

II. LEPROSY, LEPRO.

Leprosy is a parasitic disease of chronic course; it consists in the development of more or less circumscribed inflammatory new-formations, mainly in the skin and in the connective tissue of the peripheral nerves. The disease is almost invariably incurable, without being the direct cause of death.

According to its localization, two great groups of symptoms arise, cutaneous or nervous, which have of old led to the erection of two different forms of leprosy—forms, however, which but rarely develop in complete purity.

Leprosy of the *skin* is called *Lepra tuberculosa* s. *tuberosa*, s. *nodosa*, tubercular leprosy. Leprosy of the *nerves*, *lepra nervorum*, has received its titles from the most prominent symptoms: *L. anæsthetica* s. *glabra* s. *mutilans*, etc. Between the two lie the *mixed forms*; consisting mostly in cutaneous eruptions, to which the symptoms dependent on the alteration of the nerves become superadded; more rarely the reverse occurs, the cutaneous symptoms succeeding the pronounced *L. nervorum*.

SPECIAL PATHOLOGY.

1. *Lepra Tuberculosa; Lepra Cutanea.*

Although it is impossible to ascertain the date of the infection, a series of general morbid phenomena appears almost constantly which may be termed *prodromal* (premonitory symptoms)—symptoms not materially differing from those observed in other infectious diseases. There are gastric disturbances, anorexia, dyspepsia; great fatigue and somnolence, with intense vertigo, appear; they become associated with profuse sweats and frequently violent epistaxis. But the most important are attacks of pyrexia, sometimes of an intermittent, sometimes of quite irregular character. These symptoms, occurring at variable intervals and in different intensity, may precede the outbreak of the disease for months, even one or two years.

Those authors who had frequent opportunities of observing the onset of the disease designate the premonitory fever as a constant symptom.

The prodromal stage is followed by the *eruptive stage*, initiated by an erythematous exanthem of gradual origin and spread, *i. e.*, more or less deep-red spots which have a special predilection for the face, and next for the extremities; they are darker in the centre than at the periphery, may be of any size, and usually project uniformly above the level of the normal skin. Frequently the spots are slightly hyperæsthetic in their first stages or cause a certain feeling of itching. This macular form either disappears, leaving inconsiderable remnants of pigment, or else from these brownish-red spots spring tubercular neoplasms of nodular or more band-like form; often they can be felt in the depth long before, in the shape of nodular infiltrations. They sometimes spread peripherally, others grow in height; contiguous neoplasms become confluent, thus giving rise to gradual extensive infiltrations. As a rule, this process requires many months or years before the macules change into tubercles and diffuse infiltrations, or until the small, at first barely perceptible infiltrations in the corium will clearly project above the level of the skin in the shape of tubercular efflorescences.

In the further course of the disease we must follow, on the one hand, the future fate of every single node; on the other, the perpetual and irrepressible outbreak of the leprous new-formation on additional regions.

The individual nodules enlarge and appear as dark-red, soft formations; for month

they remain unchanged, at most assuming a more yellowish-brown color. The epidermis desquamates slightly, becomes rough, but is preserved. More acute necroses in the central portions of the tubercles, leading to softening, to gradual thinning of the covering layers of epidermis, and thus to shallow ulcerations, are not regular, but merely traceable to external influences. These ulcers are quite indolent, have sharply cut edges, and secrete copious quantities of thin pus from their rather smooth, badly granulating bottom. Having a slight tendency to recovery, they cicatrize only after having existed for a long time. The original hyperæsthesia of the tubercles soon gives way to a steadily increasing anæsthesia; the remaining thin flat cicatrices are usually entirely devoid of sensibility. At times, too, the tubercular eruptions vanish quite acutely with the appearance on the region in question of an erysipelas.

