In the control of an epidemic of cholera the importance of complete freedom from cholera vibrio of the stools of cases treated by seven-day drug therapy, and the prophylactic treatment of contacts with the drug, is emphasized.

The role of two properties of this drug—namely, the absence of toxic action and slow absorption and slow excretion—is discussed in its bearing on future sulpha therapy as opposed to the antibiotics.

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REFERENCES

- Astrakhsantsev, P. J., and Vasil'ev, S. M. (1940). *Formatsiya*, Nos. 9, 10, 24, 25.
 Bhatnagar, S. S., Freeman, J. F., and Dhilon, C. S. (1937). *Indian J. med. Res.*, **24**, 597.
 Bratton, A. C., and Marshall, E. K., jun. (1939). *J. biol. Chem.*, **128**, 537.
 Carruthers, L. B. (1942). *Trans. R. Soc. trop. Med. Hyg.*, **36**, 89.
 Chopra, R. N., de Monte, A. J. H., and Chatterji, B. C. (1941). *Indian med. Gaz.*, **76**, 712.
 Churg, J., and Lehr, D. (1941). *Amer. J. med. Sci.*, **202**, 687.
 Druey, J. (1948). *Helv. chim. Acta*, in press.
 Fernandes, F. (1948). Ph.D. thesis, Bombay University.
 Huang, J. (1944). *J. Amer. med. Ass.*, **125**, 23.
 Lahiri, S. C. (1945). *J. Indian med. Ass.*, **14**, 113.
 Meier, R. (1946). *Schweiz. Med. Wschr.*, **76**, 695.
 Misra, K. N. (1944). *J. Indian med. Ass.*, **13**, 279.
 Seal, S. C. (1946). *Indian med. Gaz.*, **81**, 321.
 — (1947). *J. Indian med. Ass.*, **17**, 85.
 White, H. J. (1939). *J. Bact.*, **38**, 549.

TREATMENT OF RINGWORM OF THE SCALP

BY

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Until recent years there was no reliable treatment of ringworm of the scalp which did not involve removal of infected hairs from their follicles by the use of x rays or thallium acetate or by producing a purulent folliculitis. The removal of infected hairs with masses of spores was in itself inadequate to effect a cure, but it so enhanced the effect of local treatment with fungicides that x-ray epilation became the accepted practice of dermatologists and reduced the duration of treatment from an indefinite number of years to one or two months. For example, a series of 100 cases of ringworm of the scalp were treated from Feb. 13 to Sept. 29, 1947, by Dr. McKenny, at St. John's Hospital for Diseases of the Skin, by x-ray epilation followed by the application of Whitfield's ointment and bi-weekly paintings with tincture of iodine. The x-ray technique was the irradiation of the usual five areas (Kienböck-Adamson) with a dose of approximately 400 r to each area at 90 kV, the half-value layer equivalent to 1.4 mm. of aluminium, and focal skin distance 9½ in. (24 cm.), the diameter of the active field being 5 in. (12.5 cm.). All the patients were examined by Wood's filtered ultra-violet light or microscopically, or both, to confirm the diagnosis and again about one month later, and then at intervals of two weeks until three examinations had been negative.

The average number of days for a cure was 38.4, but four cases required treatment for 85, 85, 151, and 160 days; thus the average period for cure in the other 96 was 35 days. These results are considered to be highly satisfactory, but they were obtained in a very well equipped and specialized clinic. Moreover, the x-ray technique is tedious and exacting and occupies at least an hour. Under such conditions the risk of any permanent alopecia is negligible and certainly much less than that of toxic reactions to thallium acetate, but the risks have to be borne in mind, and they have always brought anxiety to the doctor and to the parents of children under treatment.

It was therefore disappointing to find in our own experience and in that of Carrick (1946) and others that new and potent fungicides were no more effective in the treatment of scalp ringworm than the older remedies, and it was obvious that this must be due to their failure to penetrate the infected follicles. At first it was hoped to overcome this difficulty by using fat solvents such as acetone, benzene, carbon tetrachloride, chloroform, and alcohol containing iodine or benzoic and salicylic acids, but these met with little success.

