Effect of Evidence-Based Guidelines on Nurses' Knowledge and Practice Regarding Management of Post Lumbar Puncture Headache in Children with Meningitis

Yasmine Abd EL Ghany- Abd EL-Fatah [1], Reda Abd-Elmohsen Mahmoud[2], Esraa Gamal Mohammed[3]

[1,2,3] Lecturer of Pediatric Nursing, Faculty of Nursing, Banha University, Egypt

Abstract:

Background: Meningitis is a major cause of morbidity and mortality around the world. It is diagnosed via lumbar puncture that its most consequence in children is headache, so evidence-based practice guidelines offer direction for headache management. **The study's aim** was analyzing the effect of evidence-based guidelines on nurses' knowledge and practice regarding management of post lumbar puncture headache. **Research design:** A quasi experimental design. **Setting:** Pediatric Intensive Care Unit at Benha Fever Hospital. **Study sample** was a convenient sample consisted of all nurses worked in selected setting (40). **Tools of data collection** included **Tool (I)** A structured Interviewing Questionnaire Sheet that consisted of; **Part (1):** Personal characteristics of nurses. **Part (2):** Nurses' knowledge regarding post lumbar puncture headache**. Tool (II):** Lumbar puncture observational checklist. **The results** revealed that there was highly statistical significance difference between nurses' total level of knowledge and practice regarding post lumbar puncture headache in the studied nurses pre compared to post guidelines. It is **concluded** that evidence-based practice guidelines significantly improved nurses' knowledge and practices regarding management of post lumbar puncture headache in children. **Recommendation** is designing a standard for nursing practice regarding management of post lumbar puncture headache in children.

Key words

Evidence Based Practice, Guidelines, Post Lumbar Puncture Headache and Meningitis

Introduction

Meningitis is a severe inflammatory infection that affects the membranes that surround the brain and spinal cord, known as the meninges. Around the world, meningitis continues to be a leading cause of mortality and morbidity. Meningitis represents one of the top four causes of neurological disability adjusted life years (DALYs) worldwide. [1]

Meningitis is a condition caused by an infection in the meninges that might be fungal, bacterial, viral, or parasitic. The most frequent causes of meningitis are bacteria and viruses, however bacterial meningitis is typically severe and widespread. The etiological agents must be accurately and quickly identified to begin public health initiatives and proper management**.** [2]

A positive cerebrospinal fluid (CSF) culture, which is often obtained via lumbar puncture (LP), is the gold standard for the diagnosis of bacterial meningitis. Cerebrospinal fluid analysis is the only completely reliable diagnostic technique. Lumbar puncture should only be done after a thorough neurologic examination**.** [3]

Seizures, bulging fontanel, fever and aberrant consciousness raise the clinical suspicion of meningitis, but the early signs in neonates are often subtle. According to American and British recommendations, performing LP is advised in cases of possible sepsis and meningitis in

newborns and infants. In any illness that could be related to bacteremia, a strong suggestion for CSF collection to rule out meningitis must be made. [4]

Lumbar puncture is a lumbar spine invasive procedure used for diagnostic or therapeutic purposes. It is a method for drawing or sampling cerebrospinal fluid. And it is frequently used to get information regarding cerebrospinal fluid. [5]

The procedure entails inserting a needle into the lumbar sac's subarachnoid space, which is located safely below the spinal cord. It is utilized typically for diagnostic purposes in order to rule out illnesses including bacterial meningitis and idiopathic intracranial hypertension. It can also be utilized therapeutically, such as in the treatment of intracranial pressure issues. The most common reason for an LP in children is to diagnose a central nervous system (CNS) infection such as meningitis or meninge-encephalitis**.** [6]

Lumbar puncture is contraindicated in children who may have an intracranial mass or other signs of unstable hemodynamics and increased intracranial pressure. If necessary, proper CT scanning should be performed prior to LP to determine its safety. [7]

The most frequent post-lumbar puncture complication is post-Lumbar Puncture Headache (PLPH). The failure of the Dural puncture site to close properly is hypothesized to produce PLPH, leading to CSF leaking and cerebral hypovolemia. This pulls on parts of the brain that are sensitive to pain, causing a headache. Age, gender, body mass index and needle (gauge, point shape, orientation, bevel direction and core withdrawal) and operator skill level are all associated with the prevalence of PLPH. [8]

Post lumbar puncture headache is a type of position-dependent headache that is commonly accompanied by nausea, vomiting, dizziness, tinnitus, and visual abnormalities. The PLPH manifests or significantly worsens when in the upright posture, whereas in the supine posture, it disappears or improves. [9] & [10]

Children frequently experience anxiety and stress because of lumbar puncture. The nurse must educate children as well as their parents about lumbar puncture guidelines before, during, and after the procedures in order to minimize children's suffering and potential post-lumbar puncture consequences. [11]

Nurses should inform children and their parents about the lumbar puncture procedure prior to the procedure. To proceed, informed approval must be given. Instruct children to clear their bowels and bladders. Nurses should do a thorough neurological examination on children, take vital signs, prepare necessary equipment, review laboratory test results. [12]

During LP procedure, to prevent nerve damage, any children's movement should be avoided. Reassurance may be helpful and if necessary, offer the prescribed sedative, and. Children usually lie in a lateral position, with their backs close to the edge of the bed, their knees drawn as tight as possible towards their chest, and their chin flexed onto their chest. [13]

Following LP, nurses should evaluate children for any problems, recommend lying down for four hours, measure children's vital signs, encourage children to increase fluid intake if not contraindicated and check for leakage or bleeding at the puncture site. [14]

Evidence Based Practice (EBP) refers to the application of interventions and techniques whose efficacy has been verified by research. The ultimate objectives of evidence-based nursing practice are to advance high-quality treatment that is informed by research as well as cost-effective results for patients, healthcare professionals and health care system. [15]

Nurses have a critical role in ensuring Evidence Based Nursing Guidelines (EBNGs) in care provided for children who yield to LP and, in the prevention, management of complications which begins with sustaining the highest quality of care, maintaining the hemodynamic state, and managing complications. [16]

Significance of the study:

The most frequent complication in children after LP is headache, with some publications reporting an incidence of 10%–30%. [17] While others claim that it can happen in 70% of cases. [18] The variable incidence of (PLPH) is determined by several factors, including needle orientation and gauge, operator skills, and the existence of risk factors, such as PLPH history. According to some publications, the incidence of headache after diagnostic LP approaches 36%. [10] Because of the less traumatic needles used during anesthesia. [19]

Despite these high rates of occurrence, there is lack of evidence-based recommendations for the prevention and management of PLPHs in children. The aim of the current research was to develop evidence-based practice guidelines for prevention and management of PLPHs among pediatric meningitis patients.

