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PROCEDURAL DERMATOLOGY

Ice anaesthesia in procedural dermatology

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ABSTRACT

This article presents findings from a survey of Australian dermatologists who were questioned about their preferred pain control methods when carrying out injectable procedures. We also present, what is to the best of our knowledge, the first proof-of-concept experiment exploring the relationship between ice-to-skin contact time and skin surface temperature, using both ice wrapped in latex and ice wrapped in aluminium foil. Of 79 dermatologists 32 responded to the survey (41% response rate): 31 (97%) injected botulinum toxin type A (BTA) for dynamic lines, 26 (81%) injected BTA for hyperhidrosis, and 24 (75%) injected skin fillers. Ice anaesthesia was the most common method of pain control (75%) followed by use of topical anaesthesia (50%) such as EMLA, compound agents and lignocaine 4%. Ice wrapped in latex or latex-like material was the most common ice packaging used by those surveyed and the median ice-to-skin contact time was 10 s. The ice experiment results indicated that ice wrapped with aluminium foil was equivalent to ice wrapped in latex for short contact times (< 20 s), but more effective at reducing skin temperature with longer contact times (> 20 s). These findings will be of relevance to cosmetic and paediatric dermatologists or any area of procedural medicine where effective non-injectable pain control is required.

Key words: cosmetic dermatology, cryoanaesthesia, ice anaesthesia, non-injectable anaesthesia, non-injectable pain control, procedural dermatology, topical anaesthesia.

INTRODUCTION

The rising demand for cosmetic and laser procedures has resulted in patients' increased expectations for more effective anaesthesia. Inadequate pain relief causes unnecessary stress for the patient as well as the practitioner, increases procedure time, limits the extent of procedures and can discourage repeat procedures. The ideal topical pain control method is non-toxic, painless on application and effective, and carries a low risk of sensitisation. This article discusses the types of non-injectable pain control methods used by dermatologists in Australia. Particular focus is given to the more commonly used pain control methods of topical (TA) and ice anaesthesia (IA). We present the survey results as well as our findings on the ideal ice contact time for adequate IA comparing foil-wrapped ice versus latex-wrapped ice.

DERMATOLOGIST SURVEY

Methods

An e-mail survey was sent to 79 botulinum toxin injectors who were listed on the website of the Australasian College of Dermatologists.

Results

In total, 32 dermatologists responded and there were two 'undeliverables' (41% response rate). Of the responders, 31 (97%) injected botulinum toxin type A (BTA) for dynamic lines, 26 (81%) injected BTA for hyperhidrosis and 24 (75%) injected skin fillers. The types of non-injectable pain control methods used by the responders are presented in Table 1. IA was the most common method of pain control (75%), followed by use of TA (50%). In all, 52% of respondents reported using both IA and TA for injectable work. A total of 17 of 24 (71%) filler injectors routinely combined IA with TA. Of those injectors using IA, 40% believed that adequate

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Abbreviations:

BTA	botulinum toxin type A
EMLA	eutectic mixture of local anaesthetics
IA	ice anaesthesia
LMX	lignocaine 4%
TA	topical anaesthesia

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Table 1 Summary of results of pain survey of 32 clinicians

	n (%)
Clinicians using topical anaesthesia	16 (50)
Topical pain control methods used (out of 32):	9
EMLA	6
Compound LT	2
LMX	1
Topicaine	6
Other	3
Vibrator	6
Gas	5
Zimmer cooling device	3
Ice	24
Ice wrappings used:	
Foil	2
Glove/latex	8
Plastic	2
Gauze	3
Cotton towel	1
Paper towel	1
Chux	1
Cool pad (gel-plastic)	8
Unspecified	1
Ice contact time ≤ 20 s	16 (69)
With TA	11/16 (69)
No TA	5/16 (31)
Ice contact time >20 s	8 (33)
With TA	2/8 (25)
No TA	6/8 (75)
No. of clinicians using both TA and ice	16 (50)

EMLA, eutectic mixture of local anaesthetics; LMX, lignocaine 4%; LA, local anaesthetic; TA, topical anaesthesic.

anaesthesia occurs after 10 s of ice contact time (range 5 s to 5 min). Half the respondents used TA for pain control, with eutectic mixture of local anaesthetics (EMLA) being the most common ($n = 9$), followed by compound TA ($n = 6$). Other types of TA listed in the survey included lignocaine 4% (LMX) ($n = 2$) and Topicaine (ESBA laboratories, Jupiter, FL, USA) ($n = 1$).

