

PHYSIOLOGIC PRINCIPLES IN THE TREATMENT OF LEPROSY¹

S. N. CHATTERJEE, M.B., D.T.M.

*Lately of the Leprosy Research Department
School of Tropical Medicine
Calcutta, India*

In my article on "The mechanism of the neural signs and symptoms of leprosy" (1), I drew attention to the fact that although some nerves were found thickened in leprosy the clinical signs did not always tally with the signs of their degeneration. From our investigation we came to the conclusion that the clinical signs of leprosy were related to the diminished blood circulation in the capillaries of the affected parts of the skin and the nerves.

In the second article, "Mechanism of blister formation in leprosy patients" (2), it was reported that, even when the heat was not excessive, leprosy patients sometimes developed blisters in anesthetic parts, but not in the adjacent or corresponding normal parts. In these cases temperature test with a thermocouple revealed that there was less vasodilatation in the anesthetic parts when exposed to heat. As a result heat accumulated in the anesthetic parts, causing selective blistering. This confirmed my previous observation.

In the third article, "Muscular wasting in leprosy and its peculiarities" (3), it was pointed out that it was not always possible to correlate wasting of a muscle with thickening of the nerve supplying it. This led us to investigate the temperature of the wasted muscles and of corresponding normal muscles. It was found that the temperature of the wasted muscles was lower than that of the corresponding normal muscles in 42 out of 44 cases. This was indicative of smaller blood circulation in the wasted muscles. We came to the conclusion that muscular wasting in leprosy was preceded by a diminution of blood supply to the muscles, which affected their nutrition. So long as the blood circulation in the muscle was not diminished, there was no muscular wasting, in spite of considerable nerve thickening. These findings were embodied in an article entitled "Mechanism of muscular wasting in leprosy" (4).

The question now arises how this knowledge can best be applied for the benefit of leprosy patients. One of the first objects of treatment of any bacterial disease is to destroy the causative organisms, directly or indirectly. It is undisputed that for this purpose chemotherapy is the best procedure. But chemotherapeutic drugs in leprosy usually cannot prevent the development of polyneuritic signs or correct them when they are already present. Also they are not helpful as a rule in removing other blemishes of the disease. These failures are highly disappointing to the patient. Therefore, in addition to chemotherapy, measures should be taken for the prevention and correction of polyneuritic signs and removal of residual signs in leprotic patches. As these were found

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to be related to vascular changes in the affected parts, leading to diminished blood circulation, it was reasonable to expect that measures to increase blood circulation in the affected parts might be helpful in preventing the development of these changes or correcting them when they were already present. Vasodilator drugs could serve our purpose, but they were not employed, as their prolonged use might have an adverse effect on the general health of the patient. It is well known that massage, exposure to heat, and injection of an irritant drug, all increase local blood circulation (⁸). But the question is how long this lasts. In order to counteract defective local blood circulation and malnutrition, measures should be adopted that will increase and maintain a constant increased circulation.

With this object in view, we made a preliminary study, in a small number of cases, of the effect of massage, application of heat, and injection of hydnocarpus oil, on the blood circulation of the part so treated. It was noted that, after massage of the affected hand for 15 minutes, there was a rise of about 1°C, on the average, in the skin temperature of that part, but the temperature came down to its original level within an hour. When an anesthetic hand was exposed to heat (52°C) for about 5 minutes, there was a rise of temperature of varying degree (maximum 5.8°C), but on removal of the hand the temperature came back to the original level in about 10 minutes. After intradermal injection of hydnocarpus oil (which was cooler than the body temperature), there was an initial drop of about 1°C, but after 24 hours the temperature was higher than originally by about 1°C. After that the injected hand remained warmer for some days than previously.

In the light of the experiments described above, specific measures and methods of treatment were adopted. It was evident that periodic injections of oil were most helpful in maintaining an increased blood circulation in the affected part for a longer period. But considering the fact that daily exposure to heat, massage, and exercise of affected muscles, might also help to increase blood circulation, although for a shorter time, we advised fomentation after local injections of oil, massage, and active and passive exercise of muscles that were or were likely to be affected. The injections were given intradermally or subcutaneously in the affected parts once in 3 or 4 weeks. In the intradermal treatment one drop of medicine was injected at each point of puncture. This treatment was given in order to prevent the development of polyneuritic signs in cases where such development was apprehended, to correct if possible, polyneuritic signs already present, and to bring back pigmentation and sensation and help hair growth, etc., in leprotic patches. Patients who received this treatment are classified under three headings and the results are summarized under each heading:

1. Patients who had no polyneuritic signs when treatment was started, but were likely to develop them.
2. Patients who had polyneuritic signs when treatment was started. These were divided into two groups as follows: (a) Patients

who had muscular wasting, deformities, paralyses, etc., in (1) muscles of the face, (2) muscles of the hand, and (3) muscles of the leg. (b) Patients who had trophic ulcers.