The parts most affected are: face and forehead, eyebrows, nasal and oral mucous

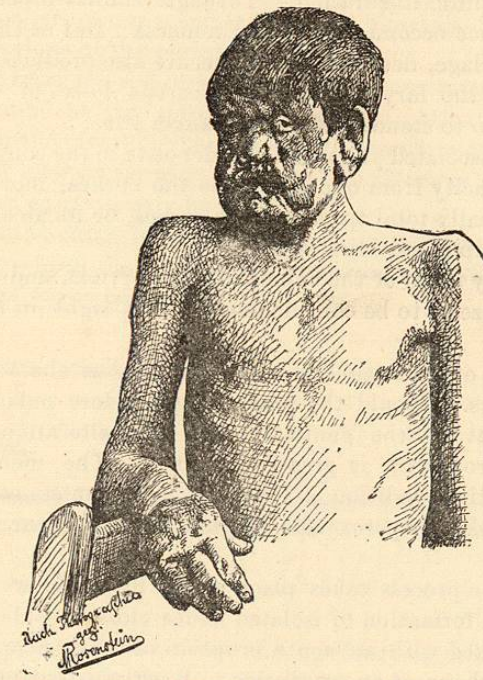


FIG. 22.—After a photograph sent me by Dr. Goldschmidt, of Funchal (Madeira).

membranes. On the extremities the points of predilection are: extensor surfaces of the knee and elbow joints, the dorsal surfaces of the hands and fingers; altogether the extensor more than the flexor surface. Every part of the body, however, may be attacked, except the scalp and the glans penis. The affected parts, of course, have their volume very materially increased, and the mobility of some limbs, for instance the fingers, is seriously interfered with; this is especially the case when the above-mentioned ulcerations establish themselves at these particularly exposed places. Quite typical, however, is the alteration of the face: by the diffuse deposition of the leprous neoplastic mass upon which secondary nodes and excrescences are again superimposed, broad wheals are produced which bulge out especially the frontal and supra-orbital regions; the cheeks gradually form thick, pillow-like protuberances on both sides of the infiltrated and nodulated, but broadened and flattened, depressed nose.

The upper lip is bloated and tumid, with slight ectropion. Withal there is more or less local alopecia of the eyebrows and the beard. The auricles grow thick, especially the lobes change into sacs sprinkled with nodes. Under the chin, itself bloated and pendulous, the voluminous groups of infiltrated lymphatic glands project. Through these slow but steadily advancing processes a physiognomy is produced which is marked by lack of expression, and naturally leads to a notable resemblance of all lepers. The immense tumefaction, especially the frontal and supra-orbital folds hanging often sac-like over the eyes, have given rise to the term, *facies leontina*.

The alterations in the mucous membranes of the mouth, the nose, the palate, and the pharynx down to the larynx, run parallel to those of the skin. Infiltration and node-formation lead to gradual thickening. Even in the early stages we meet with ulcerations covered with corresponding crusts, especially in the nose, the calibre of which is lessened thereby, leading to snuffling inspiration. Through similar processes on the laryngeal mucous membrane the voice becomes harsh and toneless. But as the leprosy infiltration extends also into the cartilage, deeper destructions are also produced; it erodes the nasal vault which sinks in; in the larynx it causes ulcerous losses of tissue which lead to absolute aphonia and often to stenoses which endanger life.

With the above are associated yellowish, flat deposits in the conjunctiva which gradually extend as a white opacity from one edge into the cornea, more and more reducing the visual power, until finally total opacity of the cornea, or its ulcerous perforation with loss of the lens, causes permanent blindness.

The glands, especially those of the submaxillary, cervical, and inguinal regions, increase so enormously in size as to be conspicuous at first sight in the shape of tubercles as large as an apple.

In reference to the other organs, we have to note as characteristic only a gradual atrophy of the testicles. Should the disease begin before puberty, the physical development, especially that of the genitals (with the alteration of the voice, etc., dependent upon these processes), is greatly retarded. The mental faculties are not deteriorated; the subjective condition is generally good, unless complications ensue in the shape of febrile attacks, or paroxysms of pain such as occur with the implication of the peripheral nerves.

