

Trichophyton tonsurans Ringworm— A New Public Health Problem

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Ringworm infections due to *Trichophyton tonsurans* are becoming an increasingly important public health problem in the United States. Isolations of this fungus from clinical cases of ringworm of the scalp, as well as from ringworm of the glabrous skin and nails, are made more frequently than heretofore in certain sections of the country, especially in Texas and other southwestern States.

Clinical Aspects

Scalp lesions are usually superficial and chronic; the infections can persist for years. The irregular bald patches produced may be small and interspersed with normal hairs (figs. 1 and 2). The indistinct appearance of the lesions, as well as the fact that trichophyton-infected hairs fluoresce very little, or not at all, under the Wood's lamp, makes their detection extremely difficult. Many cases have been mistakenly diagnosed as dandruff or psoriasis (1). In a small percentage of cases, the lesions are more widespread and are characterized by the development of inflammation and even kerion (2).

Hair infections due to *T. tonsurans* are characterized by endothrix parasitism. In scalp lesions, the organism is found almost exclusively within the hair, the spores being arranged in chains (fig. 3). The infected hairs are thickened and darkened by the mass of fungus spores within them. They tend to break off at the surface of the scalp, leaving smooth bald areas with dark hair stumps em-

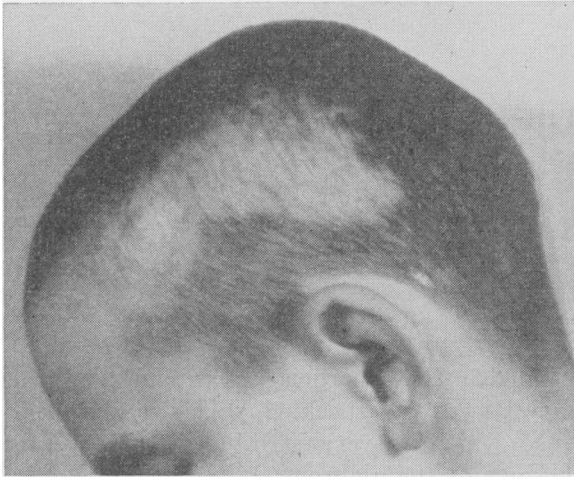
bedded in the superficial scales (fig. 2). This gives the area a speckled, "black dot" appearance which is very striking in some cases. Lesions of the glabrous skin and nails are indistinguishable from ringworm produced by other *Trichophyton* species.

Infections due to *T. tonsurans* apparently are always derived from human sources, and it is difficult to infect an experimental animal. Although the majority of scalp lesions occur in children, the infection does not, as in microsporiasis, tend to disappear at puberty but may persist into adult life. Infections are usually not epidemic but they may spread to all members of a family (1). Scalp lesions are, in general, refractory to conservative treatment, and roentgen ray epilation is considered the treatment of choice.

Laboratory Diagnosis

Diagnosis is based on direct examination of NaOH preparations of the hair stumps, removed with a fine forceps or the point of a scalpel, or of scrapings from lesions of the skin or nails. The position of the fungus mycelium and chains of spores packed within the hair is evidence of infection by an endothrix trichophyton. In order to observe the true position of the fungus, the outer walls of the hair should not be damaged. Therefore, care must be taken not to crush the preparation or to apply excess heat in clearing it. Only two recognized dermatophyte species found in the United States produce this picture in the hair, *T. tonsurans* and *T. violaceum*. The latter species is extremely rare and its colonial characteristics allow it to be readily differentiated from *T. tonsurans* (3). NaOH mounts of skin and nail

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Courtesy of Dr. E. R. Seale, Houston, Tex.

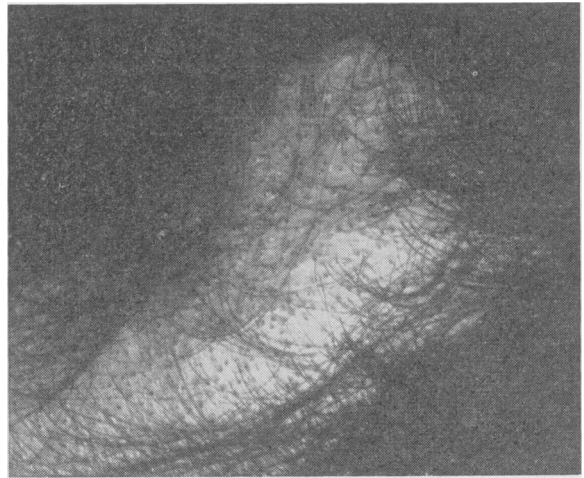
Figure 1. Typical nonsuppurative lesion produced by *T. tonsurans*.

scrapings reveal mycelia and arthrospores which are indistinguishable from those of any of the ringworm fungi.

