EFFECTIVENESS IN USING A CEREBROSPINAL FLUID LEVEL MEASURING INSTRUMENT INNOVATION AT BOROMARAJONANI COLLEGE OF NURSING, RATCHABURI[1]

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Abstract

Correct and accurate cerebrospinal fluid (CSF) level measurements can reduce the occurrence of increased intracranial pressure and brain herniation. This is vital to care for intracerebral hemorrhage patients with ventriculostomy drainage (VD). The problem of nursing students in the practice of care for neurosurgery is lack of confidence in the accuracy of the instruments and lack of skills in using CSF level measuring instrument. This study was based on a quasi-experimental research design aimed at comparing the efficiency of a CSF level measuring instrument innovation and the satisfaction of nursing students about the use of the CSF level measuring instrument innovation. The study was conducted from February to April 2017. The sample was composed of third-year nursing students at Boromrajjonani College of Nursing, Ratchaburi who were training in the Neurosurgery Department of Ratchaburi Hospital. The sample size of 40 participants was selected by random sampling. The research instruments consisted of the following two parts: 1) The experimental instrument was the innovative instrument for measuring CSF levels 2) The questionnaire on the effectiveness of using an innovative instrument for measuring CSF levels and satisfaction. Percentage, mean, standard deviation and paired t-test were used to analyze the data.

1. The mean score on the efficiency of the innovative instrument for measuring CSF levels was significantly higher than the traditional instrument for measuring CSF levels ($p<0.05$).

2. The mean scores of nursing students' satisfaction with the using of the innovative instrument for measuring CSF levels were significantly higher than the traditional instrument for measuring CSF levels ($p<0.05$).

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Based on the results of the research, the CSF level measuring instrument innovation can reduce measurement time, while the accuracy of the measurement can be used to solve the problem of setting CSF levels. The nursing students in this study were satisfied with the innovation, which is also appropriate for use in the Neurosurgery Department. In conclusion, it is suggested nursing students be taught and prepared before practicing with the innovation. In the meantime, other researchers should study the effectiveness of the innovative CSF level measuring instrument and satisfaction in professional nurses who work in neurosurgery.

Keywords: The CSF measuring instrument innovation, effectiveness, satisfaction

Introduction

Injuries with external causes are a public health issue and a leading cause of death for populations in Thailand and other countries following cancer and heart disease. According to the U.S. military in 2010, the Centers for Disease Control and Prevention (CDC) estimated that TBIs accounted for approximately 2.5 million emergency department (ED) visits, hospitalizations, and deaths in the United States, either as an isolated injury or in combination with other injuries. Of these persons, approximately 87% (2,213,826) were treated in and released from EDs, another 11% (283,630) were hospitalized and discharged, and approximately 2% (52,844) died (Centers for Disease Control and Prevention, 2015). In Thailand, a report from the Ministry of Public Health contains data on external injury reports during 2009-2014 and data on severe trauma patients from trauma records in 2011-2013 (Bureau of Non-communicable Disease, 2017). According to the findings, the cause of injuries that are a problem for both the country and large hospitals is accidents occurring during transport, which is a major problem with no likelihood for a reduction in the number of accidents. Not only does the aforementioned problem result in death, but also results in disabilities and becomes a social burden resulting in economic and national asset losses amounting to hundreds of billions of baht. Furthermore, statistics by the Royal Thai Police from 2011–2014 found severe organ injuries to be a major cause of death, e.g., head injuries. Head trauma is also the most significant cause of death and disability among adolescents (The Royal Thai Police statistics, 2017).

Head trauma has direct impact on the brain. Effects can include contusions and lacerations in addition to brain edema or cerebral hemorrhaging. As a result, brain function, particularly in the reticular activating system, which involves perception and regulation of wakefulness and fails to send signals to the cerebral cortex (Sonsnowski & Ustik, 1994). This causes changes in level of consciousness. Consciousness depends on the degree of trauma severity, which varies and can cause disability and death, especially in patients with moderate to severe head injuries. The aforementioned group of patients generally receives extended periods of hospital treatment due to brain hemorrhaging requiring surgery and postoperative rehabilitation. This directly affects the physical, emotional, social and physical behavioral aspects of patients (Booppha Laptavee, 2013). Patients who receive injuries to the brain tissue experience inflammation of the brain tissues, bleeding or blockage of the spinal fluid passage in the ventricle region. This leads to risks for high intracerebral pressure. Treatment is administered with