The extension of the process takes place either by the slow peripheral growth of existing patches and the formation of isolated nodes close to older infiltrations, or else a larger region is attacked with an acute eruption of many neoplastic foci. This last modus proceeds in the shape of an erysipelas. With considerable rise of temperature conjoined with headache, arthralgia, thirst and nausea, great debility and depression, the face and neck, or an entire extremity, become pretty uniformly turgescient, the skin reddened, very sensitive, at times exceedingly painful. At the same time the corresponding lymphatic glands swell and give pain. After a few days all these symptoms abate, and then we observe the eruptions in larger numbers, developing either as macules or as flat infiltrations. Often the same region is attacked several times in succession. In other cases there is no erysipelatous participation of larger portions of the skin; circumscribed deep infiltrations (comparable to *erythema nodosum*) form, which by-and-by prove to be fresh leprosy neoplasms.

However, attacks of fever without such eruptions also occur; they have been referred partly to metastatic invasions of other organs, partly to the absorption of softened masses of tubercle. But at all events these pyrexial periods are always a sign of the in-

crease of the disease. The patients dread these paroxysms very much, because a residual great weakness frequently keeps them confined to the bed for weeks.

The type of the fever is not quite constant, now irregular, again remittent; oftenest we find the intermittent type, owing to which fact intermittent fever is given in the history of a great many patients. For instance, in a case (from Surinam) observed by myself here at Breslau, this intermittent character is present; regularly at two o'clock p.m. on the respective days the temperature rises to 39.5° C. (103° F.), becoming almost normal at night. The pyrexial attacks each time go hand in hand with fresh eruptions.

This in brief is the course of cutaneous leprosy. We have seen that after a variable period of incubation associated with involvement of the general organism, the local processes develop on the skin, mucous membranes, in the glands, testicles, the tissues of the eye, etc., sometimes in acute progression within a few years, again chronically extending over decades with periodical eruptions separated by long intervals. To these are almost regularly superadded affections of the peripheral nerves.

The leprosy character has not been positively demonstrated in the diseases of internal organs frequently found at the autopsies of leprosy patients. It requires only brief mention here that, in the liver, cirrhosis with the presence of bacilli has been demonstrated by myself and later by Cornil. In the spleen (Norway), bacilli have been demonstrated by Hansen and subsequently by myself.

The course of tubercular leprosy in general is very unfavorable. Although the disease does not always form the direct cause of death, recoveries are very rarely observed. Hillis tabulates the following causes of death:

Nephritis,	23.5%
Pulmonary disease, including phthisis,	17. %
Diarrhoea,	10. %
Anæmia,	5. %
"Remittent fever,"	5. %
Peritonitis,	2.5%
Exhaustion by leprosy ulcerations; leprosy stenoses of the air passages; leprosy of internal organs, marasmus, atrophy; in short, direct consequence of leprosy,	38. %
	<hr/> 100. %

The same author also calculates from the mortuary records of his leprosy material (in the West Indies) that the duration of life of tubercular leprosy patients is considerably shorter than in those of the anæsthetic form (20% to 10% of mortality).

Experience shows that the prognosis becomes better when lepers immigrate into countries free from the disease. Although the process is very rarely completely arrested, it usually is evidently prolonged.

II. *Leprosy nervorum* (Virchow).

Here likewise prodromal symptoms precede the obvious outbreak of the malady; they are from the outset of a more nervous character: great sensitiveness in various parts of the body, resembling rheumatism, a sort of hyperæsthesia of the entire skin; dull, often lancinating, boring pains along the track of certain nerve-trunks, especially the median, ulnar, and peroneal nerves; pressure greatly increases the pain; gastric symptoms are also often mentioned.

