and supplements. (Cox 2008.)

When taking the history, it is advisable to widen the timeline by utilizing the perceptions of the patient's friends and family, especially in case the patient is showing signs of disorientation (Mogensen 2008, 817-819; Soinila 2014, 413). Patients' family and friends often provide first-hand information on patient's condition and may know the current health status better than the nurse on hand (Kallela, Häppölä & Eriksson 2014, 372). Moreover, it may also be useful to acquire information concerning the patient's family history and socio-economic details (Cox 2008).

7.1.2 Level of consciousness

Level of consciousness contains both sensory awareness and an appropriate motor response; that is to say, is the patient awake and alert. Assessing the level of consciousness must be acknowledged as the formal first step in a neurological assessment of a patient. (McCallum & Leonard 2013, 22.) Assessing a patient's consciousness level is essential and may occur informally during history taking (Cox 2008). Any deterioration in the patient's consciousness level is a warning sign and must be acted upon (Steen 2010, 51).

An established way of assessing a patient's consciousness level is to use quick and simple orientation measuring tests. Age is asked, as well as the current month of the year. The patient is also asked to close their eyes and to squeeze their hand into a fist. (Soinila 2014, 416.) If patient is able to correctly answer questions and follow commands, that means that they're alert. However, if the patient fails to answer questions or follow commands it could indicate that the patient is either not alert or completely unresponsive, in varying degrees. Depending on the severity of the decrease in consciousness, the patient should be assessed using the Glasgow Coma Scale (GCS). (See Table 5.) (Gocan & Fisher 2008, 40.)

A simple, but effective tool for assessing the patient's conscious level is the AVPU tool. Patients will be given an "A" if they are fully alert, "V" for being only able to respond to voice commands, "P" for only responding to painful stimuli and an "U" if they are unresponsive. If an indication of a neurological deficit is observed, the Glasgow Coma Scale shall be used. (Steen 2010, 55.) The Glasgow Coma Scale is most widely used meter in assessing level of consciousness, and has the advantages of being simple and swift, while, however, it isn't a complete meter and can not be conducted on an intubated patient (Kallela, Häppölä & Eriksson 2014, 374).

Table 5. The Glasgow coma scale (Adoni & McNett 2007, 192)

<i>The Glasgow Coma Scale</i>	<i>Points</i>
<i>Eye opening</i>	
Spontaneous	4
Response to verbal command	3
Response to pain	2
No response	1
<i>Best verbal response</i>	
Oriented	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
No verbal response	1
<i>Best motor response</i>	
Obeys commands	6
Locales to pain	5
Withdraws to pain	4
Flexion to pain	3
Extension to pain	2
No motor response	1

7.1.3 Orientation, speech and language

The initial assessment of the patient's neurological status begins as soon as a nurse encounters the patient. Assuming the patient is awake and conscious, meeting and greeting provides an opportunity to assess their orientation, thought processing and perceptions during a brief conversation initiating from the encounter. (Cox 2008; McCallum & Leonard 2013, 22-23.) Being oriented is defined as being aware of place and time. If the initial conversation does not reveal the patient's orientation, the nurse can perform the assessment by asking the patient about the date and in what city or what kind of building they are in. Soinila (2014) expresses examples on how to assess the patient's alertness, attentiveness, orientation, communication and functional activity. (See Table 6.) If the patient shows signs of disorientation, a physician should be informed. (McCallum & Leonard 2013, 22-23; Soinila 2014, 416.)

Moreover, during the initial conversation the nurse is able to assess if there are any deficits in the patient's speech or linguistic content (McCallum & Leonard 2013, 22-23; Soinila 2014, 416). Abnormal speech pattern, slurred speech, one-word responses or using incorrect words to identify objects should prompt the nurse to perform additional assessment and to notify a physician (McCallum & Leonard 2013, 22-23; Mogensen 2008, 817). If the patient mixes up the names of objects or has difficulty with expressing themselves, they might have an expressive deficit thus a physician should be notified (McCallum & Leonard 2013, 22-23).

