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Nursing Management of Extravasation Complications Related to Intravenous Catheters: A Narrative Review

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ABSTRACT

Background: The existing literature on nursing management of extravasation complications is fragmented, inconsistent, and outdated. When it comes to nursing management of extravasation complications, there are several gaps that need to be addressed as generally of study participants had poor knowledge of the prevention and management of cytotoxic extravasation, a high number of nurses were not were not trained on cytotoxic extravasation.

Methods: We conducted a narrative review by searching the following databases for relevant clinical practice guidelines published from Oct 2013 to Oct 2023: PubMed, Cochrane Library, CINAHL, Scopus and Clinical practice guidelines developed by institutes, hospitals, associations, and cancer groups, based on systematic and evidence-based review. We used the AMSTAR 2 tool for assessing the quality of systematic reviews, and summarized the characteristics and findings of the included studies in a narrative synthesis including year of publication, title, Institution/authors, key highlight (assessment, management, prevention).

Results and discussions: These Clinical practice guidelines have some similarities and differences in their scope, methods, recommendations, and quality. They all aim to provide evidence-based and standardized guidance for the prevention and management of extravasation, and to improve the quality and safety of intravenous therapy.

Conclusions: In conclusion, while significant progress has been made in understanding and managing extravasation injuries, there is still much work to be done. By continuing to research, educate, and apply evidence-based practices, healthcare professionals can significantly improve the care and outcomes for patients at risk of extravasation injuries

KEYWORDS: Nursing management, extravasation complications, intravenous catheter.

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Abbreviations

CPGs: Clinical practice guidelines

1. INTRODUCTION

Extravasation is a critical complication that can occur during the administration of intravenous (IV) medications. It refers to the inadvertent leakage of a vesicant or irritant solution from the vein into the surrounding tissue. When extravasation occurs, it can cause tissue damage, pain, and potential long-term consequences for the patient. As such, nursing management of extravasation is essential to prevent harm and promote optimal patient outcomes. Nurses play a crucial role in preventing, detecting, and managing extravasation complications by following evidence-based guidelines and procedures[1]. However, the existing literature on nursing management of extravasation complications is fragmented, inconsistent, and outdated. When it comes to nursing management of extravasation complications, there are several gaps that need to be addressed as generally of study participants had poor knowledge of the prevention and management of cytotoxic extravasation, a high number of nurses' were not were not trained on cytotoxic extravasation[2], or reported they had experienced

extravasation injury in a patient; most of nurse said they had received no instruction in the management of extravasation during their in-service training program[3]. In summary, addressing these gaps and having consistency in nursing management and prevention can improve patient outcomes and reduce the impact of extravasation complications. Therefore, this thesis aims to provide a comprehensive and up-to-date review of the current practice of nursing management and prevention of extravasation complications. The thesis will also synthesize the best practices and recommendations from various sources such as clinical guidelines, research studies, and expert opinions.

2. MATERIAL AND METHODS

Search strategy: We searched the following databases for relevant clinical practice guidelines published from Oct 2013 to Oct 2023: PubMed, Cochrane Library, CINAHL, Scopus and CPGs developed by institutes, hospitals, associations, and cancer groups, based on systematic and evidence-based review[4]. We used a combination of keywords related to extravasation, nursing management and guidelines/protocol. We also checked the reference lists of the included studies and relevant reviews for additional sources.

Study selection: We included systemic reviews, guidelines/protocol that meet the following criteria: (1) they were guidelines or systematic reviews or narrative reviews; (2) they focused on nursing management of extravasation complications in any setting and population; (3) they reported on the prevention, detection, or treatment of extravasation complications; and (4) they are published in English. We excluded studies that were not peer-reviewed, had insufficient data, or had a high risk of bias. Two reviewers independently screened the titles and abstracts of the retrieved studies and select the full-text articles for further assessment. Any disagreement was resolved by discussion or consultation with a third reviewer.

Data extraction: We used a standardized form to extract the following data from each included study: Title, year of publication, Institution/authors, evidence-based guideline, update, size of complete guideline (pages), number of references. Two reviewers independently performed the data extraction and cross-check for accuracy and completeness. Any discrepancy was resolved by discussion or consultation with a third reviewer.