After this period, lasting about a year, the disease develops in a very chronic course,

until it finally reaches a stage of stability in which we can hardly speak of an evident progress of the affection. This tardiness and indistinctness of development is a principal characteristic of the malady; the several stages merge into each other without any clear demarcation. Therefore the erection of a "prodromal" stage is really unjustifiable, for the premonitory symptoms are, strictly speaking, symptoms of the actual disease.

The morbid process of *lepra nervorum* is an inflammatory one, of rather acute onset and rapid course, in the interstitial connective tissue, leading by degrees to connective-tissue neoplasia with corresponding atrophy of the nervous elements.

Accordingly we shall be able to form two larger groups of symptoms:

- A. Such as are directly traceable to the affected nerve.
- B. Such as occur in corresponding parts of tissue in consequence of this nervous disease.

In the course of the affection, however, three periods (more or less clearly demarcated in a concrete case) will be distinguishable:

1. Prodromal stage: period of the developing neuritis.
2. Eruptive stage: in which the symptoms of nervous disease become clearly perceptible.
3. Permanent stage (completed atrophy).

The symptoms occurring in each of these stages are of a motor, sensory, and trophic nature.

1. Direct motor symptoms only with purely motor nerves. With these alone we find true muscular paralyses. In the affections of the mixed nerves the motor fibres remain intact.

2. Sensory symptoms.—Disturbances of the tactile sensation go hand in hand with those of the perception of pain until both are totally lost.

3. Trophic symptoms:

- a. Of the skin. They occur mostly in the first, more acute period of the nervous affection and consist:

1. In the development of bullous eruptions resembling pemphigus.
2. In pigment anomalies, the pigment being either increased or lost.
3. In atrophic processes (glossy skin, etc.) belonging to the later period.

- b. Of the muscles, which atrophy, with correspondingly impaired motility.

- c. Of the bones and joints, leading to the loss of phalanges, etc.; here, of course, the influence of external traumata on the absolutely insensible portions of the body must be taken into consideration.

In the main, therefore, the qualities peculiar to leprosy neuritis correspond with the description given in neuro-pathological text-books of neuritis in general, only in leprosy the acute and chronic forms are more blended together.

Entering now more closely on the symptomatology, we find, in the beginning of the disease, chills, now and then rigors with fever; furthermore, violent pain, felt usually not only in the distribution of the affected nerve, but in the whole limb which frequently is slightly swollen and erythematous. The skin is then hyperæsthetic. Still more constant are subjective symptoms such as formication, numbness, torpor, a decided sensation of heat deep down, etc. The pains are persistent, nearly equal by day and by night, and of a lancinating character. The patients are greatly reduced by the consequent loss of sleep.

Hillis holds these attacks of lancinating pain to be as characteristic prodromata of *lepra nervorum* as the fever eruptions form a pathognomonic initial symptom of tubercular leprosy. H. states he has never failed to observe this, although it was very variable

in degree. Still another phenomenon he describes as specially significant: the patients cannot grasp as firmly with their hands, allowing objects to drop. This motor weakness manifests itself at times as a tremor of single, specially attacked extremities.

In the mean time remissions occur for whole days until a fresh attack of pain reminds the patients of their disease.

The nerve itself is very sensitive to pressure. Anatomically the nerve is frequently palpable through the skin as a thickened cord. In this early stage it exceeds in thickness the swellings which develop permanently in the further course of the disease.

The farther the affection progresses, the more the neuralgic symptoms disappear.

The nerves lose their spontaneous sensibility and that to pressure; the sensations formerly producible eccentrically by compression—pain, formication, numbness, etc.—cease; the cordiform swelling of the ulnar or popliteal nerves becomes ever firmer. Anatomically we find a thickening, usually extended over considerable distances, of the nerve the sheath of which is usually adherent to the surrounding connective tissue. Most conspicuous and constant are the spindle-shaped swellings, reaching the thickness of the little finger, of the ulnar nerve on the extensor side of the elbow-joint. A transverse section shows even macroscopically that there is a deposition of wavy connective tissue which by degrees, often only after the course of years, leads to total atrophy of the nerve bundles and degeneration of the peripheral fibres.