Aim of the study

Analyzing the effect of evidence-based guidelines on nurses' knowledge and practice regarding management of post lumbar puncture headache in children with meningitis.

Research Hypotheses:

Evidence based practice guidelines are expected to improve nurses' knowledge and practice regarding post lumbar puncture headache.

Subjects and method

Research design: A quasi-experimental design with pre / post-intervention was utilized to conduct the study.

Research settings:

The study was conducted in Pediatric Intensive Care Unit at Benha Fever Hospital in Benha City, which affiliated to Egyptian Ministry of Health and Population, it contained 10 beds and allocated in 3rd floor.

Sample:

The sample of study was a convenient sample consisting of all nurses worked in selected setting (40 nurses) who provided care for children with meningitis undergoing lumbar puncture.

Tools of data collection:

Two tools were utilized to collect the data. These tools include the following:

Tool (I): A structured Interviewing Questionnaire Sheet. It was developed by the researchers and included two parts:

Part (1): Personal characteristics of nurses.

Including data related to nurses' characteristics such as Age, gender, educational level, years of experience and attending training courses regarding lumbar puncture.

Part (II): Nurses' knowledge regarding post lumbar puncture headache.

The researchers designed it depending on recent and relevant literatures [20, 21] to assess nurses' knowledge and it consisted of 22 multiple choice questions, classified in to three sub parts:

A-Nurses' knowledge regarding meningitis in children. It included (8) questions such as; Causes, risk factors, definition, signs and symptoms, diagnosis, complications, preventive measures, and nursing management for children with meningitis.

B-Nurses' knowledge regarding lumbar puncture in children. It included (8) questions such as: Definition of lumbar puncture, definition of cerebrospinal fluid, indications and contraindications of lumbar puncture, common complications of lumbar puncture, nursing care before, during and after lumbar puncture procedure.

C- Nurses' knowledge regarding post lumbar puncture headache in children. It included (6) questions such as: Definition, causes, characteristics of headache, contributing factors, prevention, and management of post lumbar puncture headache.

Scoring system of nurses' knowledge.

The studied nurses' knowledge was analyzed through answer using a model, and outcomes were evaluated as complete correct answer was given (2) scores, incomplete correct answer was given (1) score and (0) for do not know answers. According to the studied nurses' answers, the following divisions describe their overall level of knowledge; Good ≥80% was ranged from (35 - 44) points, Average :60 - <80% was fluctuated from (26 to less than 35) points, Poor: <60% was ranged from (0 to less than 26) points.

Tool (2): Lumbar puncture observational checklist.

An observational checklist was developed based on related literature [22- 23,24,25] to observe nurses practice before, during, and post LP procedure. It contained (23) steps of evidence-based nurses' practices that classified as before (5 steps), during (10 steps), and after lumbar puncture procedure in children (8 steps).

Scoring system of nurses' evidence-based practices.

Nurses' evidence-based practices evaluated and graded as (1) for done step, and zero for not done step. The total nurses' practice considered to be a competent level when total nurses' practice was ≥85% with score ranged from (19-23) points and, incompetent level when total practice was <85% with score ranged from (0- < 19) points.

Tools validity and reliability

Validity

To evaluate face and content validity of the study tools, the researchers submitted it to a jury of three experts in the field of Pediatric Nursing from Benha university. The study tools have been modified in accordance with the panel's evaluation of the sentences' clarity, appropriateness of content and sequence of items.

Reliability

Considering reliability, internal consistency of each tool's component was applied by the researchers by using Cronbach′s coefficient alpha. It was 0.887 for nurses' knowledge regarding meningitis, 0.906 for nurses' knowledge regarding lumbar puncture, 0.893 for nurses' knowledge regarding management of post lumbar puncture headache, and for all nurses' knowledge assessment sheet items was 0.960. The reliability of lumbar puncture observational checklist was 0.96.

Ethical considerations

Before beginning the study, the Scientific Research Ethics Committee of the Faculty of Nursing, Benha University provided its ethical permission. Prior to collecting data, an informed consent was obtained from the studied nurses. The nature of the study and its expected findings were stated for the studied nurses in clear and simple clarification. Nurses were guaranteed that all information gathered was handled in confidence, kept anonymous, and used only for research. Also, they informed that they had the ability to discontinue participation at any time.

Administrative Design:

A formal approval was given to the administrator of the fever hospital and the head of the PICU by the dean of the nursing faculty at Benha University. To ensure that the study would be conducted with little resistance, its nature, significance, and predicted results were clearly explained.

Pilot study

To assess the applicability and validity of the study tools and the time needed to complete the questionnaire, a pilot study was conducted over a two-week period on 10% of the total sample (4 nurses). The study sample included the pilot subjects because no significant changes were made to the study.

