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A Contribution to the Study of
Mycetoma of the Foot as it occurs in
America.

BY

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DR. HYDE'S CASE OF MYCETOMA.

A CONTRIBUTION TO THE STUDY OF MYCETOMA OF THE
FOOT AS IT OCCURS IN AMERICA.*

By JAMES NEVINS HYDE, A. M., M. D., AND NICHOLAS SENN, M. D., PH. D., LL. D.,
WITH REPORT BY DR. D. D. BISHOP, OF RUSH COLLEGE PATHOLOGICAL LABORATORY.

ON the 26th of September, 1894, W. O. H. was presented at the Surgical and thence referred to the Dermatological Clinic of Rush Medical College. He gave the following history: His parents were both living, though his mother was suffering from some renal affection. Four brothers and four sisters were living, in good health. Three children died in infancy from some cause unknown to the patient, none surviving the first year of existence.

The patient was born in America, seven years after the immigration of his parents from Bohemia, and before his present journey never had traveled outside of his native State. He was twenty years old, a student of dentistry, using tobacco and beer in moderation, and with no venereal antecedents. He weighed one hundred and forty-five pounds, was in general good health, and his functions were all fairly well performed. There were, in fact, no indications of disease beyond the morbid condition to be recognized in one foot.

The present disorder began thirteen years previously, when the patient was seven years of age. At this date he became very fond of wading barefoot with his companions in the Cedar River, near his place of residence in Iowa. At this period of his life he spent most of the summer days thus engaged. Soon after, he noticed a hard nodule, which formed within the skin of the sole of the left foot, and which very gradually spread till an area was involved of the size of a half dollar. This spot was cauterized with nitric acid, and then disappeared for a few years, but later returned and gradually spread till, as now, the anterior third of the left foot was extensively involved in a

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deformity with tumefaction. The disease is productive of little pain, and he is able to use the foot in locomotion to a surprising extent, considering the degree of its uselessness.

He has been seen by a number of physicians and surgeons, some pronouncing his case one of tuberculosis; others naming it sarcoma. The treatment thus far has been purely local, including the use of iodine and sulphuric and nitric acids. These have proved of no value.

When examined, the anterior two thirds of the left foot were seen to have been converted into a shapeless mass, the tumefaction involving the toes and the dorsal and plantar tissues. The deformity was most marked over the dorsal surface. The mass of morbid tissue represented a bulk considerably larger than that of the normal foot and terminated abruptly and by a well-defined line near the articulation of the metatarsal bones with the tarsus. (See colored plate.)

The tumefied mass had a boggy consistence when handled, and its surface was very irregularly beset with tubercles or, better, fungoid projections from the irregular surface of the infiltrated skin. Each individual papilliform mass was tunneled by one, occasionally by several, fistulous canals, which passed beneath to a softish tissue, the probe not encountering through these channels what seemed to be osseous structure. The greater number of these warty projections varied in size from a small pea to that of a large bean, and were elevated at a corresponding height above the general level. They were massed at the proximal rather than the distal portion of the foot, but were yet irregularly scattered over all its involved surface. A puriform secretion could be expressed from the orifices of some, but none furnished an exudate which might be compared with fish roe, or which had any suggestion of blackness in its color. In fact, the lesions remarkably resembled the small mounds through which the crayfish digs a tunnel, the orifice of which is apparent at the center of his tumulus of earth.

In the present case the central canal perforating the axis of each tubercle or papilloma often seemed blocked by flabby granulations springing from the walls of the excavation. These masses were, however, much softer than the nodules of hypertrophic lupus, and readily admitted an exploring instrument to the fundus of the fistulous excavation. The general color of the diseased portion of the foot was rather grayish than of an inflammatory hue.