The complex of symptoms corresponding to this stage is exceedingly interesting. I shall have to restrict myself here to giving a sketch of it in a more schematic way; mainly because of the uncommonly great variability with which the several symptoms unite into one whole.

1. Motor Paralyses

Affect only pure motor nerves, and are witnessed most frequently on the facial branches of the facial nerve. Purely motor pareses and paralyses are found also on the hand and on the feet.

2. Disturbances of Sensibility.

They form the most prominent symptom. In a gradual transition, the subjective painfulness and "hyperæsthesia" changes into a steadily increasing, finally complete anæsthesia affecting all sensory qualities to an equal degree. As to the tactile sensation, I briefly mention the following:

1. The certainty of localization is lost.
2. The quality of the object touched (form, sharpness, etc.) is not recognized. Stroking, stinging, pressing are not differentiated.
3. The examination with the æsthesiometer shows that the distance of the two points must exceed the normal to a very notable degree in order to make them distinctly perceptible. It is a very surprising circumstance that, in zones where a single point is clearly recognized, both together are perceived as a single, broad, pressing surface. On attempting to excite sensation by light stroking between the two points (felt as one mass), this not rarely succeeds.
4. At times, touches which are not felt at a single trial, are perceived on repeated tests.
5. The conduction of sensation is greatly retarded. This symptom becomes particularly obvious if a still sensible point be touched, and the patient be directed to state when the instrument is removed.

All these tests refer to light touches of the skin. Whenever the pressure employed becomes more intense, the statements are more positive.

Finally the skin (together with the parts underneath) loses all perceptive power of

pressure. The patients do not recognize any object placed in their hands; often they do not even know whether they still have it between their fingers or not.

The sensations of temperature, pressure, and sensibility to pain suffer accordingly. Like the tactile sensation, the latter is also lost first on the skin, later on the bones, muscles, etc.

Excisions, burns, etc., therefore, are not felt by the patients—a fact which in part explains the ulcerations to be described hereafter.

In this section I have made no mention of a hyperæsthesia preceding the anæsthesia because it has been already enumerated as a symptom of the beginning interstitial neuritic process.

Anatomically, the examination of the skin during this (anæsthetic) stage shows no characteristic condition. I am unable, from lack of material, to furnish any information about the presence or absence of the intra-epithelial nerve termini recently described by Unna.

3. Trophic Disturbances.

A. *Of the skin.*—Although they, in a general way, run parallel with the sensory alterations as regards the time of their occurrence, location, spread, etc., still there is no connection in the details between the two series of symptoms. Both are co-effects of the same nervous affection. We may distinguish two stages—an early one, marked by the more copious development of all the phenomena to be described; a later one, in which fresh processes appear but rarely and isolated—still, this is an artificial division, as will be evident at once. For in the beginning the disease affects an altogether healthy body, in which it can produce many eruptions synchronously or in rapid succession; while subsequently only isolated regions are capable of being affected. A division into early and late stages is admissible only in so far as the eruptive stage can be separated from that in which the atrophic processes are fully developed and remain stable.

a. *The bullous eruptions.*—Without any known external noxa, suddenly and so rapidly that usually only the completed process comes under observation, bullæ appear on the skin; mostly but one, rarely several at once; their size ranges from that of a lentil to that of the palm of the hand; their contents are clear, bright yellow; they persist a few hours or days, break, and form a more or less superficial excoriation, which heals with a correspondingly deep cicatrization and pigmentation (formation of sometimes dark, sometimes non-pigmented maculæ). Owing to the great resemblance of these eruptions to pemphigus vulgaris, they have been termed pemphigus leprosus.