Field work:

Four phases were carried out over a six-month period, commencing at the beginning of August 2022, and ending at the end of January2023, to achieve the study's objective. These phases include the following.

a) Assessment Phase

The studied nurses were interviewed to gather baseline data during assessment phase. The researchers were available two days per week (Sunday and Tuesday) on the morning shift. The purpose of the study was explained by the researchers to all participating nurses. The researchers warmly welcomed and received formal consent from the studied nurse after providing an overview about the objective, duration, and activities of the study. The researchers interviewed each nurse and provided a questionnaire sheet for completing it to assess nurses' knowledge and it lasted fifteen minutes. Each nurse was evaluated individually during their actual practice of procedures to assess their practice regarding management of post lumbar puncture headache in children at PICU in fever hospital and it took 30 minutes. This phase lasted about 4 weeks.

b) Evidence-based practice guidelines construction:

Evidence based practice is defined as the process of directing the provision of holistic childcare by utilizing validated evidence, judgment, and nursing skill. **[26]** Evidence based practice guidelines designed based on relevant and current evidence, after searching on textbooks, Systematic Reviews, Cochrane collaboration, Medline, CINAHL, Embase, PubMed, regarding evidence-based practices about post lumbar puncture headache management in children with meningitis. Guidelines developed in simple Arabic language.

General objectives:

The aim of evidence-based practice guidelines was to enhance the studied nurses' knowledge, and practice regarding management of post lumbar puncture headache in children with meningitis.

The following suggestions are offered for the prevention and treatment of post lumbar puncture headache, considering the evidence currently available. It consisted of 17 recommendations.

1- It is recommended based on (level -Ⅲ evidence), to perform brain imaging and complete neurological assessment before lumber puncture especially in cases of aberrant intracranial pressure due to heightened CSF pressure, seizures and impaired in consciousness. **[27]**

2- Check laboratory tests regarding coagulation and platelet count in recent blood analysis before lumbar puncture. **[23,27]**

3- It is recommended based on (level -Ⅲ evidence), to check for intake of anti-coagulant medications because lumber puncture contraindicated as anticoagulant drugs increase risk of procedure, but if it is one antiplatelet drug, lumbar puncture may be performed due to decreasing in potential risks of the procedure. **[23,27]**

4- Check for infection in lumbar puncture site for relative contraindication of procedure. **[24, 27]**

5- It is recommended to check for child characteristics such as younger age and history of headache as they considered as risk factors of post lumbar puncture headache. **[24,25, 27]**

6- The recommended position of the child is the lateral decubitus position with fully flexed at the waist and neck, due to the fact of more severe headache was attributed to the sitting position. **[22,23,28, 27]**

7− Utilize smaller size (19-27) of spinal needles (higher gauge) for performing lumbar punctures in children as it prevents PLPHs, when clinically applicable. **[22, 25,27]**

8- It is recommended to consider child weight and body characteristics, when choosing the appropriate needle size. [23,27]

9- The usage of pencil point needles in children undergoing lumbar puncture is strongly recommended, since it reduces the risk of PLPHs. [21,22]

10- The use of a lumbar puncture needle with a bevel orientation parallel to the long access is recommended to reduce the frequency of PLPHs [22, 25]

11- The maximum number of times a lumber puncture should be performed during the procedure is four because it increases incidence of back pain. [27]

12- It is recommended to permit passive withdrawal of CSF because there is a relation between doing so and a reduction in headache frequency. [27]

13- Collecting up to 30 mL of CSF from children is safe and well-tolerated. [27]

14- It is recommended for allowing children to move about freely after procedure, [23,27] instead of prolonged bed rest to prevent post lumbar puncture headache [22,25].

15- Using oral and intravenous hydration to shorten the duration of PLPHs is recommended. [23,25]

16- It is recommended to use epidural injections of saline fluid for promoting closure of the dural perforation. [22,25]

17- The use of an epidural blood patch in the treatment of pediatric PLPHs is recommended. [25]

c) Evidence based practice guidelines implementation:

Regarding evidence-based practice sessions implementation, 10 groups were created from the nurses under study., each group consisted of 4 nurses, according to their readiness, the evidence-based recommendations were distributed as follows; (1) session was needed for the theoretical portion, and (2) sessions for practical part. They lasted around 45 minutes, at morning shift two days each week. Theoretical portion: included knowledge regarding meningitis and lumbar puncture in children. Practical part concerned with the application of nurses' skills regarding management of post lumbar puncture headache in children with meningitis; the first session included nursing care provided before and during lumbar puncture procedure for prevention of headache, the second session included nursing management of post lumbar puncture headache.

Application of evidence-based practice. The evidence-based practice approach is applied with a questioning attitude towards clinical care. Evidence-based practice starts with a clinical query and search for the data supporting the provided care. [29] The process of evidence-based practice can be described by several steps as the following:

Step 0: Fostering a spirit of inquiry. A spirit of inquiry must be fostered in order to implement evidence-based practice. Continuous curiosity is encouraged as clinical inquiry becomes a routine aspect of practice.

Step 1: Formulating a clinical inquiry in PICOT structure.

(P)Patient population of interest, (I)Intervention or area of interest, (C)Comparison group or intervention,

(O)Outcome, and (T)Time.

Step 2: Search for the best evidence. The PICOT framework focuses on finding appropriate evidence for solving the clinical question. Finding publications to inform practice on the desired topic is made possible by database searches utilizing key words or phrases.

Step 3: Critically appraise the evidence. At this step, the articles that were found through the search are systematically evaluated. Results

from the study are examined for validity, reliability as well as applicability. A review of the available data is done to see if there is enough evidence for the current practice or if a change of practice is advised.

Step 4: Integrate the evidence with clinical expertise and patient preferences and values. Clinical expertise, and patient assessment data are considered along with the research evidence, as well as patient preferences and values.

Step 5: Evaluate the outcomes of evidence-based practice change.

Findings are analyzed after implementing evidence-based practice changes to determine the intervention impact.

Step 6: Disseminate the outcomes. It was important to communicate any lessons acquired to others. [30] Modified lectures, brainstorming sessions, demonstrations, re-demonstrations, and group discussions were among the several instructional techniques employed. To ensure that nurses fully understood the material, appropriate teaching tools were used, such as handouts, audio-visual aids, role playing, and real equipment to achieve the objectives and contents of the educational guidelines. This phase started from October 2022 to the middle of January 2023.

d) Evaluation phase:

Using pretest tools, the researchers evaluated the impact of evidence-based guidelines on the studied nurses' practices and knowledge regarding management of post lumbar puncture headache immediately after implementation, this phase lasted for two weeks.