The interesting fact that while microsporon infections of the scalp are common in children they are very rare in adults led to the discovery by Stephen Rothman and his co-workers (1946, 1947) that a certain fraction of the free fatty acids extracted from adult human hair was capable of inhibiting the growth of *Microsporon audouini* in concentrations of 0.0002–0.0005%. Pelargonic acid was the main constituent of this fraction, but no success followed its therapeutic use, probably because of its lack of penetrating power.

Penetrating Vehicles

Attention was therefore directed to the use of penetrating vehicles which might carry an effective fungicide to the base of the hair follicle and make possible the cure of scalp ringworm by simple inunction or even by painting the scalp without preliminary epilation. In recent years this problem has received considerable attention in America. Herrmann, Sulzberger and Baer (1944) and MacKee, Sulzberger, Herrmann, and Baer (1945) have reported on the use of vehicles containing wetting agents to promote skin penetration. MacKee, Herrmann, and Karp (1946) found that the most promising results in the treatment of tinea capitis were obtained with a preparation containing cetyltrimethylammonium pentachlorophenate 3.5% in "intraderm." The latter consists of a combination of sodium alkylbenzene sulphonate 5%, phenazone 12.5%, propylene glycol 10%, sulphonated castor oil 10%, and distilled water. The pH was adjusted to 4 by the addition of citric and propionic acids. In addition to the application of the solution the treatment included the use of an acid shampoo containing sodium alkylbenzene sulphonate and sulphonated castor oil. In a series of 59 cases of infection with *M. audouini*, 54% of the children were cured, the average duration of treatment being approximately 14 weeks. More recently Foley and Lee (1947) have reported on the fungicidal action of combinations of cetyltrimethylammonium pentachlorophenate with fatty acids. The combination found to be most active against pathogenic fungi was cetyltrimethylammonium pentachlorophenate and undecylenic acid.

Fungicidal Agents

In the preliminary experiments of our series phenylmercuric nitrate and salicylanilide have been used as the fungicidal agents. Phenylmercuric nitrate was investigated clinically in 1933 by Levine, who reported favourably on its use in aqueous ointment bases for the treatment of epidermophytosis and tinea. It possesses low toxicity, and

in addition to its fungicidal properties has marked bacteriostatic and bactericidal actions. Byrne (1947) reviewed its application to diseases of the skin.

An attempt was made to incorporate phenylmercuric nitrate into the intraderm vehicle of Herrmann *et al.*, using alkylnaphthalene sulphonate in place of alkybenzene sulphonate, since the latter substance was not available in this country. Phenylmercuric nitrate, however, was found to be incompatible with alkylnaphthalene sulphonate and with other wetting agents containing the sulphonic group.

A search was made for alternative wetting agents compatible with phenylmercuric nitrate. The Crill series of wetting agents* are non-ionic in character and consist of long-chain fatty-acid derivatives of various carbohydrates, such as sorbitan and mannitan. The series comprises 30 members in all, and Crill No. 6 was chosen for the present purpose as it produces the greatest reduction of surface tension in the range. Crill No. 6 is an ethylene oxide derivative of sorbitan monolaurate and is a pale-straw-coloured viscous liquid having a faint odour reminiscent of linseed oil. It is miscible with water and with vegetable and mineral oils. The solubility of phenylmercuric nitrate in water is increased by the presence of Crill No. 6, with which it is compatible.

Various combinations of Crill No. 6, propylene glycol, and water were prepared, the pH being adjusted to between 4 and 5 by the addition of a solution of citric acid (2%) and sodium propionate (1%).

Solution No. 1

Phenylmercuric nitrate	..	..	..	1 g.
Crill No. 6	..	..	..	100 ml.
Propylene glycol	..	..	..	100 ml.
Solution of citric acid and sodium propionate	..	..	..	20 ml.
Distilled water	..	..	..	to 1,000 ml.

Dissolve the phenylmercuric nitrate in a mixture of Crill No. 6, propylene glycol, and 100 ml. of distilled water. Add the solution of citric acid and sodium propionate and adjust the volume by the addition of distilled water.

This solution deposited slightly on standing for 14 days, owing to the presence of propylene glycol. It was therefore decided to replace the propylene glycol by phenoxetol, the antibacterial properties of which have been reported by Berry *et al.* (1944) and which also has a powerful fungicidal action. Phenoxetol is only sparingly soluble in water, and therefore it was necessary to increase the concentration of Crill No. 6 in order to obtain complete miscibility. The concentration of phenylmercuric nitrate was also increased.