ventriculostomy. Ventriculostomy drains spinal fluids from inside the ventricle to outside the body. Tubes are inserted through Burr holes on the upper side of the skull and into the brain in the ventricular region. The aforementioned tubes are connected to drainage tubes or a bottle for receiving spinal fluids for reducing intracerebral pressure. Changes in the cerebrospinal fluid level can affect intracerebral pressure. The intracerebral pressure normalizes when the cerebrospinal fluid level is above the ear canal by 10 centimeters, which corresponds with the Foramen of Monro. As a result, the intracerebral pressure can be maintained at a constant level. However, setting the fluid level incorrectly in line with treatment plans, such as setting the fluid level higher than normal values, can prevent spinal fluids from drainage. Otherwise, hydrocephalus or increased cranial pressure can occur. Furthermore, setting the fluid level lower than the normal value can cause spinal fluids to drain rapidly, potentially resulting in brain herniation and leading to decreased level of consciousness in patients (Tangamnuai, 1998; Nupet, 2003). In addition, when patient movements occur or patients sit or stand up, it is necessary to re-adjust the level of the head of the bed or the fluid level correctly every time in line with treatment plans. As a result, the fluid level might be adjusted by over ten times each day. Hence, high levels of experience, skill and competence are required in performing measurements. The instrument traditionally used to in the aforementioned measurements is a T-square or ruler. These are not designed specifically for measuring cerebrospinal fluid levels. According to the focus group discussions involving professors educating third-year graduates in nursing practice training at the neurosurgery patient ward, imprecise rulers or T-squares are used, leading to difficulty, especially in inexperienced graduates, and a significant amount of time spent for each measurement. Additionally, based on the focus group discussions with students, it was found that imprecise measurement instruments cause stress and anxiety about errors in addition to loss of confidence regarding CSF measurements.

As a resident professor supervising training for nursing students in neurosurgery, the researcher has gained an interest in the development of a cerebrospinal fluid level (CSF) measuring instrument innovation to compare the effectiveness of the CSF measurement instruments and satisfaction of nursing graduates about the use of the developed CSF measurement instrument in addition to the benefit of nursing training in patients with cerebral hemorrhaging in nursing graduates of Boromrajjonani College of Nursing, Ratchaburi.

Research Objectives

1. To compare the effectiveness of the traditional instrument for measuring CSF levels with that of the cerebrospinal fluid level (CSF) measuring instrument innovation developed.
2. To compare the satisfaction of nursing students in using the traditional instrument for measuring CSF levels with their satisfaction in using the cerebrospinal fluid level (CSF) measuring instrument innovation developed.

Research Questions

1. Can the cerebrospinal fluid level (CSF) measuring instrument innovation be used effectively?

2. How satisfied will nursing students who work in the Neurosurgery Department be about using the cerebrospinal fluid level (CSF) measuring instrument innovation?

Research Hypotheses

1. The cerebrospinal fluid level (CSF) measuring instrument innovation can be used more effectively than the traditional instrument for measuring CSF levels.
2. The nursing students who work in the Neurosurgery Ward will have more satisfaction about using the cerebrospinal fluid level (CSF) measuring instrument innovation than the traditional instrument.

Scope of the Study

This study was based on a quasi-experimental research design and conducted in third-year nursing students, Class 32, Room 2, at Boromrajjonani College of Nursing, Ratchaburi who worked in the Neurosurgery Ward at Ratchaburi Hospital from 27 February 2017 to 30 April 2017.

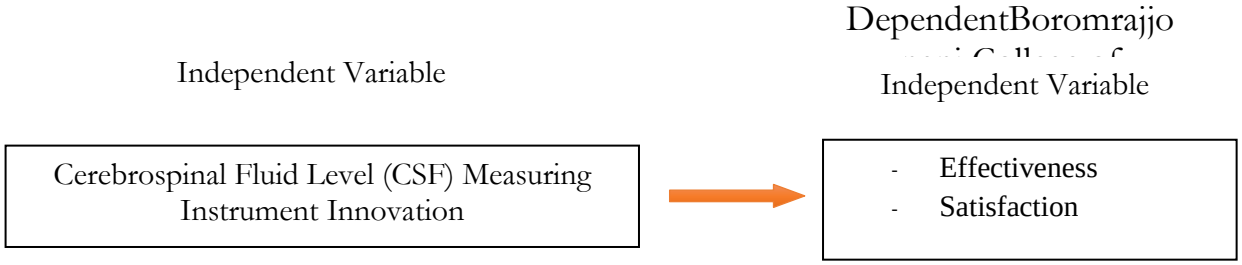
Expected Benefits

1.The cerebrospinal fluid level (CSF) measuring instrument innovation can be used to effectively measure CSF levels and reduce erroneous CSF measurements.