ICE EXPERIMENT

Methods

The aim of the ice experiment was to determine which ice packaging cooled the skin more effectively. The experiment was performed in the private rooms of authors AL and PL using four healthy volunteers (2 men, 2 women) aged 30 to 59. Ice blocks were prepared, each wrapped with either aluminium foil (foil-ice) or latex (latex-ice). Foil-ice was prepared using an ice cube wrapped in a single sheet of aluminium foil (Goliath extra-strength aluminium foil; Aldi, Melbourne, Victoria). Latex-ice was prepared using an ice cube wrapped in a digit cut off from a non-sterile latex glove (small non-sterile surgical examination gloves). Ambient temperature was set to 23°C. The ice wrapped in foil or latex was applied to eight distinct marked areas on the patients' inner thighs with specified contact times of 5, 10, 15, 20, 25, 30, 60 and 120 s. A baseline temperature of the skin was taken prior to application of the ice using an infrared thermometer (Fluke 62 mini IR thermometer gun, Everett, WA, USA): accuracy reading ± 1.5% with a set distance of 5 cm from the skin surface. This was followed by an application of the ice on the marked areas. Once the ice was removed the surface skin temperature was measured at 0, 5, 10, 15, 20, 25, 30, 45 and 60 s. The same person applied the ice in all instances to minimise variation in pressure.

RESULTS

Results are shown in Figures 1 and 2. Up to a contact time of 20 s there was little difference in the temperature drop sustained by foil-ice compared to latex-ice, however, the temperature of the skin cooled with latex-ice reached a plateau after 25 s, whereas the longer the foil-ice was applied, the cooler the skin became. After an application time of 120 s with foil-ice the mean skin temperature dropped to 2.05°C, whereas the same application time with latex-ice resulted in a mean skin temperature of only 13°C.

DISCUSSION

Half the survey respondents use TA, especially EMLA, for injectable work. EMLA is a eutectic mixture of 2.5% lignocaine and 2.5% prilocaine where the combined product has a low melting point and can remain in non-solid state at room temperature.[1] EMLA works best with occlusion where anaesthesia can be achieved to a skin depth of 3 mm after 60 min and 5 mm after 120 min.[1] A potential side-effect of EMLA is methaemoglobinemia, particularly in infants and patients on methaemoglobin-inducing drugs (e.g. sulphonamides, paracetamol, chloroquine, dapsone, nitrates and nitrites, nitroglycerin, phenytoin or quinine).

LMX is a liposomal formulation of 4 or 5% lignocaine (LMX-4, LMX-5) allowing enhanced skin penetration and therefore faster onset of action. LMX does not require occlusion and 30 min of open application is equivalent to 60 min of EMLA under occlusion.[2] However, the anaesthetic effect of LMX appears to peak at 30 min and a longer application time does not seem to confer better anaesthesia.[3] Both EMLA and LMX are Therapeutic Goods Administration approved and available in Australia.

The survey identified compound TA as one of the preferred TA after EMLA. A typical compound TA consists of lignocaine (23%) and tetracaine (7%) in either anhydrous gel or a pluronic lecithin organogel vehicle. Compound TA is generally effective with or without occlusion, does not streak at low temperature and does not cause vasoconstriction, which is a useful feature for patients undergoing vascular laser work. Disadvantages of compound TA include potential contact sensitisation with tetracaine and its para-aminobenzoic acid metabolite and a greater likelihood of lignocaine toxicity that can lead to adverse effects including death.[4]

Vibration was used by three of the respondents in our survey. Vibratory impulses can competitively inhibit pain signalling (via A-δ and C fibres) across a shared neural network. This mode of anaesthesia has been found to be useful in a number of settings: BTA and filler injections,

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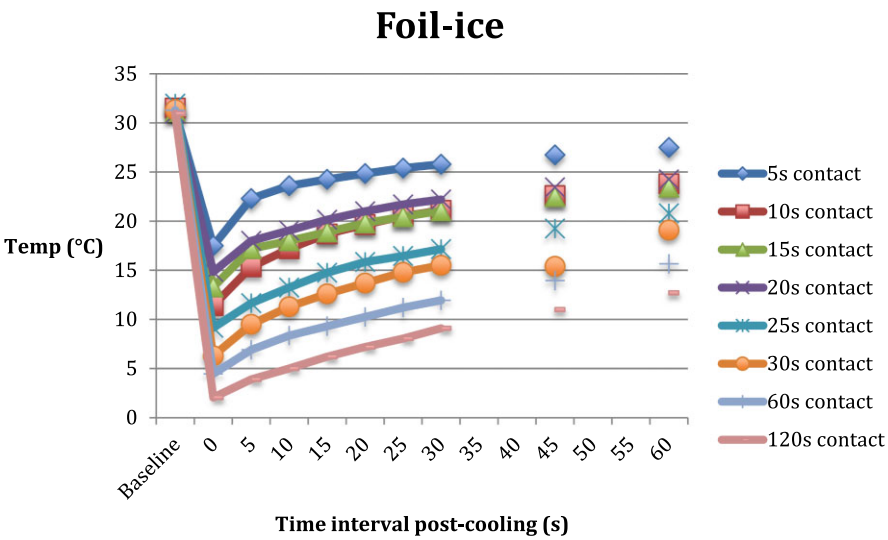

Figure 1 Skin temperature following cooling with foil-ice at given contact times.