Quality assessment: We used the AMSTAR 2 tool for assessing the quality of systematic reviews[5]. Two reviewers independently appraised the quality of each included study and assign a rating of low, moderate, serious, or critical risk of bias. Any disagreement was resolved by discussion or consultation with a third reviewer.

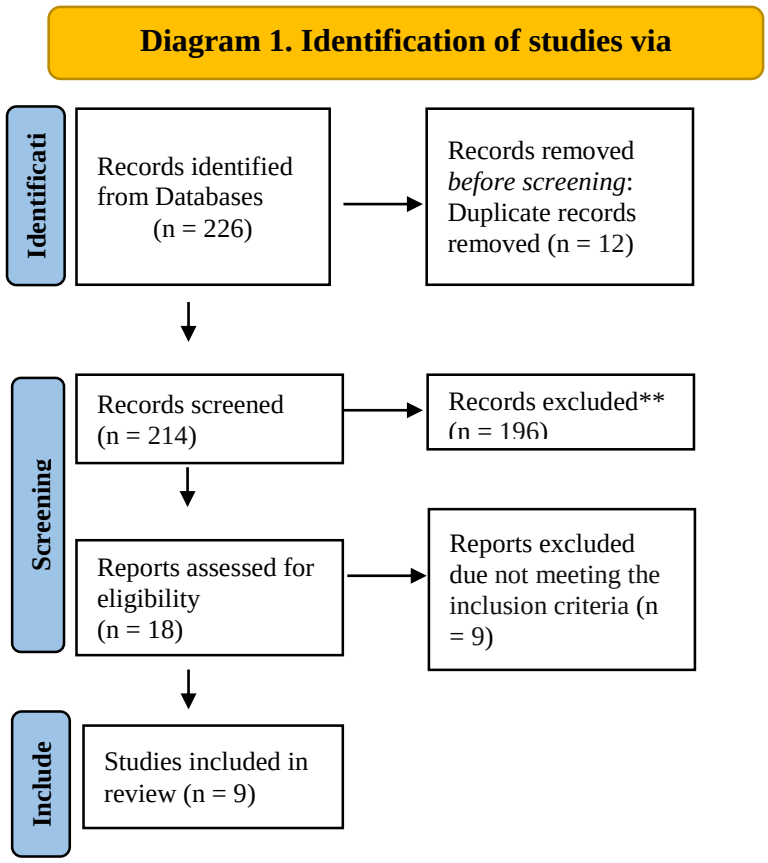
Data synthesis: We summarized the characteristics and findings of the included studies in a narrative synthesis including year of publication, title, Institution/authors, key highlight (assessment, management, prevention).

Reporting: We reported our literature review following the PRISMA guidelines[6]. We provided a PRISMA flow diagram to illustrate the search and selection process and a PRISMA checklist to ensure that all relevant items are reported. We also discussed the implications, limitations, and recommendations of our review for nursing practice and research.

3. RESULTS

3.1. Search strategy

- The PRISMA flow diagram shows the number of records identified, screened, and included in the review, as well as the reasons for exclusion.
- A total of 226 records were identified through the database searches, of which 12 were duplicates and were removed. The remaining 214 records were screened by title and abstract, and 196 were excluded for not meeting the inclusion criteria. The full texts of the 18 potentially eligible records were assessed for eligibility, and 8 were excluded for various reasons (see Diagram 1. Identification of studies via databases). Therefore, 10 records were included in the qualitative synthesis.
- The main findings of the included records are shown in Table 1. They consisted of 6 guidelines, 2 literature reviews and 1 before-and-after study. The publication year ranged from 2016 to 2023. The records covered various aspects of nursing management of extravasation complications, such as prevention, assessment, intervention, documentation, and educati



3.2. Key findings of the included records

Table 1. Key findings of the recorded guideline/protocols

No	Year	Title	Institution/authors	Key highlight
1	2016	Extravasation And Infiltration Injuries – Prevention And Management[7]	Neonatal Services Division	Assessment: Initial acute assessment: Stop the infusion immediately and remove the cannula or catheter. Assess the site for signs of injury, such as blanching, swelling, redness, pain, or blistering. Measure the circumference of the affected limb and compare it with the contralateral limb. Document the findings and notify the medical officer. Grading scale: Use the Visual Infusion Phlebitis (VIP) score to grade the severity of the injury. The VIP score ranges from 0 (no symptoms) to 4 (severe phlebitis with possible extravasation). A score of 3 or 4 indicates a need for urgent medical review. On-going assessment: Monitor the site regularly for changes in appearance, temperature, and sensation. Measure the limb circumference daily and document any increase or decrease. Assess the need for analgesia and provide appropriate pain relief. Management: Acute Management: Apply a warm or cold compress to the site, depending on the type of solution that leaked. Warm compresses are

