

Hypodermoclysis: An Alternative Infusion Technique

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Hypodermoclysis, the subcutaneous infusion of fluids, is a useful and easy hydration technique suitable for mildly to moderately dehydrated adult patients, especially the elderly. The method is considered safe and does not pose any serious complications. The most frequent adverse effect is mild subcutaneous edema that can be treated by local massage or systemic diuretics. Approximately 3 L can be given in a 24-hour period at two separate sites. Common infusion sites are the chest, abdomen, thighs and upper arms. The preferred solution is normal saline, but other solutions, such as half-normal saline, glucose with saline or 5 percent glucose, can also be used. Potassium chloride can be added to the solution bag if needed. Hyaluronidase can also be added to enhance fluid absorption. Hypodermoclysis can be administered at home by family members or a nurse; the technique should be familiar to every family physician. (*Am Fam Physician* 2001;64:1575-8.)

◉ A patient information handout on hypodermoclysis, written by the authors of this article, is provided on the AFP Web site.

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on page 1516.

Hypodermoclysis is a method of infusing fluid into subcutaneous tissue that requires only minimal equipment. Technically, it is easier to administer fluids subcutaneously than intravenously. During the past two decades, many articles advocating this method have been published in the geriatric and palliative medical literature.^{1,2} However, hypodermoclysis is suitable for use in many hospital and home-care situations regardless of the patient's age.³ The advantages and disadvantages of this technique are presented in *Table 1*.

Efficacy

A 1991 study⁴ demonstrated the efficacy of fluid absorption in hypodermoclysis. Healthy elderly volunteers were infused with normal saline either intravenously or subcutaneously, using radioisotopic tritiated water and technetium pertechnetate. The infusion included 750 IU of hyaluronidase, and the saline infusion rate was 167 mL per hour. The absorption of fluid via the intravenous route was almost identical to that with the subcutaneous route in all subjects. Radioactivity could not be demonstrated at the subcutaneous site 75 minutes after completion of the infusion.

In an uncontrolled study,⁵ hypodermoclysis was used in 36 instances in nursing-

home residents with a mean age of 85 years and was associated with a return to clinical or functional baseline in 71 percent of subjects one week after the end of clysis. In a further study,⁶ 60 patients (mean age: 80 years) with cognitive impairment who required parenteral fluids for at least 48 hours were randomly chosen to receive either intravenous or subcutaneous fluids. After adjusting for baseline differences, no differences in serum urea or creatinine levels were found between the two groups 48 hours later. The cost was much lower in the subcutaneous fluid group, and agitation related to the infusion was more prevalent in the intravenous fluid group.

Indications

Subcutaneous fluids are indicated for maintaining adequate hydration in patients who are unable to take adequate fluids orally, who are mildly to moderately dehydrated and in whom it is difficult or impractical to insert an intravenous line.⁷ The main use of subcutaneous fluids has been in geriatric and palliative medicine settings.^{1,5,6}

Oral hydration is often difficult in the presence of cognitive impairment, vomiting and nausea, infection, abdominal obstruction related to cancer, or cerebrovascular accident, especially in elderly patients.^{1,8-10} Home use of intravenous infusion entails serious risks and

TABLE 1

Advantages and Disadvantages of Hypodermoclysis**Advantages**

Low cost
 More comfortable than IV administration
 Less likely than IV administration to cause pulmonary edema or fluid overload
 Simple insertion, less distressing than IV; easier reinsertion at new site
 More suitable for home care than IV line, with less staff supervision and less need for hospitalization
 Can be set up and administered by nurses in almost any setting
 Does not cause thrombophlebitis
 Has not been shown to cause septicemia or systemic infection
 Can be started and stopped at any time by opening and closing the clamp on clysis tubing; no danger of clot formation

Disadvantages

Usual rate only 1 mL per minute; only 3,000 mL (at two sites) can be given in 24 hours
 Limitations on administration of electrolytes, nutrition additives and medications
 Edema at infusion site is common
 Possibility of local reactions

IV = intravenous.

