the use of dried milk would predispose to it, provided the proportion of fat was adequate. Whilst as regards scurvy the precaution has been taken of advising the routine administration of fresh fruit juice every other day as an antiscorbutic. There is reason to think, however, that this advice has not always been very carefully followed, nor is it certain how far it is necessary. The question as to what extent the antiscorbutic properties of fresh milk are destroyed in the Just-Hatmaker process can only be decided by practical experience. It is, of course, a very controversial question how far the use of ordinary sterilized milk predisposes to scurvy. Whilst many writers have insisted upon this supposed danger very strongly, others, like the late Professor Budin, of Paris, who made use of sterilized milk on a very large scale for many years, take the opposite view. The experience of infants' milk dépôts, both in this country and abroad, at almost all of which sterilized milk is used, and has been used for years, is to the same effect. It seems a reasonable conclusion, therefore, that the infantile scurvy danger is rather of the nature of a bogey, and not of much practical importance.

At the Leicester Infants' Milk Dépôt two grades of milk are used: one, "full-cream," containing the whole of the fat present in the original milk, amounting to about 26 per cent. of the dried milk; and a slightly less rich grade—three-quarters cream—which only contains about 20 per cent. of fat. The latter is used for babies under 6 months old. An addition of 10 per cent. of sugar is made to both grades.

The milk is supplied in airtight tins, holding about 1 lb. A special metallic scoop or gauge is supplied to each customer, and the directions specify so many scoopsfuls of dried milk to so many tablespoonfuls of water, varying with the age of the infant. The milk is prepared for use by stirring in the requisite quantity of warm (not boiling) water, and it is then ready for use with any ordinary feeding bottle. Only enough for one meal is prepared at a time.

At the present time at the Leicester Infants' Milk Dépôt dried milk has almost entirely superseded the "humanized" milk, about 200 infants out of 230 now on the books being fed on it. In addition to its intrinsic merits as a food for infants, it has the important practical advantage over humanized milk of being much less expensive. The latter, as is usual at infants' milk dépôts, is supplied on the principle of a separate feed in a separate bottle. This method, whilst it secures uniformity and appropriateness in the amount of each feed, in the number of feeds per day, in the strength of the milk, and in freedom from contamination, is very expensive, owing to the great amount of labour entailed in bottling, etc., and to the loss incurred on broken bottles, and as it is necessary to keep the price within reach of the poor it was found that a loss was incurred on every bottle of milk supplied, in addition to the cost of upkeep of the dépôt. Also, owing to the milk having to be fetched daily (or delivery paid for as an extra), poor persons living at a distance from the dépôt found the milk beyond their reach.

With dried milk both these objections are obviated. It can be sold at cost price, and, as a week's supply or more can be fetched at a time, distance from the dépôt is of little moment.

The advantages of dried milk as a food for infants may be summarized as follows:

1. *Ease of digestion*—milk not "sicked up," as is so often the case with fresh milk, however modified.
2. *Bacterial purity*—freedom from tubercle bacilli or contamination by flies.
3. *Conservability*—no "souring" in hot weather.
4. *Cheapness*—no waste.
5. *Convenience*—always ready for use, no waiting for the milkman.
6. *Palatableness*—babies love it.

Its disadvantages are of a theoretical nature, and consist in the presumed destruction of the antiscorbutic properties of fresh milk. This, however, can be compensated, if thought necessary, by administration of fruit juice. For domestic purposes, apart from infant feeding, dried milk has distinct limitations as a substitute for fresh milk, as, owing to its taste, it is not so suitable for adding to tea or coffee.

An important consideration remains to be referred to. One reason, no doubt, why dried milk is so popular with the mothers is that it possesses all the convenience of the patent "food." As a matter of fact, they like to refer to it as a "food" rather than as milk. Yet it is obvious that dried milk, being after all "only milk," stands in an entirely different category from all patent foods prepared from cereals. The serious objections rightly entertained to the wholesale use of these proprietary foods, which inevitably tend to supplant milk in the infant's dietary, sometimes almost entirely, obviously do not apply to dried milk. It may prove, therefore, to be a very real blessing to the infant population if dried milk should come to supplant patent foods of the class referred to.

