Clinical Guideline

This guideline should not replace clinical judgment.

Peripheral IV Extravasation/Infiltration (PIVIE) Treatment

Inpatient and Outpatient Pediatrics

NONCYTOTOXIC INFILTRATIONS & EXTRAVASATIONS: GUIDELINE FOR PEDIATRIC PATIENTS

Purpose:
To describe the management of intravenous (IV) infiltrations and extravasations in pediatric patients.

Applicability:
Prescribers, Pharmacists, Nurses

Procedure:

1. Definitions
    a. Infiltration: the inadvertent administration or leakage of a non- vesicant (e.g., irritant) medication or solution into the surrounding tissue instead of into the intended vascular space. This occurs when the catheter becomes dislodged or the vein ruptures, causing fluid to leak into the surrounding tissue.
    b. Extravasation: the inadvertent administration or leakage of a vesicant medication or solution into the surrounding tissue instead of into the intended vascular space. A vesicant is a solution or medication that causes the formation of blisters with subsequent sloughing of tissues occurring from tissue necrosis.

Note: Phlebitis is an inflammation of the intima of the vein, and is a commonly reported complication of infusion therapy. It is completely different from, but is often confused with infiltration and extravasation. It usually occurs when the vein is irritated from solutions.

2. Signs and Symptoms of IV Infiltrations/Extravasations
    a. Swelling
    b. Redness
    c. Stinging, burning, or pain at the administration site
    d. Loss of blood return from the IV
    e. IV flow rate that slows or stops
    f. Leaking around the IV catheter or implanted port needle
    g. Skin tightness at the venipuncture site
    h. Blotching of the skin
    i. Change in temperature of the skin, cool or warm

3. Measurement Based Assessment Tool
    a. The Cincinnati Pediatric Intravenous Extravasation Assessment System standardizes the identification and assessment in the early stage of infiltration and extravasation, thus reducing the need for treatment and serious complications.
    b. Three steps in the coding system:
        i. Volume measurement: measure max dimension of swelling of affected area (X), measure the ARM length (Y), calculate (X/Y) x 100= %. See Figure 1.
        ii. Medication Identification: Red (high risk), Yellow (intermediate risk), Green (low risk). See Figure 2.
        iii. Documentation: Document immediately in Cerner.

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Figure 1. Cincinnati Children's Hospital Medical Center IV Extravasation System

