

Diagnosis of leprosy

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Part II. Cardinal signs

The 1st cardinal sign: skin patch with loss of sensation

Sensory loss in macules or plaques is diagnostic of leprosy (Slide 2). There are very few, if any, skin diseases that present anaesthetic lesions. Only when there are very thick squamae there may be a “pseudo loss” to a very fine touch; indeed never anaesthesia.

Macules and plaques in leprosy may show several other typical abnormalities. The colour can be hypopigmented, hyperpigmented, erythematous or copper-coloured. The texture of the surface may be dry and rough for loss of sweat in some forms of the disease, or shiny and smooth in others. There may be loss of hair growth. Some macules may show typical streaming on one side of their margins and satellite lesions. The lesions may become acutely infiltrated, swollen and erythematous.

Some leprologists consider “characteristic” skin lesions an additional cardinal sign. “Characteristic” has been explained as: - hypopigmentation in dark skin in tuberculoid and indeterminate leprosy or diffuse infiltration, macules, papules and nodules in lepromatous leprosy. However, in our point of view, none of these abnormalities confirms the diagnosis of leprosy unless, there is either a loss of sensitivity, an enlarged nerve or a positive slit-skin smear.

For all purposes in leprosy loss of sensation in a skin lesion is diagnostic of the disease (Slides 5, 6). The loss of cutaneous sensation is often partial; it may be to light touch (anaesthesia), to pain (analgesia) or to temperature discrimination (hot and cold).

Testing for loss of sensation

This is a relatively simple test that confirms diagnosis of leprosy in many cases. Quietness in the environment or in the room where it is performed is important. Both the patient and the examiner must be positioned comfortably while examining.

The simplest and quickest way to test for anaesthesia is to use the tip of your finger to touch the patient. Using the pulp of your little or ring finger, touch the patient very gently. If you can feel it, he should too (Hastings 1985).

More commonly a fine, pointed wisp of cotton (Slide 3) wool is used to touch the part to be tested. First explain to the patient what you will be doing. Then demonstrate while he watches and points carefully to the exact spot touched. When he comprehends fully, then continue testing various sites in and outside the lesions but, with the patient's eyes covered (Slide 4). Touch only, do not brush across the skin. Inability to identify the point stimulated at all, denotes loss of sensation to the stimulus used. If he feels it but he cannot point to the exact spot, it is called misreference, and it is the earliest sign of hypoesthesia (Hastings 1985). The patient with closed eyes can either point with one finger to the exact spot where the cotton wool touched the skin or the patient can confirm the exact place verbally when he feels the touch. Test the reliability of the patient by asking where he feels when not touching the skin at all.

Alternatively heat sensation is tested with two test tubes, one containing hot water and the other cold water (Yawalkar S J 2002).

Cotton wool may be too delicate for the thickened skin of palms and soles. Monofilaments or nylon bristles could be used to test for sensory loss in lesions on palms and soles. The Semmes Weinstein monofilament test is nowadays recommended for assessing peripheral nerve impairment. Sensory testing (ST) will be discussed in more detail in the part about "Reactions and nerve damage".

Warnings:

1.

Loss of cutaneous sensation means that the sensation, in particular the touch, in the lesion is diminished in comparison with the surrounding skin. Loss of cutaneous sensation may also be to pain and to temperature.

2.

Sensory changes on face may be less evident than in other areas of the body because of the rich nerve supply of the face.

3.

Towards the lepromatous side of the spectrum, borderline lepromatous and lepromatous leprosy, in early cases often no loss of sensation is found. In advanced lepromatous cases there may be extensive loss of sensation and, bilateral anaesthesia of the glove-and-stocking type.

4.

In the "indeterminate" form of leprosy, loss of sensation cannot be detected; but sometimes loss of autonomic nerve function can be found.

5.

Pain sensation is tested by pin-prick (be careful not to damage the skin) and temperature by touching the skin with test tubes containing hot and cold water.

The sweat and histamine tests

Two other tests may be useful in diagnosing leprosy and are used by some leprologists: -

1.

Sweat test: sweating is dependent upon the integrity of parasympathetic nerve fibres. If a hypopigmented patch is due to leprosy the response of the sweat glands to exercise or to a cholinergic drug will be diminished (Slide 8) [Bryceson A, Pfaltzgraaf Roy E (1990)];.

2.

Histamine test: the wheal and flare response to histamine is the end product of a local reflex which depends upon the integrity of sympathetic nerve fibres. If a hypopigmented patch is due to leprosy the response of the skin to histamine will be diminished (Slide 10) [Bryceson A, Pfaltzgraff Roy E (1990); Menicucci L. et al.; Rodriguez J. et al (1931)].

