

EPIDEMIC TINEA CAPITIS: A PUBLIC HEALTH PROBLEM*

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Ringworm of the scalp is caused by several species of fungi; the most common being the *Microsporon audouini*, capable of causing widespread outbreaks, and *Microsporon lanosum*. Other species of fungi causing sporadic tinea capitis are the *Microsporon fulvum*, *Achorion schoenleinii* (favus), and other trichophyton organisms. This paper will deal chiefly with the *Microsporon audouini* infections.

In recent years, epidemic outbreaks of ringworm of the scalp in large city areas, especially in the eastern United States, have been repeatedly reported in dermatological and general medical literature. Little has been written in public health journals and the author believes that greater recognition should be taken by public health officials of the seriousness of this communicable disease.

Incidence

As early as 1899, Dr. C. J. White reported on ringworm as it existed in Boston. Lewis and Hopper in 1939 reported a series of 278 cases observed and treated at the New York Post Graduate Medical School and Hospital during the period between 1935 and 1938. All of these cases were proved by culture. *Microsporon audouini* accounted for 39.3 per cent and *Microsporon lanosum* for 39.6 per cent; together they caused 229, or 78.9 per cent of the cases. Benedeck and Felscher¹ of Chicago reported 140 cases for the period between May 1, 1940, and August 31, 1942. Of this number, 81.5 per cent were due to *Microsporon audouini* and 12.2 per cent were caused by *Microsporon lanosum*. Livingood and Pillsbury⁷ of Philadelphia in 1941 reported a series of 130 cases, 125, or 96.2 per cent of which were due to *Microsporon audouini*.

Lewis, Hopper, and Reiss⁵ reported 312 cases at the New York Hospital from July 1, 1943, to June 30, 1945. *Microsporon audouini* was present in 275 of these cases.

Miller, Lowenfish, and Beattie,¹⁰ at the Vanderbilt Clinic in New York City, reported 928 new cases from January 1, 1943, to May 1,

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1945. Of these, 96.9 per cent were caused by *Microsporon audouini*. In their report it is stated that in 1931, of the 52 cases treated at the Vanderbilt Clinic, 70 per cent were due to *Microsporon audouini* and 30 per cent to *Microsporon lanosum*. In 1944, at this same clinic, 509 cases were treated, 96.7 per cent of which were due to *Microsporon audouini* and 2.5 per cent to *Microsporon lanosum*.

Lewis et al.⁶ reported in 1944 that of the 432 cases occurring in Astoria, New York City, during an epidemic in 1943, 411 were due to *Microsporon audouini*. Statistics at the New York Skin and Cancer Hospital show that during the period from 1935 to 1942, 292 of the 616 cases of tinea capitis reported were due to *Microsporon audouini*. In 1943, of 572 cases of tinea capitis treated there, 496 were due to *Microsporon audouini*.

Carrick³ has reported on an interesting and valuable survey in 1946 among Detroit elementary school children. Of 3565 children selected at random in a city-wide survey, 96, or 2.7 per cent, showed evidence of infection under filtered ultraviolet light. On the basis of total enrollment of children susceptible to tinea, it was estimated that there were about 6,000 cases of ringworm of the scalp among the 220,291 children in Detroit public schools. In this survey, the principal of each of the twenty-one schools of the seven large districts in Detroit selected alphabetically every fifth child under thirteen years of age for examination under Wood's light.

Ringworm of the scalp has an epidemic character and is prevalent and widespread in schools and institutions. Many children with this infection are kept out of school for an average of six months or more. Some cases are cured in six months, but others remain under treatment and out of school for several years.