				recommended for solutions that cause vasoconstriction, such as dopamine, dobutamine, or calcium. Cold compresses are recommended for solutions that cause tissue necrosis, such as potassium, phenytoin, or sodium bicarbonate1. Elevate the affected limb and avoid any pressure or friction on the site. Consult the medical officer for further management, such as surgical intervention or antidote administration. Irrigation Procedure: If the extravasation injury is caused by a vesicant solution, such as dopamine, dobutamine, or calcium, the site may need to be irrigated with saline or hyaluronidase to dilute the solution and prevent further tissue damage. The irrigation procedure involves infiltrating the affected area with local anaesthetic, making multiple punctures with a needle, and injecting saline or hyaluronidase through the punctures. The procedure should be performed by a medical officer or a nurse practitioner. Ongoing Management: Apply a hydrogel dressing to the site and change it every 2-3 days or as needed. Monitor the site for signs of infection, such as increased redness, swelling, warmth, or purulent discharge. Administer antibiotics as prescribed by the medical officer. Refer the patient to a plastic surgeon or a wound care specialist if there is evidence of tissue necrosis or ulceration. Prevention: Prevention of infiltration and/or extravasation involves following the NCC clinical guidelines for insertion and maintenance of intravenous cannulas and catheters. Some of the key points are: Avoid placing cannula and catheter tips in susceptible areas, such as over bony prominences, the wrist, the dorsum of the foot, or the scalp. Apply taping loosely to allow circulation and do not obscure the site of insertion. Vesicant solutions should be administered by a central line where possible. Document and check all intravascular lines using NCC observation charts. Cannula sites should be checked hourly and catheter sites should be checked with all cares. Monitor the site regularly for signs of infiltration or extravasation, such as blanching, swelling, redness, pain, or blistering

2	2017	Development of an Evidence-Based List of Noncytotoxic Vesicant Medications and Solutions[8]	Gorski LA, Stranz M, Cook LS, Joseph JM, Kokotis K, Sabatino-Holmes P, Van Gosen L; Infusion Nurses Society Vesicant Task Force	Prevention: The first step in preventing extravasation is the recognition of vesicant infusates. Each organization should have a list of vesicant infusates and should address extravasation prevention, as well as management, in policies and procedures
3	2017	Guidelines for the Management of Extravasation of a Systemic Anti-Cancer Therapy including Cytotoxic Agents[9]	West Midlands Expert Advisory Group for Systemic Anti-Cancer Therapy (SACT)	Assessment: Initial acute assessment: The guideline recommends to stop the infusion, leave the cannula in place, aspirate as much extravasated solution as possible, mark the extravasated area, and inform the medical team. The guideline also suggests to identify the extravasated agent, collect the extravasation pack, and reassure the patient. Grading scale: The guideline does not provide a grading scale for extravasation, but it mentions some factors that influence the extent of injury, such as the type, concentration, volume, and location of the drug, and the co-morbidities and other patient factors. On-going assessment: The guideline advises to monitor the extravasated area for signs of inflammation, induration, blistering, and necrosis, and to review the patient within one week. The guideline also states that surgical debridement may be needed for unresolved tissue necrosis or pain lasting more than 10 days. Management: Acute Management: The guideline outlines different management strategies depending on the classification of the extravasated drug, such as vesicant, irritant, or non-vesicant. The guideline also specifies some antidotes for certain drugs, such as Savene for anthracyclines, DMSO for mitomycin C and mitoxantrone, and hyaluronidase for vinca alkaloids and taxanes. The guideline provides detailed instructions for the administration of these antidotes in the appendices. Irrigation Procedure: The guideline mentions that saline flushout may be performed by the local plastics or flush out team for some extravasations, but it does not provide a clear protocol for this procedure. Ongoing Management: The guideline recommends to elevate the limb, administer analgesia if necessary, and apply cold or warm compresses depending on the drug. The

