



TITLE: Volume and Site Preferences for Hypodermoclysis: A Review of Clinical Practice Guidelines

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CONTEXT AND POLICY ISSUES:

Hypodermoclysis (HDC) or subcutaneous infusion is a technique to supply fluids (electrolytes, glucose or drugs) to patients when oral intake or intravenous route is inadequate.¹ This technique is simple and particularly useful in the elderly in almost any settings, including at home, community, palliative care and long-term care for the management of mild to moderate dehydration with less cost and fewer systemic side effects than intravenous method.²⁻⁴ Evidence has shown that patients receiving hydration by HDC had general improvement, cognitive status improvement and improved oral intake.⁵ Complications associated with HDC include drip site redness, extravasations and bleeding.⁶ Other disadvantages include limitations on administration of electrolytes, nutrition additives and medications.³

This report reviews the clinical guidelines and systematic reviews for HDC regarding the maximum infusion volume, infusion rate, and sites of infusion.

RESEARCH QUESTIONS:

What are the guidelines and maximum volume recommendations for HDC as per anatomical site for infusion?

1. What is the recommended infusion rate?
2. What are site preferences identified in the literature?
3. Are there limitations on volume infusion as dictated by site preference?

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METHODS:

A limited literature search was conducted on key health technology assessment resources, including PubMed, EBSCOhost CINAHL, The Cochrane Library (Issue 9, 2010), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI (Health Devices Gold), EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between January 1, 2000 and September 8, 2010. No filters were applied to limit the retrieval by study type.

SUMMARY OF FINDINGS:

Two systematic reviews^{7,8} and 17 guidelines⁹⁻²⁵ were identified.

Systematic reviews and meta-analyses

The two systematic reviews^{7,8} on HDC did not provide any information relevant to the research questions. The summary of findings of the systematic reviews is in Appendix 1.

Guidelines and recommendations

Of the 17 clinical guidelines identified, 14 were from the UK^{9-20,22,23} and three were from Canada.^{21,24,25}

The selected recommendations of individual guidelines with respect to indications, contraindications, type of fluids for infusion, maximum volume, infusion rate and site of preference were tabulated in Appendix 2.

In general, HDC is indicated for the treatment of mild to moderate dehydration. It is contraindicated for severe dehydration, the need of precise control of fluid balance, the need of large volume perfusion (>3 L in 24 h), and in patients with coagulation defects, cardiac failure or renal failure. Fluids for infusion include normal saline or dextrose saline solutions. Infusion should be carried out by gravity. Maximum infusion volume is 2 L in 24 h per site, and no more than 3 L in 24 h total when using two sites. The perfusion rate should not exceed 2 ml per min. The infusion should begin with low rate (i.e., 0.5 ml per min) for 1 h, and then increase to 1.3 ml per min if well-tolerated.^{10,25} The infusion site should be checked frequently (i.e., every medication round), and rotated every 72 h or at first sign of complication. The sites of preference include chest wall (axillary and lateral), abdominal wall (anterior), upper arms or thighs (anterior or lateral), back (below shoulder blade), and intra-clavicular areas. Sites to avoid include bony prominences, scarred, damaged or irradiated skin, edema tissue, sites near joints, waistline, lower peripheral limbs, breast tissue, and perineum area. No guidelines indicated any limitations on volume infusion dictated by site preference.

Limitations

None of the guidelines described how they were developed, or the evidence in support of the recommendations. In all guidelines, no grading was given to the recommendations.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING:

The clinical guidelines for HDC in adults provide recommendations regarding indications and contraindications for subcutaneous fluids, type of fluids for infusion, suggested maximum volume, infusion rate, and site preference. The guidelines also have recommendations with respect to equipments, monitoring and trouble-shooting, and reporting. There was no recommendation regarding limitations on volume infusion dictated by site preference. The consistency of the recommendations between guidelines is high despite the lack of grading methods and the evidence upon which the recommendations were constructed. Systematic reviews or guidelines on the use of HDC in pediatrics were not found.

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APPENDIX:

Appendix 1: Summary of systematic reviews

The systematic review of Remington et al., 2007⁷ evaluates the use of HDC to treat mild to moderate dehydration in older adults. The intervention was assessed either alone or in comparison to intravenous (IV) method. The review included two randomized controlled trials (RCT) and six cohort studies between 1996 and 2006. One study was from US, three from Canada, three from Europe and one from Asia. The studies were conducted in both acute and palliative care environments, including long-term care facilities, geriatric units, and hospice. Mean age ranged between 71 and 85 years. Mean treatment duration was from 4 to 21 days for HDC and 5.25 to 6 days for IV rehydration.