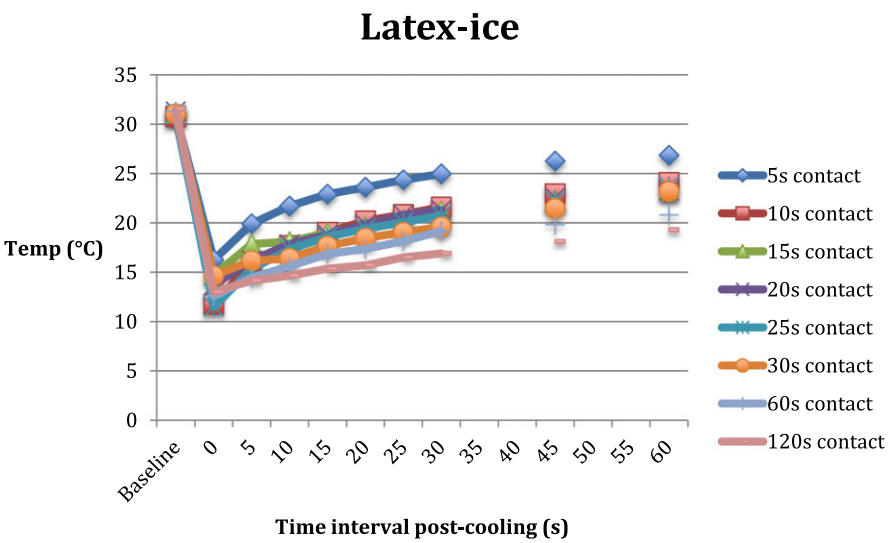

Figure 2 Skin temperature following cooling with latex-ice at given contact times.

laser therapy for leg veins, Q-switched laser ablation of tattoos, nail-fold injections, incision and drainage of abscesses, and cautery of facial warts.[5] Potential side-effects of vibration on the face include tingling teeth, increased bruising and headaches.[6]

The survey showed IA was the most popular topical pain control method. Indeed ice fulfills many of the ideal criteria for topical pain control: it is cheap, fast-acting, non-toxic and effective and has no risk of sensitisation. The two mechanisms by which IA may elevate the pain threshold are via an antinociceptive effect on the gate control system and by decreasing nerve conduction.[7] Ice is also beneficial in procedural dermatology through its ability to vasoconstrict in the skin, which reduces the incidence and severity of bruising post-injection. This vasoconstrictive effect is evident down to approximately 15°C. Below this, rebound vasodilation of the skin occurs that is tissue-protective, with maximum vasodilation occurring at 0°C.[8]

As skin temperature drops to 10°C, nerve conduction velocity is reduced by approximately 33%, resulting in a higher pain threshold.[9] For this reason, we believe that reducing skin temperature to approximately 10°C is required for an analgesic effect. Most Australian dermatologists apply a 10-second ice contact time prior to performing injectables on the basis that this provided adequate anaesthesia. Our study results support this practice: mean skin temperature remained within a range of 11.4 C to 18.0 C for up to 5 s post-cooling, for contact times of between 10 and 20 s, using either foil-ice or latex-ice.

Latex-ice is as effective as foiled ice in skin cooling for contact times of up to 20 s. However, with latex-ice there is minimal difference between the immediate skin temperature after 20 s of contact (13.7°C) and 120 s of contact (13.0°C). We hypothesize that air pockets and water from the melting ice sealed in the latex may interfere with cold conduction. Foil-ice, without any trapped liquid, continues to lower skin temperature as skin contact time increases. Unless sterile water is used with foil-ice there is a theoretical concern for injection-related skin infection. However, we have never encountered any infection issues using

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tap-water ice for all our procedures involving BTA, hyaluronic acid gel, poly-l-lactic acid, calcium hydroxylapatite, intralesional corticosteroids and local anaesthetic injections over a 5-year period.

There are some limitations to our study: temperature was measured in a location different from where BTA and fillers are usually injected and only adults were included in the study. Contact pressure was not experimentally controlled, which can affect skin cooling and may explain some of the minor anomalies in skin temperature measurements for the shorter contact times (< 20 s). A 41% response rate may limit the external validity of the survey findings. However, the filler injector subset includes most of the dermatologists with regular or high caseloads and constitutes the main target group that we were only able to reach via the botulinum injector list (a filler-only list was not available on the Australasian College of Dermatologists' website).

In conclusion, IA and TA are two of the most commonly used methods of pain control during injectable work. In our study, most survey respondents tended to favour short contact times (< 20 s) for IA. Many practitioners also use TA such as EMLA and compound preparations in conjunction with IA. Regarding IA, ice wrapped with foil is uncommonly used but appears to be as effective as ice wrapped in latex for short contact times (< 20 s) and to be more effective for longer contact times (> 20 s). This has important implications in the field of cosmetic dermatology, as well as for minor paediatric dermatology procedures.

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