				guideline also advises to follow up the patient within one week and to refer to surgical management if needed. Prevention: The guideline identifies some risk factors for extravasation, such as patient factors, cannulation and infusion procedure factors, equipment factors, and treatment factors. The guideline also suggests some preventive measures, such as staff training, site selection, choice of equipment, patient education, administration technique, and documentation.
4	2017	Saline irrigation for the management of skin extravasation injury in neonates[10]	P N Gopalakrishnan, Nitin Goel, Sujoy Banerjee	Assessment: Initial acute assessment: The paper does not provide a clear protocol for the initial acute assessment of extravasation injury in neonates. However, it mentions some factors that may influence the severity of the injury, such as the type, concentration, volume, and duration of the infusate, the size and location of the affected area, and the presence of signs and symptoms such as pain, swelling, erythema, blistering, necrosis, or infection. Grading scale: The paper does not recommend a specific grading scale for extravasation injury in neonates. On-going assessment: The paper does not provide a detailed guideline for the on-going assessment of extravasation injury in neonates. However, it suggests that regular monitoring of the wound healing process, the occurrence of complications, and the need for surgical intervention should be performed. It also mentions some outcome measures that have been used in previous studies, such as the time to complete healing, the need for surgical intervention, the cosmetic appearance of the scar, and the functional impairment of the affected limb. Management: Acute Management: The paper does not provide a clear protocol for the acute management of extravasation injury in neonates. However, it mentions some general principles that should be followed, such as stopping the infusion immediately, removing the cannula, elevating the affected limb, applying a warm or cold compress, marking the extent of the injury, and consulting a plastic surgeon if needed. Irrigation Procedure: The paper reviews the evidence for the use of saline irrigation with or without prior hyaluronidase infiltration as a

				treatment for extravasation injury in neonates. Saline irrigation is a procedure that involves injecting normal saline into the affected area to dilute and flush out the infusate, while hyaluronidase is an enzyme that breaks down the connective tissue and facilitates the spread of the saline. The paper reports that there are no randomized controlled trials that have evaluated the efficacy and safety of this intervention in neonates, and that the available evidence is based on case series or reports with variable results. The paper also discusses the potential benefits and risks of saline irrigation, such as reducing the tissue damage, preventing infection, improving wound healing, and causing pain, bleeding, infection, or allergic reaction. Ongoing Management: The paper does not provide a clear protocol for the ongoing management of extravasation injury in neonates. However, it mentions some general principles that should be followed, such as providing adequate analgesia, applying appropriate dressings, monitoring the wound healing process, preventing infection, managing complications, and providing long-term follow-up. Prevention: The paper does not provide a clear protocol for the prevention of extravasation injury in neonates. However, it mentions some general principles that should be followed, such as using appropriate cannulation techniques, selecting suitable sites and devices, avoiding high-risk infusates, checking the patency and position of the cannula regularly, educating the staff and parents about the signs and symptoms of extravasation, and having a clear policy and protocol for the management of extravasation injury
5	2019	Assessing the Quality of Existing Clinical Practice Guidelines for Chemotherapy Drug Extravasation by Appraisal of Guidelines for Research and Evaluation II[4]	Bahrami M, Karimi T, Yadegarfar G, Norouzi A	Assessment: Initial acute assessment: The paper does not provide specific recommendations for the initial acute assessment of chemotherapy drug extravasation, but it mentions that some CPGs suggest stopping the infusion, disconnecting the catheter, aspirating the residual drug, and marking the affected area. Grading scale: The paper does not mention any grading scale for chemotherapy drug extravasation, but it refers to the Oncology Nursing Society (ONS) guidelines that classify the drugs into four categories based on their potential for tissue damage: vesicants, irritants,