requires close supervision by skilled medical staff. However, hospitalization is inconvenient for patients and families, and many patients wish to stay at home. The cost of hospitalization and the danger of nosocomial infections are further disadvantages of admitting a patient for hydration. Because of its safety and ease of administration, hypodermoclysis is a useful alternative to intravenous hydration.¹¹

Terminal cancer patients usually stop eating and drinking near the end of life. The use of fluids in this situation is subject to debate, because nutrition and hydration have not been proved to prolong life or improve patients' well-being.^{12,13} Several authors claim that hypodermoclysis (at a rate of 500 to 1,500 mL per 24 hours) circumvents many of the objections to other methods of hydration.^{14,15} Clinical studies suggest that terminally ill

patients with cancer may achieve adequate hydration with much lower fluid volumes than recommended for the average medical and surgical patient.¹⁶ Also, patients and families can be disturbed by low fluid intake, particularly when there is active fluid loss from diarrhea, vomiting, bowel obstruction or profound sweating. In these situations the physician should discuss hypodermoclysis with the patient and/or caregivers.

Contraindications

There are few contraindications to hypodermoclysis. It should not be used when fluids must be administered rapidly and in large amounts, such as in patients with collapse, shock, severe electrolyte disturbance or major dehydration. It is also contraindicated when the patient may be at increased risk of pulmonary congestion or edema, such as severe congestive heart failure. Because of bleeding at the injection site, clotting disorders are another contraindication.

Technique**SITE**

In ambulatory patients, hypodermoclysis sites include the abdomen, upper chest, above the breast, over an intercostal space and the scapular area. In bedridden patients, preferred sites are the thighs, the abdomen and the outer aspect of the upper arm.^{3,17} After one to four days, the needle and tubing should be changed, although infusion sets have been left in place for much longer periods without complications.² The reported duration of any one site in a palliative care unit was 4.7 days. Total hypodermoclysis duration was an average of 14 days.¹⁴ In another study¹⁸ using a Teflon cannula, the site duration was 11.9 ± 1.7 days versus 5.3 ± 0.5 days using a butterfly needle.

VOLUME AND RATE

Fluid can be delivered subcutaneously by gravity at a rate of 1 mL per minute at one site; thus, about 1.5 L can be delivered at one site and 3 L at two separate sites over 24 hours.² In a

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prospective study¹⁴ in a palliative care unit, 100 consecutive patients received an average volume of $1,203 \pm 505$ mL per day. One to 2 L can be given overnight to allow freedom from tubes during the day.³ Another method involves administration of 500-mL boluses over one or two hours three times a day, with 150 U of hyaluronidase (Wydase) given at the subcutaneous site before the first morning infusion.¹

EQUIPMENT

The equipment consists of a solution bag, a tube with a drip chamber, a 21- or 23-gauge long-tube butterfly needle, povidone-iodine solution or alcohol skin preparation, and a sterile occlusive dressing.

FLUID AND ADDITIVES

Usually, normal saline (0.9 percent) is infused,^{2,19} but 0.45 percent saline, one third saline with two thirds glucose 5 percent, or 5 percent glucose alone or with normal or half-normal saline have been administered in clinical practice.^{1,2,5-7,19} Past reports warned of the danger of rapidly infusing electrolyte-free solutions such as 5 percent glucose. More recently, reports have been published on the use of 5 percent dextrose with no attendant risk.⁷

Hyaluronidase, an enzyme obtained from bull testes, has been used to enhance fluid absorption from subcutaneous tissue. Hyaluronidase temporarily lyses the normal interstitial barrier, which consists mainly of hyaluronic acid, a polysaccharide found in the intercellular ground substance of connective tissue.¹ Hyaluronidase decreases the viscosity of the connective tissue, thus increasing diffusion of the fluid administered subcutaneously for about 24 to 48 hours.⁵

When hyaluronidase is used to increase fluid absorption, one method of doing so is to add 150 U per L to a fluid infusion bag and to inject 75 U of hyaluronidase into each clysis site through the short latex tubing near the needle.² Some physicians have used 10 times this dose for hypodermoclysis by priming the needle and infusion set with hyaluronidase