Statistical analysis

Using an electronic computer and the SPSS version 20 statistical tool, the accumulated data were arranged, tabulated, and analyzed. For the data, descriptive statistics were computed in the following formats: frequency and distribution for qualitative data, mean and standard deviation for quantitative data. Moreover, the chi square test was used in analytical statistics to compare categorical data between groups (X2 value). Pearson's correlation coefficient test was also applied

Results

Table (1): Illustrates that, 47.5% of the studied nurses age is about 30 <40 and the mean age is 34.825±8.995 year. While more than three quarters of them (82.5%) are female. Regarding educational level, half of nurses (50.0 %) have technical nursing institute and less than half (47.5%) of nurses having 5 < 10 years of experience. It also shows that less than two thirds (62.5%) did not attend training courses related to lumbar puncture.

Fig. (1): Demonstrates that less than two thirds of the studied nurses (62.0%) pre-guidelines have poor level of knowledge regarding meningitis. While the majority (93.0%) have a good level of knowledge in post guidelines. Therefore, there are highly statistical significance difference (P<0.000) between nurses' total level of knowledge regarding meningitis pre compared to post guidelines.

Fig. (2): Clarifies that 70.0% of the studied nurses at pre-guidelines have poor level of knowledge regarding lumbar puncture. While the majority (96.0%) have a good level of knowledge in post guidelines. Therefore, there are highly statistical significance difference (P<0.000) between nurses' total level of knowledge regarding lumbar pre as compared to post guidelines implementation.

Fig. (3): Illustrates that nearly two thirds of the studied nurses (67.0%) pre-guidelines have poor level of knowledge regarding post lumbar puncture headache. While the majority (94.0%) have a good level of knowledge post guidelines implementation. Therefore, there was highly statistical significance difference (P<0.000) between nurses' total level of

knowledge regarding post lumbar puncture headache pre compared to post guidelines.

Table (2): Demonstrates that mean knowledge about meningitis is 2.250± 4.632 in studied nurses pre guidelines, while mean knowledge is 2.945± 4.121in post guidelines. It also shows that, mean knowledge about post lumbar puncture headache in children is 1.887±0.899 in pre guidelines, while mean knowledge is 2.125±0.745 in post guidelines. Moreover, there is a highly statistically significant difference (p <0.001) at post guidelines.

Fig. (4): Shows that, more than three quarters of the studied nurses (82.5.0%) pre-guidelines have poor level of knowledge regarding meningitis, lumbar puncture and post lumbar puncture headache in children. While the majority (89.0%) have a good level of knowledge in post guidelines. Therefore, there are highly statistical significance difference (P<0.000) between nurses' total level of knowledge regarding meningitis, lumbar puncture and post lumbar puncture headache in children pre compared to post guidelines.

Table (3): Demonstrates that, mean practice of the studied nurses before procedure is 2.800±0.242 pre guidelines, while mean practice is 5.150±0.276 in post guidelines. It also shows that, mean practice post procedure is 2.650±0.2083 in pre guidelines, while mean practice is 6.300±0.3880 in post guidelines. Moreover, there was a highly statistically significant difference (p <0.001) at post guidelines.

Fig. (5): Shows that, (93.0%) of the studied nurses at pre-guidelines have incompetent total level of practice regarding management of post lumbar puncture headache in children. While the majority (87.5%) have a competent total level of practice post guidelines. Therefore, there are highly statistical significance difference (P<0.000) between nurses' total level of practice regarding management of post lumbar puncture headache pre compared to post guidelines.

Table (4): Demonstrates that, there is a positive correlation between the studied nurse's total knowledge score and total practice pre / post evidence-based guidelines (P<0.001)

Table (1): Distribution of the studied nurses according to their personal characteristics (n=40)

Items	The studied nurses n=40	
	N	%
Age/years		
19 < 30	12	30.0
30 <40	19	**47.5**
40 ≤ 50	9	22.5
Mean± SD	**34.825±8.995**	
Gender		
Male	7	17.5
Female	33	**82.5**
Educational level		
Bachelor	7	17.5
Technical nursing institute	20	**50.0**
Diploma	13	32.5
Years of experience		
< 5	14	35.0
5 < 10	19	**47.5**
≥ 10	7	17.5
Mean± SD	**6.450±3.4932**	
Attended training courses related to lumbar puncture		
Yes	15	37.5
No	25	**62.5**

