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Article Review

Effectiveness of Nursing Interventions and Nurses' Competencies in the Use of Chemoport in Cancer Patients: A Systematic Review

Lisna[1*], Allenidekania[1], Chiyar Edison[1]

[1] Master of Nursing Science Program, Faculty of Nursing, Universitas Indonesia, Depok, West Java, Indonesia

(Correspondence author's email, lizhnakarim@gmail.com)

ABSTRACT

Chemoport is an implanted device, placed in the central venous system especially for infusion of chemotherapy drugs in oncological diseases that can reduce vascular inflammation during chemotherapy because this device is implanted under the skin, making IV (intravenous) drug administration easier and reducing pain. Nurses as officers must be able to provide more specific care and therapy based on patient needs, and must understand the lives of cancer patients and their families. The purpose of this study was to determine the effectiveness of nursing interventions and nurse competence in the use of chemoport in cancer patients. The research method used a systematic review with article searches on five trusted journal databases, such as EBSCOhost, ClinicalKey Nursing, Sage Journal and Science direct. Article analysis using the PRISMA method. The results showed that there were ten articles that fit the criteria for articles related to nursing interventions and nurse competence in the use of chemoport in cancer patients. All articles used quantitative research methods with a randomized control trial design. The conclusion is that nursing interventions and nurse competence in the use of chemoport in cancer patients, among others, are divided into nursing interventions to reduce pain, namely virtual reality interventions, giving Valsalva maneuvers, skin stimulation, and giving local anesthesia. While nursing interventions to reduce anxiety include virtual relity interventions, visual blocking information interventions and patient education and nurse competence through increasing nurse knowledge and providing training.

Keywords: *Chemoport, Nursing Interventions, Nurse Competency.*

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INTRODUCTION

Cancer is a global health issue that affects people from all walks of life regardless of their social status. In 2020, an increase in cancer cases was observed, with 25% of the world's population being diagnosed with cancer and expected to suffer from the disease throughout their lives. Cancer treatment is not evenly distributed worldwide, especially in developing countries, which often struggle to control and treat cancer due to limited resources[1].

Cancer is a disease that psychologically devastates patients from the moment of diagnosis. Furthermore, the treatment process itself can exacerbate the discomfort experienced by cancer patients. Currently, there are various cancer treatment methods such as surgery, radiotherapy, and chemotherapy, each of which has its own complications. Patients undergoing radiotherapy and chemotherapy may experience skin problems, loss of appetite, nausea, fatigue, hair loss, and many other side effects during the process. Therefore, similar to

cancer itself, its treatment has the potential to traumatize patients[2].

A study evaluating the effects of chemotherapy on muscle strength, quality of life, fatigue, and anxiety in 37 breast cancer patients conducted in Brazil showed that three cycles of chemotherapy treatment could disrupt isometric handgrip strength and quality of life in breast cancer patients[3]. Another study indicated that chemotherapy not only affects physical strength but can also impact the memory of cancer patients who have undergone chemotherapy. Chemotherapy treatment can disrupt and damage brain structures related to memory, leading to slow synaptic consolidation in the brain and memory deficits in patients undergoing chemotherapy[4].

One of the safest methods of chemotherapy delivery is chemoport, which minimizes pain from repeated venous punctures during each chemotherapy cycle consisting of multiple cycles. Patients receiving chemotherapy via the peripheral IV route experience multiple punctures, discomfort, pain, redness, or swelling of the arm[5]. In addition to providing benefits, chemoport can also lead to complications. Research results show that some complications that may arise from the use of chemoport include pneumothorax, infection, thrombosis, hemothorax, drug extravasation, and chemoport malfunction[6].

Chemotherapy management is a collaborative nursing intervention, within the authority of Post Basic Register Nurses or oncology specialist nurses, and nursing interventions are provided based on clinical assessment and knowledge where nurses act with the goal of effective patient recovery. In the field of collaborative intervention, nurses have expertise in a number of limited interventions that reflect their expertise, but the overall classification may represent nursing expertise[7].