Epidemics of ringworm of the scalp resulting from *Microsporon audouini* have occurred in Europe for years, especially in France and England. In the United States, sporadic epidemics have been observed and reported, but it was not until about 1942 that widespread epidemics were reported in the large eastern cities. One of the first outbreaks was reported in Astoria, New York City, by Lewis et al.⁶ They felt that the outbreaks resulted from the fact that during the war there were decreased maternal care and supervision, and that infected children were moved from place to place because of changes of residence of their parents who were in the armed forces or were war workers. During this period most of the institutions for children were crowded and had inefficient

supervision. It is also pointed out that the disease was inadequately dealt with by health authorities, partly because of ignorance concerning its epidemiology, lack of experience with the epidemic character of the disease, procrastination because the disease causes no mortality, and the difficulty of carrying out a diagnostic and treatment program of city-wide proportions.

Characteristics of the disease

Ringworm of the scalp is characterized by localized, round, scaly patches of alopecia with short broken-off hair. The fungus invades the hair and hair follicle, multiplies, and progresses down the wall of the follicle. Soon large numbers of mycelia form around the hair between it and the walls of the follicle. The mycelia and spores increase and proceed downward in the hair to the point where the hair bulb begins, the hair papilla which is responsible for the reproduction of new hair not becoming involved. However, the hair will break off at the weakest point, which is the position of greatest parasitic invasion just a few millimeters above the surface of the scalp. The bottom end of the hair is still infected and because it remains in the follicle the infection goes on. As fast as the hair grows upward it is filled with spores and mycelia. Until some means is used to get the whole hair out en masse, or there is developed a vehicle containing the fungicide that can penetrate into the hair follicle, it is practically impossible to cure this disease. The x-ray has fortunately furnished one such means.

The spread of infection to other parts of the scalp and to other persons is easily brought about by thousands of parasites on the smallest piece of hair which breaks off and falls on new regions of the skin or scalp. Infection is readily transmitted from one child to another by the interchange of caps or mufflers, by barber shop instruments, and by the backs of subway and theater seats, etc.

In *Microsporon audouinii* infections little inflammatory reaction occurs around the lesion and only a small percentage of cases show this. Livingood⁷ and others have found that where there is a localized inflammatory reaction manifested by redness, or by pustular or true kerion reaction, the prognosis for cure by local medication is very good. Tinea capitis caused by the animal type fungus, which produces an inflammatory reaction of varying degree, gives a much better prognosis and responds readily to treatment without the need of such intensive therapy as x-ray epilation. The pustular and inflammatory reaction aids in the spontaneous expulsion of the infected hair.

The incubation period of this infection is undetermined, the period of communicability remaining as long as the fungus or its spores can be found at the site of the lesions. Susceptibility in childhood is universal. Reinfection is common and there is no immunity after cure. *Microsporon audouini* infection, known as the human type, is rare after puberty; while adults as well as children are susceptible to the animal type, *Microsporon lanosum*, which is transmitted by contact with the lesions or with the hairs from lesions of cats and dogs.

Prevention and control

Methods for prevention and control include the early recognition and reporting of the disease. Like any other communicable disease, isolation and early and adequate treatment are required of each case to prevent spread of the infection to other areas of the scalp and body of the same individual as well as to prevent its spread to other children. Infected children should be excluded from school until recovery, and in institutions the infected should be separated from healthy children. Each child should use a stocking cap or other type of inexpensive head covering which can be destroyed by burning after use. All home, school, and other contacts with children under fifteen years of age should be examined with suitably filtered ultraviolet light at regular intervals until the source case is completely cured. The health or school department should have available filtered ultraviolet equipment and a nurse trained in the technique of examining the scalp under the Wood light to carry on case-finding activity in the school and among pre-school children in the home. Schools and institutions in epidemic areas should carry out a case-finding program every three months. The examining team should be equipped or have available instruments to take material for microscopic examination and cultures.

Funds should be available to provide adequate personnel and diagnostic and treatment facilities for the early and immediate treatment of infected cases. Educational material describing ringworm of the scalp in simple terms should be given to every parent of school children. Other educational tools should be used in epidemic areas. In *Microsporon audouini* infections x-ray epilation is still the treatment of choice followed by local fungicidal treatment. Such treatment results in the most rapid cure and in the least loss of school time. Precautions should be taken to prevent reinfection after x-ray treatment. Cleanliness of the hair and scalp, and education of the parents and school authorities must be

maintained on a continual basis. The health department should register all cases of ringworm of the scalp to insure prompt and adequate treatment for every infected child. Public health nurses should be available for the follow-up of cases after epilation to insure adequate treatment.