ON THE THERAPEUTIC VALUE OF CARBON DIOXIDE SNOW IN THE TREATMENT OF VASCULAR NAEVI, MOLES, ETC.*

BY

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THE value of cold as a local therapeutic agent has long been recognized, but until recently its field of utility in the treatment of skin affections has been limited and practically confined to its employment as a local anaesthetic. With the discovery of liquid air and the intense cold (-250° C.) associated with it, new therapeutic possibilities presented themselves. It was recognized early in America that in liquid air we had a valuable addition to our local destructive agents, and a remedy which might be of great service in reducing or removing such superficial lesions of the skin as vascular naevi and moles. It was found that the application of liquid air caused an immediate freezing of the underlying skin, succeeded some hours later by an inflammatory reaction, and that if the application lasted only a few seconds complete recovery followed, while if it was more prolonged a destruction of the tissue would occur with ulceration or sloughing. Inflammation properly controlled is followed by a process of repair and a rebuilding through the formation of new fibrous tissue. Liquid air, if applied for a few seconds, is capable of producing an inflammatory reaction and subsequent repair, and of replacing certain superficial skin lesions by a scar which is hardly appreciable.

At the July meeting of the Dermatological Section of the Royal Society of Medicine, the late Dr. Radcliffe Crocker showed a series of cases of naevi, lupus vulgaris, etc., which he had treated with benefit by liquid air, and conclusively demonstrated the value of this method of treatment. There were certain disadvantages, however, associated with its employment which detracted from its utility—namely, the costliness of liquid air, and the difficulty of obtaining it, and of definitely restricting its area of action by the method adopted—namely, of dipping a pad of cotton-wool on the end of a rod into the liquid air and applying it to the affected skin. Previous to this an excellent substitute for liquid air had been found in carbon dioxide snow. This material, though not so cold—its temperature being about -90° C.—has all the advantages of liquid air and none of its disadvantages, for it is easily obtainable, cheap, and is capable of being applied in the most definite manner. One of the first to use carbon dioxide for therapeutic purposes was Dr. Allen Pusey, of Chicago, who described the method he adopted in 1908.¹ Three years before this Juliusberg had employed carbon dioxide for local treatment in the form of a spray; but, so far as I am

Fig. 1

* Being a demonstration given at Charing Cross Hospital on Thursday, November 25th, 1909.

aware, Pusey first used it in the form of snow, a method which has certain distinct advantages over the spray.

In the department at Charing Cross Hospital under my charge I have been employing carbon dioxide snow since March, 1909, and have treated by it a considerable number of cases of vascular naevi, moles, lupus vulgaris, lupus erythematosus, etc. At the meeting of the Dermatological Section in July, already referred to, I demonstrated a series of cases successfully treated by it, and since then further experience has only more firmly convinced me of its value.

METHOD.

The procedure adopted has been as far as possible that described by Pusey, but never having seen the application of carbon dioxide before I attempted to use it, I encountered certain difficulties both in obtaining the snow and in applying it satisfactorily. The following method was eventually arrived at. An iron cylinder containing 7 lb. of liquid carbon dioxide was obtained (Fig. 1), fitted with a central tube so that the cylinder might be placed vertically in an iron stand while the carbon dioxide was allowed to discharge itself. A cylinder of this size is not too heavy, and can easily be lifted. The nozzle of the cylinder is horizontal, and the key is at the top. When the key is turned so as to open the valve, a jet of carbon dioxide rushes out horizontally with great force, and is quickly volatilized.

The snow is obtained by allowing the carbon dioxide to play on a piece of baize folded in the form of a conical sugar bag about 9 in. long. This is held in the left hand over the nozzle, so that the nozzle is well inside the bag, without being in contact with the baize, and the controlling key is turned gently by the right hand. The carbon dioxide jet is allowed to play into the bag for 15 to 30 seconds or longer according to the amount of snow required. The baize is then spread out on a table, and is found to be thickly coated with fine snow. The snow is scraped off with a teaspoon, and the requisite applicator filled with it. The applicators are funnel-shaped, like aural specula, and are made of vulcanite. Their diameter at the narrow end varies from $\frac{1}{4}$ in. to 1 in., and they are fitted with rod-shaped plungers, by means of which the snow is pressed down. When filled, the applicator is transferred to the lesion to be treated, so that the snow is in contact with the skin, the applicator being held firmly by the left hand, while the plunger is held by the right hand and the requisite amount of pressure exerted. During this procedure, it is necessary to wear a

glove on the left hand to protect it from the extreme cold.