Nurses as caregivers must be able to provide more specific care and therapy based on patient needs, and must understand the lives of cancer patients and their families. The goal of cancer care is to improve the quality of life of cancer patients, through nursing care, both independent and collaborative interventions. In a study related to the effects of evidence-based nursing intervention improvement on treatment compliance, quality of life, and self-efficacy of lung carcinoma (LC) patients undergoing radiotherapy and chemotherapy, it was found that evidence-based nursing interventions can improve treatment compliance, lung function, self-efficacy, and quality of life of chemotherapy patients[8] .

The results of research on oncology nursing certification training show that there are significant differences in pre-test and post-test scores of nurse staff. Where knowledge and clinical skills have proven effective in enabling nurses to provide high-quality care. chemotherapy management[9].

Based on the above explanation, it is deemed important to investigate the effectiveness of nursing interventions and nurse competency in the use of chemoport in cancer patients.

METHOD

This study employed a systematic review design using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) method. The search strategy for articles/journals utilized relevant data sources related to the research topic, such as EBSCOhost, ClinicalKey Nursing, Sage Journal, and ScienceDirect, with keywords: "Cancer patient undergoing Chemotherapy" OR "Chemotherapy" OR "Use of chemoport" AND "Nursing interventions" OR "Nurse Competencies".

The researchers retrieved several journal articles through online databases that met the predetermined criteria, namely full-text articles published between 2014 and 2023 with a quantitative research method of Randomized Controlled Trials, describing nursing interventions and nurse competency in the use of chemoport in cancer patients of all ages. The researchers eliminated research journals that did not discuss nursing interventions and nurse competency in the use of chemoport in cancer patients. They collected all relevant journals and analyzed each journal according to the predefined criteria by reading and summarizing them. Subsequently, the results of the analysis were concluded into the topic of discussion, which is the spiritual needs of advanced-stage cancer patients.

Based on the analysis results from four databases, 12,280 references related to the topic were obtained. Figure 1 displays the article selection process for inclusion in this study. The articles were screened by rereading for title

similarity (duplicates), inclusion criteria, full-text availability, specific material suitability to the research title, and material congruence in the abstract. Afterward, all identified articles underwent critical appraisal using the Critical Appraisal Skills Programme checklist specifically for Randomized Controlled Trial Standard research types. In each critical assessment process, two reviewers discussed, and if there were differences of opinion, a third reviewer was involved to reinforce the analysis and provide reviews of the filtered articles. In the final selection stage, 10 journal articles were chosen for review.

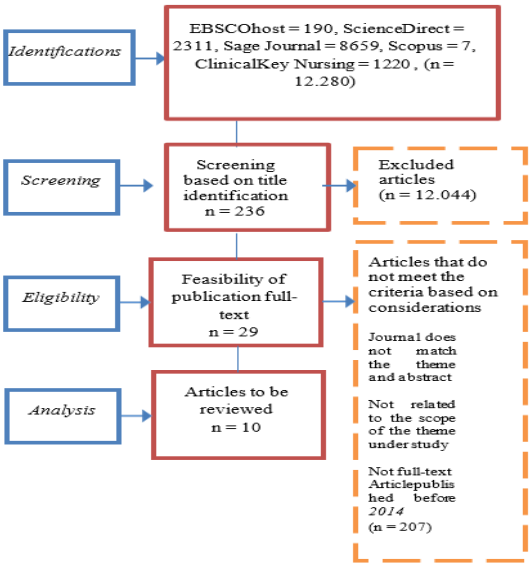

Figure 1. PRISMA

RESULTS

The results of the analysis of ten articles where eight articles discuss nursing interventions and two articles discuss the competence of nurses in patients attached to chemoport. A summary of the literature analysis can be seen in table 1.

