

Radiation Therapy of Ringworm of the Scalp

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SUMMARY

A recent epidemic of tinea capitis in children has revived a considerable interest in the methods of treatment of this disease.

The most efficacious form of therapy for M. audouini infections is roentgen epilation.

The various methods of x-ray treatment are briefly presented and compared. A modification of the four-point technique is shown to offer a simple yet safe method of curing ringworm of the scalp. Results with this method compare favorably with the best of those reported by the use of other methods.

Cure was effected by this method in all of a group of 125 cases.

RINGWORM of the scalp in the last few years has again reached epidemic proportions in this country.^{7, 8, 14} It is most efficiently treated by epilation of the scalp.⁸ It is our purpose to present a simple and safe method of epilation by x-ray which we have used successfully in over 125 cases.

NATURE OF THE DISEASE

Ringworm of the scalp is also known as tinea capitis or tinea tonsurans. The majority of infections are due to the fungus *M. audouini* and smaller numbers to *M. lanosum* or to trichophyton.

Diagnosis is usually made by clinical and microscopic examination and use of the Wood's light. *M. audouini* is separated from the other organisms by means of culture. Tinea capitis is a disease of childhood and more frequently occurs in boys. It tends to persist until puberty¹⁵ unless cured by topical or x-ray therapy.

The latest epidemic started in this country in the East in 1943. Prior to 1944 the incidence in San Francisco was small. The reported cases in San Francisco school children suddenly increased from 268 in 1944 to 613 in 1945 and 616 in 1946. Since then the incidence has diminished sharply.

CONTROL

Unless a vigorous program of control is instituted, epidemics of ringworm disease tend to continue unabated and to spread rapidly. In San Fran-

cisco ringworm of the scalp is not a quarantinable disease. A child with the disease is readmitted to school upon presentation of a statement from a physician that he is receiving treatment.²

Many public health measures for control of the disease have been advocated, such as detection of cases, isolation of infected children and organization of sanitary regimes in barber shops, schools and theaters.^{7, 14} Treatment of the infected child is either by a physician in private practice or at specially organized treatment centers. The main type of treatment has been topical medication. Salicylanilide ointment has been found to be the most effective medicinal agent. However, a large number of treatments (50 to 100) are usually necessary in order to obtain a cure, and a relatively large percentage of *M. audouini* infections do not respond to topical medication.

Manual and chemical epilation have been used in the treatment of tinea capitis with varying degrees of success. These procedures are apt to be painful and slow and are associated with the dangers of local infection or permanent alopecia. Epilation by means of x-ray treatment has proven to be not only the best and the least dangerous method of epilation, but also the most efficacious in treatment of ringworm of the scalp.

X-RAY TREATMENT

It is difficult to understand why tinea capitis is still a therapeutic problem today when such an effective method of treatment as radiation epilation is available to the medical profession. X-ray treatment has been all too infrequently used because of the fears engendered by the damaging effects of irradiation which sometimes occurred in the period shortly after Roentgen's discovery, and prior to the introduction of a reliable method of dosage measurement.

Calibration of equipment and measurement of the dosage by means of ionization are no longer a problem. However, there are in general use today several methods of x-ray epilation. These revolve around (1) the number of fields or centering points, (2) the size of the fields, and (3) the doses per field.

In an attempt to obtain a uniform distribution of dosage over the entire scalp several overlapping fields are used—usually from three to five.^{1, 4, 5, 6, 8, 10, 13, 15} However, in no method is there perfect uniformity of the dosage. In the Kienbock-Adamson technique where five fields are used, there are two areas on each side of the scalp where three fields overlap and in which the accrued dosage may be two to two and a half times that received at the

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centering points.^{3, 11} In contradistinction to the five-point method, Schreus and Proppe³ have shown that the four-point technique has only a single and smaller area of triple overlap on each side and these areas receive a smaller accrued dosage than is given by the Kienbock-Adamson method. Even though some regions receive considerably greater dosage than others, permanent epilation has been reported in a very few instances where the Kienbock-Adamson technique is used and then only in the triple overlap areas; it has never been reported with use of the four-point method.

AUTHOR'S METHOD

The following is an account of our procedure in handling cases of ringworm of the scalp.

We believe that only cases refractory to topical medication should be treated with x-rays.

Children approaching puberty should not be treated. Rothman¹² has found that a certain component of adult human hair is five times as effective as that found in children's hair in inhibiting the growth of *M. audouini* *in vitro*. This is believed to be the explanation for the spontaneous cures which occur at about 15 years of age (puberty) and why tinea capitis is rarely seen in adults.