The proximal limits of the disease were fairly well defined both on the plantar and dorsal surfaces of the feet at the level of the tarsal extremities of the metatarsal bones. The involvement of the inner as

contrasted with the outer face of the foot was marked. Thus the big toe and the adjacent digits were, both on the interdigital, the dorsal, and the plantar faces, much more extensively involved than the little toe and the digit adjoining; and over the inner part of the foot thus outlined the lesions were larger, some of the size of a coat button and more closely set together. The sinuses here were also more obvious, each leading down to the depth of an inch or more to the fascia and sheaths of the tendons beneath. The abnormal convexity of the sole of the foot was distinctly marked. This was most evident in the regions of involvement, the effect being somewhat visibly increased as the result of overuse of the posterior portion of the foot in locomotion. There was hence some swelling of the part of the sole not beset with tubercles, this condition extending slightly upward at the heel as far as the insertion of the tendo Achillis. The nails of the toes were in a gryphotic state, this also most marked in the nails of the first two toes.

Reservation was made respecting the question of diagnosis till microscopical examination of the tissues had been completed, the attention of the class present being directed to the strong resemblance of the member to Madura foot, due reserve being made in view of the fact that the subject of the disease was a native of America and had never visited another country.

A piece of the morbid tissue, having been excised, was submitted to examination. Two guinea-pigs were also inoculated with material taken from a discharging sinus, the result being that one died in the course of four days, the autopsy revealing nothing as to the cause of death. As we have since discovered that the effective fungus of the disease is deeply buried beneath granulation tissue, we think no inferences can be drawn from these facts.

The patient after this experience returned to his home and in the course of a few weeks came again to Chicago and underwent amputation of the leg in the lower third by Dr. Senn. We examined him with care about eight months after the date of the amputation, on the 14th of June. At that time he was a picture of sound health, and was walking with ease by the aid of an artificial limb.

The amputated member was examined in the Bacteriological Laboratory, Dr. Bishop subsequently reporting on the pathological conditions present as follows:

Gross Appearances.—Distributed over the dorsum of the foot, particularly the tarsal and metatarsal regions, the toes, and to a less extent upon the plantar surface, numerous spongy nodular projections, half pea to hazelnut in size. Most of the nodules show one or more openings at their summits.

Section through the nodules and underlying part brings to view a spongy reticulated tissue, fairly well circumscribed, at times having a rather dense fibrous wall. These collections of spongy tissue are easily traceable down to the periosteum of the underlying bone. The periosteum is very much thickened, but at certain points presents a reticulated appearance, identical with that observed in the softer tissues.

Longitudinal section of the first metatarsal bone brings to view two small rounded areas, one the size of a pea, the other slightly larger, both filled with a whitish, granulationlike tissue. These collections are surrounded by a firm fibrous capsule which is easily separated, leaving a smooth-walled cavity in the bone. They are situated just beneath the periosteum and communicate with the reticulated meshwork in the latter. The rest of the osseous structure appears more spongy than normal.

On pressure over the soft tissues, numerous whitish, small pinhead-sized bodies escape from the meshes of the reticulum; and scraping of the whitish collections in the bone removes similar bodies.

Microscopic Examination.—One of the smaller and presumably younger nodules, with no demonstrable external opening, was hardened in alcohol, imbedded in celloidin, cut, and stained with Delafield's hæmatoxylin and aqueous eosin solutions. The general appearance given by such sections is that of rather active inflammation. As to the epidermis, the intercellular spaces, especially in the superficial layers (but in places reaching into the rete mucosum), are considerably enlarged. Here and there are widely open spaces in which the rete cells are drawn out into long strings. Granular deposits in these spaces are often seen, suggesting the presence of a serous exudate. Leucocytic infiltration between the epidermal cells has also taken place. The membrana propria seems undisturbed.