The effect of the snow on the tissue is dependent on the length of the exposure and the degree of pressure. No hard and fast rules can be laid down as a guide in these matters, as each case requires to be treated on its merits, but a short experience will enable the operator to judge of them. The degree of pressure should be just sufficient to

cause a slight depression in the frozen tissue when the applicator has been removed. After an application of five seconds the underlying skin is frozen into a solid white disc, about $\frac{1}{8}$ in. thick. This thaws in about a minute. Some hours afterwards, it may be ten or twelve, the inflammatory reaction sets in, and a blister may form. This subsides, and perfect healing takes place in a few days. Exposures of healthy skin up to thirty seconds' duration are followed by complete heal-

ing; should the exposure be prolonged to a minute or longer sloughing is apt to occur with subsequent scarring. In the case of soft lesions, such as vascular naevi, the exposure should not exceed thirty seconds, so as to avoid scarring; in the case of hard lesions, such as warts, rodent ulcers, etc., a more prolonged exposure is indicated, as it is the destructive effect which is chiefly required. If the lesion to be treated be greater than the diameter of the

largest applicator, it is attacked piecemeal, or a piece of thin lead is cut the size of the lesion and placed between it and the applicator, as the metal conducts the cold, and by it irregularly shaped lesions can be treated exactly. When lead is interposed a longer exposure is necessary than when the snow is applied directly to the skin. The application is not unbearably painful, and no anaesthetic is required, the cold itself having an anaesthetic action. The amount of pain varies according to the situation of the lesion. I have noticed, also, that some patients scarcely feel it sore, while others have said that it was as painful as a fine-pointed actual

cautery. When the reaction sets in there is the usual discomfort associated with inflammation. Should the application result in vesication and breaking of the skin it is advisable to dress the part with a mild antiseptic ointment to prevent contamination with pyogenic micro-organisms.

LESIONS TREATED.

Naevi.

The lesions in which I have found this treatment to act most satisfactorily are the common raised angiomatous

Fig. 2.—Case i. Reproduction of water-colour drawing.

Fig. 3.—Case i. From a photograph.

Fig. 4.—Case v. Reproduction of water-colour drawing.

Fig. 5.—Case v. From a photograph.

naevi of infants. The only other treatment which can compare with it in my opinion is that by radium. So long as our chief methods of dealing with these naevi were excision, cauterization, and electrolysis, it was doubtful whether it was advisable to treat them at all, as in a considerable number of cases they eventually disappeared spontaneously; and it was only when one's hands were forced by the anxiety of the parents that one felt warranted in subjecting an infant to the risks of electrolysis under a general anaesthetic. By the introduction of these newer methods all such risks are at an end, and the naevus can be easily removed by one or two applications of the snow, with little or no scarring. Up to the present the largest raised naevus I have treated successfully by the snow has been about 2 in. long and 1½ in. broad; but there is no limit to the size of lesion which could be attacked in this way. When the naevus is very soft a single exposure of twenty seconds may suffice to remove it; if it be harder owing to the presence of fibrous tissue, several exposures at intervals of ten days may be required.

It is advisable to let the inflammatory reaction completely subside before a second application is made, as this may prove to be unnecessary, as a process of involution is set up which continues for a considerable time after the acute inflammation has gone down. One

Snow applications were given, of 30 seconds to one minute, on May 18th, 25th, June 1st and 15th. The lesion diminished slowly under the treatment, but as it did not react so satisfactorily as the soft flat lesions, a ligature was tied round it on June 15th. When seen in October it had disappeared, leaving a good scar. Case shown at the Dermatological Section, Royal Society of Medicine, July 15th, 1909.

The advantages of the snow treatment of raised vascular naevi over that by electrolysis, cauterization, etc., are so obvious that it is unnecessary to labour them further, but in the case of radium the choice is more difficult. The following cases treated by radium will serve for comparison:

CASE IV.

G. C., aged 14 months; sent to Charing Cross Hospital by Dr. Peter Harper, with a raised vascular naevus the size of a threepenny piece on the skin of the upper lip on the right side of the middle line.

Exposed to 5 mg. of radium bromide of 1,800,000 activity spread out and screened by a thin sheet of mica and a thin layer of indiarubber, for fifteen minutes on March 23rd, April 6th, May 4th, and May 18th. By the end of July the naevoid tissue had almost completely gone and the scar was all that could be desired. The same result might have been obtained more quickly even by a single long exposure, but as the object was to leave as little scar as possible the more tedious method was adopted, to avoid the risk of a reaction with subsequent telangiectasis.

