either condition; izar is better under the former, and monsol under the latter. These germicides are less poisonous than lysol and less irritating to the skin, despite their much greater efficiency. They can, however, presumably be irritating in the vagina, since the strengths recommended for use are respectively 1 in 600, 1 in 600, and 1 in 500 (increased). Even in these weak dilutions there is a clear margin of safety.

Acriflavine and Rivanol.—These may be considered together, since they are compounds of somewhat similar composition, and they share the property of exerting a bacteriostatic action in enormous dilutions, whereas their bactericidal power in short periods of time is comparatively feeble. The former action is in both cases unaffected by blood. The bactericidal power of acriflavine is somewhat diminished by the presence of blood: this contrasts with the statement that it is actually enhanced by the presence of serum (Browning).³

Brilliant Green.—It may be said at once that brilliant green emerges from this investigation as by far the most potent of all the substances tested. The fact that it destroys *Strep. pyogenes* even in the presence of blood at a dilution of 1 in 10,000 becomes even more striking and significant when it is remembered that even strong solutions are without irritant action. In "blue paint" (Bonney and Browning)⁴, which has now been used for obstetric and other purposes for fifteen years, its concentration is 1 in 200. It is thus practicable to employ a solution of fifty times the strength demanded for rapid bactericidal action.

Mercurochrome.—It is evident from the results in Table I that mercurochrome (of which two makes were tested) is a germicide incomparably weaker than is commonly supposed. Others have obtained similarly unsatisfactory results with it (Simmons,⁵ Ramos,⁶ Walker⁷), and an explanation of the discrepancy between these results and those of Young, who introduced the drug, has been suggested elsewhere (Garrod).⁸ A solution of a strength of no less than 1 in 25 has, however, been said to reduce the incidence of puerperal sepsis (Mayes).⁹

COMMENTARY

In drawing practical conclusions from these results it is necessary first to decide whether the purposes of obstetric prophylaxis can be served by merely bacteriostatic action; if this be so, acriflavine is the most powerful agent we possess. In order that this action should be effective, an adequate concentration would presumably have to be maintained in the birth canal for several days, immobilizing any streptococci which might gain entrance, until the states of the placental site and the cervical laceration were such that bacterial invasion could no longer readily take place. That a rapid bactericidal action, if obtainable, is preferable to this, must be obvious.

Of the germicides tested, few possess a bactericidal action on *Strep. pyogenes* which appears adequate. The meaning of the chief results may be concisely stated by calculating the ratio of effective strength to strength employed, which may be termed the factor of safety. Taking the figures in Column 2 as the effective bactericidal strength, the factor of safety for brilliant green is 50, for cyllin 3, for lysol 0.75, for mercury biniodide 0.1. The contrast thus afforded between two effective and two ineffective agents is sufficiently striking.

There is no doubt that brilliant green is by far the surest safeguard against streptococcal infection which can be used; it would be interesting to know whether grave sepsis has ever been seen to follow its employment. It is objected to on account of its staining propensities; whether stained linen or death from septicaemia is the

greater evil is a question which seems to admit of only one answer. Next in order of efficiency come the proprietary coal-tar germicides, monsol, izar, and cyllin; these are sometimes objected to on account of their smell. Acriflavine, rivanol, and one brand of lysol are on the borderline of bactericidal efficiency; other lysols, mercurochrome, and mercury salts are ineffective.

The purpose of this paper is to indicate which germicides may be expected to prevent streptococcal infection during childbirth: the method of their application is outside its scope. That a technique can be devised which would ensure their effective action is hardly doubtful.

CONCLUSIONS

1. The bactericidal and bacteriostatic action of fifteen germicides used in obstetrics have been tested, the test organism being *Strep. pyogenes*, and the conditions employed such as to imitate as far as possible those of obstetric use.

2. Four of the germicides tested are calculated to be effective in the dilutions employed clinically, one, brilliant green, affording a very wide margin of safety; of three the efficiency is doubtful; the remaining eight are judged to be untrustworthy.