HDC was safe compared to IV administration (three studies). Both methods had the same rate of systemic adverse effects (cardiac failure $P=0.68$; hyponatremia $P=1.0$) in one RCT. Same number of patients experienced major local adverse effects, including edema, phlebitis, and cellulitis in one study. Mild local adverse effects were more frequent in the IV than the HDC method (0.21 per day for IV and 0.7 per day for HDC, $P=0.04$) in a prospective observational study and were similar between groups in the other RCT (25 patients in HDC and 24 patients in IV, $P=1.0$). Both methods were equally effective for general improvement in laboratory indicators of dehydration ($P=0.19$), duration of the site of infusion (site changes on average of 2 days for HDC and 2.8 days for IV, $P=0.14$), improvement in daily activities ($P=0.74$), and patients' rating discomfort. Patients receiving hypodermoclysis were less agitated than those receiving IV hydration (37% vs. 80%, $P<0.005$). For feasibility, physicians rated HDC higher than IV, whereas nurses rated both methods the same. Nursing times to start infusion was lower for HDC compared to IV (3.4 versus 6.1 minutes, $P<0.001$).

Three studies (one retrospective chart review and two prospective cohort studies) assessed the safety of HDC alone and reported local complications ranging from 11% to 16%. These included local inflammation, pain, swelling, bruising, edema, extravasation, and bleeding. Most of the adverse events were reported after 3 days of HDC. No occurrence of sepsis or systemic side effects was found. Intravenous hydration was prescribed more often during the last week of life in acute care providers (82%) than hospice providers (2%), resulting in fluid overload. The majority of patients showed improvement in general conditions (from a retrospective chart review and a prospective cohort), cognitive status (from a prospective cohort), and oral intake (from a prospective cohort) with HDC. No improvement was found for serum nitrogen and creatinine in HDC or IV (from a RCT). Intravenous method was more costly than hypodermoclysis in terms of supplies and nursing supervision (from a RCT).

One of the methodological weaknesses of the studies was small sample size (12 to 48 patients in five studies). Meta-analysis was not conducted due to diversity among methodologies and baseline population characteristics. The review did not identify the maximum volume use, infusion rate, or sites of preference for HDC.

The authors concluded that HDC is as effective as IV method in the treatment of mild to moderate dehydration in older adults. Several advantages of HDC over IV rehydration included fewer complications, cost savings, greater patient comfort, less nursing time to start and maintain the infusion.

The systematic review of Turner et al., 2004⁸ assessed the safety and effectiveness of rehydration using HDC (5% dextrose) compared with IV (5% dextrose) in elderly patients. Four

articles (one systematic review, two randomized controlled trials, and one cohort study) were included for appraisal. The fluids were in the form of half-normal saline-glucose 5% (40 g/L dextrose and 30 mmol/L NaCl, or 5% dextrose solution in 4 g/L NaCl, or two-thirds 5% glucose and one-third normal saline.

There was no difference in absorption or adverse events when the fluids (40 g/L dextrose and 30 mmol/L NaCl, or 5% dextrose solution in 4 g/L NaCl) was delivered either through subcutaneous or IV routes (evidence from the systematic review). HDC was well-accepted by older patients, well-tolerated by elderly confused patients, and was of comparable efficacy and safety to IV rehydration (evidence from two RCTs). HDC was as effective as IV infusion and associated with local reactions and complications.

The authors concluded that all four articles provided evidence that appropriate volume of HDC dextrose infusion could be used effectively to treat dehydration in older patients as compared to IV infusion. However, the evidence was limited due to the lack of methodological rigorousness.

Appendix 2: Recommendations for the administration of subcutaneous fluids (hypodermoclysis) in adults

