

Perishing with cold: a GP's guide to cryotherapy

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Cryotherapy is an invaluable tool in treating certain skin lesions.

A diagnosis is essential before it is undertaken, and it is most effective for superficial lesions.

Many general practitioners and most dermatologists use cryotherapy on a daily basis to produce quick, effective results with usually only minor discomfort to the patient. The use of cold to treat skin lesions dates from 1899, when Dr A.C. White, a New York dermatologist, dipped a cotton-tipped applicator in liquid air and successfully treated warts, keratoses and other lesions.¹ The liquid nitrogen spray was introduced in the 1960s by Dr Setrag Zacarian, a dermatologist in Boston,¹ and the popularity of the treatment modality has since spread worldwide.

Uses of cryotherapy

Many texts and articles on cryotherapy (or cryosurgery) have advocated its use for nearly every imaginable skin lesion, from inflammatory dermatoses to malignant tumours.^{1,2} However, the mainstream of dermatological opinion has seen its use limited to only a few conditions where its efficacy has been proven and its side effect profile is acceptable.

In general terms, cryotherapy is most effective for superficial lesions. In deeper lesions, the response may be only partial, morbidity following treatment may be

considerable, healing can be slow, and the resultant hypopigmented depressed scar may be unacceptable. Lesions commonly treated with cryotherapy are listed in Table 1.

Methods of application

Liquid nitrogen is the preferred cryogen, with a boiling point of -196°C . Two methods are commonly used to apply it:

- a cotton-tipped applicator
- a nitrogen gun.

Storing the liquid nitrogen

A thermos flask can be filled with nitrogen at a supply depot, or more commonly it is filled from a large Dewar flask kept at the surgery. The Dewar flask is filled as needed by the liquid nitrogen supplier (Figure 1). The cost is moderate (about \$2.60 per litre plus a small delivery charge). A large Dewar ensures a ready supply is always on hand. Flasks may need to be filled weekly, fortnightly or monthly depending on use; however, efficient vessels boast holding times of up to 90 days.

A thermos containing liquid nitrogen must never be capped, unless the cap is perforated to allow for escape of gaseous nitrogen. Capped flasks may otherwise explode.

Cotton-tipped applicator

Cotton-tipped applicators are best rolled by hand because the proprietary ones are

Table 1. Lesions commonly treated with cryotherapy

Premalignancy

Actinic keratosis
Leucoplakia

Malignancy

Small superficial basal cell carcinoma in low risk sites
Bowen's disease (in situ squamous cell carcinoma)

Benign neoplasms and hyperplasias

Skin tag (acrochordon)
Seborrhoeic keratosis (small)
Sebaceous hyperplasia and angiomas (small)

Viral lesions

Viral warts
Molluscum contagiosum

tightly rolled and do not hold nitrogen very well. A portion of cotton wool is teased out and rolled onto an orange stick with a twirling motion between the index finger and thumb (Figures 2a and b). This produces a large applicator suitable for most lesions.

When a cotton-tipped applicator is used, the liquid nitrogen should be



Figure 1. Dewar flask being filled from 'cryo-truck' outside the rooms.

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Figure 2a. Cotton wool is teased out and rolled onto an orange stick.



Figure 2b. The applicator is suitable for most lesions.



Figure 3. Two models of nitrogen gun.

decanted into a styrofoam cup or small steel bowl, to avoid contamination of the nitrogen container. This applies especially when treating viral warts, but it is a prudent measure for all lesions.

Nitrogen gun

Several models of nitrogen gun are available, two of which are shown in Figure 3. The model on left of the photograph is one of the most popular: the mini Brymill Cry-Ac unit. This 300 mL unit generally needs to be refilled two or three times a day from the Dewar flask if it is being used regularly. The nitrogen guns are supplied with a choice of spray tips, varying in aperture to regulate the flow of nitrogen, as well as with various probes and

nozzles for difficult sites or unusual applications.

The procedure

General points

Cryotherapy involves tissue destruction. The mechanism is divided into four phases:³

- heat transfer: heat is transferred rapidly from the tissue to the cryogen
- tissue injury: ice crystals form, initially outside cells but then intracellularly, damaging cell membranes and intracellular organelles permanently
- vascular stasis and occlusion: dermal vasculature is damaged, leading to ischaemic necrosis of treated tissue

- inflammation: over the next day, oedema and inflammation follow, and healing occurs over successive days.

Healing times vary with site, degree of freezing and general health. More damage is done with longer freezing times and repeated freeze–thaw cycles. The time taken to thaw is an indication of degree of tissue damage.

If a cotton applicator is being used, it is dipped into the nitrogen, and then applied firmly to the lesion. The time of application will vary according to the lesion type; your experience will determine the appropriate application time.