Only by culture of the infected hairs, skin, or nail scrapings can the identity of the etiologic agent be determined. *T. tonsurans* grows readily on Sabouraud's dextrose agar, producing a colony which is characteristically heaped and folded in various patterns. The surface is usually finely powdery and may show a wide range of pigmentation from white to tan, or shades of rose, violet, or yellow. One variety, which is particularly common in this country, has sulfur-yellow pigment and is known as the variety *sulfureum*.

Microscopic observation shows long, septate hyphae that are often highly irregular and varying in thickness. Some of the thick mycelium may have a knobby surface. Microconidia are numerous in the powdery surface growth of the colony, appearing as large pyriform or elongate spores that develop along the sides of the mycelium or in loose clusters. They are extremely variable in size and shape and in some instances are two-celled or appear to be budding. Macroconidia are only occasionally found and are thin-walled, slightly clavate or club-shaped, abortive structures usually of only two or three cells. Old cultures show masses of chlamydospores.

The literature lists *T. tonsurans* under many names in the "crateriform group of the endothrix trichophytons." The most common syno-



Courtesy of Dr. J. L. Pipkin, San Antonio, Tex.

Figure 2. Close-up of a lesion showing "black-dot" appearance.

nymys are: *T. crateriforme*, *T. sulfureum*, *T. acuminatum*, *T. epilans*, and *T. sabouraudi*. According to Carrión and Silva (4) and González Ochoa and Romo Vázquez (5), it seems logical to consider these as colonial variants of the single species *T. tonsurans*, since the differences are based only on general colony form and pigmentation. Colony form, particularly the manner of the surface foldings, and pigmentation are highly variable within any of the single dermatophyte species. Figure 5 shows four common colonial variations of *T. tonsurans*.

Epidemiology

For the past 8 to 10 years, the common agent of ringworm of the scalp in the United States has been *Microsporum audouini*, and this organism has been responsible for widespread epidemics in many communities. In some sections of the country it is the cause of 80 to 90 percent of the cases of ringworm of the scalp (6). In Mexico and Puerto Rico, however, *M. audouini* infections are rarely seen, and a large percentage of the cases are due to the endothrix fungus, *T. tonsurans*. In a survey of cases of ringworm of the scalp in Puerto Rico, Carrión and Silva (4) reported that 15 of 35 cases seen over a period of 11 years, or 40 percent, were due to *T. tonsurans*. No cases of infection due to *M. audouini* were reported. González Ochoa and Romo Vázquez (5) have described 268 cases of ringworm of the scalp from Mexico. They

ascribed 89.4 percent to *T. tonsurans* and none to *M. audouini*.

T. tonsurans infections have been thought rare in most sections of the United States. A number of cases have been reported from several of the eastern port cities, particularly New York City, but here the percentage of tinea capitis cases caused by *T. tonsurans* was never high. Lewis and Hopper (3) reported only 13 from a series of 748 cases seen over a period of 6 years, or approximately 1.7 percent. Montgomery, Heinlein, and Karpluk (7) listed only 0.2 percent in a series of 2,857 cases of tinea capitis seen over a period of 7 years, and Benham (8) cited 0.8 percent in a series of 677 cases seen from June 1949 to June 1950. My personal observations of cases of *T. tonsurans* infections seen at Vanderbilt Clinic, New York City, indicated that these infections commonly occurred among Puerto Ricans who had recently immigrated to the United States. Scattered cases have been reported from Illinois (9), Pennsylvania (1), Massachusetts (10), Tennessee (11), Michigan (12), a case with lesions of the smooth skin only, Minnesota (6), Missouri (2), Oklahoma (13), and Cali-

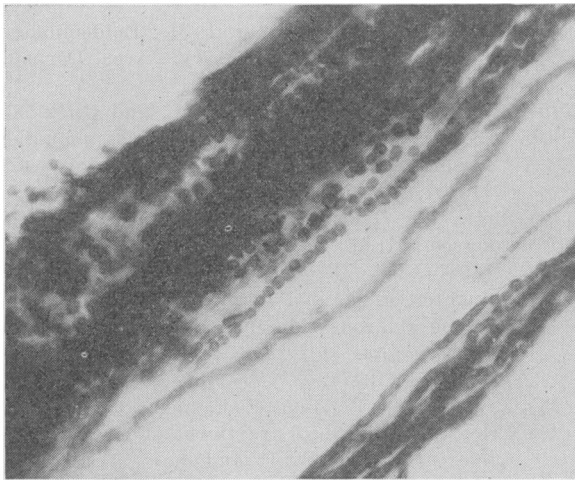


Figure 3. Hair showing endothrix invasion.

fornia (14), and recently the mycology laboratory of the Communicable Diseases Center has received cultures of *T. tonsurans* for identification from Indiana, Iowa, Massachusetts, Virginia, and Canada.