Guidelines	Indications	Contra- indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
Clinical guidelines for subcutaneous infusion (hypodermoclysis). 1.3 ed. South Gloucestershire: NHS South Gloucestershire (UK); 2010 ⁹	Short term hydration for patients having inadequate oral intake of fluids; mild to moderate dehydration; difficulty in inserting IV line	Severe dehydration, clotting disorders; fluid overload; required IV therapy; renal dialysis; the need of precise control fluid balance	Sodium chloride: 0.9% or 0.45% Dextrose Saline: 2.5% glucose, 0.45% sodium chloride Infusion by gravity No medications added, unless prescribed	1.5 L in 24 h per site Two sites if more than 1 L in 24 h is needed	1ml per min per site Formula for calculating number of drops per minute*	Inner thigh, anterior chest wall, lateral abdominal wall, back (below shoulder blade) Check the site at least daily; rotate site every 48 to 72 h	NM
Procedure for the administration of subcutaneous fluids (hypodermoclysis). 2nd ed. County Durham: Tees, Esk and Wear Valleys NHS Foundation Trust (UK); 2010 ¹⁰	Mild to moderate dehydration	Clotting disorders; low serum albumin	Sodium chloride: 0.9% Dextrose Saline: 4% glucose, 0.18% sodium chloride Infusion by gravity	2 L in 24 h	30 ml to 80 ml per h Start with 30 ml per h Inspect site regularly Increase to 80ml per h if there is no pooling, redness or pain after 1 h	Lower abdomen, thigh (lateral), scapula, upper arms Sites that are healthy, clean and free from edema Avoid sites with bony prominences, irradiated or excoriated skin Check infusion	NM



Guidelines	Indications	Contra-indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
						site every 2 h	
Administration of subcutaneous fluid replacement for adults: policy and procedure. Peterborough: Peterborough Community Services (UK); 2010 ¹¹	Poor venous access; risk of dehydration (poor fluid intake, excessive blood loss)	Severe dehydration; need more than 2 L of fluid in 24 h; need precise control of fluid balance (renal failure or heart failure); edema or lymphoedema; hypotensive or in shock; pediatric patients; clotting disorder; severe electrolyte disturbance	Sodium chloride: 0.9% or 0.45% Dextrose Saline: 4% glucose, 0.18% sodium chloride Solutions may contain 5% glucose (≤ 2 L), or potassium (maximum 20 mmol/L)	2 L in 24 h per site	Maximum 1.4 ml per min Formula for calculating number of drops per minute*	Abdomen, chest, arm or thigh (lateral), scapular (for confused patients) Avoid lymphoedematous tissue, irradiated skin, area with rash, bony prominences, joints, tumors, infected or inflamed skin, ascites Check site every 4 h; rotate site every 72 h	NM
Administration of subcutaneous fluids. Walsall: Walsall Community Health (UK); 2010 ¹²	Patients with mild dehydration in palliative care; patients not requiring acute hospital care; in community setting; hypercalcemia	Life threatening situations; coagulation defects; circulatory overload; use of non-electrolyte solutions (e.g. 5% glucose)	NM	NM	NM	Chest wall or abdominal wall (anterior); upper arms or thighs (anterior) Avoid edematous limbs; painful sites; hard tissue, bony	NM

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Guidelines	Indications	Contra-indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
						prominences; near joints; irradiated skin; broken or infected skin; bruised or scarred tissue, near breast tissue	
Standards for infusion therapy. 3rd ed. London: Royal College of Nursing; 2010 ¹³	Refer to Hypodermoclysis Working group, 1998	Refer to Hypodermoclysis Working group, 1998	Refer to Hypodermoclysis Working group, 1998	Refer to Hypodermoclysis Working group, 1998	Refer to Hypodermoclysis Working group, 1998	Site with intact skin Avoid infected, inflamed or broken skin; irradiated skin; near joints; waistline; lymphoedematous limbs	NM
Procedure for the administration of subcutaneous fluids by Wirral admission prevention service. 2nd ed. Wirral: NHS Wirral (UK); 2009 ¹⁴	Mild dehydration	Severe dehydration; cardiac or renal failure; bleeding disorder; existing fluid overload; need more than 3 L of fluid in 24 h	Dextrose Saline: 4% glucose, 0.18% sodium chloride	3 L in 24 h	Per prescribed	Abdomen; chest; upper arm and thigh (lateral) Avoid lymphoedematous tissue; irradiated skin; rash; below knee or elbow; bony prominences; site of infection; near	NM