Table 6. Assessment of confusion (Soinila 2014, 417)

Cognitive activity	Assessment
Alertness	<i>Is the patient asleep? Is one able to wake the patient up with speech or shaking?</i>
Attentiveness	<i>Is the patient able to concentrate on the interview and examination?</i>
Orientation	<i>Can the patient tell the time and place?</i>
Communication	<i>Is the speech clear and the content appropriate?</i>
Functional activity	<i>Does the patient obey the requests appropriately? Is the activity appropriate and logical according to the situation?</i>

7.1.4 Pupillary assessment

One key component in assessing the patient's neurological status is the pupillary assessment. It is one of the few neurologic signs that can be assessed even if the patient is unconscious. It can provide essential information about the severity as well as the progression of the patient's condition. Subtle changes can be noticed in this minimally invasive assessment. (Adoni & McNett 2007, 191-192; McCallum & Leonard 2013, 24.)

Pupil size should be assessed by observing the pupil before and after a response to direct light. The pupils should be measured and compared in each eye for equal size. The reporting should be carried out in millimetres either as the width or diameter of each pupil. The use of a standardized pupil gauge helps in decreasing subjectivity and should be used especially when performing serial assessments. The average pupil diameter is 3.5 millimetres, although it is considered normal when ranging between 2 and 5 millimetres. Equality between both pupils' is desirable, however, a 1 millimetre difference is considered a normal deviance. (Adoni & McNett 2007, 193; McCallum & Leonard 2013, 24.)

The shape of pupil is normally round, although it can also be reported as irregular or oval. It is possible that an irregular-shaped pupil may be the result of a procedure

done in the past, for example, a cataract surgery. It should be taken into account in the assessment and further information should be inquired from the patient or the family. An oval-shaped pupil should be addressed immediately since it may be the sign of increased intracranial pressure. (Adoni & McNett 2007, 193).

The pupil reactivity is assessed by shining a bright light from the outer corner of the eye to the inner corner. The assessment is done one eye at a time. The reaction that each pupil has to the light should be reported as the response or reflex. The speed of the pupillary reaction should also be reported as brisk, sluggish or nonreactive. A normally reacting pupil should constrict briskly in response to light. There should also be a simultaneous constriction in the other eye as well. Slow response might be a sign of increased intracranial pressure and should be addressed immediately.

Nonreactive pupils are frequently associated with severe intracranial pressure and/or severe brain damage. (Adoni & McNett 2007, 193; Cox 2008; McCallum & Leonard 2013, 24.)

The assessment of pupil reactivity should also include the consensual pupil response and accommodation. When light is shined to the opposite eye, the constriction that happens in the pupil of the other eye is called the consensual pupil response. Several seconds should be waited before assessing the pupillary light reflex in the other eye as the pupil might be constricted. When a conscious patient is focusing on a close object, constriction of pupils, accommodation, occurs. The accommodation can be tested by holding an object within 4 to 6 inches of a patient's nose. It can also be checked by holding a finger in front of the patient and asking them to focus on the finger. It should be moved gradually towards the patient's nose. The normal reaction is for the pupils to constrict bilaterally and the eyes should converge. (Adoni & McNett 2007, 193; Cox 2008.)

Eye movements are checked by moving a finger upwards, downwards, sideways and diagonally and asking the patient to follow the finger. To assess the presence of nystagmus, flickering of the eye, the finger should be held at the extreme of each movement. (Cox 2008; Sojnila 2014, 416.)

When performing a neurological assessment, the patient should always be looked straight into their eyes (Kallela, Häppölä & Eriksson 2014, 373). An assessment of pupils should be included by all nurses while doing a neurological assessment (McCallum & Leonard 2013, 24). Regardless of the cause, when an abnormal pupil is detected or there are changes in the pupillary response, a physician should be notified immediately (Adoni & McNett 2007, 196).

7.1.5 Vital signs

Measurements of vital signs which include temperature, pulse, blood pressure, as well as respiratory rate and oxygen saturation should be performed and monitored in a neurological assessment (Gocan & Fisher 2008, 34; Cox 2008; Steen 2010, 51). (See Table 7.) In addition, blood glucose should be checked to exclude hypoglycaemic coma (Steen 2010, 55; Gocan & Fisher 2008, 34; McCallum & Leonard 2013, 22). The results and changes in patient's condition should be documented accurately (Gocan & Fisher 2008, 35).