Fig. 6.

of the chief merits of the treatment is the nature of the resultant scar, if it can be called a scar, for in many of the cases it is difficult to detect any cicatrix. In one instance a girl aged 5 weeks (Case II), had a raised naevus in the centre of the breast; it was removed by one exposure to the snow, and the scar was so slight that the nipple in the centre of it seemed to be preserved.

CASE I.

Kathleen B., aged 5 months, raised naevus 1½ in. in length, bright red in colour, situated on the right breast, including nipple (Fig. 2). Snow applied for 30 seconds on June 5th, 22nd, and 29th. A severe reaction occurred after the last exposure, followed by disappearance of most of the naevoid tissue. When seen in October the resultant scar was little noticeable, and the nipple was apparently preserved (see Fig. 3).

CASE II.

B. D., aged 5 weeks; raised vascular naevus, size of sixpence, bright red in colour, situated in centre of right breast, including the nipple. Case shown at the Dermatological Section, Royal Society of Medicine, July 15th, 1909.

A single exposure to carbon dioxide snow was given on April 5th. A marked reaction occurred with the formation of a bulla the same night. When the reaction subsided a fortnight later the naevoid tissue had gone, there was scarcely any scar, the nipple itself not being destroyed.

CASE III.

F. A., aged 5 months; fibrous pyriform vascular naevus about the size of a large pea situated behind the left auricle.

Fig. 7.

So far as the resultant scar is concerned, there is in my experience little to choose between the snow treatment and radium, and radium has the advantage of being absolutely painless. On the other hand, the carbon dioxide snow acts far more rapidly, for by it a small raised naevus may be removed by an application of half a minute, while the same lesion might require an exposure to radium of an hour or longer, and it is much less costly, as the amount of snow required for an exposure costs a fraction of a penny. There is another great advantage which the snow treatment has over that by radium—namely, that by it there is no danger of producing a scar with telangiectases, such as may occur after a radium exposure if it has been excessive.

Several cases of "port-wine-stain" naevi have been treated at Charing Cross Hospital by the snow, but so far without marked improvement.

Telangiectatic or stellate naevi can be removed by a single application of the carbon dioxide snow of five seconds, but the treatment has no advantage over that by a fine-pointed cautery or an electrolytic needle.

Pigmented and Hairy Moles.

These lesions can be appreciably reduced, and in some cases satisfactorily removed, by the snow, with a cosmetic result which is superior to other forms of treatment. The following notes of a case will serve to illustrate this:

CASE V.

W. T., aged 10 years; hairy mole like a mouse, $1\frac{1}{2}$ in. long and $\frac{3}{4}$ in. broad on left cheek (Fig. 4).

Exposed piecemeal to the snow for five seconds on March 16th. A reaction occurred next day, followed by a marked improvement, and the lesion became less prominent and paler. An application of forty seconds was given on April 15th, and as a result the pigmentation and much of the hair was destroyed.

Subsequent applications were given on July 6th of forty seconds, August 24th of sixty seconds, and October 12th of twenty seconds. The condition on November 23rd is as shown in the illustration (Fig. 5). The lesion has been replaced by a supple, little disfiguring scar, and almost all the pigmentation has gone. A certain amount of thickening still persists towards the lower edge. The treatment of the case is not yet completed, and further applications will be given to remove the slight thickening and to destroy the remaining hairs.

Lupus Vulgaris.

A number of cases of lupus vulgaris have been subjected to this treatment, and where the lesions are superficial in type I have found it to be of definite value, but in deep-seated lesions it seems to be less effective and penetrating than Finsen light.

Lupus Erythematosus.

I have treated several cases of lupus erythematosus of the chronic discoid variety by this method, and though they have all benefited by it, and none of them have been aggravated, I am not convinced that it is as good a local remedy for this disease as zinc ionization. The following is an illustrative case:

R. S., aged 49, with a patch of lupus erythematosus on the bridge of the nose extending towards the left cheek and another patch in front of the left ear. It was exposed to the snow piecemeal for five seconds on July 21st. A sharp reaction occurred, which on subsiding left considerable improvement.

A second application was made on October 9th. On November 23rd a great improvement was noted: the greater part of the nasal lesion had healed with slight scarring, and the patient said that the affected skin felt much more comfortable.

Rodent Ulcers.

Carbon dioxide snow is capable of destroying rodent ulcers provided they are superficial and do not involve deep structures. In a case of such a lesion situated on the cheek, an excellent result was obtained (Figs. 6 and 7), but in this affection the treatment does not seem to me to be much better than the careful application of the actual cautery, and where the lesions penetrate deeply it is of less value than radium.

