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Subcutaneous instillation of donor sites in burn patients

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SUMMARY. **A simple technique of powered subcutaneous instillation of split-thickness skin graft donor sites in burn patients and other plastic surgical patients has been developed. The necessary equipment required, including a standard pneumatic tourniquet, arterial pressure bags and spinal needles, is available in any plastic surgery operating theatre. In over 300 cases in which it has been employed, no complications have been encountered.**

Subcutaneous instillation of donor sites with sterile fluid is a well known method used to smooth bony prominences and provide a flat, even surface facilitating the harvesting of skin grafts with a power dermatome. Most standard textbooks describe the use of a manually-driven "Pitkin" syringe for this technique.[1–4] This syringe, however, is slow and tiring, especially if needed for large donor sites.[5] We describe a non-pulsatile powered technique of instillation which is safe, rapid and simple to use.

Materials and methods

The equipment required for the subcutaneous instillation set-up is listed in Table 1 and illustrated in Figure 1. These materials are available in most plastic surgery operating theatres. A pneumatic tourniquet system is used as a pressure source with a dual bladder control valve. Each of two hoses from the tourniquet is connected to the limb of a one-litre arterial-line pressure bag by a 3-way stopcock. These pressure bags can be inflated to a maximum of 700 mmHg; however, manufacturer recommendations are not to exceed 400 mmHg. Each pressurised litre of intravenous fluid (either normal saline or Ringer's lactate) is connected via a regular intravenous solution set to a spinal needle. The spinal needle is placed subcutaneously and the rate of instillation can be controlled by adjusting the regulating clamp on the intravenous tubing.

Table 1 Equipment list for subcutaneous instillation set-up

1.	Tourniquet system with dual bladder control valve (ATS 1000 Tourniquet System, Aspen Labs)
2.	2 * One litre arterial-line pressure bags (C-Fusor 1000, Medex, Inc.)
3.	2 * One-litre intravenous fluid bags (Normal Saline or Ringer's Lactate)
4.	2 * Three-way stopcocks (Medex, Inc.)
5.	2 * Regular intravenous solution set (Baxter Labs)
6.	2 * 18-gauge, 3 and 1/2 inch spinal needle (Becton-Dickson & Co.)

Because one tourniquet box can pressurise two set-ups, two operators can work together to cover a large area in a short period of time. The technique is illustrated in Figures 2A and B.

Discussion

As well as allowing complete and successful donor site harvesting from large areas with bony prominences, subcutaneous instillation also facilitates harvesting of split-thickness skin grafts from areas otherwise impossible to use. There is a potential risk of body cavity penetration (*i.e.* hydrothorax) with any instillation set-up used, but we have not had any such problems to date.

The technique we have described has been used in our hospital since 1988 in over 300 cases. There are several advantages with this set-up as compared to previous methods. It is quicker and less tiring than the Pitkin syringe, which is operated manually and it provides a closed sterile system compared to the open Pitkin or repeat syringe filling technique. Since the equipment is readily available, no added expense is incurred.

In contrast to Baack *et al.*, who have described a technique of powered clysis using a modified pneumatic pulse lavage,[5] our tourniquet system provides a smooth, continuous and non-pulsatile flow of fluid. These authors state that usually no more than one litre of fluid is needed for even the largest of donor areas, but we have used up to four litres in some adult cases when multiple sites were harvested (*i.e.* back and abdomen harvested to cover defects of both lower extremities). Nevertheless, the volume of infiltrated fluid should always be measured and considered as part of the total fluid intake during surgery.[2] This is particularly important in children, patients with underlying cardiovascular problems, and the elderly, all of whom may be more sensitive to fluid overload.

