



Prevention and Management of Extravasation Associated with Non-Cytotoxic Agents: A Review Study

Bat Shatha R. Zaidan^{1*}

¹Department of Microbiology, Alkindy College of Medicine, University of Baghdad, Baghdad, Iraq

Author Designation: ¹Researcher

*Corresponding author: Bat Shatha R. Zaidan (e-mail: Shatha.r@kmc.uobaghdad.edu.iq).

How to Cite the Article:

Zaidan, Bat Shatha R. "Prevention and Management of Extravasation Associated with Non-Cytotoxic Agents: A Review Study." *Journal of Advanced Biological Sciences*, vol. 02, no. 02, December 2025, pp. 16-19. <https://doi.org/10.66590/jabs2025020203>

Abstract | Intravenous medication administration is associated with a higher risk of complications and medication errors compared with other routes of drug delivery. Such errors may negatively affect both patients and healthcare professionals, particularly nurses responsible for medication administration. Although only a small proportion of these errors result in severe patient outcomes, even minor incidents may lead to significant physical, psychological and professional consequences for nursing staff. Phlebitis and extravasation are among the most common adverse complications associated with intravenous therapy. Nurses play a critical role in monitoring intravenous medication administration, alleviating patient discomfort and preventing the occurrence of extravasation and related complications through the application of appropriate clinical techniques and preventive strategies, thereby improving patient safety and quality of life. The incidence of extravasation in adults has been estimated to range from 0.1% to 6%. Several reports suggest that the frequency of extravasation events has decreased in recent years due to improvements in infusion technologies, early detection of medication leakage, adherence to safe administration protocols and enhanced staff education and training regarding prevention and management strategies. Nevertheless, despite the implementation of preventive measures, including standardized administration procedures, institutional regulations and continuous healthcare staff education, extravasation remains a clinically important complication of intravenous therapy.

Key Words Nursing Prevention, Extravasion, Cytotoxic Agents

INTRODUCTION

Extravasation is a common complication among patients receiving intravenous administration of recognized vesicant agents [1]. These complications may negatively affect patient safety, increase healthcare costs, prolong treatment duration and delay recovery [2,3]. Extravasation injuries result in tissue damage through a sequence of pathological events. The principal mechanisms of tissue injury include vasoconstriction, osmotic injury, pH-related damage and cytotoxic skin reactions. Therefore, identifying high-risk patients and applying appropriate cannulation techniques are essential preventive measures [4].

Continuous surveillance and close monitoring of high-risk intravenous medications remain the gold standard for preventing extravasation-related tissue injury. Management of extravasation injuries often requires

immediate multidisciplinary intervention to minimize tissue damage and improve clinical outcomes [1,5,6].

Understanding the mechanisms underlying extravasation-induced tissue injury, as well as the available pharmacological antidotes and non-pharmacological therapeutic interventions, is critically important [7,8]. Intradermal phentolamine is considered one of the most effective treatments for vasopressor extravasation [9]. In addition, topical vasodilators and subcutaneous terbutaline may provide therapeutic benefit in selected cases. Dermal hyaluronidase has demonstrated effectiveness in managing hyperosmotic extravasation injuries; however, its use may be limited because of the potential risk of additional tissue damage.

Extravasation of acidic or alkaline solutions may initiate severe inflammatory reactions leading to tissue injury.

Prevention and conservative management remain the fundamental principles for managing this condition [1]. Highly acidic vesicant solutions may cause severe and potentially devastating tissue injury if inadvertently administered through the arterial route [4].

Comprehensive anticoagulation therapy remains the standard management approach for intra-arterial promethazine injection injuries. Overall, current evidence regarding the prevention of extravasation caused by non-cytotoxic medications remains limited, with most available data originating from isolated case reports. Therefore, further studies are needed to better evaluate patient-related risk factors, improve early recognition of extravasation events, understand the progression of tissue injury and develop effective prevention strategies [10].

The present review study summarizes the major causes, risk factors, preventive measures and management strategies associated with the intravenous infusion of non-cytotoxic medications.