In the derma, and more deeply situated, are bodies having a ray-like appearance; these were found in all the nodules examined (Fig. 1). These bodies consist of more or less rounded masses, often having a scalloped border. They occur singly and in groups. In all there is a central area which stains faintly with hæmatoxylin; surrounding this, a zone which also stains deeply with the same dye; and outside of all, a narrow margin staining with eosin only. These three divisions of the fungus may be called, as suggested by Kanthack, in his description of mycetoma, the central area (1, Fig. 2), the marginal zone (2, Fig. 2), and the radial zone (3, Fig. 2).

When examined with an oil immersion, $\frac{1}{12}$ inch lens and No. 3 eyepiece, Leitz, the central area appears granular, but shows a few delicate filamentous threads, resembling long, slender bacilli, having

an obscure radial arrangement. In the marginal zone are seen numerous long, deeply staining threads, having a distinctly radial arrangement. These are also very slender and stain best at the periphery, giving the appearance of a fine mycelial network. The radial zone is separated from the marginal zone by a narrow space, which stains scarcely at all, and which appears in the main to be granular (6, Fig.

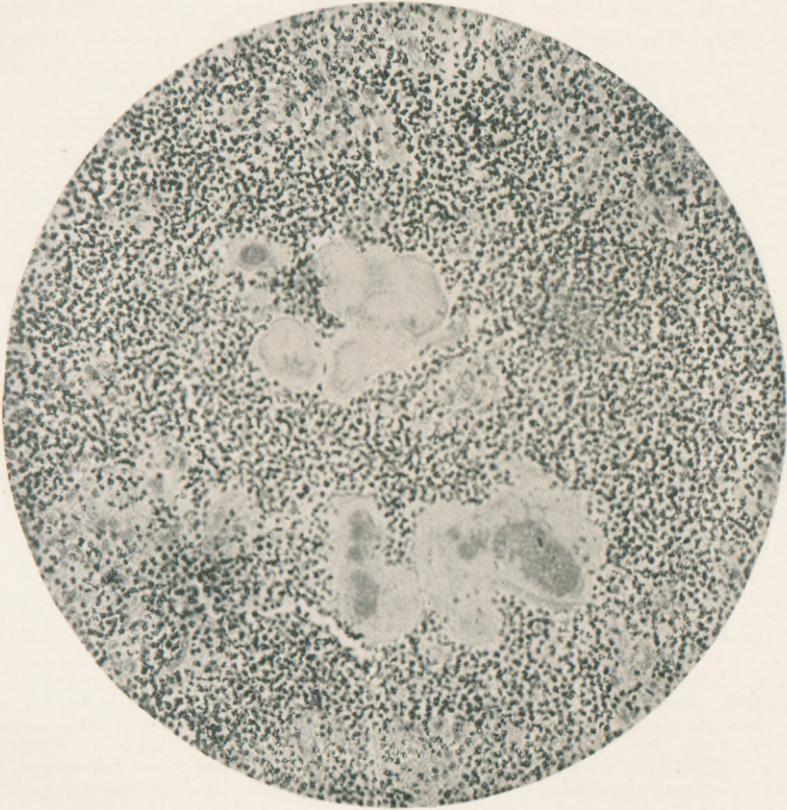


FIG. 1.—Photomicrograph to show groups of organisms and surrounding leucocytic infiltration, from a section stained faintly with eosin and hæmatoxylin. Spencer half-inch, Zeiss projection ocular 4, $\times 200$.

2). A few delicate threads, however, may be traced through this light area, connecting the marginal and radial zones (8, Fig. 2).

The radial zone, when observed with a Zeiss apochromatic 2.0 mm. eyepiece 8, appears granular in most of the sections, but in well-prepared specimens one can make out distinctly radiating lines, giving an appearance of more or less wedge-shaped bodies closely packed

together, with their broad ends presenting peripherally. These radiating lines, suggesting in appearance the rays of actinomyces, are, it is true, difficult of demonstration; but after a careful study of a large number of specimens I am convinced of their presence. Most of the features here described are shown in the carefully executed drawing forming one of the illustrations of this paper, and made by Dr. E. R. Le Count, of the Rush Pathological Laboratory.

