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# Pediatric Subcutaneous Fluid Rehydration (Restricted)

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# I. Description

Describes the procedure for administering subcutaneous fluids to pediatric patients including the administration of recombinant human hyaluronidase (*Hylenex*) to enhance fluid absorption.

# II. Rationale

The administration of isotonic solutions via subcutaneous access device can be considered for the treatment of mild to moderate dehydration.

## A. Dehydration in pediatric patients

The most common type of dehydration in pediatric patients is an isotonic fluid loss - a balanced depletion of water and sodium, causing extracellular fluid loss. Patients presenting with dehydration have most likely experienced fluid loss from gastrointestinal fluids, like those lost from vomiting and diarrhea. It may also be caused by osmotic diuresis from hyperglycemia.

Dehydration can be measured through a physical assessment and clinical indicators. Signs of dehydration are listed in Table 1 below.

Additionally, clinicians may measure a child's urinary output (UOP). Normal UOP is 1mL/kg/hr in children and 2mL/kg/hr in newborns.

**Table 1: Signs of dehydration in children**

| | Mild | Moderate | Severe |
|---|---|---|---|
| General appearance & mental status | Normal | Thirsty, restless or sleepy; irritable when touched | Drowsy, limp and cold, may be comatose |
| Heart Rate/Pulse | Normal rate & | Increased rate; decreased or | Increased; thready |

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| | strength | weak | |
| Respirations | Normal | Tachypnea | Tachypnea |
| Capillary refill | Normal | Slightly prolonged (2-3 seconds) | Prolonged (≥3 seconds) |
| Blood pressure | Normal | Normal; slightly increased diastolic BP | Decreased; decreased diastolic BP |
| Fontanelle | Normal | Sunken | Sunken |
| Eyes | Normal | Slightly sunken | Deeply sunken |
| Tears | Present | Decreased | Absent tears |
| Tongue | Moist | Sticky | Dry |

# III. Policy

## A. Subcutaneous Rehydration Therapy (SCRT)

Subcutaneous rehydration therapy (SCRT), or hypodermoclysis, is considered an alternative to intravenous (IV) access, and is a way to maintain and preserve the health of vessels. It is an acceptable treatment for mild to moderate dehydration when oral rehydration therapy (ORT) or intravenous (IV) hydration is not feasible. It can also be used a bridge or temporary means for fluid rehydration while clinicians attempt further or additional means to intravenous cannulation for fluid or other medications.

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### 1. Anatomy and Physiology of SCRT

The subcutaneous (SQ) tissue is made up of a dense gel-like matrix that contains a long-chain polysaccharide (glycosaminoglycan) called hyaluronan. Medications or fluids that are injected into the subcutaneous tissue must be absorbed through this matrix in order to enter the vascular or lymphatic system. That occurs via the sodium-potassium channel pumps that help regulate the osmotic gradient.

### 2. Advantages of SCRT

- Cost and time effective solution for parenteral fluid administration in patients with mild to moderate dehydration.
- SQ route may decrease the number of failed vascular access attempts.
- May be used as a bridge therapy to rehydrate patients until more substantial vascular access can be established.
- Smaller devices accessing SQ tissue may be better tolerated than venipuncture.

### 3. Disadvantages of SCRT

- Not acceptable for larger-volume or rapid fluid resuscitation

- Requires frequent assessment and close monitoring for complications

## 4. Indications for SCRT

- Patient age greater than 4 weeks and ≤17 years old
- Mild to moderate dehydration
- Unable to establish IV access for fluid administration.

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| **NOTE:** | **RNs will follow policy for Peripheral Intravenous Device and Venipuncture for difficult insertions and/or choosing the appropriate access site.** |

- Failed oral rehydration therapy (ORT)
- Patients with a developmental venous anomaly (DVA) who are not in a life-threatening state

## 5. Contraindications of SCRT

- Age < 4 weeks
- Infection/cellulitis, or burns at the insertion site
- Severe dehydration, requiring rapid fluid rehydration (i.e. shock, sepsis)
- Documented allergy or hypersensitivity to recombinant human hyaluronidase (*Hylenex*)
- Severe electrolyte abnormalities
    - Severe hyponatremia (Na < 130 mmol/L)
    - Severe hypernatremia (Na > 150 mmol/L)
    - Hypokalemia (K < 3.5 mmol/L)
- Diabetic ketoacidosis
- Life-threatening situations
- Pulmonary congestion or edema, congestive heart failure.
- Patients with clotting disorders. Bleeding may occur at the injection site.

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# B. Human Recombinant Hyaluronidase (*Hylenex*)

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| **KEY POINT:** | **SCRT may be performed with or without the use of the medication human recombinant hyaluronidase (*Hylenex*).** |

Human recombinant hyaluronidase or *Hylenex* is a medication that reacts with the hyaluronan in the subcutaneous tissue. It causes the subcutaneous matrix to become less viscous, allowing fluids that are injected into the subcutaneous space to be absorbed through the capillaries and lymphatic vessels.