Table 1. Summary of Literature Analysis

No	Journal Title	Aim	Design	Result Can be Expanded	Notes
1	Effect of lidocaine spray on relieving non-coring needle puncture-related pain in patients with totally implantable venous access port: a randomized controlled trial	To explore the effectiveness, acceptability, and safety of lidocaine spray in reducing pain from non-coring needle puncture in patients with TIVAP	Randomized controlled trial	The pain scores in the intervention and control groups were 15.12±6.61mm and 36.50±18.79mm respectively (P<0.05), 33 patients (78.6%) in the intervention group and 12 patients (28.6%) in the control group reported that they would choose the same spray for future interventions (P<0.001).	The use of local lidocaine spray in TIVAP patients is effective, acceptable, and safe to reduce pain from chemoport non-scoring needle puncture.
2	The Effects of Nursing Intervention on Pain Control during	To determine the effect of Lidocaine Cream, cryotherapy, and	Randomized controlled trial	All anesthetic methods (i.e., application of Lidocaine Cream, cryotherapy, and skin stimulation) applied prior	All three interventional measures (use of Lidocaine Cream, cryotherapy, and skin stimulation) may contribute to effective pain

	Chemoport Needle Insertion	skin stimulation on Pain Control due to Chemoport Needle Insertion.		to Chemoport needle insertion were effective in reducing patients' pain levels. In summary, all three anesthetic methods evaluated in this study reduced cancer patients' pain levels during Chemoport needle insertion.	and anxiety management during Chemoport needle insertion in the clinical environment (but remain subject-specific and subject to other hospital factors).
3	Improving the K ving the Knowledge of P nowledge of Port-A-Cath Car t-A-Cath Care For Nurses	To evaluate a program to improve knowledge of port-a-cath care for nursing staff. To assess nursing staff knowledge of the port-a-cath care process before the training program and measure knowledge of the device and procedures related to device use and maintenance after the training.	Rando mized controll ed trial	Nurses caring for port-a-cath patients were as follows: never (58.89%), one to five times (31.11%) 6-10 times (2.22%) and >10 times (7.78%). The study intervention significantly improved nurses' knowledge regarding port-a-cath care. Nurses achieved an average of 12.5 points at pretest (40.4%) and the score increased by an average of 27 points posttest (88.1%).	These findings relating to the low level of pretest knowledge by nurses provide strong evidence of the need for hospital-based education/training related to chemoport care.
4	Effects of Virtual Reality on Pain During Venous Port Access in Pediatric Oncology Patients: A Randomized Controlled Study	To evaluate the effect of Virtual Reality method on pain during venous port access in pediatric oncology patients aged 7 to 18 years.	Rando mized controll ed trial	Descriptive characteristics of the children (n = 71) showed a homogeneous distribution between groups. During the procedure, children in the control group (n = 36; 5.03 ± 3.35) experienced more pain than children in the VR group (n = 35; 2.34 ± 2.76; p < .001). Parental proxy reports in the experimental group (1.77 ± 2.46) were found to be lower than in the control group (4.67 ± 2.56; p < .001)	The VR method is effective for reducing pain during venous port access in pediatric oncology patients. VR should be used as a distraction method during venous port access.
5	Comparison of the effects of Valsalva maneuver, EMLA cream, and the combination of both in relieving pain of needle	To compare the effectiveness of Valsalva maneuver, eutectic cream mixed local anesthetic (EMLA), and the combination of both in	Rando mized controll ed trial	Group E and Group EV had the least pain scores at needle insertion, which was significantly lower than Group V and Group C.	EMLA cream is a safe and effective way to reduce pain during non-coring needle insertion in TIAP and improve overall patient comfort. We recommend using EMLA cream 1 hour before TIAP needle insertion, especially in patients who have needle