Intravenous drug Administration Strategies [6,11]

- Select a newly started line for the distribution of medicine to ensure the patency of a peripheral line. A lymph node dissection site, for example, or any location with sclerosis, thrombosis, scarring, or restricted circulation should not be venipuncture. The following order of preference should be used when selecting infusion sites: Antecubital fossa, wrist and forearm dorsum
- The veins that will be used to administer medication can be dilated using a warm compress, by persuading the patient to hang his or her hand and arm over the edge of the bed, or by inflating an upper arm blood pressure cuff to 40 to 50 mm Hg
- Use a "butterfly" needle or plastic cannula to insert a suitable IV line with enough fluids (only one venipuncture) and then tighten it in place (without covering the entrance site) to enable viewing. There should never be a line test for vesicant agents. Vein flow and integrity can be evaluated using 10 mL of saline or dextrose. The patient's pain is observed; it is often described as a mild to severe burning radiating down the vein. The afflicted region is examined for erythema and edema. A healthy blood return and patency are accomplished by gently drawing back blood before starting to give the medication through the tube

- Any discomfort or burning sensations should be reported immediately by the patient. If there is any question, the infusion should be discontinued and the infusion site should be changed

Regularly check the IV site for signs of redness and edema as well as venous blood return. The vein should be flushed with IV fluids every 2 to 3 minutes in between bolus injections of the vesicant non-cytotoxic or cytotoxic medication and once more following therapy. There are several vesicant noncytotoxic medications and drinks available, which can lead to extravasation issues [6,11].

Table 1 provides a list of non-cytotoxic drugs that have been described in several documented studies about extravasation problems [12].

Factors that Cause Extravasation

The most frequent first signs and symptoms at the injection site or surrounding the VAD are erythema, edema and a visible accumulation of fluid beneath the skin. Some of the delayed clinical symptoms include inflammation, induration, blistering, necrosis and blistering [8,13]. These side effects could endure for months and might start to show themselves minutes after taking the medicine [9]. Even if extravasation doesn't produce symptoms, it can still have disastrous consequences including necrosis and painful sores that extend far beyond the area that was first affected [10,14].

Risk Factors for Extravasation

Extravasation is more likely when certain risk factors are present (Table 2). Early recognition of these variables and the application of different preventative measures or, in certain situations, the use of numerous preventive measures.

Extravasation Avoidance (General Guidelines)

Utmost extravasations can be averted by systematically implementing cautious, consistent and verify direction approaches and protocols. Nurses should be included in instructional courses and educational seminars to minimize intravenous leakage of non-toxic medications, as they are responsible for providing therapy to patients. It is critical to remember that the intensity of the damage is decided by the type of drug, concentration, extravasation site and the time it takes for the chemical to establish its potential to hurt [10,15,16].

Table 1: Extravasation Injuries have been documented as a Result of NonCytotoxic Intravenous Fluid

Antimicrobials	Electrolytes and IV Solution	Other Medication
Aciclovir	50 percent dextrose	Amiodarone
Cefotaxime	Mannitol (20%) and mannitol (10%)	Diazepam
Gentamicin	8.4 percent sodium bicarbonate	Digoxin
Levofloxacin	Calcium chloride is a mineral composed of calcium and chlorine (10%)	Vasopressor
Meropenem	Gluconate of calcium (10%)	Dobutamine
Metronidazole		Epinephrine
(Flagel)		Norepinephrine
Piperacillin		
Thiopental		
Vancomycin		
This isn't a complete list [12,14,20,9,21,22]		

Table 2: Risk Factors for Extravasation

Patient-related factors	Veins that are little and delicate	Procedure-related factors	A person who is inexperienced or unskilled
	Veins that are swollen and/or hard (e.g., as a consequence of multiple previous courses of chemotherapy or drug abuse)		Trials at catheter insertion on many occasions
	Veins that are visible yet move around (e.g., elderly people)		Cannulation over a joint or at an inconvenient location (e.g., antecubital fossa, back of the hand, inner wrist)
	Problems with communication (making it more difficult to quickly identify extravasation symptoms)		Pressure is created via a pump that delivers a non-cytotoxic vesicant medication through a peripheral line.
	Some medicines may increase blood flow, predispose patients to bleed, decrease the inflammatory process, lessen pain feeling and so on, depending on whether they are given intravenous or oral medications.		Cannulation errors (weak reservoir location, mobility in the catheter's distal end, trouble securing the non-coring needle, lack of periapical or blood return, etc.)
	Obesity is a problem that affects many people (making peripheral venous access more difficult) [2,3,23,24]		Continuous vesicant Non-Cytotoxic infusion of more than 30 to 60 minutes.
			If the length of the cannula in your veins is insufficient, use a larger cannula to reduce the risk of your vein being dislodged.