				irritants with vesicant potential, and neutral agents. On-going assessment: The paper does not give any specific recommendations for the on-going assessment of chemotherapy drug extravasation, but it states that some CPGs advise monitoring the patient for signs and symptoms of infection, inflammation, necrosis, and ulceration Management: Acute Management: The paper does not provide any specific recommendations for the acute management of chemotherapy drug extravasation, but it reviews the different antidotes and treatments that are suggested by various CPGs, such as cold or warm compresses, topical or systemic corticosteroids, hyaluronidase, dexrazoxane, dimethyl sulfoxide, and sodium thiosulfate Irrigation Procedure: The paper does not mention any irrigation procedure for chemotherapy drug extravasation, but it notes that some CPGs recommend flushing the extravasation site with normal saline or sodium bicarbonate Ongoing Management: The paper does not provide any specific recommendations for the ongoing management of chemotherapy drug extravasation, but it indicates that some CPGs suggest wound care, pain management, infection prevention, and patient education Prevention: The paper does not offer any specific recommendations for the prevention of chemotherapy drug extravasation, but it emphasizes the importance of following the CPGs and the evidence-based practices to reduce the risk of this complication. It also highlights the need for more research and evaluation of the existing CPGs to improve their quality and applicability
6	2020	Guidelines for the management of extravasation[11]	Kim JT, Park JY, Lee HJ, Cheon YJ	Assessment: Initial acute assessment: The paper recommends that the nurse should perform the following steps at the first sign of extravasation: Stop administration of IV fluids immediately. Disconnect the IV tube from the cannula. Aspirate any remaining drug from the cannula. Administer drug-specific antidote. Notify the physician. Grading scale: The paper does not provide a specific grading scale for extravasation, but it mentions some factors that can affect the severity of the injury, such as the type,

				concentration, volume, and pH of the drug, the duration of exposure, the location and size of the affected area, and the patient's age, health status, and comorbidities. On-going assessment: The paper suggests that the nurse should monitor the patient's condition and document the following information: Date and time of extravasation occurrence. Name, dose, route, and infusion rate of the drug. Location and size of the extravasation site. Signs and symptoms of the patient. Interventions performed and their outcomes. Patient's response and satisfaction. Management: Acute Management: The paper recommends that the nurse should apply local thermal treatments to decrease the site reaction and absorption of the infiltrate. The type of thermal application depends on the properties of the drug. For example, local cooling (ice packs) is advised for drugs that cause vasoconstriction, such as epinephrine, norepinephrine, dopamine, and vinca alkaloids. Local warming (warm compresses) is advised for drugs that cause vasodilation, such as nitroglycerin, calcium channel blockers, and hydralazine. The paper also provides a table of drug-specific antidotes and their administration methods. Irrigation Procedure: The paper does not mention a specific irrigation procedure for extravasation, but it refers to some studies that have used saline or sodium bicarbonate solutions to flush out the extravasated drug1. However, the paper notes that the evidence for the effectiveness of irrigation is limited and that it may increase the risk of infection or tissue damage. Ongoing Management: The paper advises that the nurse should provide supportive care and follow-up for the patient, such as: Elevating and immobilizing the affected limb. Applying topical agents, such as hydrocortisone cream, silver sulfadiazine cream, or honey dressing, to promote wound healing and prevent infection. Administering analgesics, anti-inflammatory drugs, or antihistamines to relieve pain, swelling, or itching. Referring the patient to a specialist, such as a plastic surgeon, a dermatologist, or a wound care nurse, if needed.

				Educating the patient and the family about the signs and symptoms of complications, such as infection, necrosis, ulceration, or nerve damage, and the appropriate actions to take. Prevention: The paper emphasizes that the best way to prevent extravasation is to avoid it in the first place, by following these guidelines: Selecting the appropriate vein, catheter, and infusion device for the drug and the patient. Checking the patency and placement of the catheter before and during the infusion. Securing the catheter and dressing properly and changing them regularly. Observing the infusion site and the patient frequently for any signs of extravasation. Asking the patient about any sensory changes, tingling, or burning sensations at the infusion site. Stopping the infusion immediately and following the initial acute assessment steps if extravasation is suspected or confirmed.
7	2020	Clinical practice guideline on the prevention and management of neonatal extravasation injury: a before-and-after study design[12]	Chan KM, Chau JP, Choi KC, Fung PG, Lui WW, Chan MS, Lo SH	Assessment: Initial acute assessment: The study was conducted in a neonatal unit with a controlled before-and-after design Grading scale: Not explicitly mentioned in the available snippets. On-going assessment: Post-intervention data for nurses, including the nurses' level of knowledge and adherence, were collected at six months after the program. Management: Acute Management: The extravasation rate before and after the intervention was 14.04 and 2.90 per 1,000 peripheral intravenous catheters days, respectively Irrigation Procedure: Not explicitly mentioned in the available snippets. Ongoing Management: The educational program will have to be conducted periodically and incorporated into the nurses' induction program to maintain nurses' knowledge and adherence to the evidence-based practice Prevention: The implementation of an evidence-based clinical practice guideline significantly reduced the rate of peripheral intravenous extravasation and extravasation from a central line in neonates