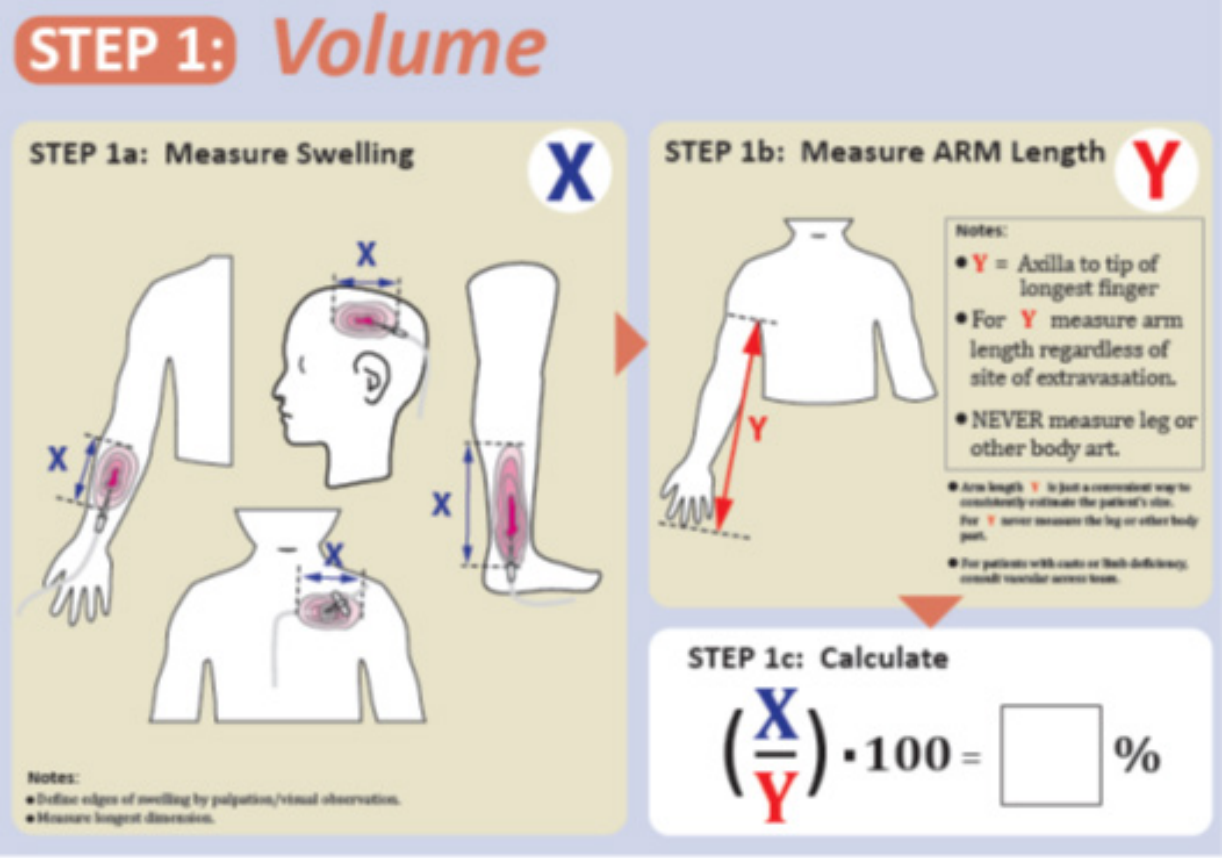

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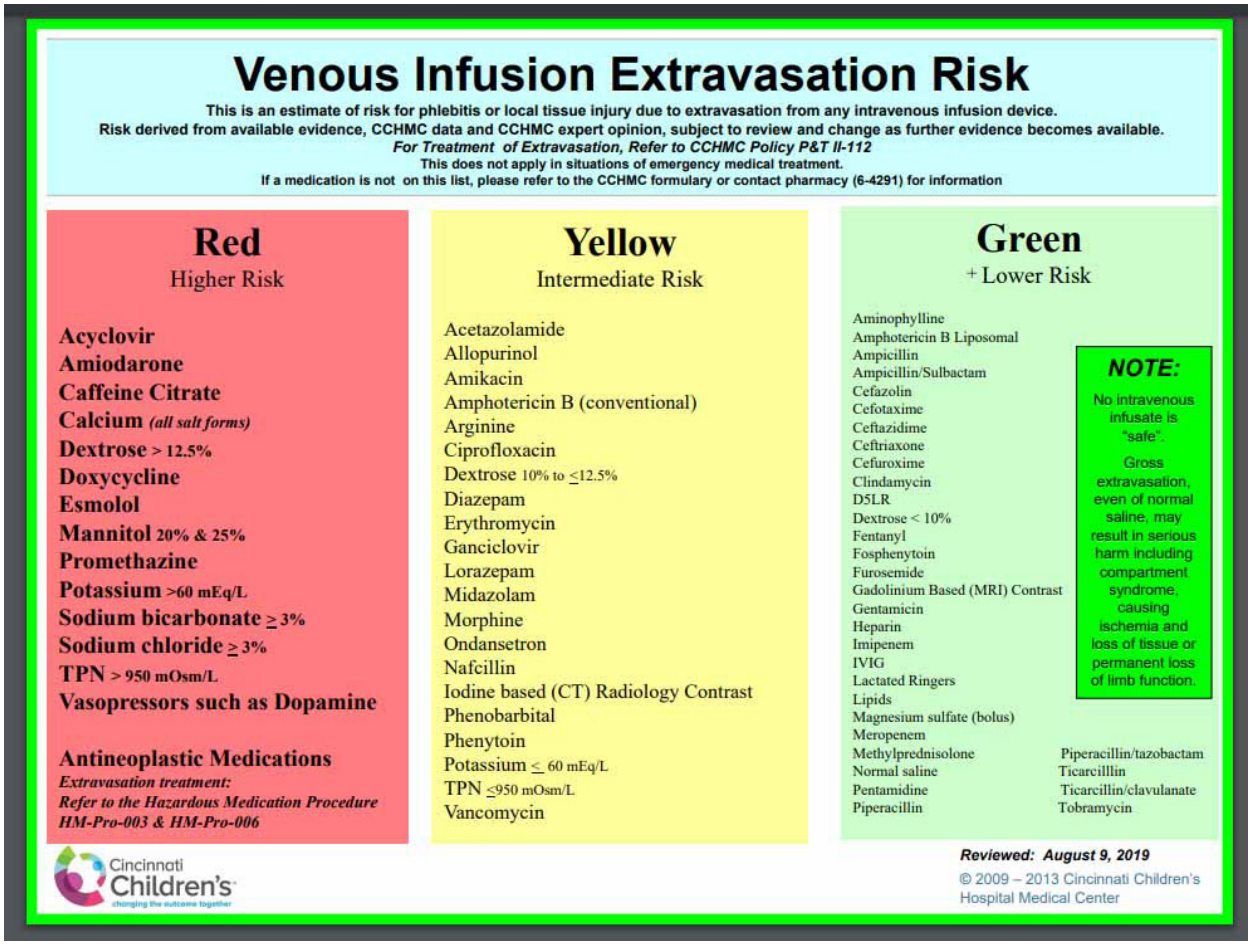
Figure 2. Venous Infusion Extravasation Risk Chart