This work was carried out during the tenure of a grant for work on streptococci from the Medical Research Council, to whom I express my thanks, and to my assistant, Miss G. E. Root, for assiduous help in the laborious work involved.

REFERENCES

- ¹ *British Medical Journal*, 1930, i, 359.
- ² Ministry of Health: Maternal Mortality Committee's Report, Appendix D, 1930.
- ³ Browning, C. H., Gulbransen, R., and Thornton, L. H. D.: *British Medical Journal*, 1917, ii, 70.
- ⁴ Bonney, V., and Browning, C. H.: *Ibid.*, 1918, i, 562.
- ⁵ Simmons, J. S.: *Journ. Amer. Med. Assoc.*, 1928, xci, 704.
- ⁶ Ramos, A. Silveira: *C. R. Soc. de Biol.*, 1928, xcix, 1537.
- ⁷ Walker, J. E.: *Arch. Path. and Lab. Med.*, 1926, i, 199.
- ⁸ Garrod, L. P.: *Proc. Roy. Soc. Med.*, February 3rd, 1931.
- ⁹ Mayes, H. W.: *Journ. Amer. Med. Assoc.*, 1927, lxxxix, 1685.

THALLIUM ACETATE IN TREATMENT OF RINGWORM OF THE SCALP

A STATISTICAL INVESTIGATION OF SUBSEQUENT NUTRITION

BY

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Since November, 1928, 139 children suffering from ringworm of the scalp have received an epilating dose of thallium acetate at the skin department, Royal Infirmary, Edinburgh. The dosage employed was 8.5 milligrams of thallium acetate per kilogram of body weight; this was administered to children weighing up to 33 kilos. The treatment has been successfully completed in 122 of these cases, the remaining 17 being still under supervision. During the same period only 29 children suffering from ringworm of the scalp have received an epilating dose of x rays. From a survey of the cases treated with thallium acetate it seems that the immediate results of this method of treatment are on the whole superior to those obtained in cases treated by x rays.

ADVANTAGES AND DISADVANTAGES OF THALLIUM

Thallium is easily and rapidly administered. On account of this a large number of children can be dealt with in a very short time, whereas an epilating dose of x rays for the entire scalp takes at least an hour to administer,

* In receipt of a grant from the Medical Research Council.

even with appropriate apparatus and skilled technique. This fact renders thallium especially suitable when a sudden epidemic has to be dealt with. For instance, a comparison of the average period elapsing between the administration of thallium and the treatment by x rays respectively and the discharge of the case, shows that in 122 thallium cases this period was 113.5 days; in 29 x -ray cases of one series it was 152 days, and in 50 cases of another group it was 135 days. Further, in 1923, the average period of isolation of ringworm cases treated with x rays was seven months, this delay being due to the occurrence within a short period of time of a large number of cases which could only be dealt with gradually on account of the time occupied by the administration of the x -ray dosage. Epilation with thallium is as certain as that obtained by x rays; there is no risk of permanent baldness, and it can be produced in children who are too young to receive x -ray treatment.

On the other hand, the alopecia resulting from thallium is of much shorter duration than that brought about by x rays, so that with thallium very careful local antiparasitic treatment is required. Another disadvantage of thallium is that it regularly produces mild constitutional symptoms in a proportion of cases (44 per cent. in 50 of the present series). These are never serious with ordinary dosage (up to 0.25 to 0.28 gram) in children under 11, and are no more severe than those which may accompany scarlatinal or diphtheria immunization. They are quickly recovered from, and no immediate harm seems to result. In view of the fact that they do occur, that thallium is a substance capable of producing, in larger doses, profound toxæmia and grave pathological changes, and that its fate in the body and mode of action as a depilatory substance are unknown, it is possible that it may cause deleterious influences on growth and development which only become evident at some later period. Up to the present, however, no data on this subject have been available. This aspect of the problem is obviously a most important one if the therapeutic use of the drug is to be continued.