Solution No. 2

Phenylmercuric nitrate	..	..	..	2 g.
Phenoxetol	..	..	..	200 ml.
Crill No. 6	..	..	..	400 ml.
Solution of citric acid and sodium propionate	..	..	..	20 ml.
Distilled water	..	..	..	to 1,000 ml.

In order to obtain a preparation easier to apply, a cream was made according to the following formula:

Cream No. 1

Phenylmercuric nitrate	..	..	..	2 g.
Phenoxetol	..	..	..	200 ml.
Crill No. 6	..	..	..	200 ml.
Solution of citric acid and sodium propionate	..	..	..	20 ml.
Lanette wax SX	..	..	..	100 g.
Distilled water	..	..	..	to 1,000 ml.

Heat together, over a water-bath, the phenoxetol, Crill No. 6, and lanette wax SX until the latter is melted. Dissolve the phenylmercuric nitrate in the mixture. Add the solution of citric acid and sodium propionate to the distilled water, heat over a water-bath and add gradually with constant stirring to the mixture of lanette wax SX and other ingredients. Stir until cool.

The concentration of phenylmercuric nitrate was subsequently increased to 0.5%:

Cream No. 2

Phenylmercuric nitrate	..	..	..	5 g.
Phenoxetol	..	..	..	200 ml.
Crill No. 6	..	..	..	200 ml.
Solution of citric acid and sodium propionate	..	..	..	20 ml.
Lanette wax SX	..	..	..	100 g.
Distilled water	..	..	..	to 1,000 ml.

Another type of ointment base used in America consists of polyethylene glycol, the dermatological applications of which have been described by Hopkins (1946). This substance* is available in various grades, the lower members being liquids and the higher members having consistencies varying from that of soft paraffin to hard waxes. "Carbowax '1500'" is a member of the polyethylene glycol series, and is similar in consistency and appearance to white soft paraffin. It is soluble in water but immiscible with mineral and vegetable oils and fats. Carbowax "1500" will itself dissolve many organic compounds, and by the addition of Crill No. 6 its solvent powers may be increased.

Phenylmercuric Nitrate

In these experiments the preparation giving the best results consists of phenylmercuric nitrate 0.5% in a base composed of carbowax "1500" and Crill No. 6, the pH being adjusted to between 4 and 5 by the addition of a solution of citric acid and sodium propionate. Unfortunately we have no experimental evidence of the penetrating properties of the carbowax compounds or of the effect of adding wetting agents to ointment bases of this type, but this is a matter which we have under investigation.

Ointment No. 1

Phenylmercuric nitrate	..	..	..	5 g.
Crill No. 6	..	..	..	100 ml.
Solution of citric acid and sodium propionate	..	..	..	20 ml.
Carbowax "1500"	..	..	..	to 1,000 g.

Melt together the carbowax "1500" and Crill No. 6 over a water-bath; add the phenylmercuric nitrate, previously triturated with the solution of citric acid and sodium propionate, and continue heating until the phenylmercuric nitrate is completely dissolved. Allow to cool.

Salicylanilide

Salicylanilide is another fungicide which has received attention in America; in this series it has been used in order to assess its value against that of phenylmercuric nitrate. Of 17 preparations tested by Schwartz (1946) the most efficacious was an ointment containing 5% salicylanilide and 5% hyamine in carbowax "1500." In the present series an ointment containing 5% salicylanilide in the carbowax "1500"—Crill No. 6 base is under investigation.

J. L. Miller *et al.* (1946) reviewed the use of various fungicides in special vehicles, including carbowax, using sodium tetradecyl sulphate as a wetting agent. Daily manual epilation of the diseased hairs was part of their technique.

Ointment No. 2

Salicylanilide	..	..	..	50 g.
Crill No. 6	..	..	..	100 ml.
Solution of citric acid and sodium propionate	..	..	..	20 ml.
Carbowax "1500"	..	..	..	to 1,000 g.

Heat together the carbowax "1500" and the Crill No. 6 over a water-bath, dissolve the salicylanilide in the mixture, and add the solution of citric acid and sodium propionate. Stir and allow to cool.