2.Nursing students who wor Independent Variable rk in neurosurgery at Ratchaburi Hospital will be able to use the cerebrospinal fluid level (CSF) measuring instrument innovation conveniently, while spending less time in setting each CSF measurement.

3. Nursing students who work in neurosurgery at Ratchaburi Hospital will gain confidence in measuring CSF levels in their work.

Conceptual Framework of the Study



Definitions of Variables

The **traditional instrument for measuring CSF levels** means a wooden T-square shaped in the form of the letter "T" with a scale in centimetre. The T-square was adopted an instrument for measuring cerebrospinal fluid level in brain surgery patients that require cerebrospinal fluid drainage by ventriculostomy drain insertions.

The **cerebrospinal fluid level (CSF) measuring instrument innovation** means the instrument developed for assisting measurements of cerebrospinal fluid level in brain surgery

patients requiring cerebrospinal fluid drainage by ventriculostomy drain placement. The instrument is in the form of plastic pieces assembled into a square box that contains a measuring tape on the inside with fluid level measurement instruments for measurement precision. Additionally, a pivot is included for use in setting the right-angle axis with a height of ten centimeters. The instrument is for use in measuring from the front of the ear canal to the cerebrospinal fluid level at the ventriculostomy drain bottle.

Satisfaction means the mean level of satisfaction of nursing students about the use of the cerebrospinal fluid level (CSF) measuring instrument innovation as assessed by the satisfaction questionnaire on the use of the cerebrospinal fluid level (CSF) measuring instrument innovation covering two aspects, namely, usage effectiveness and satisfaction about the use of the cerebrospinal fluid level (CSF) measuring instrument innovation.

Effectiveness of the innovation means the mean score obtained from evaluation of nursing students covering effectiveness in time reduction in cerebrospinal fluid level measurement at the cerebrospinal fluid bottle, effectiveness in decreasing discrepancy in the level of the ventriculostomy drain bottle and effectiveness of the innovation in regards to compact size, strength and usage durability.

Nursing students mean students third-year bachelor students Class 32, Room 2, of the 2016 academic year studying the bachelor of nursing science course at Boromrajjonani College of Nursing, Ratchaburi, receiving training at the neurosurgery patient ward at Ratchaburi Hospital from 27 February 2017 to 30 April 2017.

Population and Sample

Population

The population used in the present study was composed of 77 third-year bachelor of nursing science students Class 32, Room 2, Boromrajjonani College of Nursing, Ratchaburi, who received training in neurosurgery at Ratchaburi Hospital.

Sample

In the present research, the researcher determined the size of the sample group by using the G*Power computer software package with a reliability score set at 0.05, effect size at 0.5 and power analysis at 0.8. Based on calculations using the G*Power software package, the sample size was set at 34 subjects. In order to prevent data attrition, the researcher increased the total sample size to 40 subjects by probability sampling and simple random sampling by drawing lots. The researcher subjected the names of the population of 77 to a lottery in order to ensure that each member of the population has equal sampling probability.

Materials and Methods

The instrumentation employed in the present study was composed of the instrument used in the experiment and the instrument used in research as follows:

1. The instrument employed in the experiment was the cerebrospinal fluid level (CSF) measuring instrument innovation. The cerebrospinal fluid level (CSF) measuring instrument innovation was made of acrylic sheet made into a square box. Inside the box is a measuring tape with a scale for measuring the fluid level for precise measurement. There is also a dial used in vertical settings with a height of 10 centimeters. Measurements are taken from the level of the ear to the drop of spinal fluid after the bottle for the ventriculostomy drain.

2. The instrument used in the research was the scale for assessing satisfaction about using the CSF measuring instrument, which was divided into the following two sections:

Part 1 – Demographic data composed of gender, age and level of education.

Part 2 – The questionnaire on effectiveness and satisfaction in using the CSF measuring instrument.