3. Patients who had patches with hypopigmentation, anesthesia, depilation, anhidrosis, keratosis and other abnormalities.

1. PATIENTS WHO HAD NO POLYNEURITIC SIGNS WHEN TREATMENT WAS STARTED, BUT WERE LIKELY TO DEVELOP THEM

(a) *Lesions of the face.*—Patients with lesions on the face usually develop lagophthalmos or facial paralysis or both, according to the site of the skin lesion. Forty-two such cases were treated. In 40 cases (95.2%) paralysis did not develop. In 17 cases lagophthalmos appeared likely to develop, as the lesions were on the upper parts of the face, including the eyelids. In 13 cases lesions were on the lower part of the face and facial paralysis was expected. In 10 cases both lagophthalmos and facial paralysis appeared probable, as the lesions covered the whole of the face.

Of the 40 cases with paralysis, 31 were tuberculoid, 6 maculo-anesthetic, 1 borderline, and 2 lepromatous. Three patients had lacrimation from the affected eye, indicating a tendency to develop lagophthalmos, and in one case there were fibrillary twitchings of the muscles of the face indicating impending facial paralysis. The period of treatment and observation in 40 cases was 1 year in 3 cases; 2 years in 7; 3 years in 7; 4 years in 1; 5 years in 4, and more than 5 years in 18.

(b) *Lesions of the hands.*—Patients with lesions on the ulnar side of the hand and thickening of the ulnar nerve, usually develop claw-hand, and patients with lesions on the radial side of the hand and thickening of the radial nerve sometimes develop radial paralysis. One hundred and thirteen such cases were selected for treatment. Thirty-four patients discontinued treatment. In 74 (93.7%) out of 79, deformities did not develop. Forty-four of these were tuberculoid, 20 maculo-anesthetic, 3 pure polyneuritic, 1 indeterminate, 2 borderline, and 4 lepro-

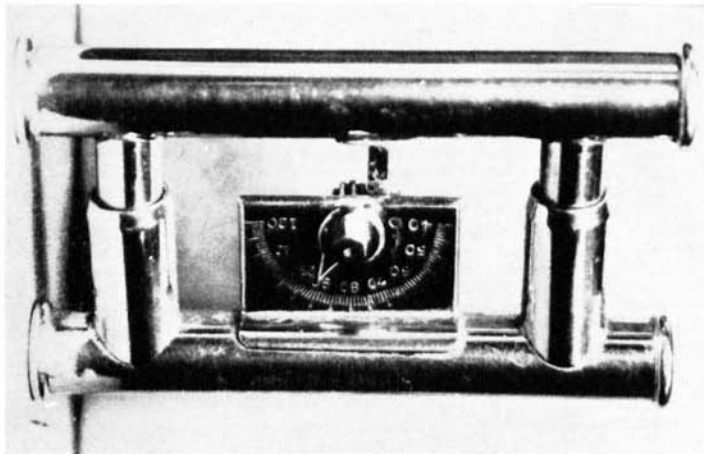


FIG. 1. Dynamometer. The pointer is pointing to 92.

matous. Nerve thickening was 1+ in 12; 2+ in 32; 3+ in 25, and 4+ in 5. Nerve abscesses were present in 2 cases. The length of treatment was 1 year in 12 cases; 2 years in 22; 3 years in 7; 4 years in 7; 5 years in 9, and more than 5 years in 17.

Patients with lesions on the hand and thickening of the ulnar nerve, but without deformity, often complained of loss of strength and loss of function in the affected hand. This problem was investigated with the help of a dynamometer (Fig. 1). The apparatus has a semicircular scale ranging from 40 to 120. A pointer moves when the two sides of the instrument are pressed in a grip. The figure indicated by the pointer indicates the strength of the grip in pound-pressure. The grip of the affected hand was found weaker. This improved gradually with treatment.