Careful search failed to disclose the presence of any of the larger club-shaped bodies described in connection with such fungous growths,

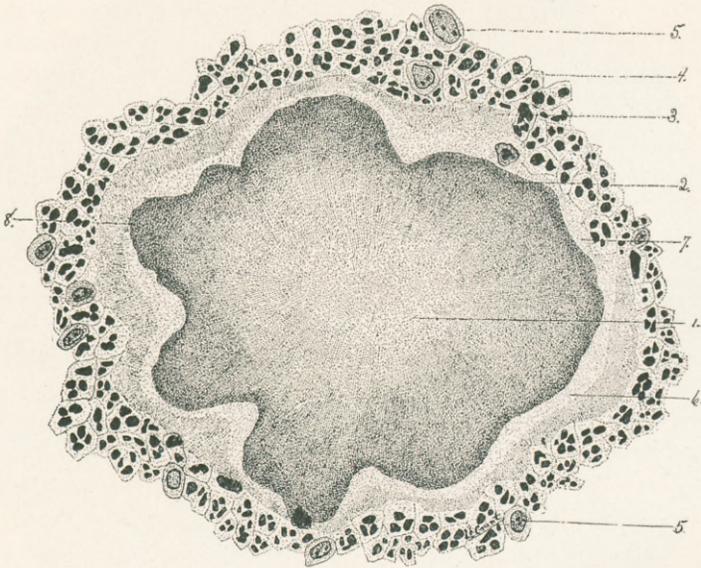


FIG. 2.—Drawing of a single micro-organism and zone of leucocytic accumulation. Camera lucida, diameters 810, reduced one third; objective, one-twelfth-inch oil immersion, eyepiece III (Leitz). Specimen fixed in Flemming's solution and stained with aqueous methylene blue. 1. Central area. 2. Marginal zone. 3. Radial zone. 4. Polynuclear leucocytes. 5. Embryonal cells. 6. Light area between marginal and radial zones. 7. Point of invasion of radial zone by leucocytes. 8. Mycelial threads extending across light zone (6).

nor was I able to demonstrate any branching of the mycelial threads. Again, no distinct evidences of segmentation were observed; in specimens, however, prepared by Weigert's fibrin stain, the radiating filaments appear as rather long bacilli, now and then meeting at their ends, suggesting a division of such threads. The same appearance was noted by Kanthack in his sections, stained with a modification of Gram's method, but it was looked upon by him as an effect produced by the method employed.

The Tissue Changes.—Immediately surrounding the fungus is a wide zone of deeply staining polymorphous nuclei, plainly leucocytes (4, Fig. 2). In sections from the larger and presumably older nodules, these cells are seen to have involved the radial zone (7, Fig. 2). The surrounding tissues show numerous newly formed blood-vessels; other better formed vessels distended with blood-corpuscles are seen, and in many a well-marked proliferation of endothelia has occurred. The vessel walls are often infiltrated with proliferating connective-tissue or endothelial cells. Leucocytes and epithelioid cells are also abundant in the rather large connective-tissue spaces. Here and there giant cells are seen, at times with peripherally arranged nuclei like those of general occurrence in tuberculosis; again, other forms are seen in which the nuclei are more diffusely distributed throughout the cell body. Granular material staining with eosin, so commonly present in œdematous tissues, is often present in the connective-tissue spaces. The connective-tissue fibers are apparently increased in number, but there is no encapsulation of the fungus.

Microscopic sections through the larger nodules show sinuses lined with granulation tissue extending down to the abscesslike formations. Serial sections failed to demonstrate any relationship between the growth of organisms and the blood-vessels. None of the individual filaments or rays was seen in the tissues remote from the main growth. With Weigert's fibrin stain the mycelial threads were deeply colored, appeared rather broader than with the other dyes, and as before shown were broken into short segments. With Gram's stain they were decolorized. Flemming's hardened sections stained with aqueous methylene blue brought out the mycelial threads very clearly; safranin was also successful, but none of these basic dyes stained well the radial zone.