With the nitrogen gun, if the nozzle aperture is large a 2-second spray may be all that is required, or longer if it is a finer spray nozzle.

Some cells are more sensitive to cold: melanocytes are more sensitive than keratinocytes, explaining the frequency of postinflammatory hypopigmentation in cryotherapy sites. Thicker lesions require deeper and longer freezing, but this will increase side effects both in the short and long term.

A diagnosis is the principal requirement before cryotherapy is undertaken.⁴ If this is not apparent then one can be obtained by referral or skin biopsy. The ‘let’s freeze it and see what happens’ approach has no place in today’s increasingly litigious society.

Treatment of skin lesions with liquid nitrogen

- Lesions blister, crust over and then heal, usually in 7 to 10 days.
- Sometimes, unusually large blisters may appear because of individual variation. If this happens and you are worried about it, contact the surgery.
- It helps to bathe the treated area in warm saline (1 teaspoon of salt in a glass of warm water) twice a day, or to apply an antiseptic powder (such as Evans Dermal Powder, Savlon Antiseptic Powder, Medi Pulv or Rapaid Medicated Powder) twice a day.

Budding cryotherapists would be well advised to limit their endeavours initially to some of the lesions listed in Table 1 – principally actinic keratoses, small seborrhoeic keratoses and viral warts.

Actinic keratoses

In Australia, the actinic keratosis is a very common lesion. Lesions vary from pink, slightly scaly patches (Figure 4) in exposed sites to indurated horny nodules in more advanced lesions (Figure 5).

They are precursors of squamous cell carcinoma. Signs of conversion to squamous cell carcinoma include pain, rapid growth and fissuring. Lesions where there is some suspicion of conversion should be biopsied or excised. Sites prone to metastasis from squamous cell carcinoma include ear, lip and scalp.

Actinic keratoses are frequently infected, especially on the scalp. *Staphylococcus aureus* is the likely culprit, and pre-cryotherapy treatment with a suitable antistaphylococcal topical antibiotic can clarify the clinical picture, especially when an early squamous cell carcinoma is suspected.

The technique for freezing an actinic keratosis is to apply the liquid nitrogen to the lesion (Figure 6) and then allow it to thaw. The time taken to thaw depends on the amount of freezing induced.

The lesion can be grasped between the index finger and thumb and moved over deeper tissues to assess the depth of freeze. The frozen lesion has the consistency of a credit card. Thinner actinic keratoses will respond to a 2 to 3 second freeze time with the largest aperture nozzle on the gun and a 20 second thaw, but thicker lesions will need a 5 to 15 second freeze, which will result in a 40 to 60 second thaw. A second freeze and thaw may be required if the lesion is thick – sometimes thicker lesions do not respond to one freeze, and edge recurrence is quite common in diffuse actinic keratoses (Figure 7).

If a lesion persists after adequate

cryotherapy, the diagnosis may need to be reviewed.

Viral warts

Liquid nitrogen cryotherapy is an effective

treatment for many types of viral wart. Common warts may need several treatments spaced a few weeks apart (Figures 8 and 9). Plantar warts may need many treatments, as well as adjunctive therapy

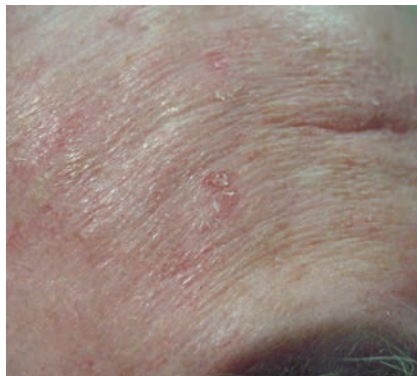


Figure 4. Erythematous, scaling actinic keratosis on the forehead.



Figure 5. An advanced, thick actinic keratosis.



Figure 6. Actinic keratosis immediately after being frozen.



Figure 7. Recurrence at the edge of a previously frozen actinic keratosis.



Figure 8. A wart suitable for cryotherapy.

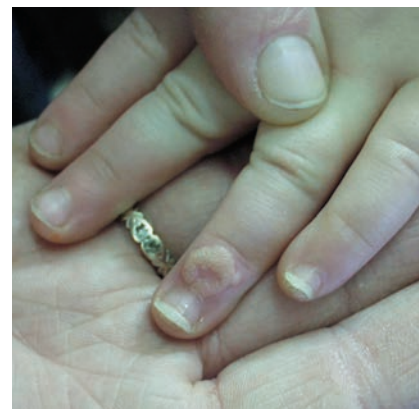


Figure 9. Wart recurring after cryotherapy.

continued



Figure 10. A large seborrhoeic keratosis. This is not suitable for cryotherapy.



Figure 11. This seborrhoeic keratosis is perhaps too thick for cryotherapy without causing scarring.