Venous Infusion Extravasation Risk

This is an estimate of risk for phlebitis or local tissue injury due to extravasation from any intravenous infusion device.
Risk derived from available evidence, CCHMC data and CCHMC expert opinion, subject to review and change as further evidence becomes available.
For Treatment of Extravasation, Refer to CCHMC Policy P&T II-112
This does not apply in situations of emergency medical treatment.
If a medication is not on this list, please refer to the CCHMC formulary or contact pharmacy (6-4291) for information

Red
Higher Risk

Acyclovir
Amiodarone
Caffeine Citrate
Calcium ***(all salt forms)***
Dextrose > 12.5%
Doxycycline
Esmolol
Mannitol 20% & 25%
Promethazine
Potassium >60 mEq/L
Sodium bicarbonate ≥ 3%
Sodium chloride ≥ 3%
TPN > 950 mOsm/L
Vasopressors such as Dopamine

Antineoplastic Medications
Extravasation treatment:
Refer to the Hazardous Medication Procedure HM-Pro-003 & HM-Pro-006

Yellow
Intermediate Risk

Acetazolamide
Allopurinol
Amikacin
Amphotericin B (conventional)
Arginine
Ciprofloxacin
Dextrose 10% to ≤12.5%
Diazepam
Erythromycin
Ganciclovir
Lorazepam
Midazolam
Morphine
Ondansetron
Nafcillin
Iodine based (CT) Radiology Contrast
Phenobarbital
Phenytoin
Potassium ≤ 60 mEq/L
TPN ≤950 mOsm/L
Vancomycin

Green
+ Lower Risk

Aminophylline
Amphotericin B Liposomal
Ampicillin
Ampicillin/Sulbactam
Cefazolin
Cefotaxime
Ceftazidime
Ceftriaxone
Cefuroxime
Clindamycin
D5LR
Dextrose < 10%
Fentanyl
Fosphenytoin
Furosemide
Gadolinium Based (MRI) Contrast
Gentamicin
Heparin
Imipenem
IVIG
Lactated Ringers
Lipids
Magnesium sulfate (bolus)
Meropenem
Methylprednisolone
Normal saline
Pentamidine
Piperacillin
Piperacillin/tazobactam
Ticarcilllin
Ticarcillin/clavulanate
Tobramycin

NOTE:
No intravenous infusate is "safe".
Gross extravasation, even of normal saline, may result in serious harm including compartment syndrome, causing ischemia and loss of tissue or permanent loss of limb function.