Other contraindications to irradiation are severe dermatitis due to infection or chemotherapeutic agents, erythema secondary to ultraviolet rays and previous unsuccessful or successful epilation of the scalp by x-rays.

It is our preference that the patient have the hair clipped, although this is not necessary. If there are heavy crusts on the scalp, these should be soaked off before therapy. A stocking cap should be worn until epilation occurs to collect the infected hairs and diminish the chance of contagion.

The child should be accompanied by a parent in order that his cooperation may be secured more

readily. We have seldom found it necessary to use restraint. Occasionally we have had the parent sit or lie down on the table beside the patient during the first treatment to keep him still.

The apparatus we use is a shockproof x-ray therapy tube which has been calibrated with a Victoreen dosimeter. At 140 KV and 25 milliamperes it delivers 100 r per minute at 40 cm. F.S.D. The HVL is 4 mm. Al or 0.2 mm. Cu.

The four fields are set up as follows:

1. Right lateral: The patient lies on his back with the head turned 90 degrees to the left. The centering point is midway between the frontal hairline and the occipital protuberance. This point usually falls just above the ear (Diagram 1).

A protective lead shield is used to cover the face.

2. Left lateral: similar to centering for right lateral (Diagram 1).

3. Occipital: The patient lies on his abdomen with a sandbag under the forehead and the neck flexed. The centering point is in the midline and is 8 cm. above the posterior hairline (Diagram 2).

4. Frontal: The patient is placed in a well-supported sitting position. The centering point is in the midline and 8 cm. from the frontal hairline. Small lead shields are placed over the eyebrows (Diagram 3).

The central beam is always directed at right angles to the central point of the field being treated.

The treatment factors are 140 KVP, 25 ma, 40 cm. FSD, 20 cm. circle field size, no added filter, 300 r in air per field, and only one field treated per day. The course of therapy is completed within a week.

We treat the four fields in the sequence given above, finding that in this manner it is easier to elicit the child's cooperation so that he will hold relatively still.

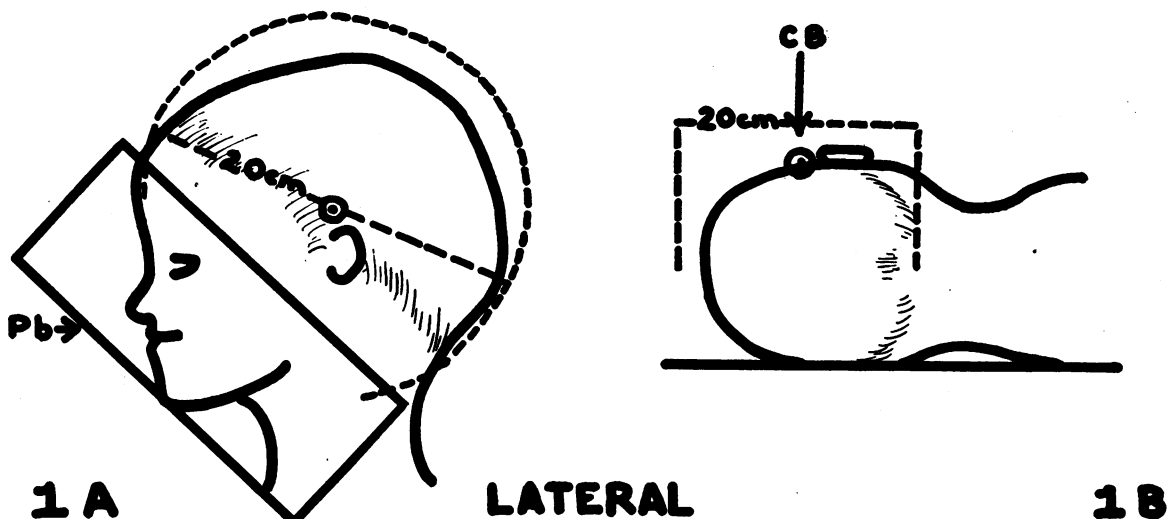
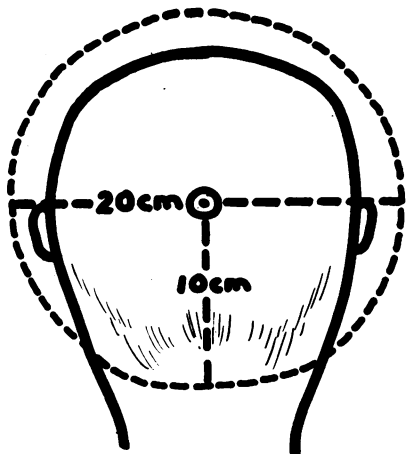
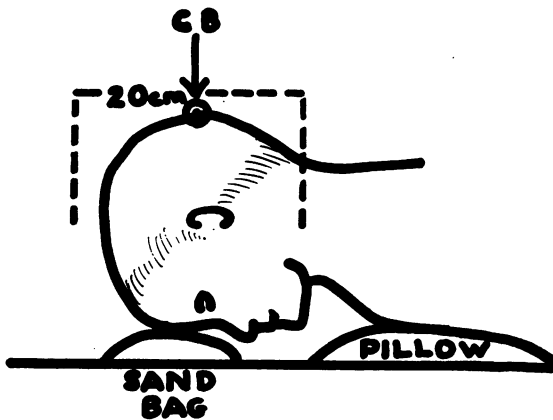