These preparations, as made and described by Mr. Hadgraft, chief pharmacist to the Royal Free Hospital,

*Marketed by Croda, Ltd., London.

*The "carbowax" compounds are marketed in this country by General Metallurgical and Chemical, Ltd.

were submitted to clinical trial, and the modifications were introduced in attempts to achieve more rapid progress. We are far from being satisfied that the present ointments represent the goal we are seeking, for we think that too much still depends upon an exacting technique of application. Moreover, in spite of the observations of others to the contrary (MacKee, Herrmann, and Karp, 1946), we find that inflammatory reactions in the follicles, if not essential, certainly are of value in accelerating cure. This has been generally accepted in the past with older methods, but it is still hoped that with more powerful fungicides and bases of greater penetrative power it may soon be possible to cure non-inflammatory ringworm of the scalp without provoking reactions in the skin and its follicles.

Clinical Results

The following is the preliminary report on 22 cases of ringworm of the scalp treated with Ointment No. 1 at St. John's Hospital for Diseases of the Skin. There were 13 boys, 8 girls, and 1 woman. All were treated as out-patients. Every patient was examined microscopically and inspected under Wood's light, and the fungus was identified by culture. There were 8 cases of *M. audouini*, 9 cases of *M. felineum*, 4 cases of microsporia, and 1 case of *Trichophyton endothrix* which could not be identified. The parents were given written and verbal instructions. The following routine was carried out:

The hair was cut short and kept short throughout the treatment; a linen cap was worn for 24 hours continuously; every morning the scalp was washed with soap and hot water and scrubbed with a nailbrush, particular attention being paid to the infected patches. The ointment was applied three times a day with a toothbrush for five minutes.

It was thought that by using a fungicide of high potency in a penetrating base, combined with mechanical irritation aimed at producing active hyperaemia and mechanical epilation, favourable results might be obtained. Phenylmercuric nitrate is a fungicide of high potency. Carbowax combines penetrating properties with pleasantness of application, thanks to its quality of mixing easily with water. The nailbrush, applied with gentle vigour to the affected parts, should help to dislodge the infected hair, which when caught by the coarse bristles should be easily removed from the follicles. This has proved to be correct. The toothbrush is a comfortable applicator, and the friction is another factor in producing irritation. We still consider epilation to be a useful preliminary measure in facilitating penetration within the follicles. X-ray epilation itself does

not cure ringworm of the scalp: treatment with fungicides must follow to complete the cure. Pustulation and kerion formation cause natural epilation. That is one reason why many cases of animal ringworm are easily cured by local applications alone. The inflammatory response, which occurs much more often in the animal than in the human type of ringworm, also plays an important part in natural cure. It is that entire lack of any local reaction which accounts for the difficulty of eradicating *M. audouini* infection by local means only.

The clinical appearance of all cases at the beginning of treatment varied between slight scaliness and severe pustulation of the patches. Co-operation of the parents was the first condition of successful treatment. Some mothers refused to cut their children's hair and some were unwilling from the very start to treat their children, and preferred the established x-ray technique. The children reacted very well to treatment, the range of reaction being that of slight erythema and scaling to more or less severe pustulation. Details are given in the Table. Some cases did not show reaction at all and it was thought that painting with pure phenol once or twice would induce pustulation, but after attempting it in three or four cases it was abandoned as unnecessary. One case reacted too violently and the mother refused further treatment; incidentally, that case when seen several weeks later was negative to Wood's light. In one case the Kromayer lamp was employed several times, but without appreciable benefit.

Summarizing, the inflammatory action when already present was welcomed, and in cases where it was absent it was intentionally provoked. Patients were at first seen every week; but later, with mounting experience, they were asked to visit the clinic every three weeks. Improvement could usually be seen between the first and seventh weeks of treatment, this showing itself by thinning of the fluorescent patches and a change in the colour of the infected hair from bright green to white. In our experience when a case became negative it remained so, therefore after the first negative reaction to Wood's light the treatment was continued for only one week and was then stopped. After three negative fluorescent tests the patient was discharged.

It was not always possible to get every patient for three-monthly tests, so that a few cases were followed up for one month only. The Table gives a detailed account of the course of treatment of the 22 cases.