Sufficient has been said to indicate the therapeutic value and possibilities of this new agent. In conclusion I must take this opportunity of thanking my clinical assistant, Dr. Dyce Fraser, for the valuable help he has given me in the treatment of these cases.

REFERENCE.

- ¹ *Berliner klinische Wochenschrift.*

SOME RESULTS OBTAINED FROM THE LOCAL APPLICATION OF SOLID CARBON DIOXIDE.

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THERE is some difference of opinion as to the relative value of solid carbon dioxide and liquid air in the treatment of naevi and other cutaneous lesions, and while I do not dispute the claims on behalf of the latter agent made by those who have had more experience with it than I have, yet I venture to say that the more they use carbon dioxide, properly compressed into a hard, firm crayon, the more they will like it, and even prefer it to any other agent.

Liquid air certainly possesses the quality of extreme cold far beyond that of solid carbon dioxide or anything else at present available; but, in my opinion, the temperature of solid carbon dioxide, equivalent to 142° of frost, is low enough for anything required in therapeutics, and yet not so low but that it is perfectly manageable and easy to control. In addition to all this, carbon dioxide can be kept in the house ready for use at any time, and no more need be taken from the cylinder than is necessary for the case in hand. There is no way of storing liquid air, and when any is wanted it is necessary to give some

hours' notice, and it must be used within a very few hours of its preparation. These conditions are not always convenient, and it is not given to every one to reside in the near neighbourhood of a laboratory where liquid air is prepared. A cylinder of the liquefied carbon dioxide (from which the solid crayon is prepared) can be sent anywhere, to be used at convenience, and now that small cylinders of CO_2 are being used by motorists for inflating tyres it is more easy than ever to obtain and use this valuable agent.

The mode of preparing and using solid carbon dioxide I have more or less fully described in another paper,¹ and in this article I propose to give the results I have obtained in a series of 123 cases. This number does not include all the cases I have treated—the total would be about 200—as at times it is very difficult to get all the cases written up. It takes no account of a number that I have treated at the West London Hospital, through the kindness of Dr. Abraham, nor does it include those that have come to me in the course of my private practice. Were all these included, the effect would be to make the general result more favourable than it is. It does include practically all the cases I have treated from the beginning, when I had everything to learn, and no past experience to guide me clear of pitfalls—cases where two or more applications were necessary, that now would be treated successfully with one. The faults were found to be due, for the most part, to an improper degree of pressure, and, to a less extent, to errors in the time of the application. If the pressure is too light, the result is incomplete; if too heavy, the reaction is needlessly severe, and some necrosis may possibly follow.

The 123 cases were made up as follows:

Naevi	...	...	...	...	105
Common warts	...	...	...	...	12
Lupus vulgaris	...	...	...	...	1
Lupus erythematosus	...	...	...	...	1
Moles	...	...	...	...	4
					123

Lupus.

The two cases of lupus were sent to me in the hospital for trial by my colleague, Dr. Sequeira, before he took up the method himself. The case of lupus vulgaris was not very suitable; the patch was near the bend of the elbow, where it was difficult to make firm pressure, and the great amount of movement incidental to the part made healing difficult. It was not successful. No one, of course, would draw any definite conclusions from this, and I may say that since then I have treated some patches on the inner side of a child's foot with, so far as it is possible to judge at present, very satisfactory results, but it is too soon to draw any conclusions as to the efficacy of carbon dioxide in the treatment of this disease. The case of lupus erythematosus was a fairly extensive one. The disease affected the face, back of the pelvis, and both anterior tibial regions. There was a very marked improvement after the reaction from each application had subsided. This, however, is no more than can be said for a number of other methods that are in more or less regular use for the treatment of this troublesome disease. Here again further investigation is called for before we claim too much or too little.

Moles.

Only 4 cases were treated, but the results have been highly satisfactory; 3 were cured, leaving a very small scar that is almost imperceptible, the result in each case being highly gratifying to the patient as well as to myself. The fourth case was improved but it was one of unusual difficulty. It was, in fact, an exaggeration and pigmentation of a little boy's left eyebrow. Its size and hairy growth were such as one would find on a full-grown man. The idea of the treatment was to destroy a part only in order to bring it to a proper size and shape. It is noteworthy that hair is removed by the application, but it is too soon to say if the epilation will be permanent.

Warts.

The treatment here is very simple, and it is not necessary to time the application; in fact, the attempt to judge the proper dose by timing is doomed to failure. The chief disturbing factor is the very poor conducting properties of