The decrease in viscosity is reversed for approximately 24 hours after hyaluronidase administration. If the SCRT is still indicated after 24 hours, hyaluronidase can be reordered by the

LIP and re-administered by the RN via the subcutaneous catheter.

### 1. Contraindications and Precautions

- Do not administer hyaluronidase if the patient has an allergy or hypersensitivity to hyaluronidase or any of the other drug components.
- Use with caution in patients with reported history of bee sting allergy; Hyaluronidase is an active component in bee venom.
- Do not inject hyaluronidase into an area of localized infection or inflammation.
- Do not use local (subcutaneous) anesthetics at selected insertion sites, such as lidocaine, including the J-Tip needless injector for lidocaine. Hyaluronidase hastens the onset of analgesia, shortens its duration, and increases the risk and incidence of systemic reactions.

### 2. Dosage

Hyaluronidase will be ordered by the Licensed Independent Practitioner (LIP).

Usual dosage is 150 units in 1 mL. It is administered directly into the subcutaneous tissue after insertion of the subcutaneous catheter and prior to fluid administration. See procedure for SCRT with Hylenex for administration information.

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## C. Subcutaneous Fluid Administration

Only isotonic fluids (0.9% sodium chloride or lactated ringers) should be administered subcutaneously. Hypertonic and dextrose-only fluids should be avoided due to possible risk for hypotension secondary to fluid shifts from the intravascular space. No fluid additives (i.e. potassium) should be infused subcutaneously.

## D. Patient & Caregiver Education

- A slightly red, fist-sized ball appears at the infusion site for the first 5 min after the fluid infusion is initiated.
- The swelling then softens as it spreads over a space covering approximately 12 x 8 cm (approximately 5 x 3 in).
- The swelling resolves soon after completion of the fluid infusion.
- The procedure is usually less painful than IV fluid administration; the patient may feel a little stretching or pulling at the infusion site, and the area may feel cool.
- If an infusion pump is used, it may make a beeping sound as it gets started and if the patient lies on his/her back.
- Staff observes the patient and the fluid administration during the procedure to ensure that all is well.

# IV. Procedure

## A. SCRT with Hyaluronidase

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| **NOTE:** | **This procedure of subcutaneous catheter insertion is restricted to Registered Nurses (RNs) with documented competency. The subcutaneous catheter and fluid infusion may be cared for and maintained by any RN.** |

1. Check the patient's chart for the following:
    - LIP order
    - Allergies
    - Contraindications
2. Explain the procedure to the patient or caregiver.
3. Apply a topical anesthetic cream to the selected insertion site, such as EMLA or LMX, per LIP order. Cover with an occlusive dressing and wait for 15 to 20 minutes.

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| **WARNING:** | **Do not use subcutaneous anesthetic medications, such as lidocaine administered subcutaneously or the J-Tip needleless injector with lidocaine, at catheter insertion site. It may result in a systemic reaction after the SQ catheter is inserted and fluids are administered.** |

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4. Prepare equipment:
    - 24g 0.75 inch angiocatheter
    - 1 vial of 150 units (1 mL) of human recombinant hyaluronidase, if ordered by LIP
    - 5 mL syringe
    - Extension tubing with luer lock/needleless connector
    - Pre-filled saline flush
    - Prep solution (any one of these is acceptable)
        - Chlorhexidine gluconate
        - Povidone iodine
        - Alcohol
    - Clean, disposable gloves
    - Tegaderm transparent dressing
    - Tape
    - Infusion tubing/infusion set
    - Fluid, per order
5. Draw up 150 units (1 mL) of human recombinant hyaluronidase into empty 5 mL syringe

6. Set up extension tubing with needleless connector attached; do not pre-flush or prime with saline syringe
7. Prime extension tubing with the 150 units (1 mL) of hyaluronidase; do not remove syringe.
8. Perform hand hygiene and don clean gloves.
9. Choose most appropriate insertion site: between the scapula or outer thigh.
10. Cleanse insertion site vigorously with prep solution and allow site to dry.
11. "Pinch an inch" of skin at selected insertion site, taking care not to touch the cleansed area of skin where the angiocatheter will be inserted.
12. Insert angiocatheter into the pinched skin at a 20-30 degree angle. Direction of the needle does not matter.
13. Attach extension tubing to luer lock hub of angiocatheter.
14. Draw back on syringe to check for blood return. If blood return is noted, remove catheter and select another site. If no blood return, flush 150 units hyaluronidase into the SQ tissue.
15. Attach saline flush to extension tubing and flush an additional 5-10 mL of saline into the SQ tissue.
16. Cover site with transparent dressing to allow for observation of site.
17. Connect IV fluid and infuse fluids at ordered rate. See fluid administration.