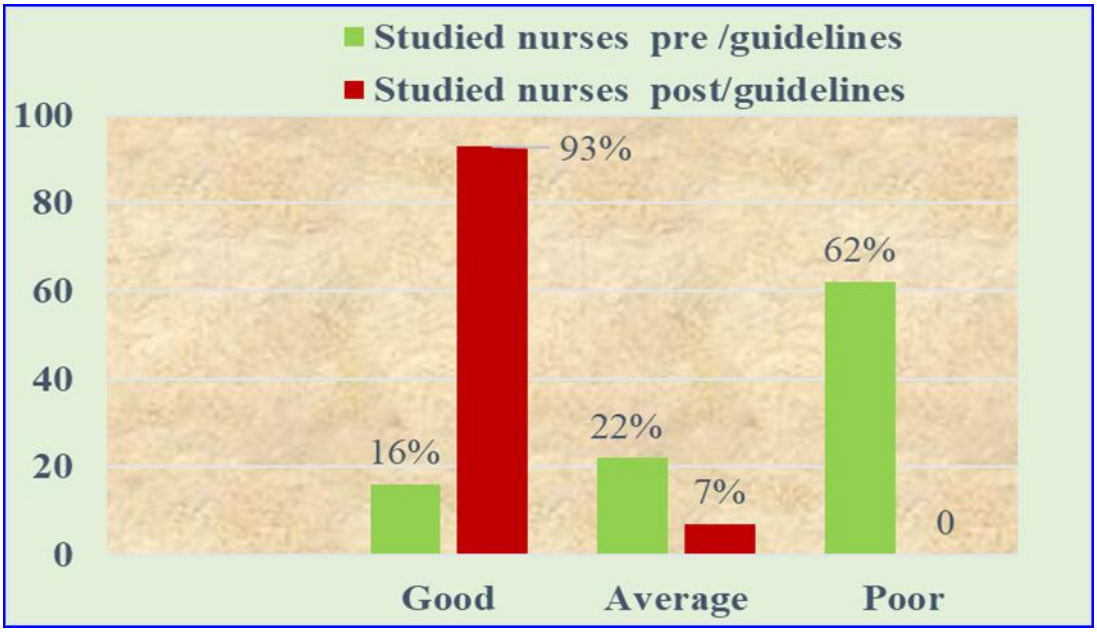

Figure (1): Distribution of the studied nurses according to their total level of knowledge regarding meningitis in children pre/ post evidence-based guidelines (n=40)

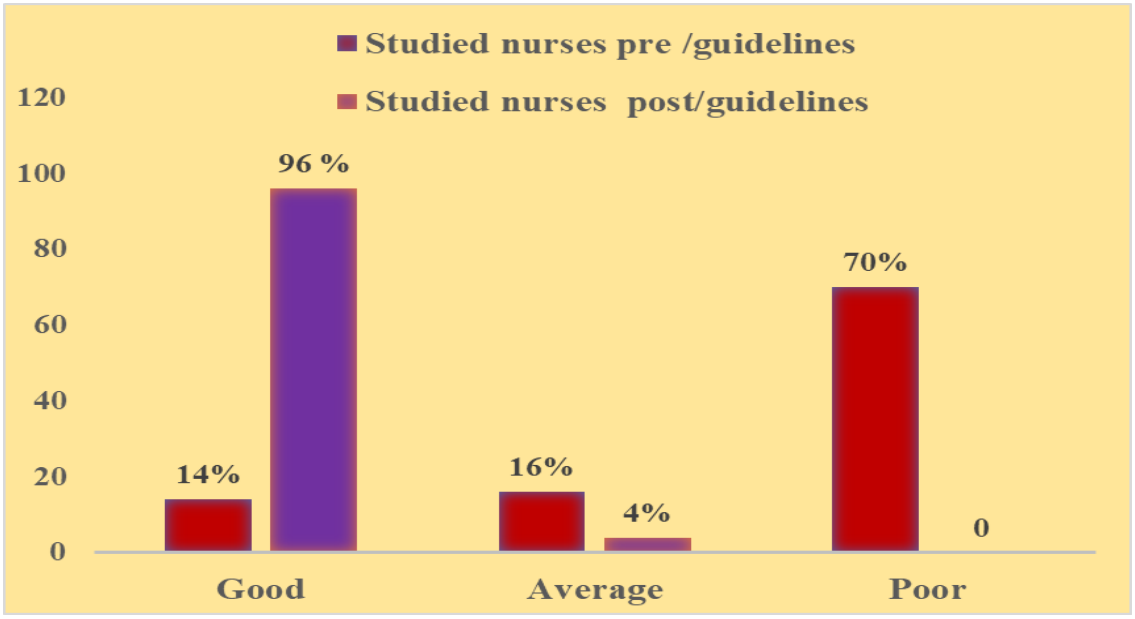

Figure (2): Distribution of the studied nurses according to their total level of knowledge regarding lumbar puncture in children pre/ post evidence-based guidelines (n=40)

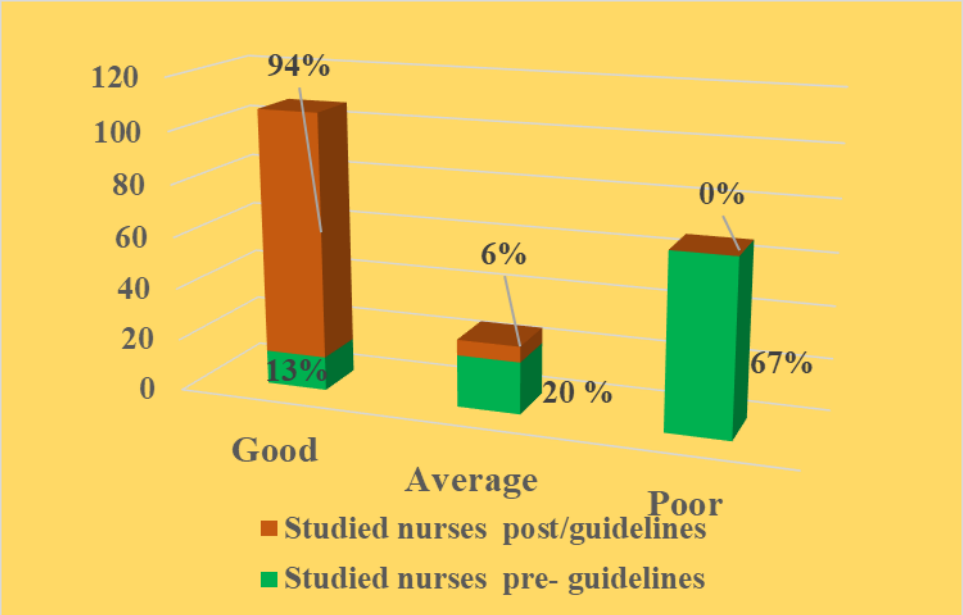

Figure (3): Distribution of the studied nurses according to their total level of knowledge regarding post lumbar puncture headache in children pre/ post evidence-based guidelines (n=40)

Table (2): Comparison of the studied nurses' knowledge related meningitis, lumbar puncture and post lumbar puncture headache in children (n=40)