Fourteen cases are illustrated in Table 1, showing the weakness of the grip before treatment and improvement after treatment. Deformity was prevented in all the cases.

TABLE 1. *Results of dynamometer grip test in 14 patients without deformity of the hand who complained of weakness.*

Case number	Type	Grip	Before treatment	After treatment		Nerve involvement
3639	T ₂	Right *	63	67	80	4+ to 1+
		Left	86	95	88	
3882	T ₁	Right	72	77	89	3+ to 2+
		Left *	52	72	87	
3966	T ₁	Right *	48	57	63	3+ to 2+
		Left	46	55	56	
3706	B ₂	Right *	52	70	75	2+ to 2+
		Left	62	71	81	
3745	MA ₁	Right *	72	84	87	3+ to 2+
		Left	80	85	86	
4099	T ₁	Right	85	81	81	2+ to 1+
		Left °	74	82	84	
4118	T ₁	Right	80	95	99	2+ to 1+
		Left °	67	86	95	
4223	T ₁	Right	62	62	81	3+ to 1+
		Left °	42	62	67	
4225	T ₂	Right	75	76	77	3+ to 2+
		Left *	58	65	64	
4264	MA ₁	Right *	60	60	80	3+ to 2+
		Left	70	77	85	
4289	T ₁	Right *	52	64	70	4+ to 2+
		Left	56	60	65	
4386	P ₁	Right	83	83	82	Abscess smaller
		Left °	55	76	83	
4455	T ₁	Right	79	73	85	Abscess absorbed
		Left °	65	68	82	
4562	T ₁	Right	85	85	80	3+ to 2+
		Left *	58	75	82	

*Affected hand.

(c) *Lesions of the foot and leg.*—(1) Patients likely to develop footdrop: Patients with lesions on the foot and leg, in the distribution of the lateral popliteal nerve, and thickening of that nerve, usually develop footdrop in the course of time. Fifty-three such cases were selected for treatment. In 50 cases (94.3%), including 33 tuberculoid, 14 maculo-anesthetic, 2 indeterminate and 1 borderline, footdrop did not develop. Nerve thickening was 1+ in 11; 2+ in 29; 3+ in 9 (1 with abscess), and 4+ in 1 case. The period of treatment and observation was 6 months or less in 5; 1 year in 3; 2 years in 11; 3 years in 7; 4 years in 2; 5 years in 8, and more than 5 years in 14.

(2) Patients likely to develop trophic ulcers: Patients having anesthesia in the soles usually develop trophic ulcers. Seventy-three such cases were selected for treatment. Fourteen patients discontinued treatment. In 56 (94.9%) out of the remaining 59 cases trophic ulcers did not develop. In all of these cases (29 tuberculoid, 12 maculo-anesthetic, and 15 lepromatous), the patients were ambulatory. The period of treatment was 1 year in 5; 2 years in 11; 3 years in 8; 4 years in 8; 5 years in 6; 6 years in 7; and more than 6 years in 11. In all cases there was gradual return of sensations.

2. PATIENTS WITH POLYNEURITIC SIGNS WHEN TREATMENT WAS STARTED

(a) *Patients who had muscular wasting, deformities, and paralyses.*—(1) Muscles of the face: Twenty-six cases were under treatment. In 20 of these there was lagophthalmos only. In 17 (85%) including 14 tuberculoid, 1 maculo-anesthetic, and 2 lepromatous cases, correction was complete. In 1 case (tuberculoid), with facial paralysis only, the correction was complete. Five patients (4 tuberculoid, 1 maculo-anesthetic) had both facial paralysis and lagophthalmos. There was complete correction in 2 and partial in 2. In 1 case the facial paralysis was corrected completely, but the lagophthalmos only partially. The period of treatment and observation varied from 6 months to 7 years.

Illustrative Cases

Partial correction.—CASE 4339 (R.S.) T3. Lesions subsided under DDS treatment, which the patient had had previously, but paralysis of facial muscles developed. He was unable to close the right eye completely (Fig. 2a) or raise the right eyebrow. Partial improvement after our treatment for 1 year (Fig. 2b).

CASE 4129 (D.H.) L2. Lagophthalmos of left eye for 3 years. Canthorrhaphy by one surgeon 2 years ago and by another 1 year ago, had been unsuccessful. Lagophthalmos of right eye for 8 months. After treatment for a year and a half the right lagophthalmos was corrected. Left lagophthalmos remained the same.