The questions on effectiveness were covered effectiveness in lessening the time spent in measuring CSF, effectiveness in reducing erroneous settings of the level for ventriculostomy drain bottles and the effectiveness of the innovation in terms of a compact size, strength and durability in use.

Data Collection

1. Once the instruments had passed examination by qualified experts, the researcher collected data from the sample, namely, 40 third-year nursing students in Class 32, Room 2, at Boromrajonani College of Nursing, Ratchaburi who worked in a neurosurgery ward at Ratchaburi Hospital.

2. The researcher then explained the methods for collecting data for the subjects' acknowledgement before data collection was commenced in order to protect the rights of the subjects.

3. Data was first collected from the sample by using the questionnaire on satisfaction about using the traditional instrument for measuring CSF levels (T-square).

4. A simulation was organized in the nursing practice room to ensure the simulation of a real situation for the experimental use of the cerebrospinal fluid level (CSF) measuring instrument innovation that was developed. Then the second data collection was performed by using the questionnaire on satisfaction about the CSF measuring instrument innovation.

Data Analysis

1. Frequency distribution and percentage were used with the demographic data on the subjects.

2. Mean and standard deviation were used for effectiveness and satisfaction about using the traditional instrument for measuring CSF levels (T-square) and the cerebrospinal fluid level (CSF) measuring instrument innovation.

3. Paired-T-Test was used to compare mean effectiveness and satisfaction about using the traditional instrument for measuring CSF levels (T-square) and the cerebrospinal fluid level (CSF) measuring instrument innovation.

Protecting the Rights of the Sample

The researcher protected the rights of the sample by submitting the research outline to the consideration of the Institutional Review Board of Boromrajjonani College of Nursing, Ratchaburi. The researcher also explained the research objectives and procedures involved in data collection, further explaining the rights of the subjects in participating in the research, adding that the subjects would be able to withdraw from the study at any time the subjects did not wish to participate in the study to its completion. The researcher explained that dropping out of the study would have no impact on the grades of the subjects. Furthermore, the subjects were assured that the data collected would be kept confidential and presented collectively.

Research Findings

According to the findings of this study, the entire sample of 40 subjects was composed of 39 females (97.5%) and one male (2.5%). Most of the subjects (26 people or 65.0%) were 21 years of age and the level of education for all of the subjects (40 people) was third-year nursing students at 100 percent.

1. The mean score for the effectiveness of the cerebrospinal fluid level (CSF) measuring instrument innovation in terms of reducing time spent in measuring CSF levels were ($\bar{x}$= 4.10, SD =0.44). In terms of minimizing problems in setting the level of the ventriculostomy drain bottle, the scores were ($\bar{x}$ = 4.35, SD =0 .53) with a score of ($\bar{x}$=4.33, SD =0.62) for compact size and durability in use.

2. The mean satisfaction in the cerebrospinal fluid level (CSF) measuring instrument innovation in terms of low cost and inexpensive price were ($\bar{x}$=4.53, SD=0.51) with a score of ($\bar{x}$= 4.35, SD=0.48) for aesthetic attractiveness. The score for suitable size for the place of use was ($\bar{x}$= 4.33, SD= 0.53) with a score of ($\bar{x}$= 4.50, SD=0.55) for convenience and an overall satisfaction score of ($\bar{x}$=4.45, SD= 0.54).

3. When the mean scores for effectiveness were compared, the cerebrospinal fluid level (CSF) measuring instrument innovation ($\bar{x}$ = 4.27, SD = 0.54) was found to have a higher score than the traditional instrument for measuring CSF levels ($\bar{x}$ = 4.06, SD = 0.55) with statistical significance at 0.05.

4. The mean scores were compared, the satisfaction of the nursing students in using the cerebrospinal fluid level (CSF) measuring instrument innovation ($\bar{x}$ = 4.45, SD = 0.54) was found to be higher than the mean score for the traditional instrument for measuring CSF levels ($\bar{x}$ = 4.20, SD = 0.56) with statistical significance at 0.05 (t=-2.360, p - value = 0.023).

Recommendations

The researcher recommends use of the innovation in teaching as a means of preparing nursing students before they practice at work and to study the effectiveness of the cerebrospinal fluid level (CSF) measuring instrument innovation satisfaction in professional nurses who regularly work in neurosurgery.

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