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| **NOTE:** | **It takes about 15 minutes to break down enough of the hyaluronan to create a less dense space to allow for the infiltration of fluid.** |

18. Label line to indicate that catheter is subcutaneous, not intravenous or an epidural catheter.
19. Consider obtaining LIP order for administering hyaluronidase every 24 hours for up to a maximum of 3 total doses, if SCRT and SQ catheter remains necessary for >24 hours.
20. Document in the patient's electronic medical record:
    - Date and time of insertion
    - Catheter gauge
    - Site of insertion (label as subcutaneous under LDAs)
    - Insertion site condition
    - Number of insertion attempts
    - Patient tolerance of the procedure
21. Document administration of topical anesthetic cream, hyaluronan, IV fluid infusion, and site on MAR, as applicable

# B. Fluid Administration

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| **NOTE:** | **Initiation of subcutaneous fluids via subcutaneous line is performed by RN with** |

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| | **documented competency. Ongoing or continued fluid administration may be performed by any RN.** |

1. Check the patient's chart for the following:
    - LIP order
    - Allergies
    - Contraindications
2. Perform hand hygiene
3. Swab vigorously with a sterile alcohol wipe (like juicing an orange) for at least 5 seconds, both tip and threads of needleless cap.
4. Connect IV tubing to needleless cap.
5. Administer subcutaneous fluids slowly via electronic infusion device, incrementally increasing administration rate to full bolus rate, if patient tolerates well.
    - Start administration slowly at 1/4 of the ordered rate for the first 10 minutes.
    - Increase infusion rate to 1/2 the ordered rate for the next 10 minutes.
    - Increase infusion rate to ordered bolus rate after 20 minutes of infusion start time.

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    | **NOTE:** | **The volume of fluid administered via the subcutaneous route should be limited to 1000 mL per day per site.** |

6. Monitor patient response and infusion site.
7. Assess site and rotate site if there is erythema, swelling, leaking, local bleeding, bruising, burning, abscess or extreme pain, outside of expected
8. Document in the patient's electronic medical record:
    - Start and stop times of infusions
    - Type of fluid administered
    - Volume/rate
    - Route of administration
    - How patient tolerated procedure

# C. Site Evaluation and Care

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| **NOTE:** | **Site evaluation performed by RN.** |
| **NOTE:** | **Care and dressing change performed by RN, LPN or NAII.** |

Patients receiving continuous infusion of fluids via subcutaneous catheter for the purpose of SCRT are evaluated for evidence of catheter related complications every hour for pediatric patients. Patients with a medlocked subcutaneous catheter are evaluated every 8-hours (every 6-hours for NCCC and PICU) and with each access.

Assess site for:

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- Signs and symptoms of systemic fluid overload
- Moderate to severe erythema, beyond expected results from SCRT
- Fluid leaking from around from catheter site
- Localized irritation or infection
- Pain at insertion site
- Catheter dislodgement

Rotate the SQ access site every 24 to 48 hours or after 1.5 to 2 liters of solution has infused and as clinically indicated based on site assessment.

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| **KEY POINT:** | **It is an expected result that the area around the insertion site will turn dark pink and swell. A dark pink color is not indicative of an allergic reaction. However, site should be assessed for tenderness, pruritis, or warmth. Swelling should feel soft and painless, unlike a traditional infiltrate. Swelling will decrease over 1-2 hours after the infusion is complete.** |

# D. Removal

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| **NOTE:** | **Performed by RN, LPN, NA II.** |

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Removal of a subcutaneous catheter requires a LIP order.

1. Gather equipment
    - Gloves
    - (2) 2x2 gauze
    - Tape
    - Adhesive bandage
2. Perform hand hygiene and put on gloves.
3. Remove dressing from insertion site.
4. Assess site condition.
5. Pull catheter device straight out, slowly.
6. Observe catheter and catheter tip for integrity.
7. Apply pressure to site with 2x2 gauze until bleeding has stopped.
8. Apply 2x2 gauze and tape or adhesive bandage to site.
9. Remove gloves and perform hand hygiene.
10. Document in the medical record:
    - Date and time of removal
    - Catheter integrity
    - Insertion site conditions
    - Adverse reactions or complications

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# VI. Related Policies

Peripheral Intravenous Device and Venipuncture

# VII. Responsible for Content

Department of Emergency Medicine Operations Network; Pediatric Emergency Department Physicians Group; Pediatric Emergency Department Clinical Practice Group; UNC Pediatric Clinical Practice Group; Nursing Policy Committee

## Approval Signatures

| Step Description | Approver | Date |
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