Diagram 1, A and B.—Lateral: Position of the head and direction of the central beam for irradiation of the lateral field(s).



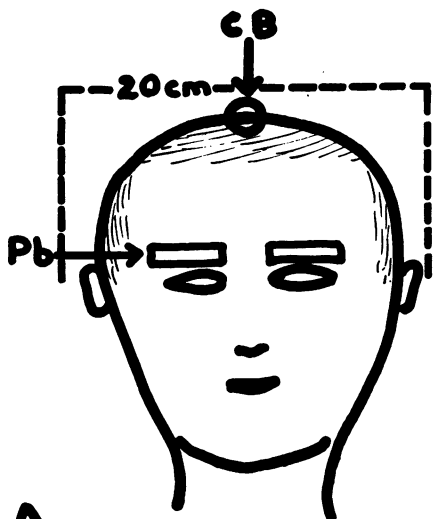
2 A



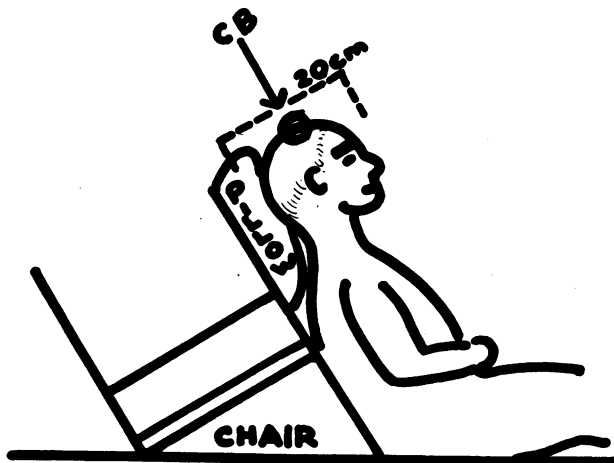
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OCCIPITAL

Diagram 2, A and B.—Occipital: Position of the head and direction of the central beam for irradiation of the occipital field.



3 A



3 B

FRONTAL

Diagram 3, A and B.—Frontal: Position of the head and direction of the central beam for irradiation of the frontal field.

RESULTS OF TREATMENT

The defluvium occurs between the 18th and 26th days following the completion of the x-ray series, and regrowth occurs in from two to four months. Cure of the ringworm is assured if epilation is complete. With incomplete epilation a cure will only be obtained if the few remaining patches are mechanically epilated and fungicidal ointment used until there are repeated negative reactions to Wood's light tests.

In our series of over 125 cases, all of which were treated by the four-point method, cures were obtained in all patients. About 40 per cent of these patients had some residual hair which was removed by their own physicians. This hair was found either

in spotty areas or in frontal or occipital fringes. We do not believe it is advisable to further irradiate the scalp to remove the residual hair.

Two patients had faint erythema following treatment, one a child who originally had a diffuse inflammatory reaction. Several patients had a vague "unwell" feeling, but only three (2.4 per cent) reported troublesome nausea or vomiting during the course of x-ray therapy. Shanks,¹⁵ who also uses the four-field technique, reports a 40 per cent incidence of vomiting after irradiation. This disparity illustrates one of the advantages of not giving all the treatments on one day. Others have reported elevation of temperature and glandular swelling; these did not occur in our series.

The majority of mothers reported no change in color or texture of the hair, but in five instances the new hair was thought to be darker, in three instances lighter, and in three others the hair came back curly.

We anticipate no damaging effects to the brain or pituitary with our technique, inasmuch as we have seen none and none has been reported to date from the many thousands of cases similarly epilated with x-rays.

We believe that our modification of the four-point method offers the following advantages:

1. Preciseness and completeness of description of technique. In practically all of the techniques which have been described to date, there is either a vagueness of the stated factors, omission of one or more factors, or discrepancies in the presentation of the method.