Items	The studied nurses (n=40)		Independent T- test	P
	Pre /guidelines	Post /guidelines		
	Mean ±SD	Mean ±SD		
Meningitis	2.250± 4.632	2.945± 4.121	3.045	0.000
Lumbar puncture	1.075±0.882	1.631±0.500	2.682	0.000
Post lumbar puncture headache in children	1.887±0.899	2.125±0.745	3.393	0.000

Highly statistically significant at P value <0.001**

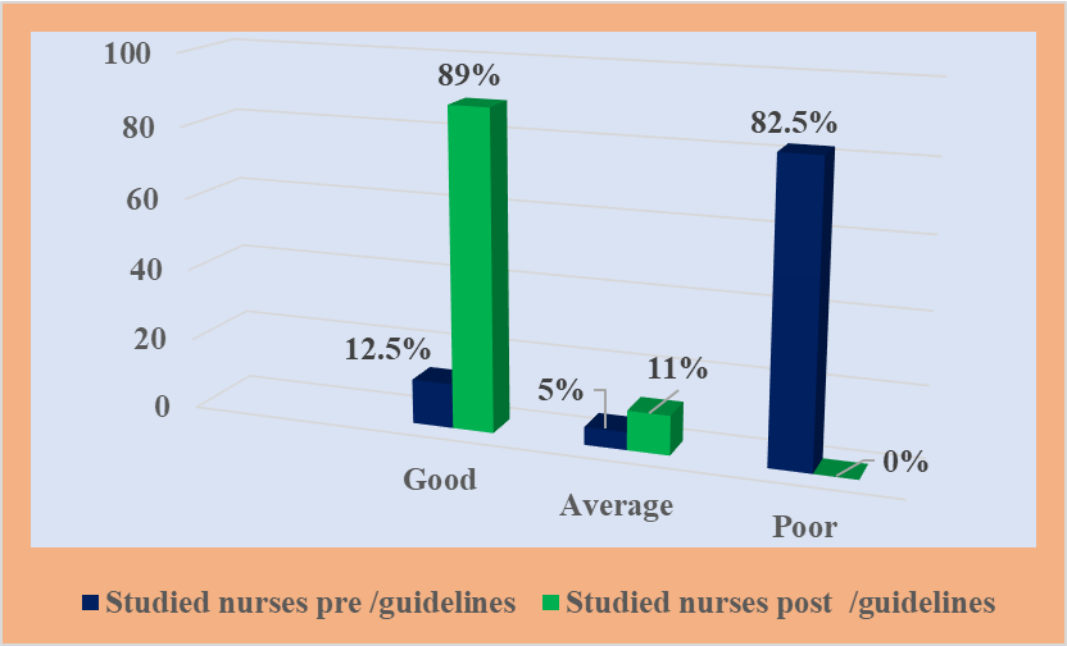

Figure (4): Distribution of the studied nurses according to their total level of knowledge regarding meningitis, lumbar puncture and post lumbar puncture headache in children (n=40)

Table (3): Distribution of the studied nurses according to their practice before, during and after lumbar puncture in children pre/ post evidence-based guidelines (n=40)

Items of procedure	The studied nurses (n=40)		Independent T- test	P value
	Pre /guidelines	Post /guidelines		
	Mean ± SD	Mean ± SD		
Before	2.800±0.242	5.150±0.276	4.246	0.000**
During	4.800±0.3034	6.85±0.549	8.562	0.000**
After	2.650±0.2083	6.300±0.3880	7.354	0.000**

Highly statistically significant at P value <0.000**

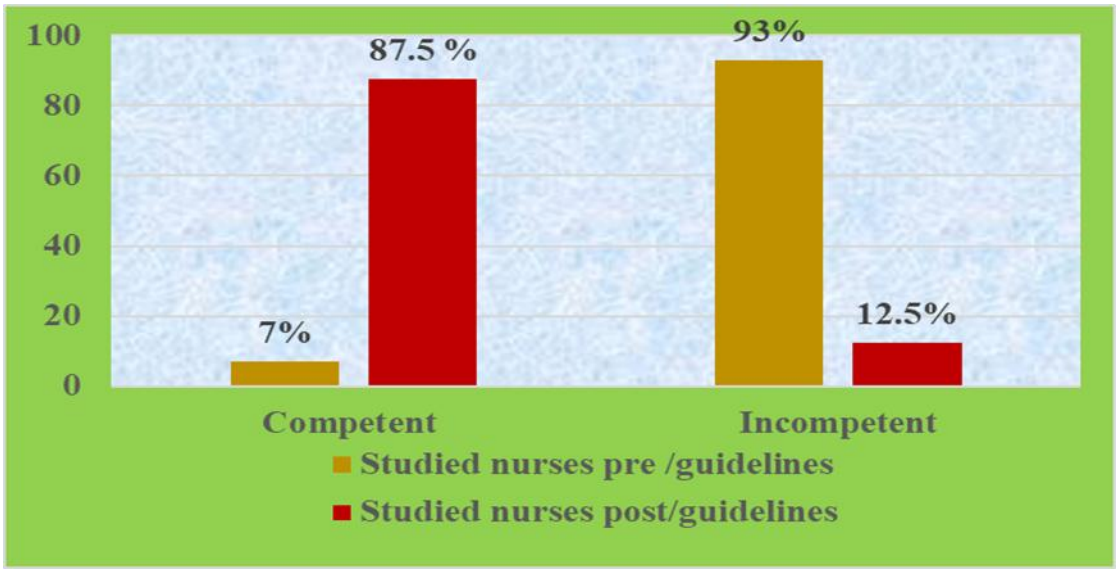

Figure (5): Distribution of the studied nurses according to their total level of practice regarding management of post lumbar puncture headache in children pre/ post evidence-based guidelines (n=40)

Table (4): - Correlation between total knowledge score and total practice of nurses through evidence-based guidelines (n=40)

Variables	Total practice			
	The studied nurses n= (40)			
	Pre / evidence-based guidelines		Post / evidence-based guidelines	
	R	P	R	P
Total knowledge score	0.199	0.000*	0.285	0.000*