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Guidelines	Indications	Contra- indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
						joint Rotate site every 72 h	
Procedure for the administration of subcutaneous fluids (hypodermoclysis) in adults. Merseyside: St Helens and Knowsley Teaching Hospitals (UK); 2009 ¹⁵	Poor IV access; any care environment; confused or agitated patients	Severe dehydration; shock; poor tissue perfusion; need more than 3 L of fluid in 24 h; heart or kidney failure	Sodium chloride 0.9% Sodium chloride 0.18% and glucose 4% Sodium chloride 0.45% and glucose 2.5% Infusion by gravity	2 L in 24 h 500 ml in 8 h (1ml/min), maximum 2 L in 24 h per site Up to 3 L can be given, but not at one site in 24 h	Not exceed 2 ml per min Use standard 20 drops = 1 ml	Abdomen; chest; upper arm or thigh (lateral); back (below shoulder blade) Avoid irradiated or injured skin; edematous tissue; lymphoedematous tissue; rash; mastectomy sites; lower peripheral limbs; bony prominences Check site every 4 h; rotate site every 72 h	NM
Administration of subcutaneous fluids. Nottingham University Hospital (UK); 2009 ¹⁶	Inadequate oral fluid intake; mild to moderate dehydration; poor IV access	Need more than 2 to 3 L of fluid in 24 h; severe dehydration; shock; diabetic coma; coagulation defects; tissue	0.9% normal saline 4% glucose in 0.18% saline 5% glucose alternate with 0.9% normal	2 to 3 L in 24 h	Less than 125 ml per h	Abdomen; chest (anterior and lateral); thigh (anterior); upper arm; scapula Avoid lymphoedematous	NM

Guidelines	Indications	Contra-indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
		fibrosis from radiotherapy; heart disease; edema; peripheral vascular disease	saline Fluid can contain up to 34 mmol/L potassium Infusion by gravity			limbs; bony prominences; irradiated skin; near a joint; near surgical or chronic wound site; site of infection or inflammation Check site every 4h	
The administration of subcutaneous fluids (hypodermoclysis) in adults. 2nd ed. Darlington: Darling Primary Care Trust (UK); 2008 ¹⁷	Mild dehydration; poor venous or oral access; cognitive impairment; stroke; palliative care (thirst); non-compliance with IV infusion	As carrier for drug; severe dehydration; shock; poor tissue perfusion; need more than 3 L of fluid in 24 h; coagulation defects; cardiac or renal failure; treatment for hypercalcemia	Sodium chloride 0.9% or 0.45% Dextrose Saline: 4% glucose, 0.18% sodium chloride 5% glucose (\leq 3 L in 24 h or \leq 2 L in 24 h per site) Fluid may contain 20 mmol per L potassium Infusion by gravity	3 L in 24 h 1 L in 24 h in community setting	No more than 2 ml per min Standard 1 ml= 20 drops	Abdomen; chest (sub-clavilar); upper arm or thigh (lateral) Avoid lymphoedematous limbs; bony prominences; irradiated skin; near joint; peripheral limbs Check site three times daily for the first 48 h, then twice a day thereafter; rotate site every 72 h	NM
Policy for	Mild dehydration	Severe	Sodium chloride	2 L in 24 h	100 ml per hour	Clean intact skin;	NM

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Guidelines	Indications	Contra-indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
subcutaneous administration of fluids (hypodermoclysis) to adults in the community and community hospitals. Cambridgeshire: Cambridgeshire Community Services (UK); 2008 ¹⁸	or at risk of dehydration; insufficient fluid oral intake	dehydration; life-threatening situations; need more than 2 L fluid in 24 h; shock; poor tissue perfusion; fluid overload; edema; coagulation defects; cardiac or renal failure	0.9% Dextrose Saline: 4% glucose, 0.18% sodium chloride		Standard 1 ml= 20 drops	fatty area; flank, abdomen; inner thigh, scapula; chest wall (axillary and lateral) Avoid irradiated skin; edema tissue; bony prominences; distal limbs Check site every 4 h for the first 24 h	
Subcutaneous fluid therapy (hypodermoclysis): guidelines for use in adults. Kirklees: NHS Kirklees (UK); 2008 ¹⁹	Mild to moderate dehydration; insufficient oral rehydration; poor venous access	Bleeding and coagulation disorders; taking anticoagulants; broken skin; severe edema; pulmonary congestion	Sodium chloride 0.9%, 0.45% or 0.18% Infusion by gravity	1.5 L in 24 h	Not exceed 1 L in 2 h	Thigh (anterior and lateral); back; abdomen; thorax Avoid bony prominences; joints; blood vessels; pressure areas; waistline Check site every 4 h; rotate site every 72 h	NM
Nursing policy no. 19: subcutaneous fluid	Inadequate fluid intake; no indication for	Severe dehydration; shock; poor	Sodium chloride 0.9% Dextrose Saline:	1.5 L in 24 h	1 ml per min (40 drops per min)	Abdomen; thigh or upper arm (outer); sub-scapula	NM

