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Evaluation of the Absorption of Radioactive Sodium Iodide from Various Ointment Bases by Means of a Chick Embryo Technique

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Forty-seven ointment bases were evaluated for their ability to release radioactive sodium iodide when evaluated by a chick embryo technique. In general, ointments of the hydrophilic type indicated better release of the isotope than did bases of the absorption or oleaginous type.

A PREVIOUS REPORT (1) illustrates the development of a chick embryo technique which permits the investigator to evaluate the ability of various ointment bases to release radioactive sodium iodide. This chick embryo technique is employed here to determine the release of radioactive sodium iodide from different ointment bases. Limited studies were also conducted to evaluate the effect of surface-active agents and of varying quantities of water on the degree of absorption that might take place from ointment bases.

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EXPERIMENTAL

Various ointment bases were selected as representatives of the three major categories of ointment bases as listed by Robinson (2), namely; those which are oleaginous or water repellent; those which absorb water, but are greasy and nonwashable; and those which are water miscible or water soluble.

Ointment Bases Selected.—*Oleaginous Bases.*—petrolatum U.S.P. XV; white petrolatum U.S.P. XV; yellow ointment U.S.P. XV; white ointment U.S.P. XV; lard N.F. X; Domolene, product of Dome Chemicals Inc.; Plastibase, product of E. R. Squibb and Sons; Spry, product of Lever Brothers, Inc.; Singiser base No. 200 (3); Singiser base No. 225 (3); Singiser base No. 425 (3); Singiser base No. 625 (3); 15% Epolene in liquid petrolatum, Epolene is a product of Eastman Chemical Products, Inc.

TABLE I.—PER CENT ABSORPTION OF RADIOACTIVITY BY THYROID FOR EACH OINTMENT BASE

Ointment Base	Class	No. of Embryos Used	Average % Radioactivity in Thyroid	Standard Error or Mean
Hydrophilic ointment No. 1	H	45	2.837	0.477
Vanishing cream	H	19	1.610	0.400
Hydrophilic ointment No. 3	H	18	1.532	0.405
Multibase	H	16	1.246	0.475
Omnia cream	H	13	1.203	0.425
Hydrophilic ointment U.S.P. XIV	H	13	1.138	0.503
Polysorb	A	24	0.912	0.219
Unibase	H	12	0.877	0.326
Amerchol CAB	A	23	0.866	0.200
Hydrophilic ointment No. 5	H	22	0.736	0.219
o/w Emulsion base	H	11	0.728	0.261
Qualatum	A	13	0.668	0.233
Plastibase	O	57	0.638	0.138
Hydrosorb	A	15	0.508	0.162
Hydrophilic ointment U.S.P. XV	H	27	0.485	0.112
Beeler's base	H	19	0.472	0.124
Velvachol	H	10	0.394	0.145
Domolene	O	16	0.361	0.110
Polyethylene glycol ointment U.S.P. XV	H	18	0.309	0.099
Singiser base No. 250	A	11	0.304	0.143
Hydrous wool fat U.S.P. XV	A	29	0.262	0.033
Hydrophilic ointment No. 2	H	17	0.254	0.070
Hydrophilic ointment No. 4	H	20	0.229	0.065
Hydrophilic Plastibase	A	34	0.229	0.047
Rose water ointment U.S.P. XV	H	20	0.226	0.063
Singiser base No. 625	O	20	0.212	0.056
Hydrophilic petrolatum U.S.P. XV	A	19	0.193	0.060
15% Epolene in liquid petrolatum	O	12	0.193	0.075
Almay emulsion base	H	13	0.176	0.053
Singiser base No. 200	O	12	0.163	0.049
White petrolatum	O	17	0.139	0.036
Carbowax compound 1500	H	14	0.123	0.065
Lard N.F. X	O	15	0.122	0.026
Singiser base No. 225	O	20	0.109	0.029
Hydrosorb plus 40% water	A	17	0.109	0.032
Robinson's polyethylene ointment	H	11	0.091	0.030
Spry	O	18	0.089	0.026
Yellow ointment U.S.P. XV	O	16	0.087	0.030
Hydrosorb plus 20% water	A	20	0.075	0.020
Aquaphor	A	17	0.074	0.022
Falba	A	22	0.072	0.019
Singiser base No. 425	O	14	0.065	0.019
Petrolatum U.S.P. XV	O	14	0.061	0.030
White ointment U.S.P. XV	O	22	0.041	0.017
Hydrosorb plus 30% water	A	19	0.040	0.009
Wool fat U.S.P. XV	A	17	0.021	0.007
Hydrosorb plus 10% water	A	20	0.015	0.007

Absorption Bases.—Wool fat U.S.P. XV; hydrous wool fat U.S.P. XV; hydrophilic petrolatum U.S.P. XV; Aquaphor, product of Duke Laboratories; Hydrosorb, product of Abbott Laboratories; Hydrosorb plus 10% water; Hydrosorb plus 20% water; Hydrosorb plus 30% water; Hydrosorb plus 40% water; Polysorb, product of E. Fougera and Co., Inc.; hydrophilic Plastibase, product of E. R. Squibb and Sons; Qualatum, product of Almay, Inc.; Falba, product of Pfaltz and Bauer, Inc.; Amerchol CAB, product of American Cholesterol Products, Inc.; Singiser base No. 250 (3).