Schwartz, Peck, and other workers¹² have advocated that infected children be permitted to attend school provided they have had their hair cut closely and wear caps while on the school premises and that treatments are given with topical medicaments. In the Hagerstown, Maryland, outbreak which started in 1944, a full-time officer of the United States Public Health Service was assigned to work with the deputy state health officer. He remained in charge from August, 1944, to November, 1945, with a staff assisting him. During that period 8657 children ranging from six weeks to eighteen years of age were examined; 565 children (479 boys and 86 girls) were found to be infected. Of the cases among these children all but eight were due to *Microsporon audouini*. It was found that over 65 per cent of the boys had the infection in the "clipper area." In the treatment program, in which seventeen topical remedies were tried, trained personnel carried on intensive, closely supervised care through daily treatments at clinics. The results achieved among the 493 treated at the United States Public Health Service clinic were as follows: (a) 48 were cured by manual epilation with 1 or 2 treatments; (b) 274 were cured by topical application; (c) 126 discontinued treatment before being pronounced cured; and (d) 45 were under treatment at the close of the study period. Salicylanilide ointment 5 per cent in carbowax 1500 was the most efficacious preparation, and copper undecylenate saturated solution in carbowax 1500 was the most effective topical remedy.

Thallium sulfate for epilation of the hair is not recommended because of the danger of complications. Preparations as recommended by MacKee, Hermann, et al.⁸ at the New York Skin and Cancer Hospital and by Schwartz, Peck, et al.¹² of the United States Public Health Service should be utilized, especially in areas where there is a lack of qualified dermatologists, roentgenologists, and technicians capable of the exacting technique and after-care. In restless and young children and in cases where x-ray treatment is not always successful or advisable, local therapy must be tried. Carrick² used copper oleate, undecylenate-undecylenic acid and propionate-propionic acid as fungicides for 171 cases during the period from October, 1944, to March, 1946, and re-

ported cured cases in about 41 per cent of the total number treated in this manner.

Strickler¹⁴ reports that 64 per cent, or 74 cases of *Microsporon audouini* scalp infection out of 115, were cured with 3 per cent solution of acetic acid in iodine along with a wetting agent.

Mitchell, Story, and MacDonald¹¹ emphasized the importance of the teacher and the school nurse as the first line of defense. They also stressed the need for follow-up of family contacts and for parental education.

Citing as an example an outbreak that was quickly stopped in his community, Gaul⁴ reports that the early recognition of the disease and use of Wood's light will prevent the spread of scalp ringworm in a community.

Criteria for diagnosis should include clinical evidence of the disease, characteristic fluorescence on examination of the scalp with Wood's light, demonstration of the fungi on direct microscopic examination, positive culture in all cases, and identification of the organism.

Criteria for cure should include the absence of clinical evidence of infection, absence of fluorescence when the scalp is examined under Wood's light, and negative cultures for ringworm on any scale or any other likely material which can be obtained. Three negative cultures while the patient is under treatment and three negative cultures while without treatment taken at weekly intervals should be sufficient for the cultural requirements. Any equivalent to this requirement would be satisfactory.

Discussion

Tinea capitis infection is most commonly found among the poor, living in crowded and unsanitary housing conditions. In large families all children become infected, and in institutions and crowded schools the disease spreads rapidly. Many cases are treated topically by general practitioners for months before they are referred to qualified dermatologists or clinics. Many dermatologists, health departments, and schools do not have available Wood's light so necessary for diagnosis and follow-up of the course of treatment. Every large city health department should have available the filtered ultraviolet lamp and should also be able to provide microscopic and cultural diagnostic facilities.