One of the important things is to prepare the emergency bag and prepare the necessary medicines and tools to treat or first aid the case incident of an intravenous infusion, such as a 25 gm needle, a 10 cm syringe and a 1 ml syringe; dimethyl sulfoxide solution; hyaluronidase; hydrocortisone cream; sterile gauze and adhesive bandages; saline solution; sterile distilled water (1 ampoule); dimethyl sulfoxide solution; hyaluronidase; hydrocortisone cream Thiosulfate of sodium in addition to asking the patient whether he feels tenderness or lack of sensation and burning in the cannula site, for early detection, treatment and reduction of complications [5,17].

Most Common Precautionary Measures Used To Prevent Extravasation

The intravenous line should be examined during administration to confirm any suspected extravasation. Increased resistance to IV medication delivery, poor or troublesome infusion, changes to the infusion stream and a lack or loss of blood return from the cannula are all indications of extravasation caused by the cannula (peripheral or central) [2].

Even if there is blood return, extravasation can occur. Early identification of extravasation is crucial. Extravasation can result in a wide range of non-specific signs with varying degrees of severity. Any delay in recognizing and treating extravasation might lead to tissue injury and necrosis [2,18].

Differential Diagnosis has been in use. It is critical to distinguish between extravasation and other local responses to create the proper diagnosis. Even when appropriately delivered, several infusion medicines might elicit extravasation-like symptoms (flare reaction and venous irritation) [10,19,20]:

- Avoid administering intravenous therapy near the joint sites, because movement causes the exit of the

node and the occurrence of leakage and avoid the places of drilling and difficult-to-reach areas

- Vessels on the back of the hand can be used, making inspection simpler in some circumstances. However, it must be done with caution since extravasation might induce more serious harm to this location
- Never use gauze to wrap the cannula region for observation
- Keep the cannula firm during the medication delivery.
- In delivering vesicant medications, obtain a fresh IV route even if one already exists
- Re-insert the cannula and deliver the medicine if in doubt
- While administering, keep an eye out for edema, irritation and soreness surrounding the cannula
- Before and during administration, examine for blood frequently way and always clean the line with salt water
- After removing the needle, apply force to the site for 2 minutes and uplift the patient [10,14,15,16,17,19]
- Instruct the patients about the type of medication and the most important signs that may occur late to follow-up health care providers to avoid complications

CONCLUSION

In contemporary medicine, no cytotoxic medicines have been employed widely for the cure of various illnesses. Extravasation is a common side effect of cannulation treatment. Nurses play an essential task in intravenous treatment, in addition to other activities such as establishing, monitoring and terminating the liquid flow, along with recognizing and avoiding problems. When a high-risk material is extravasated, a variety of techniques involving nurses, pharmacists, medical professionals and surgeons are frequently necessary to determine the chemical and pharmacologic properties of the infiltrated agent, the extent or potential for cellular injury and the necessity for reversal or surgical treatment. Early symptoms of symptoms suggestive and tissue injury must be carefully

examined in the extravasated substance. Extravasations are caused by a variety of mechanisms, including vasoconstriction, osmotic, pH-related and cytotoxic effects. Medical emergencies such as infiltration and extravasation injuries can leave patients permanently disabled, reduce their quality of life and put clinicians at risk for malpractice lawsuits. Conventional safety precautions and protocols can also assist, in addition to following standards of practice and receiving evidence-based treatment, to lessen or prevent such injuries [7,17].