Cincinnati Children's
changing the outcome together

Reviewed: August 9, 2019

4. Management of Noncytotoxic Infiltrations/Extravasations (See Figure 3).
    a. Stop the infusion
    b. Assess the affected site for pain, erythema, and size of the infiltration
    c. Elevate the affected extremity to reduce swelling
    d. Notify provider of suspected infiltrate
        i. A provider must evaluate an extravasation.
        ii. A provider must write orders for compresses and antidotes as appropriate. (Refer to Tables I and II)
        iii. All treatments, including warm and cool compresses, require a provider order
        iv. All orders for compresses must include the frequency and duration of application
    e. Estimate total volume of fluid that escaped into the tissue
    f. Obtain orders for treatment interventions as needed
    g. Attempt to aspirate residual drug from the IV needle/catheter using a small (1-3 mL) syringe. If administering antidote, the first dose (see Table I) may be administered into the subcutaneous tissue via this cannula
    h. If not administering an antidote, remove IV catheter
    i. Apply cold or warm compresses as ordered (see Table II)
        i. Do not apply pressure to the site
        ii. Compresses should never be warmed in the microwave
        iii. For extravasation in the neonate, defer to the provider for use of compress
    j. Assess skin surface every hour x 24 hours for induration, discoloration, and feeling of numbness in the affected extremity
    k. Educate patients/families on worsening symptoms and to notify a provider:
        i. Increased swelling
        ii. Increased pain
        iii. Blistering, ulceration, induration or other skin changes
        iv. Altered tissue perfusion
        v. Changes in sensation
    l. Consider a plastic surgery consult for any of the following:
        i. Increased swelling
        ii. Increased pain
        iii. Blistering, ulceration, induration or other abnormal skin changes
        iv. Large infiltrate (greater than 25-50 mLs)
    m. Consider a vascular surgery consult for any of the following:
        i. Altered tissue perfusion
        ii. Change in sensation
    n. Elevate the affected extremity for 48 hours to reduce swelling. After 48 hours, encourage the patient to use the extremity normally to promote full range of motion

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Figure 3. Treatment Plan

% Swelling and Infusate Component	Action
Extravasation >/= 30% AND Red list infusate	Treat with Hyaluronidase or appropriate antidote per provider order
Extravasation >/= 30% AND Red list infusate	Clinical evaluation of the extravasation site by bedside RN, provider, and RRT RN to determine if hyaluronidase or appropriate antidote is clinically indicated. Decision criteria include imminent skin loss, and/or peripheral circulation impairment (compartment syndrome)
Extravasation >/= 30% AND Yellow or Green list infusate	Clinical evaluation of the extravasation site by bedside RN, provider, and RRT RN to determine if hyaluronidase or appropriate antidote is clinically indicated, but hyaluronidase treatment usually NOT indicated.
Extravasation < 30% AND Yellow or Green list infusate	No treatment indicated
Extravasation of any % of a Red list Vasoactive medication (dopamine, epinephrine, and related medications)	IMMEDIATE consult to provider and RRT RN, if necessary, to determine treatment plan and use of phentolamine or appropriate antidote.

5. Outpatient Instructions Related to IV Infiltrations/Extravasations
    a. These instructions pertain to infiltrations/extravasations that occur in the outpatient infusion center or if the patient is discharged within 72 hours of an inpatient infiltration/extravasation event
    b. Provide the following instructions to the patient and/or the patient's family:
        i. Continue to apply cold or warm compresses as ordered (refer to Table 1). Do not apply pressure to the site.
        ii. Continue to elevate the affected extremity for 48 hours after the event to reduce swelling. After 48 hours, use the extremity normally to promote full range of motion
        iii. Monitor the infiltration/extravasation site closely for at least 72 hours after the event. Some sequelae may not manifest for 2-3 weeks after the event. Notify your physician and go to the emergency room to seek immediate medical attention if there is:
            1. Increased swelling
            2. Increased pain
            3. Blistering, ulceration, induration or other skin changes
            4. Altered tissue perfusion
            5. Changes in sensation
    c. The provider's office and/or nurse should contact the patient the day after an outpatient infiltration/extravasation event to follow-up on the patient's status