CASE 4749 (A.M.) T1. Lagophthalmos of left eye and left facial paralysis. Patient unable to whistle (Fig. 3a). Left facial paralysis



FIG. 2a. Case 4339 (R.S.). Before treatment. Paralysis of right orbicularis oculi and of the frontal belly of the right occipitofrontalis.

FIG. 2b. Case 4339 (R.S.). After treatment for 1 year. Partial correction.

corrected in 1 year (Fig. 3b), but no improvement of lagophthalmos.

Complete correction.—CASE 4348 (M.R.) T3. Right lagophthalmos, which was completely corrected after DDS by mouth and injections of oil intradermally for 1 year.

CASE 4376 (B.S.R.) T1. Lacrimation from left eye for 2 years. Left lagophthalmos and paralysis of frontal belly of left occipito-frontalis muscle for 1 year. Difficulty in chewing. Corrected after treatment for 3 years.

CASE 2033 (M.D.) T1. Lagophthalmos of left eye. Corrected by our treatment. Oil injections stopped for 16 months and, chemotherapy

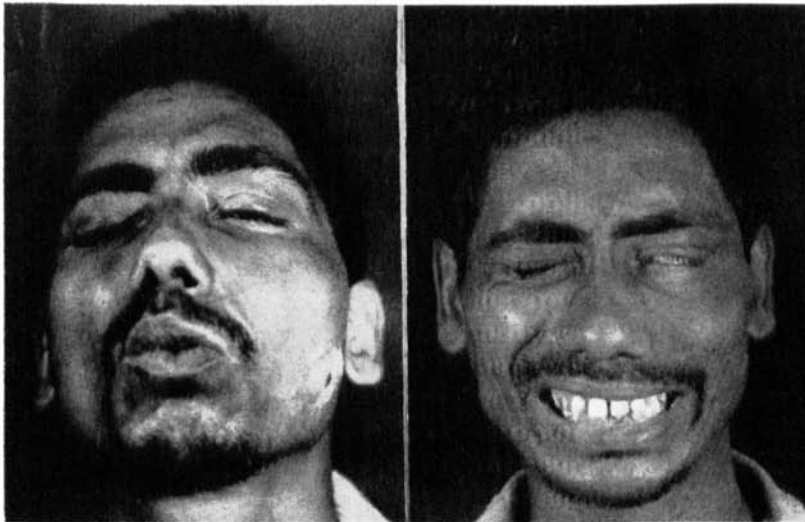


FIG. 3a. Case 4749 (A.M.). Before treatment. Left lagophthalmos and facial paralysis. Unable to close the lips properly to whistle. Attempts to do it leaves a triangular gap on the left side.

FIG. 3b. Case 4749 (A.M.). After treatment for 1 year. Left facial paralysis corrected. Left lagophthalmos same.

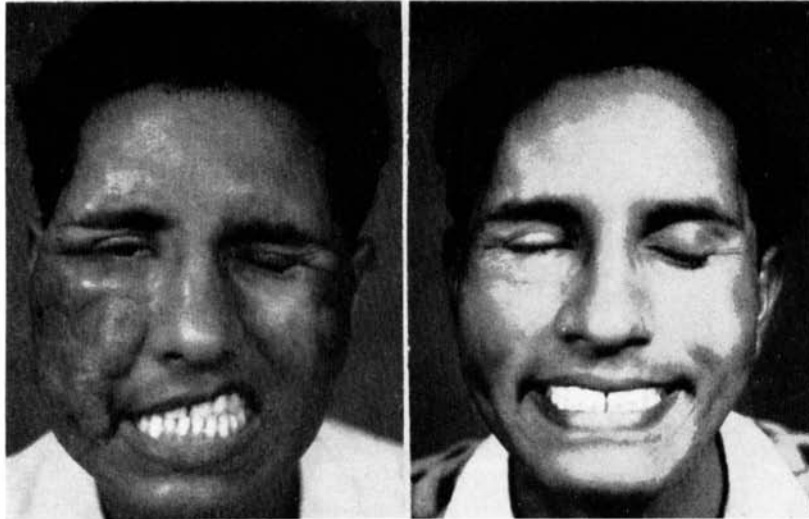


FIG. 4a. Case 4170 (M.F.). Before treatment. Right lagophthalmos and right facial paralysis.

