FOR DEBATE . . .

Hypodermoclysis—a victim of historical prejudice

PRANOY BARUA1, BIMAL K. BHOWMICK2

1Llandough Hospital, Geriatric Medicine, Vale of Glamorgan, UK
2Glan Clwyd Hospital, Geriatric Medicine, Rhyl, UK

Address correspondence to: P. Barua. Fax: (+44) 29 2071 1267. Email: cardiff15@hotmail.com

Abstract

Hypodermoclysis (HDC) had fallen into disrepute after adverse clinical incidents that were obviously the result of improper use of an ingenious technique. HDC has clear advantages over alternative parenteral routes. It has stood the rigour of scientific scrutiny but failed to regain its past glory. This is possibly because of our ignorance and inability to detach ourselves from an age-old prejudice. This is an attempt to demystify some of the myths that surround it. The hope is that older people are not denied an element of health care that they are perhaps most well suited to.

Keywords: hypodermoclysis, clysis, parenteral fluids, subcutaneous fluids, hydration

Introduction

‘Hypodermoclysis (HDC) is the technique used for the subcutaneous administration of large volumes of fluids and electrolytes in order to achieve fluid maintenance or replacement in mildly dehydrated patients, for whom intravenous access may be difficult to obtain or who cannot tolerate sufficient oral intake’ [1]. This definition encompasses some vital issues in the understanding of the practical utility of this procedure, although there are caveats that need mentioning. HDC used to be commonplace, particularly in geriatric medicine up until the 1950s, when it was marginalised almost into oblivion for reasons that were ascribed to ‘a hazardous technique’, although it was actually related to ‘improper use of an ingenious technique’. Unfortunately several attempts, by several experts, to rekindle the glory that it once enjoyed have failed to restore its place in clinical practice. Guidelines were formulated in 1998 by the Hypodermoclysis Working Group comprising a wide range of professionals from various parts of the UK—physicians in oncology and palliative care, geriatric medicine and general medicine, nursing representatives, pharmacists and a service manager. However, sadly enough, albeit anecdotally, only a few clinicians have heard or know enough about HDC to feel confident in prescribing it more routinely or in making changes in hospital policies to ensure that most of our eligible older patients derive the benefits of HDC.

This is an attempt, yet again, to do justice to a procedure that has been wronged! Hopefully we will be able to dispel some of the myths that surround HDC and better the understanding of the biochemistry, physiology and the pharmacokinetics of infusates administered via HDC.

Historical prejudice

Description of ‘adverse events’ that were the basis of the adverse publicity attached to HDC in the literature cannot seem more obviously ridiculous now. These are ostensible related to misuse rather than an inherently flawed technique. First used in paediatric medicine in the 1940s [2], incidents such as a 5-month-old infant given ‘unspecified amount of normal saline and 5% glucose’ subcutaneously and who nearly died [3] started the ‘thumbs-down’ trend. Experiments have shown similarly that rapid administration of electrolyte-free solutions has dire consequences [4–8]. Wrong clinical settings and the nature, quantity and the rate of administration of fluids all seem to be the areas that needed clarification to get the best out of a technique that has many advantages to offer. Used correctly by several experts in their own series and in experiments compared to intravenous administration, HDC has been shown to be an effective and safe technique and, in fact, to be safer and more effective than the intravenous route [9–12].

Physiology and pathophysiology involved in HDC

In 1909, Starling described the osmotic and hydrostatic pressures that caused ‘diffusion’ [13] and in 1968 Perl and Chinard described ‘perfusion’ [14]. Way back in 1894, Starling and Tubby observed that constituents moved between fluid placed in the pleural cavity and blood in adjacent blood vessels, so that each took from each other, constituents it did not possess’ [15]. They observed that hypertonic sugar or salt solutions in the pleural cavity caused a copious drain of fluid into the cavity and the flow slowed down after osmotic equilibrium was reached. While there is room for variation in the composition of the fluid used for HDC, it was felt to be crucial that if hydration is the intention, the composition of the infusedate should be such that it does not draw sodium and water out of the intravascular compartment and the rate of infusion should be within the limits of tissue perfusion [16]. Rapid administration of large quantities of electrolyte-free solutions by HDC results in osmotic shift into the ‘clysis pool’. Segregation of solutes to this injection site lowers the concentration of solutes in the extracellular space. Peter and Van Slyke have observed that glucose (as the infusedate) would diffuse slower than either water or salt across the erythrocytes, vascular membranes and even through the interstitial spaces [4]. So water moves into the cells and this raises the haematocrit as a result of plasma constriction. With changes of sufficient magnitude, particularly in an older patient who may already be volume-, sodium- and chloride-depleted, this could result in prolongation of circulatory time, fall in venous return and cardiac output, and hence lead to shock [7].

Absorption of subcutaneous fluids (SCF) is complete and comparable to intravenous fluids (IVF) when the amount and rate of an appropriate fluid are given due consideration. Lipschitz et al. showed that 500 ml of 0.9% saline labelled with tritium and technetium pertechnetate and given over 3 hours was completely absorbed 1 hour after completion of infusion into the infra-clavicular site [10]. Challinor et al. [9] randomised 34 older patients, requiring parenteral fluids after a stroke, to SCF and IVF administration for maintenance of hydration. Although a standard fluid regime was prescribed to all patients and clinical markers of hydration like postural blood pressure were not measured, there was no difference in plasma osmolality (used as a biochemical marker of dehydration) between the two groups and the cost of cannulas was reduced by nearly a third. Schen and Singer-Edelstein showed in a large study of 1,850 SCF administrations to 270 older patients, that side-effects with HDC were few and not serious (four had local oedema and one patient with disseminated intravascular coagulation had ecchymoses) [17].