	insertion on totally implantable access port: A randomized controlled stud	relieving cannulation pain in chemoport.			phobia or high pain scores from previous non-coring needle insertion.
6	Setting the stage: innovation in port access education for pediatric emergency nurses	To describe the knowledge and self-efficacy gained after receiving training on sterile access techniques for chemoport and see the effect of training on nurses in accessing chemoport sterile.	Randomized controlled trial	Thirty-four pediatric emergency nurses participating in the study demonstrated an overall increase in knowledge and self-efficacy with port access maintained throughout the 3-month follow-up. Data revealed positive responses regarding the simulation experience of the study participants	Effective sterile chemoport access training for nurses requires a comprehensive curriculum that integrates procedural aspects and situational techniques to address components of the actual chemoport access experience involving pediatric patients and families. The curriculum in this training combines skill-based practice with situational management, and promotes self-efficacy and nursing competence with port access in the pediatric population.
7	Improving cancer patients' knowledge about totally implantable access port: a randomized controlled trial	To evaluate the effectiveness of educational methods related to chemoport on increasing patient knowledge and reducing anxiety in patients with chemoport.	Randomized controlled trial	Results after 3 months, pairwise comparisons showed a significant increase in chemoport knowledge in each group. ($p < 0.001$), significant difference in group C compared to group A ($p < 0.001$) and Group B ($p < 0.001$). Anxiety decreased in the intervention group and control group after receiving information related to chemoport.	Educational interventions related to chemoport in cancer patients are effective in increasing knowledge about chemoport in 3 months and effective in reducing anxiety in patients who are placed on chemoport.
8	The Effect of Virtual Reality Distraction Intervention on Pain, Anxiety, and Vital Signs of Oncology Patients Undergoing Port Catheter Implantation: A Randomized Controlled Study	To determine the effect of virtual reality (VR) distraction intervention on pain, anxiety, and vital signs of oncology patients undergoing port catheter implantation.	Randomized controlled trial	There was an increase in pain scores in both groups after chemoport implantation however, pain scores in the intervention group were lower and there was a statistically significant difference between the two groups after implantation. In the intervention group there was a decrease in anxiety, systolic blood pressure, diastolic blood pressure, heart rate, and respiratory rate, and an increase in SpO2. The use of VR had a large effect on pain scores (Cohen's d = 3.023) and a large effect on SAI scores (Cohen's d = 8.770).	VR distraction intervention was found to be an effective way to reduce pain, anxiety, , blood pressure, blood pressure (systolic diastolic), heart rate, and respiratory rate and improve SpO2 of patients undergoing port catheter implantation.

9	The Effect of Visual Information Blocking Nursing Intervention on Stress and Anxiety during Chemoport Insertion in Adult Cancer Patients of Operation Rooms	To examine the effect of visual information blocking (VIBNI) nursing intervention on stress and anxiety of patients undergoing chemoport insertion in the operating room.	Quasi Eksperimen	The difference in cortisol levels between the two groups was statistically significant after the VIBNI intervention (p=0.007). In terms of systolic blood pressure (p=0.005) and pulse rate (p<0.001), the interaction between the two groups was significant over time.	Participants who received VIBNI reported lower stress responses (cortisol level, systolic blood pressure, and pulse rate) during chemoport insertion. Based on the results of this study, further evaluation in a larger sample and objective anxiety is needed.
10	Effect of Educational Guidelines on Nurses' Performance regarding Prevention of Port-A-Catheter complications among Patients Undergoing Chemotherap	To evaluate the effect of educational guidelines on nurse performance regarding the prevention of port-A-catheter complications in patients undergoing chemotherapy.	Quasi Eksperimen	There was a correlation between the knowledge and practice of the studied nurses regarding Port-A catheter guidelines before and after education. There was a statistically significant positive correlation between total knowledge and practice before and after the implementation of educational guidelines (p= 0.00003* and 0.00067*, respectively).	Nurses are the backbone of the oncology team, so nurses must be continuously educated to implement new developments in their practice. As nurses are responsible for identifying patients who will benefit from port-A-catheters, performing teaching, accessing the port, administering medications, completing on-site care and preventing complications. Therefore, continuing education is essential to provide optimal care to patients with A-port catheters.

DISCUSSION

A chemoport is an implanted device placed in the central venous system, primarily for the infusion of chemotherapy drugs in oncological diseases. Chemoport, mediport, cancer port, or portacath can reduce inflammation of blood vessels during chemotherapy because this device is implanted under the skin, making intravenous drug administration easier and reducing pain. It facilitates healthcare workers in locating patients' blood vessels[10].