Table 7. Vital signs (adapted from Steen 2010, 51)

Vital signs

<i>Parameter</i>	<i>Normal range</i>
Breathing rate	12-20 breaths per minute
Oxygen saturation	>94%
Pulse rate	60-100
Blood pressure	100-140/60-90 mmHg
Temperature	35.5-37.5°C
Blood glucose	4-8mmol/L (<i>in non-diabetic patients</i>)

7.1.6 Motor assessment

A neurological assessment should cover and examine the motor and sensory function (Cox 2008). Moreover, a neurological assessment should include a motor exam that consists of measuring balance, pronator drift, strength and coordination (Gocan &

Fisher 2008, 34). In addition, assessment of the facial motor symmetry (McCallum & Leonard 2013, 24), and sensory perception should be included (Cox 2008).

When the nurse, the examiner, smiles, the patient may respond with a spontaneous smile as well, which gives an opportunity to observe the patient's bilateral facial movements. It is a way to assess facial motor symmetry. (McCallum & Leonard 2013, 24.) Lopsided facial expression, inability to smile and drooping eye or mouth are signs of neurological problems (Cox 2008). To examine possible facial palsy, the examiner can ask the patient to show teeth, raise eyebrows and squeeze eyes shut (Gocan & Fisher 2008, 40).

The balance can be assessed simply by observing patient's walking (Soinila 2014, 418; McCallum & Leonard 2013, 24). Romberg's test is a traditional balance test in which the patient stands upright and still for 20 seconds and then is asked to close the eyes and remain standing still. Losing balance, falling and swaying in the test is a common reason for referral for further care. Only slight swaying should occur to be normal. Moreover, heel-to-toe walking may help identifying a gait disturbance. Balance can be assessed by looking for "pronator drift" as well. (Cox 2008; Soinila 2014, 414, 418.)

The pronator drift test is an easy and quick motor and sensory assessment that includes multiple areas of brain functioning. Independently the test carries a sensitivity of 22% in identifying an early focal neurological lesion. (McCallum & Leonard 2013, 24.) In pronator drift test patient is asked to hold their arms out in front of them, palms facing upwards, with eyes open and then closed. (See Figure 4.) It is considered abnormal and requires further investigation if there is any drifting of either arm up or down, or inability of either arm to resist a sharp downward tap from the examiner. (Cox 2008.) In order to test motor strength, the examiner can apply pressure to the outstretched arms and attempt to push the patient's arms down. Performing the pronator drift test for full 45 seconds is a good method to test motor strength as well. (McCallum & Leonard 2013, 24.) When testing motor strength, the patient should be able to hold arms up for at least ten seconds, and legs for five

seconds to achieve a normal result. The motor strength from the both upper limbs can be measured at the same time or separately, but the lower limbs should only be measured separately. (Soinila 2014, 416; Gocan & Fisher 2008, 40.) Ideally the pronator drift test is intended to be assessed in standing position, however, it can be done in a sitting position or lying down with the head of the bed elevated. (McCallum & Leonard 2013, 24). When assessing motor strength, the limbs should be at 90 degrees when sitting down, and at 45 degrees when lying down (Soinila 2014, 416). Another way to test motor strength is to test the grip strength (Mogensen 2008, 817; Soinila 2014, 414). The examiner holds both of the patient's hands and asks the patient to squeeze (Soinila 2014, 414; Cox 2008). The examiner can evaluate the strength and differences in coordination on each side to find abnormalities (Soinila 2014, 414). Limb weakness can indicate a deterioration in the brain function (Steen 2010, 55).