STATISTICS OF TREATMENT

Through the courtesy and co-operation of Dr. Guy, medical officer of health for Edinburgh, I have been able to follow up a series of 76 male and female school children who received thallium acetate treatment for ringworm of the scalp at periods varying from four months to two years. Each of these children was examined physically, and all appeared to be healthy; indeed, many of the parents volunteered the statement that in their opinion the child's general health had improved after the administration of the thallium. In addition, each child was measured and weighed. The group consisted of 51 males and 25 females.

First of all the children were divided into age groups according to their age on the last birthday, and the average weights of the corresponding age groups before and after thallium administration were compared. The average weights on these two dates do not represent the weights of the same children for any one age group, since a child aged 5 at the time of administration of thallium may have been examined eight months or two years later, in which case this child's weight would go to make up the average either of age period 5 again, or of age period 7. In spite of this, the data provide a comparative index of the nutrition of the children before and after thallium administration, since the weights before thallium treatment indicate the type of population dealt with and those after thallium deal with the same population, so that any redistribution into different age groups is immaterial. The average weights on these two dates were compared with the average normal weight of Edinburgh

school children for the same age periods. The total numbers in each age group were as follows:

TABLE I

Age Last Birthday	Males		Females	
	Before Thallium	4 months to 2 years after Thallium	Before Thallium	1 to 2 years after Thallium
1	1	—	—	—
2	—	—	—	—
3	1	1	1	—
4	5	1	3	—
5	11	3	1	2
6	10	9	6	3
7	11	10	7	4
8	8	10	3	6
9	4	9	2	5
10	1	5	1	3
11	—	3	1	1
12	—	—	—	1
	51	51	25	25

Table II shows the average weights in kilograms according to age period of 51 male children immediately before the administration of thallium, and of the same children four months to two years after they had received a single epilating dose of thallium. The average height in inches and the average normal height is also shown.

TABLE II.—Males, Four Months to Two Years after Thallium

Age Last Birthday	Average Weight before Thallium	Average Weight 4 months to 2 years after Thallium	Average Normal Weight	Average Height 4 months to 2 years after Thallium	Average Normal Height
1	11	—	9.5	—	—
3	13.9	16.6	14.1	38.1	35
4	15.74	15.9	15.9	35.5	38
5	18.32	17.53	18.2	41.4	41
6	19.32	20.6	20.2	44.3	44
7	22.22	22.8	22.6	46.4	46
8	23.59	25.4	24.9	43.3	47
9	24.2	23.9	27.4	49.57	49.7
10	25.4	25.6	30.7	49.5	51.8
11	—	28.3	32.7	51.3	53.5

TABLE III.—Females, One to Two Years after Thallium

Age Last Birthday	Average Weight before Thallium	Average Weight 1 to 2 years after Thallium	Average Normal Weight	Height 1 to 2 years after Thallium	Average Normal Height
3	14.4	—	12.6	—	—
4	15.8	—	15.4	—	—
5	17.9	17.9	17.8	40	40.5
6	19.1	20.0	18.9	45.5	42.8
7	20.88	23.0	21.3	45	44.5
8	23.4	23.9	23.7	47.4	46.8
9	25.5	26.2	25.2	48.4	48.7
10	26.06	28.5	28.1	52.9	51
11	28.24	31.8	30.9	51	53.1
12	—	32.7	34.7	55.5	55.6

In order to control the results of a comparison of the average weights before and after thallium, and of the average normal weight classified according to age periods, the average weights after thallium according to height were compared with the average normal weights for the same heights. Table IV shows the average weight in kilograms according to height in inches four months to two years after thallium in 51 male children, and one to two years after thallium in 25 female children.