The 2nd cardinal sign of leprosy: enlarged peripheral nerve

An enlarged peripheral nerve represents the 2nd cardinal sign of leprosy (Slide 2). Enlarged peripheral nerves are very rarely found except in leprosy. Other conditions which could present enlarged peripheral nerves are: primary amyloidosis and some hereditary peripheral neuropathies (like the neuropathy of Charcot-Marie-Tooth). These are all very uncommon. In a leprosy endemic area, the finding of enlarged peripheral nerves is an important element to establish the diagnosis.

The palpation of the nerves at the “sites of predilection” is performed during the physical examination of the patient. Palpation is performed gently using the pulp of the fingers, not the finger tip or finger nail. Watch the person’s face to make sure you do not cause him unnecessary pain when you touch the nerve. Evaluate the tenderness (spontaneous or when palpating), consistency (soft, hard, irregular) and size (enlarged, normal, small) of the nerve; however, only the size is important for the diagnosis of leprosy (Slide 3). Tenderness when palpating the nerve or spontaneous nerve pain are signs of a reaction. Additionally, signs and symptoms of peripheral nerve sensory, motor and autonomic involvement may be present.

It is essential to know the normal limits by constant practice in palpating nerves. During an examination one should always compare nerves on the opposite site of the body.

All peripheral nerves may be enlarged in leprosy. Cutaneous branches associated with a skin lesion may be enlarged as well (Slides 34-35). The two most commonly affected are the ulnar nerve and, in the second place, the lateral popliteal (also called common peroneal) nerve. In the following paragraphs, how to locate and palpate the peripheral nerves of predilection in leprosy will be illustrated. They will be described systematically starting from the head, then those of the upper limbs and finally those of the lower limbs.

Supraorbital nerve

An enlarged supraorbital nerve is palpable as it passes upwards out of the orbit (Slide 8). To palpate it run your index finger across the forehead from the midline laterally. A branch of this nerve can be seen in Slide 9.

Great auricular nerve

The great auricular nerve can be seen in the neck emerging from the posterior border of the sternocleidomastoid muscle. The patient turns his/her head to one side, thus this muscle is stretched. The great auricular nerve courses anteriorly and superiorly across the muscle towards the earlobe (Slides 10-13).

Ulnar nerve

The forearm of the patient is bent at 90°-110° over the arm. The examiner uses his left hand to palpate the right ulnar nerve and his right hand to palpate the left ulnar nerve. The nerve can be palpated first at the elbow in the olecranon groove, between the olecranon and the medial epicondyle of the humerus. Then it can be felt and evaluated immediately above the groove (Slides 15 - 16). In comparing left and right ulnar nerves it is useful to ask the patient to put his hands on the examiner's shoulders; in this case the bending is about 135° (Ben Naafs, personal communication). Alternatively the patient may hold his own hands in front of him. Branch of the ulnar nerve can be palpated on the dorsum of the hand as it curls round the 5th metacarpal bone. This is a useful confirmatory sign in someone with vague neuritis symptoms in the fingers and no other signs of leprosy (Grace Warren personal communication).

Radial cutaneous nerve

The radial cutaneous nerve is palpated at the wrist. It can be rolled under the tips of the examiner's fingers as it crosses the lateral border of the radius just proximal to the wrist and courses onto the dorsum of the hand (Slides 17 - 21). The radial cutaneous nerve can also be palpated as it rolls round the 2nd metacarpal bone. No other clinical or laboratory test has the same high sensitivity and specificity (van Hees C., Naafs B., 2009).

Median nerve

The median nerve is felt in front of the wrist when the wrist joint is semi-flexed, proximal to the flexor retinaculum. It is often easier to see than to palpate due to the presence (if present) of the tendon of the palmaris longus muscle. (Slides 22 - 24).

Lateral popliteal nerve (Common peroneal nerve)

The lateral popliteal nerve can be palpated, with the knee joint semi-flexed, in the popliteal fossa, just medial to the biceps femoris tendon (Slides 25 - 27) and, as it passes round the neck of the fibula. Alternatively it can be felt with the patient and the examiner, one seated in front of the other.

Superficial peroneal nerve

The superficial peroneal nerve (also called dorsalis pedis) can be easily palpated on the dorsum of the foot (Slides 28-30).