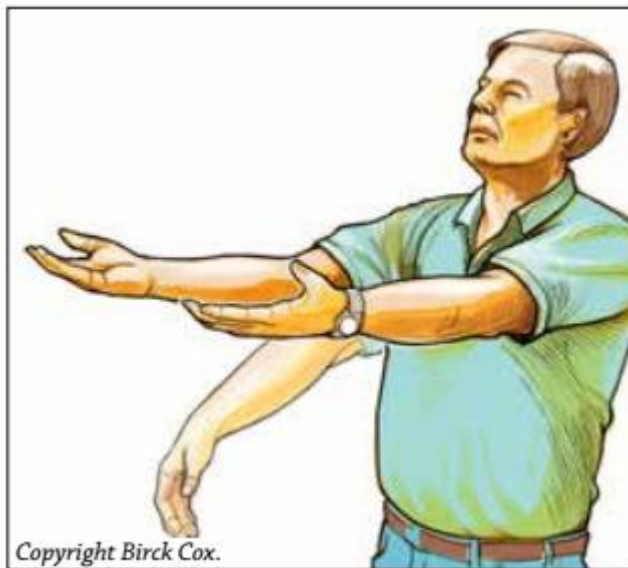


Figure 4. Pronator drift illustration (McCallum & Leonard 2013, 23)

Poor coordination is often one of the first signs of an underlying neurological problem (Cox 2008). Finger-nose test is used to assess coordination (Cox 2008; Gocan & Fisher 2008, 40; Soinila 2014, 414). The patient is asked to stretch out their hand to touch the examiner's index finger and then to immediately touch the tip of their nose. This manoeuvre is repeated several times and then done with the patient's

eyes closed. Missing the target may occur at first but the patient should be able to adjust quickly. Any failure to pinpoint or coordinate correctly can suggest an underlying disorder. (Cox 2008).

The sensory perception to touch is tested from a patient that is able to communicate whereas from an unconscious patient the sensory perception to pain is tested (Soinila 2014, 416). Cotton wool can be useful when assessing to recognise a soft touch. A sharp object, for example a pin, can be used when testing the pain. (Cox 2008.) Pricks or touches to face, trunk, both arms and legs are done and compared side to side to spot abnormalities (Gocan & Fisher 2008, 40).

7.2 Overview of the results

The results indicate that a nurse can implement a brief evidence-based neurological assessment in acute care by following guidelines that include six key components. Moreover, each component consists of more detailed parts, and when performed together will reach the full benefit of the assessment. (See Table 8.)

Table 8. Guidelines for a brief neurological nursing assessment in acute care

<i>Guidelines for a brief neurological nursing assessment in acute care</i>	
<i>History taking</i>	<ul style="list-style-type: none"> • History of the presenting complaint • Full medical history • Family history • Socio-economic details
<i>Level of consciousness</i>	<ul style="list-style-type: none"> • Measuring orientation • Questions and commands • AVPU tool • Glasgow Coma Scale
<i>Orientation, speech and language</i>	<ul style="list-style-type: none"> • Self-expression • Awareness of place and time • Thought processing • Deficits in speech or linguistic content
<i>Pupillary assessment</i>	<ul style="list-style-type: none"> • Size • Shape • Symmetry • Reactivity
<i>Vital signs</i>	<ul style="list-style-type: none"> • Breathing rate • Oxygen saturation • Pulse rate • Blood pressure • Temperature • Blood glucose
<i>Motor assessment</i>	<ul style="list-style-type: none"> • Facial motor symmetry • Balance • Pronator drift • Motor strength • Coordination • Sensory perception to touch/pain

8 Discussion

8.1 Ethical considerations, validity and reliability

According to Roberts and colleagues (2006) validity and reliability are ways of determining and communicating the rigour of research processes and the trustworthiness of research findings. The trustworthiness is dependent on a variety of research features. These include the initial research questions, the way the data is

collected and how it is analyzed as well as what conclusions are drawn. (Roberts, Priest & Traynor 2006, 41).

The process of making a literature review is challenging and time consuming due to different phases of the review (Johansson, Axelin, Stolt & Ääri 2007, 55). The search of the articles was done in a wide scale to minimize literature related bias. In addition, the search was directed to articles in both Finnish and English to avoid language bias. There is a great deal of opportunities for flaws and inconsistencies in the process of making a literature review. However, a literature review is a very competent way of getting an overall picture of specific subject based on already existing scientific knowledge. (Johansson et al. 2007, 3, 53-55).