This pemphigus I interpret as a tropho-neurosis, dependent on the irritative effects exerted on the (trophic) nerve-fibres by the commencing interstitial neuritis through the developing neoplasm. Hence we find these bullæ frequently in the first stages of the disease, later much more rarely; for this reason we find them on the hyperæsthetic, painful regions, connected (co-ordinated) with the entire complex of symptoms of acute neuritis. For the same reason, a place formerly covered by a bleb will often exhibit anæsthesia soon, namely, when the compression in the nerve-trunk acts simultaneously on the trophic and the sensory fibres. As the anæsthesia is brought about by atrophy of nerve-fibre, and the bullous eruption by an irritant effect, it is clear that the latter usually precede the former. The bullæ appear on the anæsthetic skin much less frequently.

The picture of ordinary pemphigus in isolated cases can be altered by inflammatory processes supervening from without, in consequence of which there may be deeper ulcerations, thicker crusts, and denser cicatrization.

b. *Pigment Changes.*—Sometimes these processes are erected into a special form of leprosy (*lepra maculosa*), sometimes they are separated and distributed among several chapters. Moreover, these alterations produce quite different appearances in the white and the colored races.

In the main we encounter:

α. The occurrence of abnormal pigment.—Yellowish-brown to somewhat reddish spots appear; they are either quite flat or rise slightly above the surface; either smooth or with branny, very insignificant desquamation; either sharply demarcated or diffusely merged into the surroundings. The spots have a very variable size, partly no larger than small coins, partly occupying more extensive regions; also spreading toward the periphery, when the centre may change its color and grow pale again. The margin is then often raised to a low wall and of fresher red color. Usually the pigmentations persist for years unchanged. The degree of pigmentation in a concrete case is very variable; the light-brown may give way to an ashy-gray blackish tint.

β. The formation of white, quite unpigmented spots, developing either from formerly abnormally pigmented or from the normal skin. The latter seems to be of rarer occurrence. The process corresponds altogether with ordinary leucopathy. In regard to these pigmentations, it should be noted by the way that they are to be differentiated from the spots mentioned above as the initial stage of the tubercular eruption.

Following J. Hillis' description, I here place both forms side by side.

Lepra nervorum.

The spots do not fade under pressure. They are oval in shape and usually symmetrical in arrangement; more numerous; lighter in color; not elevated at first, later with wall-like margins; at the outset small, gradually enlarging, and sometimes coalescing into large surfaces. They persist as long as the disease, and do not form the precursors of other eruptions. They are to be interpreted as local atrophic processes, and lead also to the loss of pigment in the hair situated within their confines. They arise without fever. They are usually situated on the dorsum of the body.

Lepra tuberculosa.

The spots fade under pressure, are usually round, not symmetrical, of decided red color; they project above the level of the skin with non-elevated margins. They may disappear or become smaller; the local erythema changes into an exanthem. There is no tendency to a peripheral enlargement. The hairs fall from the affected spots without other alterations. Their appearance is regularly associated with fever; they predominate on the anterior surface of the body.

It is necessary to state quite explicitly that most of the cutaneous alterations designated as morphaea (*alba*, *lardacea*, etc.) and enumerated as symptoms of lepra have nothing in common with this disease. This is true also of some circumscribed atrophies of the skin, which Kaposi, for instance, includes under leprosy.

γ. To be interpreted as atrophic conditions (as symptoms of *lepra nervorum*), however, are certainly the degeneration of the sweat-glands on the affected regions with cessation of secretion; also the shrinking and thinning of the skin on the hands, forearms, etc., occurring in the terminal stages; finally the exfoliation and breaking-down of the nails.

B. *Trophic Disturbances of the Muscles.*—These processes running their course in muscles must be termed the most conspicuous symptoms. Clinically they consist in a steadily advancing and finally complete loss of capacity for action of the muscles. The motor power decreases with the atrophy of the muscular tissue. Through the microscope we ascertain that there is here not only a simple atrophy of the contractile substance,