Regarding Patricia Benner's nursing theory on the interrelation between knowledge and practice, where nurses have a role in developing knowledge in practice in line with the research findings by Navin Rajendra in 2021 conducted in India concluded that the chemotherapy method through chemoport access needs to be offered to patients requiring long-term venous access, and its use can be controlled by a trained team. Chemoport is safe for children requiring long-term chemotherapy. Studies have shown that the use of Port-A-Cath in the treatment and management of cancer patients results in shorter hospital stays[11].

The use of chemoport in developing countries is increasingly common. In Indonesia, the use of chemoport is on the rise, with breast cancer patients typically choosing to use chemoport after receiving education about the low and mild complications that may occur[12]. However, in other studies, several complications arising from the use of chemoport are mentioned, including pneumothorax, infection, thrombosis, hemothorax, drug extravasation, and chemoport malfunction[6].

In a quantitative observational study conducted by Madabhavi in 2017 in India involving 100 patients requiring port catheter placement, the research findings showed that the most disturbing aspect of treatment for patients is repeated venous punctures for the administration of cytotoxic agents, antibiotics,

blood products, and nutritional supplements, which can cause pain and discomfort to patients[13].

The Nursing Interventions Classification (NIC) standard classification encompasses independent, collaborative interventions, and direct or indirect care. Chemotherapy management is a collaborative nursing intervention that can be performed by oncology nurse specialists after basic nursing registration. Nursing interventions involve handling or treatment based on assessment and clinical knowledge where nurses take action with the aim of improving patient outcomes[7].

Based on Patricia Benner's Nursing Theory on caring, clinical wisdom, and ethics in nursing practice, Benner states that nursing practice is an effort toward the interconnection between knowledge and nursing practice. Nursing knowledge in practice is acquired over time and developed through experimental learning, situational thinking, and reflection in specific practices. Patricia Benner describes the mastery of skills and development in nursing practice divided into levels starting from novice, advanced beginner, competent, proficient, and expert. Nurses as caregivers must be able to provide more specific care and therapy according to the needs of patients because the life journey of cancer patients and their families must be understood.

The goal of cancer patient care is to improve the quality of life of cancer patients through both independent and collaborative nursing interventions. The choice of cancer treatment through chemotherapy, as described above, has an impact on cancer patients, both from the chemotherapy regimen and the method of drug administration[14].

Based on the systematic review conducted, several nursing interventions and nurse competencies in the use of chemoport in cancer patients include interventions for reducing pain such as virtual reality intervention, Valsalva maneuver, skin stimulation, and local anesthesia administration. Meanwhile, nursing interventions to reduce anxiety include virtual reality intervention, visual blocking information intervention, patient education, and nurse competency through knowledge enhancement and training.

Nursing Interventions to Reduce Pain

Inadequate pain management can negatively impact children, parents, and healthcare providers. Distraction is an active coping strategy where patients divert their attention from nociceptive stimuli to reduce pain awareness. Virtual reality intervention is one intervention that can effectively reduce pain during chemoport access. Virtual Reality is a distraction method that helps patients actively participate in a task with cognitive or behavioral functions.

The effect of Virtual reality on pain scores was obtained from the research findings of Semerci (2021) where pain evaluation was obtained through self-reports of children and proxy reports of parents, using the Wong-Baker FACES Pain Rating Scale. It was found that when procedural pain during chemoport access in children was evaluated using the Wong–Baker Faces Pain Rating Scale (control group = 5.02 ± 3.35; VR group = 2.34 ± 3.27), there was a significant difference between the control group and the VR group ($p = 0.001$)[15]. The average pain scores of children in the control group were significantly higher than in the Virtual reality group. Parent proxy reports in the experimental group (1.77 ± 2.46) were found to be lower than in the control group (4.67 ± 2.56; p (<0.001)). Virtual Reality is useful for reducing procedural pain in children. VR can be used in pediatric clinics during painful procedures such as chemoport access and also to improve procedure success. Additionally, it is suggested that VR be combined with proven methods such as topical anesthesia and parental presence to reduce needle pain [15].