Clinical considerations

Advantages of HDC include reduced distress for patients, particularly those cognitively impaired, compared to IVF administration [18], little pain or discomfort with the insertion and maintenance of the subcutaneous ‘line’ [18, 19], no concerns with ‘line-thromboses’ with ‘stop-start infusions’ [16], easier to maintain and re-site in any setting, does not take up a doctor’s time for this, requires less nursing supervision, limbs can be spared from infusions allowing for a change of position in bed and overnight infusion makes patients free for rehabilitation activities during the day [9], can circumvent acute hospital admissions from care homes [16] and in the case of the terminally ill possibly allows patient care to continue in their own homes. HDC does not cause thrombophlebitis and septicaemia, unlike with the intravenous route. This is because HDC should not breach any endothelium under the skin and therefore there is no exposure of basement membrane and collagen, which does occur in intravenous cannulation. This causes platelet aggregation, which in turn attracts more platelets and fibrin to provide a perfect ‘umbrella’; and with the right amount of reduced haemoglobin in the venous blood Escherichia coli and Staphylococcus aureus thrive and avoid phagocytosis [16]. Moreover, HDC leads to significant savings compared to cannula use for the intravenous route (not taking into account ‘failed attempts’) [9] and also resources in terms of medical staff time, which would seem obvious though not formally evaluated.

Indications for HDC include maintenance of hydration with parenteral fluids for those who are unable to take fluid orally, e.g. those with swallowing problems following stroke, the frail and ill, the post-operative older patient, correction of mild dehydration as a supplement to inadequate oral fluid administration and in the palliative care setting, e.g. malignant partial obstruction of the gastrointestinal tract. A thin frail and emaciated older patient is probably most suitable for HDC, contrary to a popular misconception amongst some, usually nursing staff, that they are not. Every so often, a patient coming in through the admission door ‘needs an intravenous line’ almost like a knee-jerk reaction and all too often the poor house-officer is bleepeed in the wee hours of the morning to hunt for a shy and fragile vein that just seems to escape cannulation. So often in these cases HDC may have been more appropriate.

Disadvantages of HDC would include the limitation of the procedure in severe dehydration and shock, or for that matter in any situation requiring more than 3 litres over 24 hours, and in circumstances where careful titration of fluid administration is required, e.g. heart failure and renal failure [1].

Fluids that have been safely given by HDC include 0.9% saline [18, 20] or 0.45% saline [18, 20, 21] and 5% glucose [11, 18]. Five per cent dextrose has a higher hydrogen ion concentration and is likely to cause local irritation and inflammation. It is to be given no more than 2 litres in 24 hours and at a rate that does not exceed 2 ml/minute [1]. A higher strength of dextrose solution is not recommended. For the others, no more than 3 litres in 24 hours and not more than 2 litres in any one site should be given [1]. Solutions containing up to 34 mmol potassium/litre fluid may be given [12, 18, 20, 22]—there is a risk of local ulceration with a higher concentration of potassium.

Administration of SCF is with a butterfly needle that is as short as possible (21–25G is recommended as it has a maximum length of 20 mm). An alternative is a paediatric Teflon™
cannula to avoid nickel irritation. The sites recommended are the abdomen, thigh, scapula, axillary, sub-clavicular chest wall [1]. Hyaluronidase (HRD) is a hydrolysing enzyme that is also called the ‘spreading factor’ and it breaks down hyaluronic acid, which is a mucopolysaccharide naturally found in tissues like skin, joint fluid and mucous membranes. HRD is available commercially for HDC. It can be used as a pre-infusate into the clysis site and to prime the giving set, once a day, with every change of site or if more than 2 litres of fluid are required in 24 hours, the infusion rate required to be more than 2 ml/min, or there is a swelling in the clysis site that is causing concern [1]. Rotation of the injection site could reduce the incidence of localised oedema because of HDC.

**Conclusion**

HDC is a ‘proven-to-be-effective’ technique with its distinct advantages over the intravenous route. Like every treatment and procedure in clinical practice, it has been through the rigour of scientific scrutiny and has come through unscathed. But it has not quite made the resurgence that we would have liked to see. We believe that its under-use, despite its obvious benefits and safety profile, in our older patients, to whom it is probably best suited, is mainly to do with our ignorance and lack of dissemination of information. On the moral front, relocation from a care home to the acute hospital setting, of a frail older person, who has not had a drop of water to drink, can be extremely cruel and well nigh inappropriate. A possibly avoidable hospital admission and then a possible nosocomial infection causing a prolonged hospital stay would not only be unethical but also a drain on our perpetually stretched health resources. In the absence of other reasons to necessitate a hospital admission, if the physician can say ‘start the clysis’ rather than ‘call the ambulance’, the ‘number of words is the same, but the sin would surely be less’ [16].

**References**