A clear review plan, specific research questions and well specified boundaries will help in conducting the literature review and enhance the reliability (Johansson et al. 2007, 6, 55). Specific research question was formed after careful processing. There was constant documentation of the decisions that were made by the reviewers during the review process. The relevance and the quality of the articles were assessed in a profound manner, in order for the chosen articles to be able to provide proper answers to the research questions. To produce a reliable review at least two researchers are needed to review and select the materials. The cooperation of several reviewers can be very productive. As a result of the cooperation, accurate results are produced and new ideas are born. (Johansson et al. 2007, 6, 55). This particular review was executed by four researchers, which increased the reliability and accuracy of the results.

During the process of conducting the literature review all the references were used in a valid way and mentioned correctly in the in-text citations and reference list in order to avoid plagiarism. Moreover, the references were written in accordance to JAMK project reporting instructions.

8.2 Discussion of the results

The aim was to gather guidelines for a brief neurological nursing assessment of a patient in acute care. The purpose was to acquire knowledge on how to perform a brief evidence-based neurological assessment and differentiate abnormalities as a nurse. The results were found to be the six key components deemed most vital in a brief neurological assessment. The key components were as follows: history taking; level of consciousness; orientation, speech and language; pupillary assessment; vital signs; and motor assessment.

The results stated that neurological assessment starts with taking the patient's history. It was specified that the information required from the patient includes the history of the present complaint as well as full medical and family history. Moreover, the results suggested that the patient's socio-economic details should be considered. (Cox 2008.) In case of an unconscious or disoriented patient, the results considered the role of family and friends as informants as most commonly they may know the current health status better than the nurse on hand. (Mogensen 2008, 817-819; Soinila 2014, 413; Kallela, Häppölä & Eriksson 2014, 372.)

Level of consciousness was well considered in the chosen articles. Level of consciousness contains both sensory awareness and an appropriate motor response to stimulation of the sensors: is the patient awake and alert. The results stated that assessing the level of consciousness has to be the formal first step in a neurological assessment of a patient. (McCallum & Leonard 2013, 22.) Moreover, an established way of assessing a patient's consciousness level is to use quick and simple orientation measuring tests (Soinila 2014, 416). That is, if the patient is able to correctly answer questions and follow commands, it means that they're alert. The results indicated, however, that if the patient fails to answer questions or follow commands it could mean that the patient is either not alert or completely unresponsive, in varying degrees. (Gocan & Fisher 2008, 40.) The results also showed that the AVPU tool and Glasgow Coma Scale were found useful meters in assessing the level of consciousness (Steen 2010, 55; Kallela, Häppölä & Eriksson 2014, 374).

Orientation, speech and language were combined as one component due to the convenience of performing the assessment of all these three simultaneously during a brief conversation initiating from encountering the patient (Cox 2008; McCallum & Leonard 2013, 22-23). The results showed that being oriented was defined as being aware of place and time thus it can be assessed by asking simple orientation measuring questions. Moreover, during the initial conversation the nurse should assess if there are any deficits, such as abnormal speech patterns or slurred speech, in the patient's speech or linguistic content (McCallum & Leonard 2013, 22-23; Soinila 2014, 416).

Adoni and McNett (2007) stated pupillary assessment as a key component in assessment of a neurological status. Providing essential information about the severity and the progression of the patient's condition were some of the qualities of this component that were shown in the results. The results covered observations of pupil size, shape, symmetry as well as reactivity as important parts of the assessment. (Adoni & McNett 2007, 191-192; Cox 2008; McCallum & Leonard 2013, 24.)

The articles considered the measurement and monitoring of vital signs as a part of the neurological assessment. The mentioned vital signs were temperature, pulse, blood pressure, respiratory rate and oxygen saturation. In addition, blood glucose should be taken to exclude hypoglycaemic coma. Moreover, the documentation of the measurements and changes in patient condition were noted in the reviewed articles. (Gocan & Fisher 2008, 34-35; Cox 2008; Steen 2010, 51, 55; McCallum & Leonard 2013, 22.)

The results suggested that the motor assessment should cover and examine the motor and sensory function and include a motor exam consisting of measuring balance, pronator drift, strength and coordination. Moreover, assessing the facial motor symmetry and sensory perception should be included in this component. (Cox 2008; McCallum & Leonard 2013, 24; Gocan & Fisher 2008, 34.)