Several technical considerations should also be mentioned. When instilling a donor site for grafts that will not be meshed (*i.e.* harvesting scalp grafts for

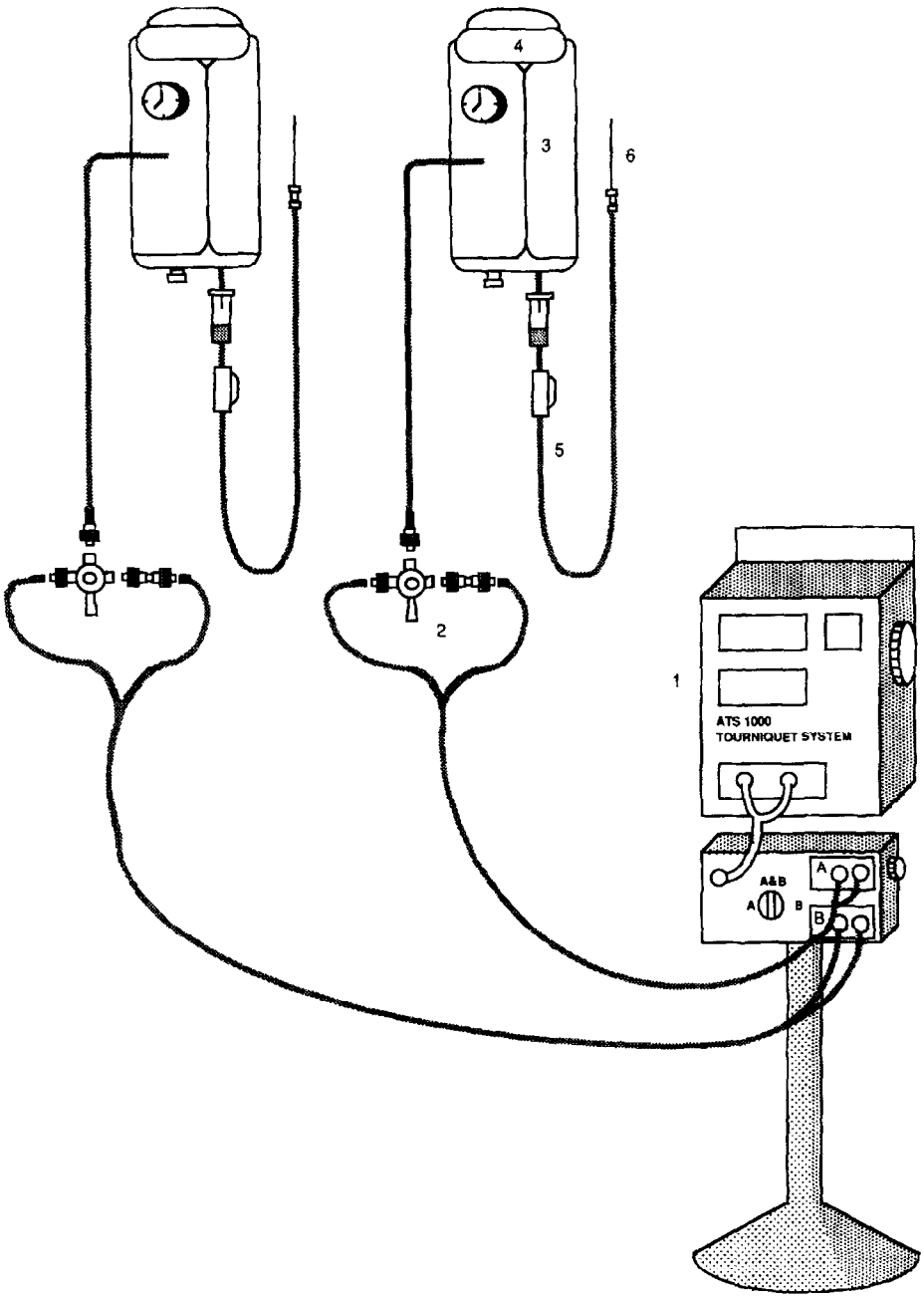

Fig. 1

Figure 1—Equipment set-up. 1. Tourniquet system. 2. 3-way stopcock. 3. Arterial-line pressure bag. 4. Intravenous fluid. 5. Regular intravenous solution set. 6. Spinal needle.