2. Simplicity of application. Regardless of the size or shape of the head, or the age of the patient, the same technical factors are used in all instances. No special frames or other methods of marking the scalp are required. Ordinary care in centering the patient and the field of irradiation is all that is required, instead of detailed linear and angular measurements as in the Kienbock-Adamson technique.

3. Saving of time. There is a saving of the physician's time by the use of four rather than five fields, and positioning is more rapid.

4. Safety. The four-point technique is just as effective as the five- or three-point methods in epilating the scalp and is a safer method than either of these because there is less overlapping of the treatment fields. Furthermore, we have been successful in the use of a relatively small exposure, 300 r in air per field, as also used by MacKee et al., and Molesworth and Riddle, in contradistinction to the 400 r per field advocated by Shanks, and by Schreus and Proppe. The small dosage, plus the fact that we treat but one field a day, probably accounts for the reduced percentage of systemic reactions in our series.

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Discussion by R. R. NEWELL, M.D., San Francisco

In general one should be slow to use x-ray in non-malignant conditions, for it is hard to be sure that no bad effects will follow later, even many years later. However, I do believe that x-ray epilation for intractable ringworm of the scalp is proper treatment, if done right and only once. The five-point technique does give the most even irradiation, but only if the distance is about equal to the diameter of the head (I use 15 cm.), and if the four non-central fields are centered at the edge of the hair. The temptation to center well upon to the hairy portion must be resisted. If the quality of the ray is soft enough, all areas can be treated at one sitting without producing roentgen sickness. Proper dosage (300 r to each field at the quality Drs. Hill and Mottram use) will always leave a few hairs or quite a number. Really complete epilation would make me suspect a dose twice as large as necessary or permissible. Considerable patches of residual hair do not necessarily preclude success in eradicating the disease. Under no circumstances should the scalp be irradiated again.

Discussion by H. V. ALLINGTON, M.D., Oakland

Doctors Hill and Mottram have done a worthwhile job in reviewing the treatment of scalp fungus infection. The time lost from school on its account and the discomfort, embarrassment and expense attendant to it make it an important disease of childhood.

The basic reason for the difficulty in clearing scalp fungus infection is the invasion of the shaft of hair by the fungus and its growth down into the follicle. Thus the infecting organism is protected from and inaccessible to topical medication. Fungicides applied locally probably accomplish little beyond controlling superficial infection and preventing spread.

Cure depends upon the involved follicles being emptied of their infected hairs. Large numbers of these are shed spontaneously and others are loosened and removed in applying medication and shampooing. Reasonably prompt loss of the infected hairs can be obtained in many cases by removal with tweezers, adhesive tape, and/or depilatory wax. Usually the greater the individual's inflammatory reaction to the fungus, the looser are the infected hairs. Thus in a kerion in which intense local allergy develops each involved follicle becomes the center of a tiny furuncle-like pustule from which the offending shaft is sloughed spontaneously.

Other conditions which favor success in treatment with local medication and mechanical epilation are: (1) relatively limited involvement; (2) ability and willingness of

patient and family to cooperate; (3) availability of a Wood's light under which infected hairs fluoresce and are more easily identified.

In other cases little inflammatory reaction is present and the infected hairs may not epilate easily. There may be extensive involvement of the scalp. It may promptly be determined that the child or parents are not going to provide the very necessary cooperation required for success with local medication and mechanical epilation. It is in these cases that epilation by x-rays is most valuable and should be used promptly. In our office we use x-rays in a little over one-third of our cases.

We use the Kienbock-Adamson five-exposure technique. We have celluloid templates with which we mark the five positions quickly and easily. We use a Coolidge tube surrounded by a shockproof shell but with a wide port and no filtration. Our factors are 80 K.V., 5 ma., and an 8-inch distance. We give 300 r measured in air to each of the five areas at one sitting. Epilation is not always complete with

this technique and dosage. There is often some hair left on the occiput at the nape of the neck and at times elsewhere. It is sufficiently complete that usually a minimal amount of manual epilation or none at all is required to complete the cure. We have had no case in which we have had to re-epilate with x-rays, none in which a satisfactory regrowth of hair did not occur, and we have had no trouble with general reaction following treatment. It is our practice to use local fungicidal medication following fall of the hair and during regrowth to care for any superficial infection which might be present and to guard against recurrence.

The satisfactory results which Drs. Hill and Mottram obtain with a technique considerably different from ours show again that there is more than one way to skin a cat.

I should like to emphasize that x-ray treatment is a simple, safe and extremely valuable method of securing the fall of hair necessary in the cure of scalp fungus infection. It is available and should be used without hesitation whenever indicated.