Health officials, nurses, teachers, and others in the field of public health and welfare should become better acquainted with this disease, its course, and its treatment. There is a real lack of knowledge among

private physicians and health workers as to the nature of epidemic ringworm infection of the scalp resulting from the *Microsporon audouini*. The long course of the disease and the ease with which it is spread make this infection a serious one. The cost and time required for treatment, the psychic insults the infected child undergoes, and the long restriction necessarily imposed on his activities are conditions which make early and adequate treatment imperative. Cipollaro and other leading dermatologists in the eastern United States have continued to stress the need for organized public health action in the prevention and control of this epidemic disease.

X-ray epilation followed by local therapy under supervision is the treatment recommended by most authors. Where such facilities and qualified personnel are not available to carry out this method of treatment, the procedure recommended by Schwartz and Peck¹² may be followed. Local treatment with penetrating liquid vehicles or other penetrating bases should be more widely utilized since x-ray epilation is not the ideal method. Immunological and hormonological methods should also be investigated further.

The results of a questionnaire to state health departments in August, 1946, showed that tinea capitis was a reportable disease only in the states of Pennsylvania, Illinois, and Ohio. However, the city health departments of Cleveland, Philadelphia, and St. Louis required the reporting of this disease. In Newark and Jersey City the health officers state that tinea capitis is a public health problem, but the reporting of the disease was not required by regulations or by law. In New York City, where a large number of cases were reported by clinics and physicians, the disease is not reportable. In a public school survey from September 1, 1943, to June 30, 1944, out of 200,000 children examined, 2208 cases were reported, and from September 1, 1944, to June 22, 1945, of 429,933 children examined, 1719 cases were found.

Philadelphia reported 2669 cases during the years 1944 and 1945; St. Louis, 1237 cases in 1945; Jersey City, 600 since 1944; Cleveland, 530 in 1944 and 1945, and Illinois, 1399 in 1945. Reporting was not required by Baltimore, Los Angeles, and New Orleans.

Exclusion of children from school was practiced in Philadelphia, Los Angeles, New Orleans, and New York City, and in the States of Texas and New Jersey.

Although reporting and exclusion from school are recommended by the Subcommittee on Communicable Disease Control of the Committee

on Research and Standards of the American Public Health Association and officially approved by the United States Public Health Service, there is little uniformity of compliance with these recommendations by state and city health departments. Criteria for diagnosis and cure, and facilities offered by health departments for diagnosis, treatment, and follow-up are variable. In order to obtain adequate control and knowledge of this epidemic disease, it is recommended that state and city health departments follow the standards of the American Public Health Association. Only thus can accurate information on the prevalence of the disease become available. Where there are adequate facilities and qualified personnel to carry on a program of treatment and supervision, such as was conducted by Schwartz and his associates in Hagerstown, Maryland, health officials may be justified in allowing infected children to attend school. Otherwise, strict compliance with recommended standards should be followed to obtain maximum control of this epidemic infection of children.

Conclusion

The successful control of epidemics of tinea capitis infection resulting from *Microsporon audouini* will take place when health departments become aware of the need for early diagnosis and early and adequate treatment of every case. The disease should be reportable in every city in the United States having a population of over 100,000 so long as epidemic areas exist in neighboring communities. The filtered ultraviolet lamp, microscopic and cultural facilities, personnel to assist in case finding, diagnostic and follow-up clinics, periodic surveying, and dissemination of educational information about the disease are all necessary services that should be available in every large city. Treatment by qualified dermatologists should also be available, and those individuals who are unable to pay for private care should be treated under government auspices. Communities free of the disease should take active steps to prevent its introduction and to localize any foci that may take place. In epidemic areas separate isolated classrooms for infected children may be found necessary. Health departments that are permitting infected children to attend regular classes without close supervision by qualified personnel and intensive treatment are assuming a serious risk of endangering other children. Tinea capitis caused by *Microsporon audouini* is an epidemic communicable disease and should be treated as such.

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