Hydrophilic Bases.—Rose water ointment U.S.P. XV; hydrophilic ointment U.S.P. XV; hydrophilic ointment U.S.P. XIV; polyethylene glycol ointment U.S.P. XV; hydrophilic ointment No. 1, contains all of the ingredients in hydrophilic ointment U.S.P. XV except that 0.5% Pluronic L64[1] was substituted for polyoxyl 40 stearate; hydrophilic ointment No. 2, as above with 1% Alrodyne 315;[2] hydrophilic ointment No. 3, as above with 1% Medialan LL33;[3] hydrophilic ointment No. 4, as above with 1% Deriphat 150A;[4] hydrophilic ointment No. 5, as above with 1% Deriphat XD160;[4] Velvachol, product of Texas Pharmacal Co.; Omnia cream, product of Dohme Chemicals, Inc.; Almay emulsion base, product of Almay, Inc.; Multibase, product of Ar-Ex Cosmetics, Inc.; Unibase, Product of Parke, Davis and Co.; Beeler's base (4); o/w emulsion base (5); vanishing cream (2); Carbowax compound 1500, product of Carbide and Carbon Chemicals Corp.; Robinson's polyethylene ointment (2).

For the most part, these bases were chosen because of the frequency with which they appear in dermatological preparations and also because of their availability. Some bases were chosen mainly on the basis of claims that have been made by various researchers (3–5).

Each ointment was prepared as described by Ruggiero and Skauen (1) and evaluated for its ability to promote penetration of radioactive sodium iodide through the shell membrane and chorioallantoic membrane to the thyroid glands of 11-day-old chick embryos. The percentage of

[1] Products of Wyandotte Chemicals Corp.
[2] Product of Alrose Chemical Co.
[3] Product of Antara Chemicals.
[4] Product of General Mills, Inc.

absorption that occurred in each case is reported in Table I.

Evaluation of the Effect of Water on Absorption.—The literature (6–8) reports some controversy with regard to the effect that water has in absorption from ointment bases. In order to check the efficiency of this new method in evaluating and distinguishing among bases according to their water content, a series of Hydrosorb bases was prepared, each of the bases containing different percentages of water by weight. The results of absorption from these bases is shown in Table II.

Evaluation of Surfactants in Hydrophilic Ointments.—Miller and Selle (9) report that wetting agents increase absorption by causing emulsification of sebum and making contact with the glandular and follicular cells of the skin. More recently, various researchers (10–12) have evaluated the release of medication from bases that contained various surface-active agents. In order to evaluate the efficiency of this new technique to distinguish among absorption from ointments that contain different surface-active agents, a series of hydrophilic ointments was prepared, each containing the basic formula for hydrophilic ointment U.S.P. XV except that the surface-active agent was changed in each case. The results of absorption from these bases is reported in Table III.

TABLE II.—PER CENT ABSORPTION OF RADIOACTIVITY FROM HYDROSORB CONTAINING VARIOUS AMOUNTS OF WATER

Base	No. of Embryos Used	Average % of Radioactivity in Thyroid
Hydrosorb	15	0.508
Hydrosorb plus 40% water	17	0.109
Hydrosorb plus 20% water	20	0.075
Hydrosorb plus 30% water	19	0.040
Hydrosorb plus 10% water	20	0.015

TABLE III.—EFFECT OF SURFACTANTS ON ABSORPTION FROM HYDROPHILIC OINTMENTS

Surf	No. of Embryos Used	Average % of Radioactivity in Thyroid
0.5% Pluronic L62 and 0.5% Pluronic L64	45	2.837
1% Medialan LL33	18	1.532
1% Sodium lauryl sulfate	13	1.138
1% Deriphat XD160	22	0.736
5% Myrj 52	27	0.485
1% Alrodyne 315	17	0.254
1% Deriphat 150A	20	0.229

SUMMARY AND CONCLUSIONS

Examination of Table I indicates that eight of the first 10 bases listed belong to the hydrophilic group, while no member of the hydrophilic group appears among the last ten bases. The mean percentage of absorption of radioactivity, calculated for all of the bases from each of the three ointment classes, indicates 0.969% absorption in the hydrophilic group and 0.294% and 0.248%, respectively, for the absorption and oleaginous groups. These figures indicate that absorption of sodium iodide was best from the hydrophilic group but that there was little difference between absorption from the oleaginous and absorption bases.

The ointment bases which contained polyethylene glycols showed low absorption percentages when compared to the other bases in the hydrophilic group, however, it should be noted that when these ointments were assayed, most of the chick embryos were dead before the thyroid glands were removed. Perhaps absorption had been so pronounced that death had come before the thyroids were able to concentrate more radioactive sodium iodide.

Singiser (3) has presented a series of bases that contain varying amounts of metallic soaps, liquid petrolatum, white petrolatum, and wool fat. Table I shows that of the Singiser bases which were evaluated, base No. 250, which contains 6% wool fat, is more capable of releasing radioactive sodium iodide than the other Singiser bases which were evaluated.

According to the results shown in Table II, the addition of water to Hydrosorb ointment base decreased the percentage of radioactive sodium iodide that was absorbed from the base itself. There does not seem to be any pattern established with regard to the degree of decrease and the amount of water added. This limited study indicates that the technique is capable of distinguishing among bases that contain varying percentages of water.

Results shown in Table III indicated that the chick embryo technique is capable of detecting differences in absorption of labeled sodium iodide from these ointments. The base which contains the 0.5% Pluronic L62 and 0.5% Pluronic L64 closely conforms to a formula prepared to contain the required hydrophilic-lipophilic balance for such a preparation.

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