Figure 12. Inadequately treated basal cell carcinoma, which has recurred at the edges.

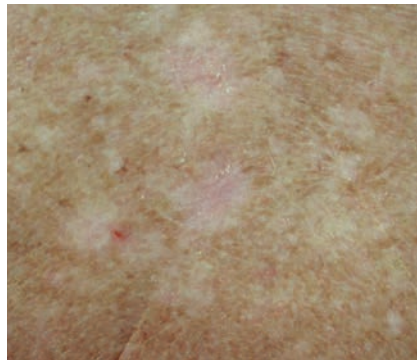


Figure 13. Recurrent basal cell carcinoma, note the loss of freckling in the centre of the previously treated area (hypopigmentation).



Figures 14a and b. Superficial basal cell carcinomas, suitable for cryotherapy.

with sclerosant pastes.

Treatment of hand warts in children is painful, and subungual warts usually do not respond, so alternative measures (such as wart paints under occlusive tape) may

be preferable as first line therapy for warts in children. Most astute toddlers will allow a practitioner only one attempt with liquid nitrogen therapy, so the modality is best reserved for small warts only.

When a cotton-tipped applicator is used to treat warts, it is applied firmly to the wart. Since liquid nitrogen does not kill the human papillomavirus, the treatment of warts warrants the use of a new applicator for each patient and the decanting of liquid nitrogen into a styrofoam cup to avoid contamination of the main container. The decanted nitrogen should be discarded after treatment of each patient.

Seborrhoeic keratoses

Small seborrhoeic keratoses respond well to liquid nitrogen, and many lesions can be treated at one sitting with only minor discomfort. Larger and thicker lesions require longer freeze times with slower healing, and scarring may result. Such lesions (Figures 10 and 11) are better treated by point electrodesiccation under local anaesthesia.

Basal cell carcinoma

Superficial basal cell carcinoma in low risk sites responds well to appropriate cryotherapy. Successful treatment requires experience.

Recurrence rates with inappropriately treated lesions are high (Figures 12 and 13). Most dermatologists today would not use cryotherapy for basal cell carcinomas on the head and neck. The Australian Cancer Network is currently preparing guidelines for the management of non-melanoma skin cancer; they recommend that cryotherapy is best reserved for low risk tumours. This generally means well defined, superficial, basal cell carcinomas of the trunk and limbs (Figures 14a and b).⁴

Skin tags (acrochordons)

A useful method for treating skin tags is the forceps-grip method. A pair of large non-toothed McIndoe forceps, DeBakey plain forceps or similar are dipped in liquid nitrogen (decanted into a stainless steel pot). After 10 seconds or so, the skin tag is grasped at its narrowest point



Figure 15. Haemorrhagic blister following cryotherapy.



Figure 16. Hyperpigmentation resulting from cryotherapy for a seborrheic keratosis.



Figure 17. Hypopigmentation following cryotherapy.

Table 2. Side effects of cryotherapy⁵

Immediate

Pain
Headache
Haemorrhage
Oedema and blister formation (Figure 15)
Syncope

Delayed

Infection
Haemorrhage
Excessive formation of granulation tissue

Prolonged but usually temporary

Hyperpigmentation (Figure 16)
Milia
Hypertrophic scars
Alteration of sensation

Prolonged and usually permanent

Hypopigmentation (Figure 17)
Alopecia
Atrophy
Ectropion
Notching of the eyelid, ear or vermilion border

(the neck) until it becomes frozen. The forceps need to be held with gauze to prevent frostbite in the operator's fingers.

This procedure is less painful than other methods of application and is less likely to produce post-treatment hypopigmentation.

Pigmented lesions

Some pigmented lesions are suitable for cryotherapy, the most common of which is the seborrheic keratosis. However, cryotherapy has no place in the treatment of melanocytic lesions.⁴

Side effects of cryotherapy

Patients should be told how a frozen lesion is expected to respond. A handout slip, such as the example shown in the box on page 106, may prevent unnecessary telephone calls to the surgery.

Side effects will vary with the depth of freeze, the type of lesion frozen, the site

and the general health of the patient. Table 2 gives a comprehensive list of side effects,⁵ some of which would be expected only with very deep cryotherapy.

One of the most common and annoying side effects from the patient's point of view is hypopigmentation (Figures 13 and 17). This is common with even light cryotherapy. Hypopigmentation is most obvious in areas of freckling or poikiloderma, which may be most apparent on the chest and lateral neck. Hypopigmentation may be limited by repeated lighter freezes and by feathering the edge of a frozen area (that is, freezing the periphery more lightly than the centre of the lesion).

Asian patients or those with olive skin may experience hyperpigmentation, which settles after a few months. The example shown in Figure 16 shows hyperpigmentation resulting from cryotherapy for a plane seborrheic keratosis. **MT**

References

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