The chosen articles were converging and answered appropriately to the research question. The articles considered what a neurological assessment should include and how to perform the assessment, while also emphasizing the importance of nurses' ability to carry out a neurological assessment.

The thesis process was hindered by lack of funding and having no access to articles requiring purchase. The inaccessible data could have increased the amount and validity of the research results. The lack of experience of the researchers limited conducting the research. The limitations concerning usability included the thesis having not been assigned by any organization or health care facility.

It is desired that the awareness of the topic increases through this research and the professional knowledge could be developed further among health care professionals. It is desirable that nurses could benefit from the research, utilize the information and gain methods and tools to better the quality of care.

In the future, it would be beneficial to conduct research on whether the nurses are aware of and motivated to utilize newly found evidence-based methods in their work. Moreover, some specifications could be made on the basis of this research on issues left unanswered, for example, whether some method in assessing a certain component is better than some other one. Some methods, such as the Glasgow coma scale, had some shortcomings to it, and it is unclear whether they affect the quality of the neurological assessment. These type of researches can lead to development and invention of new, even better methods in the future, for example, with the assistance of advanced information technology.

The results have a broader significance by preventing neurological deficits and aiding in their early detection. When nurses know how to properly perform a neurological assessment it can eventually lead to decrease in mortality and morbidity of the neurological disorders. In addition, the goal is that the care could be more effective and adequate in the future.

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Appendices

Appendix 1. Table of chosen articles and studies

N.o	Authors, year of publication and place of study	Title	Aim	Type of the article/study	How the article/study answers to the research question
1	Adoni, A. & McNett, M. 2007 United States	The Pupillary Response in Traumatic Brain Injury: A Guide for Trauma Nurses	Identify the key components of a pupillary examination and its associated physiologic response.	A peer-reviewed article, Cinahl	The article provides a better understanding of the physiologic basis of the pupillary response and the particular components of the pupillary examination.
2	Cox, B. 2008 The United Kingdom	The principles of neurological assessment	Focuses on how to perform a neurological assessment	A peer-reviewed article, Cinahl	The article specifies the components of neurological assessment and describes how to perform the assessment of these components
3	Gocan, S. & Fisher, A. 2008 Canada	Neurological assessment by nurses using the National Institutes of Health Stroke Scale: Implementation of best practice guidelines	Illustrate the integral role of nursing in acute stroke assessment, reviewing TOH neuroscience nursing experience in implementation of the NIHSS.	A literature review, Cinahl	The literature review specified the key components of an abbreviated neurological assessment and provided the NIHSS tool for neurological examination
4	Kallela, M., Häppölä, O. & Eriksson, H. 2014 Finland	Tajuttomuus	Describe the main objectives of unconsciousness: cause, treatment and examination.	An article, Medic	The article provided information on how to assess an unconscious patient and neurological status

5	McCallum, C. & Leonard, M. 2013 Canada	The connection between neurosciences and dialysis: A quick neurological assessment for hemodialysis nurses	Highlight the increased risk of stroke in persons who are dependent on renal replacement therapy, to be aware that a stroke is considered a medical emergency, and to outline a brief bedside neurological assessment screening tool for the nephrology nurse.	A peer-reviewed article, Cinahl	The article specified components for an abbreviated neurological assessment and guided how to do these examinations.
6	Mogensen, K. 2008 United States	The Whole Picture: Addressing the Diverse Needs of the Patient Treated for a Brain Tumor	Address the diverse needs of a patient treated for a brain tumor	A peer-reviewed article, Cinahl	The article described the elements of a neurologic nursing examination and explicated the assessment through a patient case
7	Soinila, S. 2014 Finland	Neurologinen statustutkimus päivystyspoliklinikassa	Describe the basic objectives of neurological clinical examination in an emergency department	An article, Medic	The article specified what is important in a neurological examination and described how it is performed in an emergency department
8	Steen, C. 2010 United Kingdom	Prevention of deterioration in acutely ill patients in hospital	Aims to explore how suboptimal care of the acutely ill patient outside intensive care or high dependency units affects mortality and morbidity rates.	A peer-reviewed article, Cinahl	The article described the neurological assessment of an acutely ill patient