FIG. 4b. Case 4170 (M.F.). After treatment for 2 years. Right lagophthalmos and facial paralysis completely corrected.

being considered better, patient took DDS only. Lagophthalmos reappeared after 8 months.

CASE 3105 (N.M.B.) T1. Previously had had DDS. This was followed by reaction and development of right lagophthalmos. Lacrimation increased, impeding reading and writing in his work. After our treatment the lesion subsided, lacrimation stopped, and lagophthalmos was corrected.

CASE 3802 (B.P.B.) T2. Had had lagophthalmos of left eye. DDS treatment without improvement. Correction by our treatment, maintained for 3 years.

CASE 4406 (N.G.) T1. DDS treatment previously. Bilateral lagophthalmos developed. Treatment for reaction was followed by our routine treatment. Bilateral lagophthalmos corrected completely and correction maintained for 1 year.

CASE 4170 (M.F.) T2. Previously patient took injections of Sulphetrone and Avlosulfone by mouth. Treatment was followed by acute reaction. Right lagophthalmos and right facial paralysis developed (Fig. 4a). We treated him for reaction. This was followed by small doses of DDS and oil injections intradermally. Lagophthalmos and facial paralysis were corrected in 2 years and improvement maintained for a year and a half (Fig. 4b).

CASE 3531 (B.S.) T2. Occupation, professor. Had facial paralysis involving orbicularis oris. Speech impaired. Patient unable to whistle. Difficulty in mastication and dribbling of food and water while eating. After our treatment for 1 year facial paralysis was corrected. Defect in speech rectified. No difficulty in chewing and no dribbling of food. Improvements maintained for 3 years.

(2) *Muscles of the hands.*—One hundred and twenty-eight cases of deformity of the hand, with corresponding nerve thickening, were selected. Thirteen patients discontinued therapy. The remaining 115 received chemotherapy and small intradermal or subcutaneous oil injections at the side of the thickened nerve. Exercise of hands, massage with oil, and night bandaging were advised. Anatomic improvement occurred in 106 cases (92.2%) and functional in all. The degree of correction was as follows:

In 38 cases (33%) (19 tuberculoid, 5 lepromatous, 10 maculo-anesthetic, 1 borderline, 2 indeterminate, and 1 pure polyneuritic), there was slight correction. Two showed no nerve thickening. Nine showed 1+; 13, 2+; 11, 3+; and 3, 4+ thickening. The length of treatment for the 38 cases varied as follows: 6 months or less, 7 cases; 1 year, 7; 2 years, 7; 3 years, 4; 4 years, 4, and 5 years or more, 9.

In 34 (29.6%) cases (15 tuberculoid, 10 lepromatous, 8 maculo-anesthetic, and 1 indeterminate), there was moderate correction. In 2 cases there was slight or no nerve thickening. Seven showed 1+ thickening; 10, 2+; 12, 3+, and 3, 4+. Six cases were observed and treated for 6 months or less; 4 for 1 year; 10 for 2 years; 5 for 3 years; 4 for 4 years, and 5 for 5 years or more.

In 34 (29.6%) cases (17 tuberculoid, 5 lepromatous, 8 maculo-anesthetic, 1 borderline, 2 indeterminate, and 1 pure polyneuritic) there was full correction. Slight nerve thickening occurred in 1 case; in 1 the thickening was 1+; in 12, 2+; in 16, 3+ (2 with abscess), and 4, 4+. Treatment was carried on for 6 months or less in 8 cases; for 1 year in 8; 2 years in 10; 3 years in 4; 4 years in 2, and 5 years in 2. Sixteen patients did not return after correction; 8 remained under observation and treatment for an additional 6 months to a year; 3 for 2 years; 3 for 3 years; 2 for 4 years, and 2 for 5 years.

In 9 (7.8%) of the 115 cases no improvement in the deformity occurred, although there was some improvement in function. In 4 cases there was extreme contraction of the fingers, and in 1 the deformity became worse from repeated reaction.

In some of the cases with deformity of the hand the grip test was made with a dynamometer to determine the strength of the affected hand before and after treatment. In all cases there was improvement in strength, as shown in Table 2.