Although the tissues were examined carefully in the fresh state, the fish-roelike particles described as occurring in mycetoma were not seen; numerous small whitish bodies, already described, were easily pressed from the cut surface of the lesions, but these were never larger than a small pinhead. When carried to a slide and mounted in the preservative fluid or washed with water and soaked in liquor potassæ these small bodies appear under the microscope as rounded objects with a mulberrylike surface. The center of these bodies is dark and granular, but the surface is covered with a more transparent coating in which an obscure radial striation can be demonstrated. The same appearances were seen in similar particles removed by scraping the granulations in the bone. In none of these, however, were typical clubs seen.

Reviewing the appearances as a whole, we find surface nodules and infiltrating deposits in the deeper tissues and bones, composed of granulation tissue, containing here and there organisms in which mycelial filaments are easily demonstrated, and possessing indistinct rays arranged around the periphery. The general characters of the organism resemble those seen in actinomycosis, but correspond more closely to those described in mycetoma.

The pathological study of mycetoma is almost limited, as to time, by the experience of the modern disciple of dermatology. The fungus originally recognized in the black variety of Madura foot by Vandyke Carter was by him later regarded as probably identical with actinomycosis, and to which the disease was then attributed. Less than ten years ago Ponfick, Crookshank, Kanthack, Hewlett, Boyce, Vincent, and others began to investigate this remarkable resemblance. As, however, this resemblance was more clearly recognized, the noteworthy differences between the two diseases have become accentuated, the result to-day being some little confusion. No attempt can be made, based upon the results of examination of a single case, to decide definitely on the question of the identity or absolute diversity of the two maladies under discussion. The subjoined points of distinction, however, are fairly well illustrated both in the literature of the two diseases and in the examination of the case here recorded. Some of them have been already formulated by Surveyor.

Madura foot is apparently a purely local disorder; in the many cases on record no history occurs of cervical or thoracic complications as in actinomycosis; mycetoma chiefly attacks the feet and hands, occasionally the ankles and knees; in India, where it is prevalent, actinomycosis is almost unknown; and the commoner cervical localizations of actinomycosis are never the sites of mycetoma. There are no black, red, and white (or pale) varieties of actinomycosis as in mycetoma, though upon this point it is to be admitted that there is a possibility that the appearance of the black grains in one variety of Madura foot is due either to an accidental change in the fungus, or, as has been suggested, to a double infection.

Respecting the fungus of mycetoma and that of actinomycosis the following differences are set forth by Surveyor and Boyce: actinomyces grows readily in a hydrogen atmosphere; the fungus of mycetoma grows in such an atmosphere, but only with exceeding slowness; it also differs in the rapidity with which it takes up aniline stain.

The following unsettled points indicate how far we are at present from understanding the exact nature of these diseases and their mutual

relations: (1) There is no agreement as to what constitute the differences between the white (or "ochroid"), the red, and the black varieties of Madura foot. These different clinical symptoms, it is to be noted, are never in any one instance commingled, so that the granules at one time black are at another red or white. (2) In some cases where the fish-roelike particles have been surgically evacuated from sinuses existing in unquestioned subjects of Madura foot, no fistulous tracts have opened externally to the outer surface of the skin. In several unmistakable cases of Madura foot, where no doubt existed as to the clinical symptoms, no fungus whatever has been detected.

Aside from the light thrown upon the nature of the morbid process by microscopical examination of the tissues, the gross appearances of the organ in the case here described were certainly such as to suggest at a glance the familiar outlines and special deformity of the Madura foot. The involvement of a single foot, the mamelonated projecting tubercles, each tunneled to a sinus extending to the deeper tissues, and the thin character of the discharge from each, were all of classical type. Exclusion of the black variety of podalcoma was readily effected on a first examination.