(a) Cases of *M. audouini*.—There were 6 boys and 2 girls in this group. Six cases were cured and two failed. The

Analysis of Cases

Case No.	Sex	Age (Years)	Mic.	Wood's Light	Culture	Improved in Weeks	First Negative W.L. Weeks	Total Time of Treatment Days	Reaction	Cured	Follow-up (Mths.)	Remarks
1	M	6	+	+	A	3	2	42	+	+	2	} Brother and sister Cured by x rays in 1 month Cured by x rays in 4 months
2	M	3	+	+	A	4	4	64	+	+	3	
3	M	9	+	+	? A	8	4	92	++	+	1	
4	F	4½	+	+	? A	3	2	34	—	+	2	
5	F	3	+	+	A	5	2	49	++	+	2	
6	M	4½	+	+	A	5	2	49	++	+	2	
7	M	7	+	+	A	—	—	78	—	—	—	
8	M	1½	+	+	A	4	—	120	—	—	—	
9	M	1	+	+	B	4	4	90	++	+	3	
10	M	1	+	+	B	Became negative suddenly	—	99	++	+	4	
11	M	8	+	+	B	3	6	84	+++	—	—	Refused further treatment owing to irritation Not followed up Kromayer; phenol
12	F	3	+	+	B	4	2	63	—	+	—	
13	F	5	+	+	B	6	4	120	+	+	4	
14	M	2	+	+	B	4	3	57	—	+	3	Neglected case, cured by x rays in 4 weeks
15	M	4	+	+	B	1	1	14	—	+	1	
16	M	7	+	+	B	—	—	63	—	—	—	
17	F	35	+	+	B	—	—	300	—	—	—	Cured by x rays in 5 weeks Cured by x rays in 4 weeks
18	F	6½	+	+	O	2	3	41	++	+	3	
19	M	9	+	+	O	1	2	23	—	+	2	
20	F	6	+	+	O	—	—	120	—	—	—	
21	F	1½	+	—	O	—	—	90	—	—	—	
22	F	9	+	—	O	7	2	53	+	+	2	

(T. end.)

A = *M. audouini*. B = *M. felineum*

number of days of treatment of the cured cases was 330, the average time for each case being 55 days. Improvement began between the third and eighth weeks of treatment, and once the improvement started it took from two to four weeks for the cases to become negative. There was no relapse. The time of observation was from one to four months. Pustulation occurred in three cases, slight reaction in two, and no reaction in one. In Case 7 the nailbrush was not used. Cases 7 and 8, which failed, were cured by x rays in one and four months respectively. It is interesting to note that Case 8, which was treated locally for 120 days, took exactly the same time for cure after x-ray epilation. It was necessary to carry out several local manual epilations combined with antiseptics to effect a cure.

(b) *Cases of M. felineum*.—There were 6 boys, 2 girls, and 1 woman. Eight cases were cured and one failed. The average time of cure was 75 days, excluding Case 17. Improvement began between the first and sixth weeks of treatment. It took one to six weeks for the cases to become negative once the improvement started. The time of observation varied from one to four months. Case 11 showed severe pustulation and refused further treatment. When examined several weeks later this patient was found to be negative to Wood's light; we considered, therefore, that he was cured.

It is interesting to note that there was a difference of about three weeks in the time of cure between the human and the animal types of ringworm. Variation in the resistance of the individual fungus, and last, but not least, the co-operation of the mother, might be responsible for variations in therapeutic response. Case 17 (*M. felineum*) started treatment in November, 1946, and was discharged cured in September, 1947. It was impossible to persuade this patient to cut her hair, and the treatment, therefore, was technically very difficult. It was confined to the inunction of ointments into the affected area. Different kinds of ointments were used for a considerable time, but when Ointment No. 1, combined with mechanical epilation, was employed she was cured in six weeks.

(c) *Cases 18–21* could not be identified by culture. We cannot therefore make any further comment upon them, except that Cases 20 and 21 were cured by x-ray epilation in five and four weeks respectively.