In contrast to these occasional isolations, relatively large numbers of cases have been reported

from Texas, and the number of cases has been increasing in the past few years. Lehmann and Pipkin first isolated *T. tonsurans* from the San Antonio area in 1927. In 1936 and 1937, these authors, in collaboration with Emmons, conducted an extensive survey of tinea capitis in this locale. At that time, approximately 13 percent of the cases seen were proved by culture to be due to this fungus (15). Pipkin, in a recent



Figure 4. Microscopic mount from a culture of *T. tonsurans* showing morphologic variation of microconidia and two abortive macroconidia.

communication, states that since this time he has seen constantly increasing numbers of cases of ringworm due to *T. tonsurans*. From 1947 through the first 9 months of 1951, he and his co-workers observed 592 cases of tinea capitis. Of these, 120, or 20.3 percent, were caused by *T. tonsurans*. Many of these cases of ringworm of the scalp recorded from Texas have been in adults. Of 57 cases of ringworm of the scalp in patients past puberty reported by Pipkin (16)—39 in adults and 18 in adolescents—42 cases were due to *T. tonsurans*. Seale (17), of Houston, also reports having seen a high percentage of ringworm cases caused by this fungus. Of 153 cases seen over a 2½-year period, 31, or 20.6 percent, were caused by *T. tonsurans*. He states, "There is no doubt that *T. tonsurans* infections are on the increase in this area."

Recently Livingood (18), of Galveston, has furnished us with statistics on the number of cases of *T. tonsurans* infections he has observed

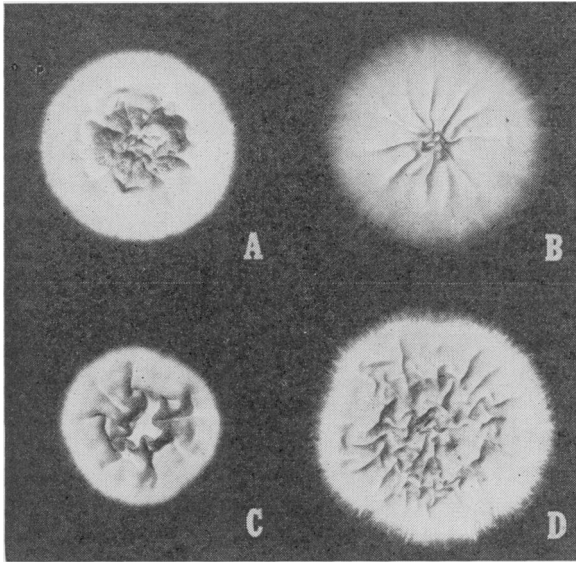


Figure 5. Colony variants of *Trichophyton tonsurans* on Sabouraud's dextrose agar. A. Variety *acuminatum*; B. variety *sulfureum*; C. variety *crateriforme*; D. variety *cerebriforme*.

in Galveston county. Of 82 patients who had tinea capitis, 56, or 68 percent, were due to this organism. Of these patients 44 were Latin-Americans. Livingood and Walton (19) have

begun a careful survey of the schools of Galveston county, and their preliminary findings suggest that *T. tonsurans* infections are not uncommon in the school children, especially in Negroes and Latin-Americans. In a Negro school in the city of Galveston, four cases were found among 146 children. In other schools in Galveston where both Latin-American and Anglo-American children attend, the percentage infected with *T. tonsurans* was considerably less. Eight cases were seen among 790 children examined. In this school survey, the children infected were either Negroes or Latin-Americans, with one single exception.

Since Mexico is an endemic area for *T. tonsurans* infections (5), it seems probable that the disease has been spreading into Texas and the southwestern States from this area. It is possible that *T. tonsurans* may produce a widespread epidemic in the school children in the United States in a fashion similar to that of epidemic ringworm due to *M. audouini*. The problem would be more difficult, however, because the infections occur in both children and adults. They are more difficult to detect and usually are more refractory to treatment.

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