REFERENCES

- [1] Mansour, K.A. "Effectiveness of an educational program on nurses' knowledge regarding management of extravasation vesicant intravenous chemotherapy at oncology centers in Baghdad city." *Iraqi National Journal of Nursing Specialties*, vol. 32, no. 2, 2019.
- [2] Hughes, R.G. and M.A. Blegen. "Medication administration safety." *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*, 2008.
- [3] Oncology Nursing Society and K.A. Brown. *Chemotherapy and biotherapy: Guidelines and recommendations for practice*. Oncology Nursing Society, 2001.
- [4] Hussin, B.K. and W.A. Razaq Ahmed. "Nurse's knowledge about management extravasation intravenous cytotoxic medication at Amal National Hospital in Baghdad city." *Indian Journal of Forensic Medicine and Toxicology*, vol. 14, no. 3, 2020.
- [5] Schulmeister, L. and C.V. Pollack. "Swollen hand." *Annals of Emergency Medicine*, vol. 57, no. 4, 2011, pp. 417.
- [6] Shaqdan, K. *et al.* "Incidence of contrast medium extravasation for CT and MRI in a large academic medical center: a report on 502,391 injections." *Clinical Radiology*, vol. 69, no. 12, 2014, pp. 1264-1272.
- [7] De Wit, M. *et al.* "Management of cytotoxic extravasation-ASORS expert opinion for diagnosis, prevention and treatment." *Oncology Research and Treatment*, vol. 36, no. 3, 2013, pp. 127-135.
- [8] Allinson, Y. *Australian Injectable Drugs Handbook*. Society of Hospital Pharmacists of Australia, 1997.
- [9] Le, A. and S. Patel. "Extravasation of noncytotoxic drugs: A review of the literature." *Annals of Pharmacotherapy*, vol. 48, no. 7, 2014, pp. 870-886.
- [10] David, V. *et al.* "Extravasation of noncytotoxic drugs." *Annals of Pharmacotherapy*, vol. 54, no. 8, 2020, pp. 804-814.
- [11] Sakaida, E. *et al.* "Incidence, risk factors and treatment outcomes of extravasation of cytotoxic agents in an outpatient chemotherapy clinic." *Japanese Journal of Clinical Oncology*, vol. 44, no. 2, 2014, pp. 168-171.
- [12] Hussin, B.K. "Assess nurse's knowledge regarding extravasation noncytotoxic medication in Baghdad Teaching Hospital." *Indian Journal of Forensic Medicine and Toxicology*, vol. 15, no. 2, 2021.
- [13] Ghaleb, M.A. *et al.* "The incidence and nature of prescribing and medication administration errors in pediatric inpatients." *Archives of Disease in Childhood*, vol. 95, no. 2, 2010, pp. 113-118.
- [14] Gorski, L.A. *et al.* "Development of an evidence-based list of noncytotoxic vesicant medications and solutions." *Journal of Infusion Nursing*, vol. 40, no. 1, 2017, pp. 26-40.
- [15] Dougherty, L. "Extravasation: prevention, recognition and management." *Nursing Standard*, vol. 24, no. 52, 2010.
- [16] Harrold, K. *et al.* "The management of cytotoxic chemotherapy extravasation: a systematic review of the literature to evaluate the evidence underpinning contemporary practice." *European Journal of Cancer Care*, vol. 24, no. 6, 2015, pp. 771-800.
- [17] Mader, I. *et al.* *Extravasation of Cytotoxic Agents: A Compendium for Prevention and Management*. Springer Science and Business Media, 2009.
- [18] Watanabe, H. *et al.* "Protection against the extravasation of anticancer drugs by standardization of the management system." *Hospital Pharmacy*, vol. 43, no. 7, 2008, pp. 571-576.
- [19] Kreidieh, F.Y. *et al.* "Overview, prevention and management of chemotherapy extravasation." *World Journal of Clinical Oncology*, vol. 7, no. 1, 2016, p. 87.
- [20] Sisan, R.N.M. *et al.* "Knowledge regarding noncytotoxic medication extravasation among registered nurses working in Western Saudi Arabia." 2017.
- [21] McGonigle, D. and K. Mastrian. *Nursing informatics and the foundation of knowledge*. Jones and Bartlett Publishers, 2021.
- [22] Rayan, A. *et al.* "Knowledge regarding noncytotoxic medication extravasation among registered nurses working in western Saudi Arabia." *Journal of Vascular Nursing*, vol. 36, no. 1, 2018, pp. 12-22.
- [23] Fidalgo, J.P. *et al.* "Management of chemotherapy extravasation: ESMO-EONS clinical practice guidelines." *European Journal of Oncology Nursing*, vol. 16, no. 5, 2012, pp. 528-534.
- [24] Boulanger, J. *et al.* "Management of the extravasation of anti-neoplastic agents." *Supportive Care in Cancer*, vol. 23, no. 5, 2015, pp. 1459-1471.