Posterior tibial nerve

The posterior tibial nerve is palpable as it passes posteriorly and inferiorly to the medial malleolus and supplies the sole of the foot (Slide 32). It is difficult to palpate due to tendons and blood vessels which also pass at the spot.

Sural nerve

The sural nerve can be palpated along the midline of the back of the lower leg. The mid to lower part of the leg, where calf muscles join to the Achilles' tendon. The sural nerve can also be palpated as it runs down behind and under the lateral malleolus and along the lateral side of the foot.

Warnings

It is not uncommon in a leprosy endemic area to find people with an enlarged great auricular nerve or radial cutaneous nerve without any other clinical sign of leprosy (including nerve function impairment) or positive bacteriology. Such patients are not put on treatment but observed and told to come back if anything changes or if the patients develop skin lesions. The enlargement of these two nerves has no direct clinical relevance.

In early cases of leprosy nerve enlargement may not be very great, the nerve may not be tender and hard palpation may not even cause discomfort. The hardness is the clue in these cases! Thin hard nerve may still be palpable years later and confirm a self healed case years after the active disease (Grace Warren, personal communication).

The 3rd cardinal sign of leprosy: positive slit-skin smear

Leprosy is the only disease in which there can be a massive invasion of the dermis or nasal mucosa with acid-fast bacilli (AFB). In some forms of the disease bacilli are demonstrated in slit-skin smears or in nasal mucus or scrapings.

Leprosy bacilli are extremely scanty in lesions of some forms of leprosy, but are present in enormous numbers in lesions of other forms of the same disease. One gram of skin tissue in lepromatous leprosy may contain as many as 7000 million leprosy bacilli (Yawalkar S J 2002).

In the context of leprosy control activities and programmes it is important to organize services for the collection of slit-skin smear (or skin smear) and their processing. Quality control and continuous supervision and monitoring of this activity are necessary in order to ensure uniformity, reliability and a high level of performance standards.

Bacteriological examination is an essential screening procedure for all patients in whom the diagnosis of leprosy is suggestive after a detailed clinical examination. It assists in: 1. The diagnosis of leprosy; 2. The classification of leprosy; 3. Monitoring of the response to treatment in skin smear positive patients; and 4. Excluding the diagnosis of leprosy.

1.

The presence of AFB bacilli confirms the diagnosis of leprosy. A positive slit-skin smear examination is the 3rd cardinal sign of leprosy (Slide 2).

2.

Bacteriological examination is useful in classifying leprosy within the Ridley and Jopling spectrum and between the two treatment groups, namely paucibacillary (PB) or skin smear negative leprosy and, multibacillary (MB) or skin smear positive leprosy.

3.

The monitoring of the response to treatment in MB patients is assisted by periodical, normally annual, skin smear examination. Viable bacilli will disappear within months from the beginning of treatment. The total number of bacilli will progressively decrease and disappear within years.

4.

In endemic areas skin smears should not only be used to prove that the patient is suffering from leprosy, but also to exclude leprosy in patients with multiple skin lesions.

Skin smears should be taken from all patients suspected of suffering from leprosy. Smears are taken from suspected skin lesions and particularly from the most active-looking edge of the lesion and especially in lepromatous leprosy from sites with a high probability of demonstrating AFB. Such sites with the highest probability of demonstrating AFB are the earlobes, forehead, chin, extensor surface of the forearms, dorsal surface of the fingers, buttocks and extensor surface of knees.

The slit and scrape method

A fold of skin is picked up between finger and thumb and is squeezed to prevent blood flow (Slide 3). A small incision, 7-8 mm length and 1-2 mm deep, is made into the dermis with a scalpel blade (Slide 4). The blade is then turned through 90 degrees and used to scrape the cut surface of the tissue (Slide 5). Care has to be taken to avoid blood mixing with the smear. The juice obtained is smeared onto a slide (Slide 6) with standard thickness and diameter and, allowed to dry. The slide is then “gently” flamed to fix the smear.

Staining and reading the smears

Smears are stained by Ziehl-Neelsen’s method. After staining, slides are examined using a 100 x oil immersion lens. Bacilli are seen as red dots against a blue background. Living (viable) leprosy bacilli appear uniformly stained; they are described as solid-staining or “solids” (S) bacilli. Dead leprosy bacilli, that stain irregularly, are described as fragmented (F) and granular (G). (Slides 8, 9)

The total number of the bacilli is recorded as the bacterial index (BI). The percentage of solid-staining bacilli is the morphological index (MI) (Slides 10 and 11). Variations of the BI along the spectrum are reported in Part I., Slide 22.