TABLE IV.—*Males and Females*

Height in Inches	Males		Females	
	Average Weight 4 months to 2 years after Thallium	Average Normal Weight	Weight 1 to 2 years after Thallium	Average Normal Weight
35	15.9	14.1	—	—
38	16.6	15.9	—	—
40	19.1	17.4	16.3	16.8
41	16.8	18.2	21.3	20.58
43	19.8	19.4	22.2	21.8
44	20.3	20.2	22.6	22.4
45	21.2	21.3	24.8	23.9
46	21.9	22.6	27.2	25.59
47	23.8	24.9	30.7	28.1
48	24.6	25.8	30.4	29.5
49	24.4	26.7	29.0	30.9
50	26.9	28.1	32.7	34.5
51	28.1	23.5	—	—
53	28.6	32.7	—	—
55	34	35	—	—

An analysis of Tables II and III shows, first, that immediately before the administration of thallium the average weight according to age of the 51 male and 25 female children dealt with in the investigation compares favourably with the average normal weight for the corresponding age periods. The weight of the males up to the age of 7, and of the females up to the age of 9, is practically identical with the average normal weight, but in the later age periods it is anything from 1.4 to 5 kilograms below normal. The difference is greatest in the males. It is to be noted, however, that in both cases there were fewer children in the age periods 9 and 10 years than in the age periods 4 years to 8 years. In Table II the average weight of the same children four months to two years after thallium is seen to be on the whole better than that for the corresponding age periods immediately prior to the administration. Table I shows that this improvement cannot be due entirely to a redistribution of the children into different age periods, at least for the period six years to eight years, since almost the same number of children appear in these groups before and after the administration of thallium. In Table II there is a fall in weight below the average normal weight for the age periods 9, 10, and 11 years, and this corresponds to that found in the average weight, before thallium was given, for the periods 8, 9, and 10 years. The average weights of the female children one to two years after thallium administration is quite appreciably higher than the corresponding average normal weights.

Table IV shows that in both male and female cases the height four months to two years, and one to two years after thallium administration bears a normal relationship to the weight; and Tables II and III show that the average height at a similar period after

thallium administration is normal for the various age periods. In males the height for the age periods 10 years and 11 years is below the average normal, but this corresponds to the subnormal average weight for the same periods. As the period elapsing between the first and second weighings varied in most of the children, no attempt has been made to ascertain the average increase in weight during this interval of children of corresponding age periods or heights.

CONCLUSION

Examined from several aspects the weights and heights of both male and female children four months to two years after thallium administration do not appear to show any gross deviation from the normal. In fact, below 10 years of age the figures are, if anything, slightly better than normal. Using the weights and heights observed in this investigation as standards on which to interpret physical development, and taking into account the results of a general medical examination, there is no evidence to show that the continued normal growth and nutrition of children are adversely influenced or interfered with as a result of the previous administration of thallium acetate in sufficient quantity to produce epilation of the scalp.

PERITONITIS DUE TO PERFORATION OF THE BOWEL BY FOREIGN BODIES

BY

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LEEDS

The following report (communicated to a recent meeting of the Leeds and West Riding Medico-Chirurgical Society) of the personal experiences with a fish bone which had been swallowed by one of us (A. H.) may be of general interest.

During October, 1929, I began to suffer from pain between the shoulder blades, which seemed to originate in the stomach. There was no pain over the stomach in front. The pain commenced as a feeling of discomfort, gradually developing a very definite character, varying greatly in intensity and in duration. When the pain was at its worst it gave rise to a feeling as if the chest would burst open. I thought at first it was angina, but soon decided that it was not so. Then I thought it was duodenal in position, and naturally wondered if an ulcer was the cause. I found out that the attacks came on mostly in the afternoon, when the stomach was empty. The pain could be cured by taking a drink of some kind or a biscuit. As I have not eaten lunch for forty years my stomach is always empty in the afternoon. The attacks of pain gradually got more severe, and the last attack I suffered from was on July 22nd, 1930. For a month prior to this date I had been in bed suffering from the effects of a motor accident. This period of rest did not alter the attacks of pain in any way. On July 24th I voided, per anum, a fish bone (Fig. 1). I have never had an attack of pain since.

FIG. 1.—A photograph of the fish bone swallowed.

Dr. Walter Garstang, professor of zoology in the University of Leeds, informs me that the bone is the