TABLE 2
Technique of Hypodermoclysis

Preparation

1. Explain the procedure to the patient.
2. Select the infusion site.
3. Wash hands.

Procedure

1. Assemble fluid and tubing. Prime line with selected fluid and hyaluronidase, using lidocaine if required.
2. Swab the site with povidone-iodine skin preparation solution using a circular motion, beginning at the center of the site. Allow at least one minute contact time. Do not touch prepared site again with fingers.
3. Insert needle, bevel up, into subcutaneous tissue at a 45- to 60-degree angle.
4. Secure needle and tubing with occlusive dressing.
5. Adjust fluid drip rate as prescribed.

Post-procedure

1. Do not set drip rate to deliver more than 1 L in two hours.
2. Date and initial dressing; date and initial intravenous tubing.
3. Document infusion fluid on medication chart.
4. Check patient and infusion after one hour to ensure that the infusion site is correct, that there are no signs of edema, leakage, disconnection or fluid collection distal to the site, and that patient does not show signs of fluid overload.
5. If necessary, the infusion site can be massaged to enhance edema absorption.

(1,500 U) and 1 to 2 mL of lidocaine.³ Usually 150 U per L is an effective dose of hyaluronidase.⁷ However, this dosage can cause discomfort and local reaction.³ Many reports suggest that the addition of hyaluronidase is not necessary to prevent edema.^{5,6,20-23} There are reports of the safe addition of 20 to 40 mmol of potassium chloride per L to the infused solution in cases where potassium replacement is needed (i.e., diarrhea, vomiting).^{2,3,7,24}

No data have been reported on the absorption of morphine and other medications added to the fluid bag or given as a bolus, although concomitant subcutaneous infusion of such medications warrants investigation.

The technique for hypodermoclysis is summarized in *Table 2*.

Adverse Effects

The risks of hypodermoclysis are minimal when it is administered in conformity with accepted indications and guidelines. Adverse effects, which are rare and easily avoidable, depend mainly on the choice of solution, the volume and the infusion flow rate⁷ (*Table 3*).

In a 1981 experiment,²¹ 4,500 infusions of normal saline and 5 percent glucose solutions were administered to 634 patients, of whom the majority were older than 80 years. Few adverse effects were noted. The most common

TABLE 3
Adverse Effects of Hypodermoclysis

Effect	Comment
Local edema	Most common adverse effect; can be resolved by massage
Local catheter reactions*	Occurred in 5% of 46 patients per day who were hydrated by hypodermoclysis compared with 25% of 18 patients hydrated by intravenous fluid. ²²
Pain or discomfort at infusion site	Rare; can be related to insertion of needle into underlying muscle or to increase in infusion rate
Cellulitis	Risk is minimal when aseptic technique is used and needle site is changed daily.
Puncture of blood vessels	Risk is minimal; subcutaneous infusion should not be performed if blood appears when needle is inserted.
Pulmonary edema	Rare; reported in 0.6% of more than 600 patients hydrated by hypodermoclysis ¹¹
Changes in plasma concentrations of electrolyte	Rare; less common than with intravenous infusion
Side effects of hyaluronidase†	Rare

Information from Schen R. Administration of fluid by subcutaneous infusion. *Harefuah* 1997;132:716-7, and Dasgupta M, Binns MA, Rochon PA. Subcutaneous fluid infusion in a long-term care setting. *J Am Geriatr Soc* 2000;48:795-9.

*—Redness, obstruction, swelling.

†—Local edema or urticaria, erythema, chills, nausea, vomiting, dizziness, tachycardia and hypotension are listed in the package insert for Wydase (Wyeth Laboratories), 1993.

problem was fluid overloading, which caused either subcutaneous edema or heart failure in nine patients. Four of five patients with subcutaneous edema in the pelvic and genital regions rapidly responded to diuretics. Local infection occurred in only one patient, who developed cellulitis at the infusion site in the thigh. Two patients had ecchymoses, one of them with probable disseminated intravascular coagulation. The investigators concluded that hypodermoclysis is safe in older patients with mild to moderate dehydration.

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