Discussion

Children having meningitis have a harder time surviving and avoiding harm. A lumbar puncture is a minimally invasive, painless diagnostic procedure that involves taking cerebrospinal fluid samples for analysis and estimating the fluid's pressure. To offer children high-quality care, nurses need to be knowledgeable, talented, and capable. Aside from that, every child wants to get care from skilled nurses who will treat them with respect, safety, and comfort. [31]

Post lumbar puncture headache (PLPH) is the most frequent complication of the lumbar puncture procedure. It can be prevented by applying evidence-based recommendations to provide optimal care for children undergoing lumbar puncture procedures. So, nurses require specific training concerning the application of Evidence Based Nursing Guidelines to provide care for children and reduce their expected complications**.** [32] This study aimed to analyze the effect of evidence-based guidelines on nurses' knowledge and practices regarding management of post lumbar puncture headache in children with meningitis.

According to characteristics of nurses under the study, the current study Illustrated that, less than half of nurses age was about 30 <40 and the mean age was 34.825±8.995 year. While more than three quarters of them were female. Moreover, half of nurses had technical nursing institute, less than half of nurses had 5 < 10 years of experience in the nursing field, and less than two thirds did not attend training courses related to lumbar puncture.

This result was correspondent to **Abdelmowla et al., (2017)** who noticed that the majority of nurses were between 25 to 45 years while the same study showed that the majority of sample was females and having more than 10 years of experience.[33]

Additionally, this result was in the same line with **Mohammed et al., (2019)** who illustrated that the nursing technical institute graduated more than two fifths of the nurses[34].

Similarly, the current study was in agreement with **Jissir and Hassan (2019)** who indicated that over half of participants were women, over a third had nursing institute, over a fifth had ages 20 to 29, and more than half had worked for one to nine years. [35]

Regarding the total level of knowledge regarding meningitis in children pre/ post evidence-based guidelines, the present study results demonstrated that less than two thirds of the nurses' pre-guidelines had poor level of knowledge regarding meningitis. While the majority had a good level of knowledge of post guidelines. According to the researchers, these findings may be related to a lack of sufficient educational opportunities in the institutions, and improvements may be attributable to the efficiency of the guidelines.

The study results were consistent with **Hussien et al, (2021)** who found that, most study participants reported insufficient levels of knowledge concerning meningitis before program implementation while two thirds of them had insufficient level of knowledge about meningitis post program implementation [36]. Also, this result comes in accordance with (**Oladele et al., 2020**) who noticed that most of nurses under the study had poor knowledge about meningitis before training program with a statistically significance difference between pre and post program. [37]

The results of this study illustrated that there was highly statistical significance difference between nurses' knowledge regarding meningitis pre compared to post guidelines (P<0.00). From researcher' point of view, it might be connected to how knowledge was conveyed throughout educational instruction. The learning process was also improved by the assistance provided when applying. Thus, this improvement illustrates the value of the educational instructions on nurses' acquiring knowledge. These results were in harmony with **Mohammed, et al., (2019)** who presented a significant difference in acute meningitis knowledge between the total mean score of nurses' knowledge before and after the instruction program with (P< 0.001). [34]

Concerning total level of nurses' knowledge about lumbar puncture in children pre/ post evidence-based guidelines, the present study results clarified that, more than two thirds of the studied nurses at pre-guidelines had poor level of knowledge

regarding lumbar puncture. While the majority had a good knowledge level in post guidelines. Therefore, there was highly statistical significance difference between nurses' total level of knowledge regarding lumbar puncture in the study group pre compared to post guidelines (P<0.000).

From researcher' perspective, it could be interpreted that the nursing guidelines' impact on improving nurses' levels of knowledge and the lack of educational and training programs, seminars, and workshops are significant factors in the nurses' lack of knowledge.

This finding was consistent with **Abdelmowla et al., (2017)** who found Difference in nurses' knowledge of lumbar puncture before and after applying the nursing instructions booklet that is extremely statistically significant. After using the nursing instructions pamphlet, all nurses in the neurosurgery department caring for patients receiving lumbar punctures had a satisfactory level of knowledge in their fields. While more than three quarters of them had insufficient knowledge prior to applying the nursing instructions pamphlet. [33]

Regarding the total level of knowledge regarding post lumbar puncture headache in children pre/ post evidence-based guidelines, the current study results Illustrates that, nearly two thirds of the studied nurses pre-guidelines had poor level of knowledge regarding post lumbar puncture headache. While the majority had a good level of knowledge in post guidelines. From researcher' viewpoint, it can be explained as dissemination of information on evidence-based guidelines was done so simply. Additionally, the use of appropriate media for clarification and the assistance provided when applying the guidelines improved the learning process. As a result, this improvement demonstrates the efficacy of evidence-based guidelines in enhancing nurses' knowledge acquisition.

This finding was in agreement with **Niemantsverdriet et al., (2020)** who stated that after application of educational intervention, the majority of participated nurses had correct information concerning lumbar puncture headache as compared to pre-educational intervention. [5]

Also, there were highly statistical significance difference between nurses' total level of knowledge regarding post lumbar puncture headache pre compared to post guidelines (P<0.000). This result was consistent with This finding was agreed with **Dunaway., et al, (2021)**, who reported that there was statistical significance difference between nurses' total level of knowledge pre compared to post intervention. [28]

Regarding Comparison of the studied nurses' knowledge related meningitis, lumbar puncture, and post lumbar puncture headache in children pre/ post evidence-based guidelines, the result of the current study demonstrated that, mean knowledge about meningitis was 2.250± 4.632 pre guidelines, while mean knowledge was 2.945± 4.121in post guidelines. It also showed that, mean knowledge about post lumbar puncture headache in children was 1.887±0.899 in pre guidelines, while mean knowledge was 2.125±0.745 in post guidelines.