(d) *Case 22*.—A 9-year-old girl had suffered from *T. endothrix* infection for seven months. Clinically she presented widespread inflamed patches over the scalp. The Wood's light test was negative. No identification was possible by culture. *Endothrix* is notoriously resistant to treatment unless epilated by x rays. Another patient, who refused x-ray epilation, was treated for nine months with local applications unsuccessfully and had to be x-rayed eventually. Case 22 is all the more remarkable as it became clinically and microscopically negative after 53 days' treatment, and has remained so for the last two months.

A new series of cases has been started on 5% salicylanilide in carbowax and Crill No. 6, and of 23 under treatment 10 cases of *M. felineum* have been cured after two to nine weeks and are still under observation.

Summary

A preliminary report is given on new advances in the local treatment of ringworm of the scalp, demonstrating that infections due to *M. audouini* can be cured in a reasonable time without previous epilation.

With 0.5% phenylmercuric nitrate in carbowax and Crill No. 6, 22 cases were treated, including 8 of *M. audouini* infection, 9 due to *M. felineum*, 4 due to unidentified microspora, and 1 due to *T. endothrix*.

Seventeen cases were cured in an average time of 2½ months.

In this small series of cases we found no significant differences between the responses to treatment of the human and that of the animal type of ringworm.

Preliminary epilation, even when followed by old-time remedies, still affords the quickest prospect of cure.

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REFERENCES

- Berry, H., Gough, J., and Still, B. M. (1944). *Lancet*, 2, 175.
 Byrne, E. A. J. (1947). *British Medical Journal*, 1, 90.
 Carrick, L. (1946). *J. Amer. med. Ass.*, 131, 1189.
 Foley, E. J., and Lee, S. W. (1947). *J. Amer. pharm. Ass.*, 7, 199.
 Herrmann, F., Sulzberger, M. B., and Baer, R. L. (1944). *N.Y. State J. Med.*, 44, 2452.
 Hopkins, J. G. (1946). *J. invest. Derm.*, 7, 171.
 Levine, B. (1933). *J. Amer. med. Ass.*, 101, 2109.
 MacKee, G. M., Herrmann, F., and Karp, F. L. (1946). *J. invest. Derm.*, 7, 43.
 — Sulzberger, M. B., Herrmann, F., and Baer, R. L. (1945). *Ibid.*, 6, 43.
 Miller, J. L., et al. (1946). *J. Amer. med. Ass.*, 132, 67.
 Rothman, S., et al. (1946). *Science*, 104, 201.
 — (1947). *J. invest. Derm.*, 8, 81.
 Schwartz, L., et al. (1946). *J. Amer. med. Ass.*, 132, 58.

PREVENTION OF RINGWORM IN THE TROPICS

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Ringworm is a far greater problem in the Tropics than in temperate climates, and for the British Army in the Netherlands East Indies (N.E.I.) in 1946 it was at one stage the commonest cause, apart from venereal disease, for admission to hospital. In February and March, 1946, ringworm accounted for 19.2% and 21.2%, respectively, of all admissions to a military hospital in Batavia receiving all types of cases except venereal disease. To these must be added the far greater number of cases treated by unit M.O.s, some having up to 50% of their men affected. These figures give a fair picture of the epidemic proportions which ringworm reached in this area. Furthermore, from discussions with colleagues in other parts of the East, I realized that these numbers were typical rather than exceptional for the Tropics.

To reduce this incidence was a military necessity of considerable urgency, in view of the fact that the N.E.I. was an active theatre of operations at the time. This paper describes a successful experiment carried out with 400 British other ranks (B.O.R.s) to test the efficacy of certain preventive measures which were later adopted on a much larger scale, and which may have a wider application to civil life as described later.

In temperate climates ringworm is largely confined to the feet, and from these it spreads to certain selective areas, notably the groins, axillae, and, in women, the submammary regions. In the Tropics, however, it is much more widespread because of the profuse sweating, and although these selective areas are usually the first and more severely affected the whole of the skin may rapidly become involved. In this way a man might have two or three lesions one morning and within a few hours his body, including the face, might be covered with confluent ring-like figures consisting of vesicles and pustules round the edge of an erythematous area, which in the more severe cases would be moist or even weeping. The effect of this was to produce intense irritation; the body became covered with scratch marks, and the man no longer efficient as a front-line soldier. An associated and usually severe tinea interdigitalis, consisting of the typical white sodden skin between the toes, sometimes fissured and sometimes partially detached, occurred in 98% of the cases.