8	2020	Nursing guidelines: Extravasation Injury Management[13]	Royal Children's Hospital Melbourne	Assessment: Initial acute assessment: A site assessment should be conducted every hour when there are fluids or medications running through the line. If nothing is being infused, the site should be assessed before accessing the line and at least every eight hours. Grading scale: The guideline provides a grading scale for extravasation injuries, ranging from Grade 1 (Painful IV site, Difficulty running infusion) to Grade 4 (Painful IV site, Skin blanching, Very marked swelling, Cool to touch, Cap refill >4 seconds at site, Decreased or absent pulse, Skin breakdown or necrosis). On-going assessment: Not explicitly mentioned in the available snippets. Management: Acute Management: Early identification and appropriate management of extravasation is crucial in order to prevent serious adverse outcomes. Under NO circumstances should the device be flushed. Irrigation Procedure: Not explicitly mentioned in the available snippets. Ongoing Management: Not explicitly mentioned in the available snippets. Prevention: Nursing vigilance along with prompt recognition and management is the key to avoiding or minimising injury. Limiting the pump cycle to one hour may minimise the extent of tissue damage from extravasation by triggering a reminder to inspect the insertion site and limb for signs of extravasation
9	2023	NCCP Guidance: Prevention and Management of Extravasation of Systemic Anti-Cancer Therapy (SACT)[14]	Health Service Executive (HSE)	Assessment: Initial acute assessment: The guidance includes a standardised nursing document for the assessment of a suspected or diagnosed extravasation injury. Grading scale: The document does not provide specific details on a grading scale in the search results. On-going assessment: The document does not provide specific details on ongoing assessment in the search results. Management: Acute Management: The document does not provide specific details on acute management in the search results. Irrigation Procedure: The document does not provide specific details on an irrigation procedure in the search results.

				Ongoing Management: The document does not provide specific details on ongoing management in the search results. Prevention: The guidance is aimed at preventing extravasation of SACT

4. DISCUSSION

4.1. Discussion on the scope, methods, recommendations, and quality of recorded guidelines in this study

These CPGs have some similarities and differences in their scope, methods, recommendations, and quality. They all aim to provide evidence-based and standardized guidance for the prevention and management of extravasation, and to improve the quality and safety of intravenous therapy. They all acknowledge the lack of high-quality evidence and the need for further research on this topic. They all recommend similar steps for the nursing intervention and thermal application for extravasation, and provide similar lists of antidotes and their administration methods. However, they also differ in their target population, setting, and type of infusate. Some of them focus on neonates or children, while others focus on adults. Some of them focus on SACT or cytotoxic agents, while others cover a wider range of noncytotoxic vesicants. Some of them are developed by professional organizations or expert groups, while others are developed by individual hospitals or health services. Some of them are based on systematic reviews or literature searches, while others are based on expert opinions or consensus. Some of them use validated tools or frameworks to assess the quality of evidence and the strength of recommendations, while others do not. Some of them provide detailed and comprehensive guidance, while others provide concise and practical guidance.

The quality and consistency of these CPGs can be improved by conducting more RCTs or systematic reviews on the prevention and management of extravasation, and by using standardized definitions, classifications, and grading systems of extravasation. Moreover, the development and evaluation of CPGs should follow the best practices and criteria of the AGREE II tool or other similar tools, and involve relevant stakeholders and end-users. The implementation and dissemination of CPGs should be supported by multifaceted educational programs, audit and feedback mechanisms, and local adaptation and customization. The CPGs should be regularly updated and revised based on the latest evidence and feedback. The users of CPGs should critically appraise and apply them in their specific context and population, and monitor and report the outcomes and adverse effects of extravasation.

4.2. Discussion on the key findings of guidelines to nursing management of extravasation complications

Extravasation is a serious complication of intravenous therapy that can cause tissue damage, infection, and functional impairment. Several clinical practice guidelines (CPGs) have been developed to provide evidence-based recommendations for the prevention and management of extravasation in different settings and populations. However, the quality and consistency of these CPGs vary widely, and there is a need for a comprehensive and critical appraisal of their strengths and limitations.