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6. Documentation of IV Infiltrations/Extravasations
    a. All infiltrations and extravasations must be verbally reported to the treating provider and the charge nurse on the inpatient unit.
    b. All infiltrations and extravasations must be electronically reported in the Safety Intelligence Reporting System.
    c. All infiltrations/extravasations must be documented in the medical record and include the following information:
        i. Date and time of infiltration/extravasation
        ii. Infiltrating/extravasating agent (including concentration and diluent)
        iii. Estimated volume of infiltration/extravasation
        iv. IV catheter type
        v. Location of IV insertion site
        vi. Description of infiltration/extravasation (including but not limited to the following):
            1. Size of the affected area
            2. Presence of swelling or redness
            3. Report of stinging, burning, or pain at the administration site
            4. Presence/absence of blood return
            5. Decreased IV flow rate
            6. Leaking around IV needle/catheter
        vii. Name of the provider that was notified and time notified
        viii. Any interventions (including compresses and antidotes)
        ix. Any response to interventions
        x. Patient education
    d. All site checks performed must be documented.

Table I. Treatment of Extravasation

Overview of Treatment Modalities for Non-cytotoxic Medications		
Non-Pharmacologic		
Elevation	elevate	
Thermal	Warm /cold compress **(See Table I)** apply x 15 mins QID or continuously on initial injury Warm compress disperses agent via increase circulation like hyaluronidase Cold compress – limit the spread i.e. localizes the drug	
Topicals	bacitracin/ collagenase	
Pharmacologic		
	NICU	**Pediatrics**
Hyaluronidase Injection	**Dilution:** Withdraw 0.1 ml hyaluronidase 150 unit/ml & place in 0.9 ml NS for concentration **15 units/ml.** **Administer:** 15 units by Injection of 0.2 ml at 5 points around periphery of extravasation site. May repeat in 30-60 mins if no resolution. DO NOT use near active infection or purulence.	Dilute 0.1 mL hyaluronidase 150 unit/mL with 0.9 mL NS for a final concentration of 15 units/ml. Administer as five 0.2 mL injections around the periphery of the extravasation site May repeat in 30-60 minutes if no resolution Do NOT use near active infection or purulence

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Phentolamine Injection*	**WEIGHTS < 1 kg: use 0.1 mg/ml concentration** Inject Total dose 0.05 mg by using **0.1 ml SQ at five** points on edge of swelling/blanching can repeat in 60 mins but watch for low BP **WEIGHTS > 1-2.5 kg: USE 0.1 mg/ml concentration** Inject total dose 0.1 mg, by Using **0.2 ml** SQ at five points on edge of swelling/blanching can repeat in 60 mins but watch for low BP **Weights 2.5-5 kg: USE 0.5 mg/ml concentration** Inject Total dose 0.25mg, by using 0.1 ml SQ at five points on edge of swelling/blanching can repeat in 60 mins but watch for low BP-	**Weight < 5 kg: see NICU** recommendations **Weight > 5 kg: USE 0.5mg/ml concentration** Inject Total Dose 0.5mg, by Using 0.2 mL SubQ at five points at the leading edge of swelling/ blanching. Can repeat in 60 minutes. Monitor for low BP
Topical Nitroglycerin ointment Apply ONCE if no resolution can follow Every 8 hr x 3 dose	Some say use on Postnatal age >/= 21 days Do not use on broken skin **DOSE: 4 mm/kg of ointment MAX of 25 mm (1 inch)** Use Gramfield tape: Order sentences: Nitroglycerin 2% ointment, **4 mm, (weight 1 kg)** ,Apply ONCE MONITOR BP every 5 min x 15 mins Nitroglycerin 2% ointment , **8 mm, (weight 2 kg)**, Apply ONCE Monitor BP every 5 mins x 15 mins Nitroglycerin 2% ointment **12 mm, (weight 3kg)**, Apply once Monitor BP every 5 mins x 15 mins Nitroglycerin 2% ointment **16mm, (weight 4kg)**, Apply once Monitor BP every 5 mins x 15 mins Nitroglycerin 2% ointment **20 mm, (weight 5kg)**, Apply once Monitor BP every 5 mins x 15 mins	Weight < 5 kg: 4 mm/kg (max 25 mm) of ointment apply to affected area. Use Gramfield tape to measure. Weight > 5 kg: 1 inch apply to affected area Monitor BP every 5 minutes x 15 minutes
Terbutaline (pediatrics)	Half-life too long in neonates	**Do not use in patients < 2 years of age** Patient's ≥ 2 years: Dilute 1 mg of terbutaline in 9 mL of NS to make a final concentration of 0.1 mg/mL. Inject 0.1-0.2 mL SubQ doses at the leading edge of the extravasated site

*Phenolamine: extracted form NeoFax and Lexicomp & dose adjusted from pediatric cardiovascular surgery & dental literature.