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Guidelines	Indications	Contra- indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
administration. 3rd ed. Dorset: Royal Bournemouth and Christchurch NHS Foundation Trust (UK); 2008 ²⁰	direct IV infusion	tissue diffusion; need precise volume and rate infusion; coagulation defects; heart disorders; edema site	4% glucose, 0.18% sodium chloride Infusion by gravity			Avoid scar tissue or bruising; edema area Check site every medication round; rotate site every 72 h	
VIHA EOL symptom guidelines: dehydration. Victoria (BC): Vancouver Island Health Authority; 2008 ²¹	Insufficient intake of fluid orally;	Respiratory condition; edema; need immediate high volume fluid replacement; coagulation or bleeding problems	Sodium chloride 0.9% Dextrose Saline: 2/3 glucose (5%), 1/3 sodium chloride (0.9%) Ringer lactate D5½NS Infusion by gravity Fluid may contain up to 40 mEq per L	1 to 1.5 L in 24 h	NM	Upper chest, back (below scapula); thigh, abdomen Avoid irradiated skin; edema area; ascites; breast tissue; lateral placement near shoulder; arms; perineum/groin	NM
Administration of subcutaneous fluids (hypodermoclysis). 2nd ed. Bolton:	Poor venous access; poor oral access; cognitive impairment; stroke;	Severe dehydration; shock; poor tissue perfusion; need more than	Sodium chloride 0.9% or 0.45% Glucose 5% (with care)	2 L in 24 h per site; maximum 3 L in 24 h	Maximum 2 ml per min (1 L over 8 h)	Upper arms or thigh (lateral); abdomen; chest (below clavical); back	NM

Guidelines	Indications	Contra-indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
Bolton Primary Care Trust (UK); 2007 ²²	obstruction of GI tract (palliative)	3 L fluid in 24 h; need precise control of volume and rate of infusion	Fluid may contain potassium up to 27 mmol per L			Avoid lymphoedema limbs; bony prominences; irradiated skin; near joint Check site regularly; rotate site every 72 h	
Policy for the administration of subcutaneous fluids. Birmingham: Birmingham North and East Primary Care Trust (UK); 2006 ²³	Mild dehydration; insufficient rehydration by IV or oral hydration	Severe dehydration; cardiac or renal failure; coagulation disorders; edema	Sodium chloride 0.9% Dextrose Saline: 4% glucose, 0.18% sodium chloride Infusion by gravity	2 L in 24 h	Per prescribed Standard 1 ml = 20 drops	Abdomen; chest; upper arm or thigh (lateral) Avoid lymphoedema tissue; irradiated skin; rash; peripheral limbs	NM
Hypodermoclysis (HDC) administration protocol for palliative care patients. Edmonton: Edmonton Regional Palliative Care Program;	As per physician decision	As per physician decision	Sodium chloride 0.9% Dextrose Saline: 2/3 glucose (3.33%), 1/3 sodium chloride (0.3%) Ringer lactate	As per physician decision	As per physician decision Depend on individual's fluid requirement	Supra scapular; upper chest; abdomen; upper thigh Avoid breast tissue; upper arm	NM

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Guidelines	Indications	Contra- indications	Fluids for infusion	Maximum volume	Infusion rate	Site preference	Limitations on volume infusion dictated by site preference
2005 ²⁴							
Guidelines for the proper use of hypodermoclysis. Canadian Nursing Home, 2001 ²⁵	Mild dehydration	Need rapid IV fluid replacement; need more than 3 L of fluids in 34 h; bleeding or coagulation disorders; no intact skin site for insertion of winged-tip needle	Sodium chloride 0.9% Dextrose Saline: 5% glucose (2/3), 0.9% sodium chloride (1/3) Not recommended 5% or 10% glucose alone Infusion by gravity	2 L in 24 h	Begin with 30 ml per h for 1 h; if tolerate well then increase to 75 ml to 80 ml per h Change site every 72 h, or at first sign of complication	Thigh and hip (anterior and lateral); upper abdominal wall; intra-clavicular areas Avoid arms; edematous tissue; bruised or scared skin; breast and perineum area	NM

* Number of drops per min = [Volume of fluid (ml) x No. of drops per ml (giving set)] / Infusion duration (min)
h: hour; IV: intravenous; L: litre; ml: millilitre; min: minute; mmol: millimole; NM: not mentioned