In line with this, research conducted by Shi, et al., (2023) found that the Valsalva Maneuver intervention is also effective in reducing pain during chemoport access[16]. Modified Valsalva Maneuver can alleviate pain during non-injury needle insertion on TIVAP, which may benefit from increased chest wall stiffness as they hold their breath. Simultaneously, applying the Valsalva Maneuver during coring needle insertion into the port allows patients to focus on their breathing, diverting attention and maintaining emotional stability through breathing control and ultimately resulting in pain relief. The research findings indicate that pain scores in patients with the Valsalva Maneuver are smaller compared to the control group[16].

Another nursing intervention to reduce pain during chemoport access is the administration of local anesthesia such as

lidocaine spray, cryotherapy, and the use of EMLA cream, which has been proven to reduce pain during chemoport access. The research findings of Zhu (2023) regarding the effect of lidocaine spray in relieving pain caused by non-coring needle insertion in patients with total implantable venous access port showed that the pain scores in the intervention and control groups were 15.12 ± 6.61mm and 36.50 ± 18.79 mm, respectively ($P < 0.001$). There were 2 (4.8%) patients with moderate pain in the intervention group and 18 (42.9%) patients with moderate pain in the control group ($P < 0.001$). In the control group, (7.1%) patients reported severe pain. This study concluded that the use of local lidocaine spray in TIVAP patients is effective, acceptable, and safe for reducing pain caused by non-coring needle insertion[17].

In another study by Menekli (2022), nursing interventions such as the administration of local anesthesia with lidocaine cream, cryotherapy, and skin stimulation were effective in reducing pain during chemoport needle insertion. The research results showed a significant difference in pain scores between the experimental groups (lidocaine cream group, cryotherapy group, and skin stimulation group) and the control group (without anesthesia) validated by statistical analysis of subjective pain scores: $F=26.76$, $p < 0.000$. Pain scores (subjective and objective scores) in the intervention groups were significantly lower than scores from the control group[18].

Nursing Interventions to Reduce Anxiety

Chemoport has many beneficial effects on the quality of life of patients. It is reported in the literature that besides patients experiencing pain in the incision area after implantation, patients may also experience anxiety before, during, or after implantation. Due to pain and anxiety, changes in patients' vital signs may occur. Distraction is effective in managing anxiety, such as active distraction techniques like toy provision, virtual reality, integrated imagination breathing control, and relaxation.

In a study conducted by Menekli (2022), Virtual reality intervention was proven effective in reducing anxiety in cancer patients with chemoport placement. In the intervention group, there was a decrease in the level of patient anxiety while there was an increase in the control group. The use of virtual reality has a significant effect on the State Anxiety Inventory score (Cohen's $d = 8.770$) in patients undergoing chemoport implantation[18].

The findings of this study, reporting that most studies report positive findings supporting the use of VR for anxiety-related disorders. In this regard, the literature review findings regarding nursing interventions in patients with chemoport placement also indicate that virtual reality is effective in reducing anxiety.

Another intervention to reduce anxiety is visual blocking information intervention. To test the effect of nursing intervention of visual information blocking (VIBNI) on stress and anxiety levels of patients undergoing chemoport placement in the operating room. VIBNI intervention is a nursing intervention for visual information blocking where nursing actions provided by nurses to block information by covering the eyes using gauze with attention to thickness, size, and weight of the gauze and illumination measured with a light meter (CENTER-337, Center Technology, Taiwan) and 330 Lux illumination provided, and the spatio-temporal process measured during the chemoport placement procedure in the operating room.

The level of patient anxiety in this study was assessed by examining serum cortisol levels taken during the operation. The research findings showed a significant difference in cortisol levels between the two groups statistically after the VIBNI intervention ($p=0.007$). In terms of systolic blood pressure ($p=0.005$) and heart rate ($p < 0.001$), the interaction between the two groups appeared significant over time. Participants receiving VIBNI reported lower stress responses (cortisol levels, systolic blood pressure, and heart rate) during chemoport placement[19].