facial resurfacing as described by Engrav *et al.*[6]) we try to use as few needle stabs as possible to limit a "pock-mark" appearance in the facial skin grafts post-operatively. Hill *et al.* described a technique that uses a modified pneumatic pump to generate a pressure of 800 mmHg.[7] We have not used such a high pressure but perhaps if longer intravenous tubing is to be used, this increased pressure may be advantageous to counteract the increased resistance of the longer tubing. Hill *et al.* also suggest placing one milligram of 1 : 1000 epinephrine into each litre of intravenous fluid, as a method to help control bleeding. This may be a useful adjunct, but many centres, including our own, already routinely use epinephrine-soaked telfa gauze sponges as a superficial vasoconstrictor on both donor sites and debrided wounds to obtain haemostasis.[3] Extremely high blood levels of epinephrine within 5 min of application have been measured by Timmonen *et al.* after the use of this technique[8] yet the reported adverse effects are rare.[9] However, if one were to apply epinephrine in the instillation fluid, as well as in telfa gauze, the resultant amount of epinephrine absorbed systemically might cause significant effects. For this reason, we have not used epinephrine subcutaneously when we are already applying it topically.

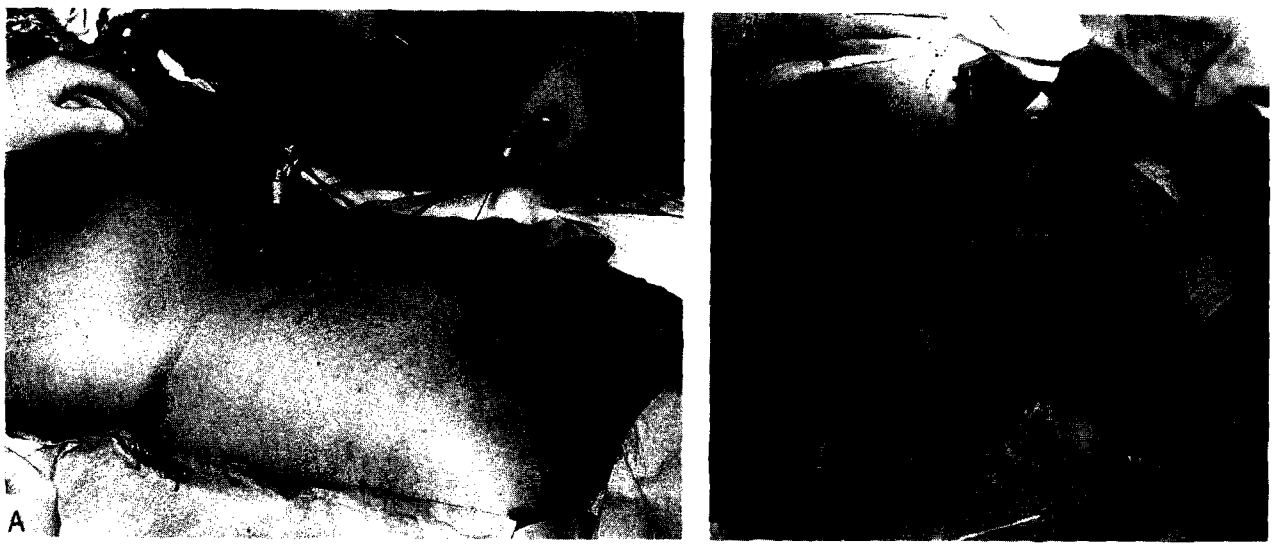

Fig. 2

Figure 2—(A) Patient's back prior to instillation. (B) Same patient after instillation of lower back. The lower back is harvested while instillation of the upper back continues so as not to allow time for the subcutaneous fluid to diffuse into nearby soft tissues.

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