Moreover, there was a highly statistically significant difference between nurses' knowledge regarding meningitis, lumbar puncture, and post lumbar puncture headache in children pre compared to post guidelines (p <0.001). From the researcher's point of view, it could be related to the fact that knowledge about evidence-based guidelines was delivered in a straight forward manner. In addition, the use of appropriate media for clarification enhanced the educational process. As a result, this improvement demonstrates the efficacy of evidence-based guidelines in enhancing nurses' knowledge acquisition.

The finding of this study was in agreement with **Mahmoud and Abd-ElSadik (2019),** who state

that the total mean score of nurses' knowledge regarding meningitis, lumber puncture and post lumbar puncture complication improved after receiving clinical pathway-related health education [41]

According to studied nurses' total level of knowledge regarding meningitis, lumbar puncture, and post lumbar puncture headache in children pre/ post evidence-based guidelines, the current study results showed that, more than three quarters of the studied nurses pre-guidelines had poor level of knowledge regarding meningitis, lumbar puncture and post lumbar puncture headache in children. While the majority had a good level of knowledge in post guidelines.

This finding was consistent with **Kafl, (2019),** who discovered that after implementing the training program, the majority of the evaluated sample had a thorough comprehension of meningitis. [38] Similarly with **Hamad et al., (2022**) who reported that on the post-test and follow-ups test, nurses who had received the nursing intervention had more knowledge about lumbar puncture than they did on the pretest. [39].

In addition, there were highly statistical significance difference between nurses' total level of knowledge regarding meningitis, lumbar puncture and post lumbar puncture headache in children pre compared to post guidelines (P<0.000). This finding was coherent with **Temsah et al. (2021)** who discovered a statistically significant variation in post-educational meningitis knowledge; lumbar puncture and post lumbar puncture headache and self-reported intended practice. [40]

According to the studied nurses' practice before, during and after lumbar puncture in children pre/ post evidence-based guidelines, the results of the present study indicated that, mean practice before procedure was 2.800±0.242 pre guidelines, while mean practice was 5.150±0.276 in post guidelines. It also shows that, mean practice post procedure was 2.650±0.2083 in pre guidelines, while mean practice was 6.300±0.3880 in post guidelines. Moreover, there was a highly statistically significant difference at post guidelines (p <0.001).

Regarding to researchers, this may be connected to the effectiveness of evidence-based guidelines for promoting the level of nurses' practices, involving providing the nurses under study with ongoing explanations, reinforcement, and feedback, as well as continuous demonstration and re-demonstration.

This finding was in friendship with **Hamad et al., (2022**) They discovered that while all of the nurses under study performed poorly on the pre-test about lumbar puncture, they all performed satisfactorily on the post-test and the follow-up test, respectively. [39] Similarly, **Jissir & Hassan (2019)** illustrated that after the program implementation, skills of the studied nurses had improved statistically when compared to pre-test**.** [35]

Also, there were highly statistical significance difference between nurses' practice before, during and after lumbar puncture in children pre compared to post evidence-based guidelines (P<0.000). From researcher' perspective, these findings highlight the value of practical training done on the job for nurses to develop their skills. The finding was in accordance with **Temsah et al., (2021)**, whose self-reported planned practice and post-educational knowledge showed a statistically significant difference[40].

According to the studied nurses' total level of practice about management of post lumbar puncture headache in children pre/ post evidence-based guidelines, the result of the existing study Showed that, the majority of the studied nurses at pre-guidelines had incompetent total level of practice regarding management of post lumbar puncture headache in children. While the majority

had competent total level of practice in the study group post guidelines.

From the point of view of the researchers, this is because nurses learned knowledge and skills from the instructional materials, post-test errors were less common among them. This may be demonstrated by the impact of nursing evidence-based guidelines on nurses' practice (effective children preparation and care prior to, during, and following lumbar puncture), which resulted in prompt relief of headache following lumbar puncture.

These results agreed with **Abdelwahab Abdallah Srour& Alsayed Ahmed, (2023)** who found that, most of the nurses under study improved their level of competence after the program's implementation, followed by a phase of follow-up testing, but only one third did so before the program's implementation.[42] Similarly, with **Abdelmowla et al., (2017)** who reported that following the use of the nursing instruction leaflet, the majority of nurses had a sufficient level of practice. [33]

Also, there were highly statistical significance difference between nurses' total level of practice regarding management of post lumbar puncture headache pre compared to post guidelines (P0.000>). This result was consistent with **Jissir & Hassan (2019)** observation that nursing skills improved statistically significantly between the pre- and post-test after the programs were implemented. [35]**.** Similarly, **Rusch et al., (2014)** who reported that statistical significance difference between nurses' total practice regarding management of post lumbar puncture headache in the study group pre compared to post evidence-based practice recommendations.[25] By investigating the correlation between nurses' total knowledge score and total practice using evidence-based guidelines, it was stated that, there is a positive correlation between nurse's total knowledge score and total practice pre / post evidence-based guidelines. From the researchers' point of view This may be attributed to the high level of knowledge exhibited in nurses' practices; knowledgeable nurses provide more precise care.

This finding agreed with **Abdelmowla et al., (2017)** who identified a positive relationship between nurse knowledge and practice **[33]**also, this result was in the same line with **Abdelwahab Abdallah Srour& Alsayed Ahmed, (2023)** They revealed that the nurses under study had a strong, statistically significant positive correlation with their overall knowledge and practices regarding the care of patients having meningitis during the preceding, post, and three months follow up. [42] Similarly, **Hamad et al., (2022**) found that there was a highly statistically significant positive correlation between total knowledge and total practice. [39]

Conclusion:

On the basis of the present study's results, it can be noticed that evidence-based practice guidelines significantly improved nurses' knowledge and practices regarding management of post lumbar puncture headache in children.

Recommendations:

- Design a standard for nursing practice regarding management of post lumbar puncture headache in children.
- Conducting continuous education about management post lumbar puncture complications in children.
- Further studies regarding the effect of EBP on the clinical outcome of children undergoing lumbar puncture.

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