The history of this case is nearly in the line of those of a similar sort thus far recorded. The exposure of the bare foot to the sources of the disease by wading in watercourses, the slow onset of the malady, at first localized in a minute nodule in the sole, and the chronic evolution of the disease in years are noticeable features. The period of time required to produce the degree of deformity present in this case, viz., ten to thirteen years, is less than others on record in which twenty and even thirty years have elapsed before the subject of the disease came under observation. In the present case the bulk of the foot, though much less than in some of the formidable cases seen in India, presents a deformity of the dorsum and sole in strict conformity with the outlines usually recognized in Madura foot. Its occurrence in the male by preference can, I believe, be satisfactorily explained by the more frequent exposure of barefooted men in the beds of watercourses, though the disease has been also produced by tramping with the bare feet in the fields, and the traumatism of these members by thorns.

The commonly accepted title of the Indian disorder, viz., Madura foot, has perhaps contributed to the general belief that the disease exists in India only. Cases, however, are on record of its occurrence in Africa, in Syria, in Europe, and in other countries.

The only recorded instance of the production of Madura foot in America accessible when these pages were first written was that given

by Kemper, in the *American Practitioner* of September, 1876. One of us (J. N. H.) has published briefly detailed observation of a case of podelcoma occurring in the practice of our late colleague, Prof. Charles T. Parkes, of Chicago. During his lifetime these details were obtained from a verbal description of the symptoms exhibited by the patient, and the features of the disorder were without question those of true mycetoma. As the subject of the malady, however, had been a resident of India, the case has no bearing on the history of Madura foot in America. A brief abstract of Kemper's case is subjoined for the purpose of comparison :

The patient was a native of Ohio, twenty-four years old, and by occupation a clerk. There was no history of venereal disease. In December of 1875 the right foot became swollen, reddened, and painful, this condition persisting till the following April, a period of but four months, and it is noticeable that in three weeks from the date of the onset of the disease there had been involvement of the entire sole.

Subsequently "blebs" appeared, in number five or six, and ranging in size from a split pea to lesions with a diameter of half an inch. Each bulla had a centrally situated opening from which issued a non-purulent, foul-smelling secretion, resembling the white of an egg. Gradually ulcers formed and spread by extension till they were separated only by bridges of undermined integument. They finally fused until a single large ulcer formed on the inner side of the foot, with two smaller and similar excavations in the neighborhood.

The subsequent history is chiefly descriptive of the intense grade of pain experienced by the patient, and the exquisite sensitiveness of the affected foot which resented the slightest degree of pressure. Hypodermic injections of morphine and even anæsthesia were tried without effective results. On the 16th of June, six months after the onset of the malady, relief was secured by amputation, and this was followed by satisfactory healing of the stump.

The report of the gross and microscopical appearances includes a description of a "white, fluffy substance" visible to the naked eye upon the surface of the ulcerations. The fistulous channels were found to lead to muscular tissue. Microscopically, rough, irregularly outlined, yellowish, and refractive granular bodies were recognized, and these were supposed to be the spores of a vegetable fungus.

In the following points it will be seen that the symptoms given above are wholly different from those of mycetoma as it is described by Indian authorities :

1. The process was manifestly of an acute type both in the matter of time and of severity of symptoms. In a series of recently reported