Children's Hospital of Richmond at VCU

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Table II. Medications Specific Treatment Modalities

* For THERMAL Treatment in the neonate, defer to the provider for use of compress

Drug	Mechanism of injury	Antitdote	Primary Thermal Compress*	Other
Acyclovir	pH	Hyaluronidase	warm	
Ampicillin	Osmolarity	Hyaluronidase	warm	
Amiodarone	pH	Hyaluronidase	warm	
Amphotericin B	unknown	Hyaluronidase	warm	
Aminophylline	osmolality/osmolarity	Hyaluronidase	warm	
Arginine	pH /osmolarity	Hyaluronidase	warm	
Calcium salts	osmolarity	Hyaluronidase	warm	
Dantrolene	pH	Hyaluronidase	warm	
Dextrose 10% W,12.5%	osmolarity	Hyaluronidase	warm	
Diazepam	osmolarity	Hyaluronidase	warm	
Digoxin	osmolarity	Hyaluronidase	warm	
DoBUTamine	vasoconstriction	Phentolamine	warm	nitroglycerin ont/terbutaline-ped
DOPAmine	vasoconstriction	Phentolamine	warm	nitroglycerin ont/terbutaline-ped
Doxycycline	pH	Hyaluronidase	warm	
EPInephrine	vasoconstriction	Phentolamine	warm	nitroglycerin ont/terbutaline-ped
Esmolol	pH	Hyaluronidase	warm	
Etomidate	osmolarity	Hyaluronidase	warm	
Fat Emulsion w/out TPN		Flush Out with Normal Saline	warm	FLUSH OUT procedure by Martin PH British J of Anaesthesia 1994;72:702.

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		procedure		
Gentamicin	pH	Hyaluronidase	warm	
Immune globulin	osmolarity	Hyaluronidase	warm	
IV Contrast		No antidote	cool	Symptomatic treatment, defer to radiology IV Contrast policy
Lorazepam	osmolarity	Hyaluronidase	warm	
Mannitol>/=20%	osmolarity	Hyaluronidase	warm	
Metronidazole	unknown	Hyaluronidase	warm	
Nafcillin	osmolarity	Hyaluronidase	warm	
NOREpinephrine	vasoconstriction	Phentolamine		nitroglycerin/terbutaline-ped
Parenteral Nutrition	osmolarity	Hyaluronidase	warm	
Pentamidine	pH	Hyaluronidase	warm	
Phenobarbital	pH/osmolarity	Hyaluronidase	warm	
Phenobarbital	pH/osmolarity	Hyaluronidase	warm	
Phenytoin	pH/osmolarity	Hyaluronidase	warm	
PHENYLephrine	vasoconstriction	Phentolamine		nitroglycerin/terbutaline-ped
Potassium Chloride	osmolarity	Hyaluronidase	warm	
Potassium Phosphate	osmolarity	Hyaluronidase	warm	
Penicillin G Aqueous	unknown	Hyaluronidase	warm	
Propofol		Hyaluronidase	warm	Flush out
Promethazine	pH	Hyaluronidase	warm	
Sodium Bicarbonate	osmolarity	Hyaluronidase	warm	Flush out/lidocaine
Sodium Chloride >=3%	osmolarity	Hyaluronidase	warm	
Sodium Phosphate		Hyaluronidase	warm	
Valproic acid	unknown		cold	
Vancomycin	pH	Hyaluronidase	warm	
Vasopressin	vasoconstriction	Nitroglycerin ont	warm	Phentolamine/terbutaline-ped

* *For extravasation in the neonate, defer to the provider for use of compress

Ong J J infusi Nursing 2020 43(6)

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Executive Summary

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Executive Summary

Nitroglycerin

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