One of the main challenges in developing and evaluating CPGs for extravasation is the lack of high-quality evidence from randomized controlled trials (RCTs) or systematic reviews. Most of the existing CPGs are based on expert opinions, case reports, or observational studies, which have a high risk of bias and heterogeneity. Moreover, the definitions, classifications, and grading systems of extravasation are not standardized across different CPGs, making it difficult to compare and apply them in practice.

Another challenge is the diversity of the clinical scenarios and factors that influence the occurrence and outcomes of extravasation. These include the type, concentration, and volume of the infusate, the site and duration of the infusion, the size and condition of the vein, the age and comorbidities of the patient, and the timing and technique of the intervention. Therefore, CPGs should be tailored to the specific context and population, and consider the local resources and preferences of the stakeholders, in which:

- The guideline Extravasation and infiltration injuries – prevention and management: This CPG provides detailed and comprehensive guidance for the prevention, recognition, and management of extravasation and infiltration injuries in neonates. It covers the risk factors, signs and symptoms, grading, documentation, and treatment options for different types of infusates, including parenteral nutrition, lipids, glucose, electrolytes, blood products, and medications. It also includes algorithms, flowcharts, and checklists to facilitate the implementation of the CPG.
- The guideline Development of an Evidence-Based List of Noncytotoxic Vesicant Medications and Solutions: This CPG aims to identify and classify the noncytotoxic vesicant medications and solutions that can cause extravasation injury. It is based on a systematic review of the literature and expert consensus. It provides a list of 49 noncytotoxic vesicants, categorized by their pH, osmolality, and mechanism of action. It also provides

recommendations for the prevention, assessment, and management of extravasation caused by these agents.

- The guideline Guidelines for the Management of Extravasation of a Systemic Anti-Cancer Therapy including Cytotoxic Agents: This CPG focuses on the management of extravasation of systemic anti-cancer therapy (SACT), including cytotoxic agents, in adult patients. It provides general principles and specific guidance for the prevention, recognition, and treatment of extravasation, based on the type and severity of the injury. It also includes a list of antidotes and their indications, contraindications, and administration methods. It emphasizes the importance of multidisciplinary collaboration and documentation in the management of extravasation.
- The review Saline irrigation for the management of skin extravasation injury in neonates: This is a Cochrane systematic review that evaluates the effectiveness and safety of saline irrigation or saline irrigation with prior hyaluronidase for the management of skin extravasation injury in neonates. It did not find any RCTs that met the inclusion criteria, and concluded that there is no evidence to support or refute the use of this intervention. It suggested that future research should focus on conducting RCTs to evaluate the efficacy and safety of saline irrigation, as well as the optimal timing, volume, and frequency of the intervention.
- The systemic review Assessing the Quality of Existing Clinical Practice Guidelines for Chemotherapy Drug Extravasation by Appraisal of Guidelines for Research and Evaluation II: This is a study that assesses the quality of five existing CPGs for chemotherapy drug extravasation, using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) tool. It found that the methodological quality of the CPGs was good in the domains of scope and purpose, stakeholder involvement, clarity of presentation, and applicability, acceptable in the domain of rigor of development, and poor in the domain of editorial independence. It recommended that the CPGs should improve their transparency, consistency, and evidence base, and that the users should critically appraise the CPGs before applying them in practice.
- The study Guidelines for the management of extravasation: This CPG provides practical and concise guidance for the prevention and management of extravasation in various clinical settings. It covers the definition, incidence, risk factors, diagnosis, differential diagnosis, and extravasation injuries of different types of infusates. It also provides step-by-step instructions for the nursing intervention and thermal application for extravasation, as well as a list of antidotes and their administration methods. It emphasizes the importance of continuous education and training for health professionals regarding extravasation.
- The study Clinical practice guideline on the prevention and management of neonatal extravasation injury: a before-and-after study design: This is a study that evaluates the effectiveness of a clinical practice guideline (CPG) on the prevention and management of neonatal extravasation injury, developed by a multidisciplinary team and implemented through a multifaceted educational program. It used a controlled before-and-after study design, and measured the outcomes of extravasation rate, nurses' knowledge, and nurses' adherence. It found that the implementation of the CPG significantly reduced the rate of peripheral intravenous extravasation and extravasation from a central line, and improved the nurses' knowledge and adherence. It suggested that the educational program should be repeated periodically and incorporated into the nurses' induction program.
- The guideline Nursing guidelines: Extravasation Injury Management: This CPG provides comprehensive and evidence-based guidance for the prevention, recognition, and management of extravasation injury in children. It covers the risk factors, signs and symptoms, grading, documentation, and treatment options for different types of infusates, including parenteral nutrition, lipids, glucose, electrolytes, blood products, and medications. It also includes algorithms, flowcharts, and checklists to facilitate the implementation of the CPG. It highlights the importance of early detection and intervention, and the role of the plastic surgery team in the management of extravasation injury.