Oriental cases none exhibited any characteristically developed deformity in so brief a period of time as three weeks, and none had advanced to a state requiring surgical interference in six months. 2. The pain experienced by Kemper's patient is wholly absent in the enormous majority of all Indian cases. The subjects of the disease are usually found pursuing their vocations, and consent to removal of the offending organ chiefly because of its bulkiness and unwieldiness. In the case of our patient, locomotion by the feet had been steadily practiced for years, and he informed me after the amputation and the adjustment of an artificial limb, that with this member he walked no better than with his tumefied foot, the chief advantage of the former being its appearance. 3. In Kemper's case the external lesions are described as bullæ surmounting sinuses, a description consistent with the acuity of the process illustrated by other symptoms. In most of the subjects of mycetoma, however, the lesions are of the order of those recognized in the Iowa patient—viz., tubercles, nodes, warty and papillomatous elevations of the surface, indolently formed and scarcely changed for years after the central channel has penetrated to the deeper tissue. 4. The occurrence of distinct ulceration in Kemper's case, and the relatively rapid extension of the destructive process, as a result of which fusion of contiguous ulcers occurred, forming thus a large loss of continuity, are rare features when the foot is involved in mycetoma. Lastly, the occupation of the subject of the disease was not such as to render it probable that he had exposed his bare feet to the sources of the disease. Kemper's patient was a clerk, and the acuity of the symptoms forbids the supposition that he had been affected for years before the onset of his malady. Some, however, of the Oriental subjects of the disease pursued occupations usually practiced within doors in this country but in other lands often in the open air—as, for example, barbers, weavers, shoemakers, and blacksmiths.

In view of the facts detailed it would seem that, apart from the failure to recognize radiating hyphæ in the tissue examined, Kemper's case can only with great reserve be accepted as an illustration of mycetoma occurring in America.

The following conclusions are based upon a study of the case here described, as well as upon reports of Indian observers published within the last two years :

There are clinical symptoms of mycetoma which are to be recognized in some cases and not in others. These may be termed non-essential features of the malady. They are: (*a*) the appearance of blackish or reddish granules of pigment, free and within the cells furnished by the secretion; (*b*) the discovery of particles resembling the

roe of fish, either expelled from the sinuses or imprisoned within the unbroken surface of the skin; (*c*), the occurrence of sinuses leading from without inward as far as muscle, tendon, or blood-vessel. Cases of unquestioned mycetoma are on record where none of these features was exhibited.

The constant symptoms of the Madura foot are practically reduced, then, to a characteristic deformity of the affected part, predominantly the foot, and in men; but also the hand, shoulder, knee, and a few other regions in the two sexes, and the discovery of a radiating fungus. With the deformity there is a tolerably constant history of a slowly progressing involvement of the tissues; and, when the feet are affected, of exposure of the subject of the disease barefooted, in the beds of watercourses or in the open fields. There is further a notable absence of complaint of pain, of occurrence of relatively acute symptoms, and of the accidents commonly complicating elephantiasis of the lower extremities, such as, for example, recurrent attacks of lymphangitis, of erysipelas, of eczema, or of furunculosis.

The essential microscopical features of the disease in its several forms can not be classified accurately in the present state of our knowledge of the subject. There should be recognized a septate vegetable fungus set in granulation or necrotic tissue with a number of unusually large giant cells which seem to be exercising a phagocytic effect upon the intruder. The several forms displayed by the vegetable growth, in consequence of its highly pleomorphic variability, differ not only in different cases, but in different stages of development, and in different infected animals. It is this feature which up to the present time seems to have furnished such widely different pictures that it is not to-day known whether actinomycosis and the several varieties of mycetoma are produced by one or more varieties of a single fungus or by wholly differing organisms.

In well-marked cases of mycetoma there is usually a central body or mass made up of semilunar or reniform bodies, traversed by a network of mycelium. The hyphæ exhibit the widest variation, being at times long and slender; at others, short and "dwarfed"; and again spherical in shape rather than elongated. In other cases no mycelium can be recognized. The "clubs," of which so much has been detailed by the earlier writers, are often wholly wanting, and at other times are evidently rudimentary as to their formation. They are believed to be produced by the reactionary processes of the tissue against the presence of a foreign element—the process, in fact, which accounts for the presence of unusually large giant cells in the necrotic tissue. The radiations from the central bodies forming a definite zone, the

nature of which is not fully determined, seem to be a tolerably constant feature of mycetoma, and are readily distinguished in the sections made from the foot furnishing the basis of this contribution. Lastly, the fungus burns with a luminous flame, the incinerated ash having the odor of burnt feathers and a shade of color supposed to be due to the presence of iron.

