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Effects of vapocoolant spray on skin sterility prior to intravenous cannulation

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SUMMARY

Background: Alkane vapocoolant sprays evaporate rapidly, lower skin temperature and result in a temporary interruption in pain sensation. They reduce the pain of intravenous cannulation. However, concern exists that they may recontaminate the sterile cannulation site.

Aim: To determine the effects of vapocoolant spray on skin sterility prior to cannulation.

Methods: Fifty patients from the emergency department of a large tertiary metropolitan hospital were enrolled in this study. Bacterial skin swabs were taken from the dorsum of both hands of each patient. From one hand, a swab was taken following standard chlorhexidine disinfection, and a second swab was taken following the application of vapocoolant spray. From the other hand, a swab was taken from unprepared (non-disinfected) skin, and a second swab was taken following vapocoolant application. Skin swabs were sent for microbiological culture and quantitative comparison.

Findings: The administration of vapocoolant after skin disinfection did not increase the bacterial colony count significantly: median 0.0 [interquartile range (IQR) 0.0] vs 0.0 (IQR 0.0) ($P = 0.71$). The administration of vapocoolant to the unprepared skin decreased the colony count significantly: median 33.5 (IQR 68) vs 3.0 (IQR 11) ($P < 0.001$).

Conclusion: Alkane vapocoolant spray does not recontaminate the skin after disinfection, and should pose no increased risk of infection when used as an anaesthetic agent prior to intravenous cannulation following disinfection. While it does have inherent bactericidal activity, this is not sufficient for it to be used as the sole disinfectant.

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Introduction

Intravenous (IV) cannulation is an invasive procedure in which a cannula is inserted into a vein to provide venous access.[1] It is one of the most common procedures undertaken in the hospital setting.[2] However, approximately one-half of patients report moderate pain and anxiety when no anaesthesia is

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administered.[2–4] Much cannulation pain is avoidable with the administration of a local anaesthetic agent.[3–5] A range of anaesthetic techniques have been compared, although none has proven to be superior in all outcome measures.[2–5] Accordingly, less than 20% of medical and surgical doctors use a local anaesthetic agent for the insertion of commonly used cannulae (20 gauge), and less than one-half use a local anaesthetic agent for the insertion of large-bore cannulae.[6]

Hijazi *et al.*[5] reported that the administration of a topical alkane spray (vapocoolant), immediately prior to cannulation, reduces the pain of cannulation significantly. Page and Taylor[7] compared vapocoolant spray with subcutaneous lignocaine. They reported that vapocoolant causes less administration pain, has reduced preparation and administration time, requires less technical skill, avoids the risk of needlestick injury, has greater cannulation success and is more cost-effective.[7] They concluded that vapocoolant is, arguably, the superior agent.

There are anecdotal reports that a spray film dressing, when applied to sterile wounds following cardiac surgery, is associated with increased incidence of wound infection (L. Grayson, personal communication, 2014). It is thought that bacteria are transmitted from the spray nozzle directly to the wound. There are concerns, therefore, that spray applications such as vapocoolant may contaminate the sterile cannulation site, thereby increasing the risk of local and systemic infection. The present authors hypothesized that, given the very cold skin temperatures induced by vapocoolant, contamination is unlikely, and that vapocoolant may, in fact, have bactericidal properties of its own. These hypotheses were explored by comparing bacterial colony counts from the skin of patients who had been prepared for cannulation in a variety of ways. The findings will better inform clinicians as to the safety of vapocoolant in regard to the potential for infection.

Methods

A single-blinded, controlled experimental study was undertaken in the emergency department (ED) of a large tertiary metropolitan hospital between February 2014 and April 2014. Patients served as their own controls with four skin swabs taken from each patient. The study was approved by the Institutional Human Research Ethics Committee, and all patients provided informed written consent to participate.

Patients were eligible for inclusion if they were relatively well with uncomplicated presentations, aged ≥18 years and had not yet received an IV cannula. Exclusion criteria were refusal to participate, inability to provide informed consent (non-English speaking, altered mental state, significantly impaired vision, significant illness), skin disease of any sort [especially infection, trauma, lacerations and cold intolerance (e.g. Raynaud's disease)], hands washed/cleansed with antiseptic agents while in the ED, or known allergy/sensitivity to vapocoolant spray.

Patients were recruited during periods when the principal investigator was present in the ED (09:00–17:00 h, weekdays). Emergency department staff notified the principal investigator of patients who met the entrance criteria. These patients received a verbal and written explanation of the study, and gave written consent to participate.

For each patient, each hand was allocated for use in either Part 1 or Part 2 of the study using a computer-generated random number sequence. Using the same process, bacterial swab samples were assigned random numbers in order to blind the microbiology laboratory staff to the nature of the skin preparation. Randomization was undertaken by an independent person prior to study commencement. Each patient was assigned to the next sequential set of random numbers. Unblinding of samples was only undertaken at completion of the study.

Study procedure

The dorsum of the hand allocated to Part 1 of the study was first disinfected in accordance with the Austin Health standard cannulation guideline (see below). After disinfection, the skin was swabbed for bacterial culture. Swabs were run over the entire dorsum of the hand four times. No/minimal bacterial growth was expected, and this swab served as the Part 1 'control'. Vapocoolant was then applied in accordance with the standard procedure. After application, the skin was swabbed again. Significant bacterial growth (compared with the control) would indicate contamination by the vapocoolant spray.

The dorsum of the hand allocated to Part 2 of the study had a swab taken from the unprepared skin (no disinfectant or vapocoolant application). This swab served as the Part 2 'control'. Vapocoolant was then applied and the skin was swabbed again. A significant reduction in bacterial growth after vapocoolant application (compared with the control) would indicate disinfectant properties of the vapocoolant spray.

For all patients, the skin was prepared (disinfection with/without vapocoolant) by a single investigator (DT). All swab samples were collected by another investigator (JE). In all cases, the swabbed skin was the same size and taken from the same area of the hand.

The Austin Health standard skin disinfection procedure is the same as that recommended by Selby and Bowles,[4] as follows:

- the applicator washed his/her hands with 0.5% chlorhexidine gluconate and 70% isopropyl alcohol (in an emollient base);
- non-sterile gloves were applied; and
- the skin site was wiped with a swab stick impregnated with 2% chlorhexidine gluconate and 70% isopropofol alcohol, and allowed to dry.

The vapocoolant application procedure[5] was as follows:

- the applicator washed his/her hands and applied non-sterile gloves, as above;
- the skin site was sprayed with COLD Spray from approximately 12 cm for 2 s; and
- any liquid spray remaining on the skin was allowed to dry.

Consumables

COLD Spray (DIFA Chemical Industries, Slacks Creek, Australia) was used as the vapocoolant. It is a blend of propane, butane and pentane supplied in a hand-held pressurized spray can.[8] It is registered with the Therapeutic Goods

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