The guideline NCCP Guidance: Prevention and Management of Extravasation of Systemic Anti-Cancer Therapy (SACT) This CPG provides national guidance for the prevention and management of extravasation of SACT in adult patients. It provides general principles and specific guidance for the prevention, recognition, and treatment of extravasation, based on the type and severity of the injury. It also includes a list of antidotes and their indications, contraindications, and administration methods. It emphasizes the importance of multidisciplinary collaboration and documentation in the management of extravasation.

5. LIMITATIONS OF THIS REVIEW

This review results have some limitations that should be acknowledged. First, the web search results may not be comprehensive or representative of all the available

guidelines for extravasation injuries. There may be other guidelines that are not included in the web search results, or that are not accessible online. Second, the web search results may not be current or accurate. There may be newer or updated guidelines that are not reflected in the web search results, or there may be errors or biases in the web search results. Third, the web search results may not be applicable or generalizable to all settings and situations. There may be differences in the definitions, classifications, and reporting of extravasation injuries, as well as in the availability and feasibility of the interventions and antidotes for extravasation injuries, across different settings and situations.

6. RECOMMENDATION

6.1. For Health care system and nurse staff:

Based on the discussion, it is clear that the management of extravasation injuries is a complex and critical aspect of healthcare, particularly in neonates and patients undergoing chemotherapy. The various studies and guidelines reviewed provide valuable insights and practical strategies for the prevention and management of these injuries.

However, there are some key recommendations for healthcare professionals:

Early Detection: The importance of early detection of extravasation injuries cannot be overstated. Prompt recognition of the signs and symptoms can significantly reduce the severity of the injury and improve patient outcomes.

Education and Training: Continuous education and training for healthcare professionals are crucial. This includes understanding the risk factors for extravasation, being able to identify the early signs, and knowing the appropriate steps to take when an injury occurs.

Use of Guidelines: Healthcare professionals should make use of the available guidelines to inform their practice. However, it's important to note that guidelines should be used as a guide rather than a rigid set of rules. Patient care should always be individualized based on the specific circumstances and needs of the patient.

Research and Improvement: There is a need for further research to improve the management of extravasation injuries. This includes developing more effective prevention strategies, improving early detection methods, and finding more effective treatments.

6.2. For Nursing school and nurse student:

Enhanced Understanding: The review provides nursing students with a comprehensive understanding of extravasation injuries, their prevention, and management. It exposes students to various studies and guidelines, helping them understand the complexity of managing such injuries and the importance of individualized patient care.

Evidence-Based Practice: The review emphasizes the importance of evidence-based practice. It encourages students to critically appraise and apply guidelines in their practice, fostering a culture of evidence-based care from the early stages of their nursing education.

Improved Patient Outcomes: By understanding the importance of early detection and appropriate management of extravasation injuries, nursing students can contribute to improved patient outcomes in their future practice.

Curriculum Development: For educators, this review can inform curriculum development in nursing schools. It highlights key areas of focus such as early detection, appropriate intervention, and continuous education, which can be incorporated into the teaching curriculum.

Research Opportunities: The review also identifies gaps in the current research, providing opportunities for nursing students to engage in meaningful research projects that can contribute to the field.

7. CONCLUSION

In conclusion, while significant progress has been made in understanding and managing extravasation injuries, there is still much work to be done. By continuing to research, educate, and apply evidence-based practices, healthcare professionals can significantly improve the care and outcomes for patients at risk of extravasation injuries.

CONFLICTS OF INTEREST

The authors declare that there are no conflict of interests

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