Patient education intervention is an intervention that is much needed by cancer patients related to the need for important and specific information which, if addressed, can reduce anxiety and mood disturbances and result in a better quality of life. Most cancer patients want to receive as much information as possible, but at least half are not at all or slightly satisfied with the amount of information received. Nurses can be very effective as providers of cancer patient information and can play this role with several strategies. In addition to oral communication, written education, especially in brochure format, personalized and reviewed with healthcare professionals, is highly appreciated by cancer patients[20].

The findings of this literature review are in line with this. In a study conducted by Piredda (2016) to evaluate the effectiveness of an information booklet on patient knowledge about chemoport in a short time and after 3 months and in reducing physiological indicators of patient anxiety immediately after chemoport implantation. The research findings showed a significant difference in knowledge in group C compared to group A ($p < 0.001$) and group B ($p < 0.001$) from each other. Physiological indicators of anxiety decreased in the intervention group compared to the control group immediately after chemoport implantation[21].

Nurse Competencies in Providing Interventions for Patients with Chemoport

The care and rehabilitation of cancer patients are interdisciplinary work. Optimal care and complication avoidance require collaborative efforts from all specialists involved, not only doctors who perform port system implants but also oncologists, nutritionists, and especially nurses. Continuing education also plays a role in improving outcomes[20].

All individuals caring for cancer patients with port systems must take responsibility for the care of these special systems. Nurses are the basic element of the oncology team. Nurses are primarily responsible for ensuring that patients receive chemotherapy safely and providing effective self-care support needed for patients to cope with their treatment. Nursing care and catheter management are complex, and many controversial practice issues pose challenges for nursing specialists[22].

In this regard, the results of this systematic review found research findings by Hoa (2019) showing that the study intervention significantly improved nurses' knowledge of port-a-cath care, where nurses' knowledge reached an average of 12.5 points on the pretest (40.4%) but increased scores averaged 27 points posttest (88.1%). It is important to realize that nursing staff play a significant role in reducing port-a-cath complications and are directly responsible for ensuring patient safety and improving hospital service quality[23].

In another study, the results of this literature search also stated that improving nurses' knowledge about effective chemoport access requires a comprehensive curriculum that integrates procedural aspects and situational techniques to address the actual chemoport access experience involving pediatric patients and families. The research findings indicate that providing skills-based practice education is effective in increasing self-efficacy and nursing competence in accessing chemoport in children[24].

Competent nurses with broad knowledge in key aspects of chemoport care and maintenance can ensure that the specific needs of patients are met and optimal health outcomes are achieved. However, nurses working in oncology require a higher level of knowledge and skills in managing port-a-catheters.

The findings of this literature search also show research results that are consistent with the research conducted by Mersal (2012) showing nurses' knowledge of complications related to pre- and post-chemoport education guidelines, less than a quarter of nurses (20%) had a satisfactory level of knowledge regarding chemoport complications such as catheter cutting and pre-education guidelines for lung collapse while more than three-quarters of nurses (76.66%) had a satisfactory level of knowledge regarding the same items after education guidelines. Additionally, one-third (33.33%) of nurses had a satisfactory level of knowledge regarding chemoport complications such as site infection, bleeding, clot formation, and nerve damage, while most nurses (80%) had a satisfactory level of knowledge regarding the same items post-education guidelines. Moreover, this study illustrated that there was a statistically significant difference between nurses' knowledge before and after education guidelines about chemoport complications with $p < 0.005$[25].

CONCLUSION

The results of a systematic review that have been carried out, obtained several nursing interventions and nurse competencies in the use of chemoports in cancer patients, among others, are divided into nursing interventions to reduce pain, namely virtual reality interventions, giving Valsalva maneuvers, skin stimulation, and giving local anesthesia. While nursing interventions to reduce anxiety include virtual relity interventions, visual blocking information interventions and patient education and nurse competence through increasing nurse

knowledge and providing training. meaning/purpose, and transcendence.

For further research, it is recommended to conduct research related to complications and causes of complications in patients with chemoport.

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