When the manuscript was preparing for the pages which precede, the authors were not aware that Prof. J. G. Adami, of McGill University, Montreal, had reported, and but a brief time before printed his report in the *Transactions of the American Association of Physicians* for 1895, a case of Madura foot occurring in America. Attention was called to the fact when one of us (J. N. H.) presented a report of our case to the American Dermatological Association, meeting in the city of Montreal, in September, 1895. Prof. Adami at that time kindly exhibited to the reader the bones of the foot amputated in the case of his patient, and also examined sections of the tissue stained and mounted in Chicago. He was also shown the original drawings of the foot seen in the accompanying illustration (Fig. 3), and fully recognized the identity of the disease in the two patients.

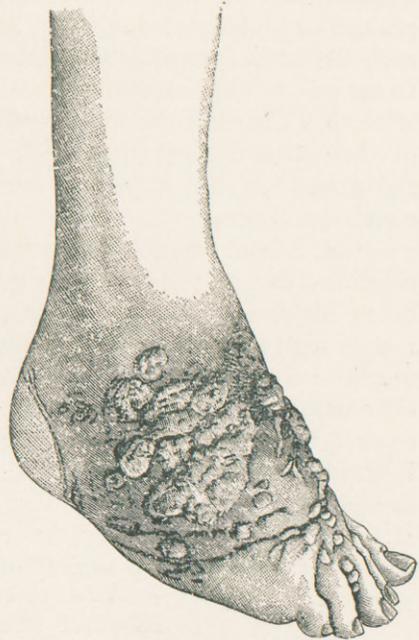


FIG. 3.—Lesions shown in Prof. Adami's case of mycetoma.

Prof. Adami and his colleague, Dr. Kirkpatrick, are entitled to the credit of observing and publishing the report of the first undoubted case of mycetoma occurring on the American continent. The Iowa case, now reported, is probably the first of occurrence in the United States. A brief abstract of the Canadian case is herewith appended:

The patient was a French Canadian, twenty-one years old, and a native of Montreal, who had never been away from Canada. There was no history of tuberculosis in his family. A bluish spot appeared on the inner side of the right foot at the eleventh year, slowly increas-

ing to the size of a small coin. Then followed a history of traumatism and disappearance of the plaque; occurrence of another lesion, described as a *bouton de chair*; later, disappearance also of this last, followed by the formation of a sinus; later, a second traumatism, followed by swelling and tenderness of the foot, but the disorder was throughout painless, as in our case, and as distinguished markedly from that of Kemper. Eventually the foot was studded with buttons, generally discrete, occasionally grouped, most extensively developed on the dorsum of the foot, but seen elsewhere, subpedunculated when isolated, each representing a cutaneous overgrowth of low vitality and pinkish or bluish-pink in color. A few had closed, and in the site of such a cicatrix formed. The sinuses led to carious bone, and the entire tissue was riddled extensively with these fistulous tracts. The bones were in a carious state and affected with a rarefying osteitis. Some of the articular faces were destroyed. Radiating osteophytes were recognized on the cutaneous surfaces of the scaphoid and internal cuneiform bones.

Prof. Adami was able to express from some of the sinuses pinhead-sized and larger yellowish-gray granules, their appearance in general being identical with that of the ray fungus, forming lobate-reniform masses with a central dense mycelium and a radiate arrangement of filaments or clubs at the periphery, larger than those of actinomyces and bifurcating. These were surrounded by leucocytes. Some of the separated hyphæ showed evidence of being formed of joints, varying in length and breadth; but Prof. Adami concludes (a conclusion confirmed in a personal communication made later to one of us, J. N. H.) that these segmented hyphæ are an intrusion, and that the sinuses contained more than one variety of fungus.

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