Illustrative Cases

Results of treatment. *Slight correction of deformity.*—CASE 1903 (S.B.) MAI. Occupation, typist. Lesion of left hand, nerve thickened. Slight wrist drop. Unable to use left hand while typing. Reaction of degeneration found. Patient took electric treatment to stimulate the muscles. No improvement and he was about to lose his job. After our treatment for 1 year some improvement occurred and he became able to use fingers of left hand for typing. Remained under observation and treatment for 10 years. Improvement maintained.

TABLE 2. Results of dynamometer grip test in 19 cases with deformity of the hand.

Case number	Type	Deformity	Grip		Correction
			Before treatment	After treatment	
2757	T ₂	Rt. little & ring	Right—60 Left —73	75 94	Considerable
3230	L ₂	Rt. little	Right—55 Left —75	75 72	Complete
3328	T ₂	Rt. little, ring, middle & index	Right—43 Left —52	59 59	Partial
3585	T ₂	Left little & ring	Right—70 Left —66	72 72	Complete
3935	B ₂	Rt. little	Right—50 Left —60	80 90	Complete
4031	T ₂	Rt. little & ring	Right—63 Left —91	79 88	Considerable
3709	MA ₁	Left little & ring	Right—88 Left —58	87 79	Complete. Nerve abscess absorbed
3832	MA ₁	Rt. little, ring, middle & index	Right—49 Left —53	61 64	Considerable
3994	I ₂	All fingers rt. hand	Right—57 Left —74	73 72	Partial
4065	T ₂	Lt. index	Right—62 Left —45	67 60	Complete
4189	T ₂	Rt. little & ring	Right—60 Left —67	75 75	Almost complete
4170	T ₂	Lt. little & ring	Right—83 Left —55	85 70	Complete
4303	T ₂	Fingers of both hands except thumbs	Right—55 Left —47	68 60	Out of 8 fingers 4 became straight
4328	MA ₂	All fingers of left hand	Right—65 Left —50	84 82	Moderate
4380	T ₂	Rt. little, ring & middle	Right—45 Left —80	60 100	Partial
4442	MA ₁	Rt. little & ring after de-capsulation	Right—55 Left —80	80 81	Partial
4496	T ₁	Lt. little & ring	Right—91 Left —65	90 82	Almost complete
4524	T ₂	Lt. little, ring & middle	Right—88 Left —54	97 70	Complete
4572	T ₂	Rt. little & ring	Right—42 Left —75	79 89	Complete

CASE 2692 (B.B.G.) MA2. Occupation, chemist. Deformity of right little and ring fingers. Considerable wasting of muscles. Patient had difficulty in doing experimental work. After our treatment for 2 years fingers became less bent. Some return of strength, function and sensation. Blistering of right hand stopped. Patient remained under obser-

vation and treatment for 7 years. Improvement maintained.

CASE 3204 (K.C.B.) T3. Occupation, fishmonger. Previous treatment by Sulphetrone injection. Deformity of both hands developed. Stopped all treatment. Deformity became worse, and patient became unable to carry on his business. After our treatment for 7 years the deformities became less. Return of strength and function in both hands.

CASE 3219 (A.G.) MA1. Lesion of right hand. Right ulnar nerve thickened (1+). Injections of oil for 3 years. Patient improved. After that she stopped oil injections and took DDS only for 1 year. Right little, ring, and middle fingers became deformed. After our treatment for year and a half right ring finger became straight and right middle finger less bent. There was better sensation, strength and function. Blistering stopped.

CASE 3994 (S.S.P.) I2. Previously patient took injections of Sulphetrone for 9 months, which induced reaction and acute pain in right ulnar region. All fingers of right hand became deformed. Right ulnar 3+. After our treatment for 3 years deformity became less and strength and function improved.

CASE 4442 (S.P.) MA1. Lesion right hand. Right ulnar 2+. Previous treatment, decapsulation of right ulnar, 1 month ago. Immediately after that, right little and ring fingers became bent. After our treatment for year and a half right ring finger became straight. There was better strength and function in right hand.

Moderate correction of deformity.—CASE 4496 (A.S.) T1. Lesion on left hand. Left ulnar, 4+. Deformity of left little, ring, middle, and index fingers. After our treatment for year and a half the left index, middle, and ring fingers became straight, and left little finger almost straight. Considerable return of strength and function.

CASE 4078 (S. De.) L2. Both ulnars, 1+. Previously patient had injections of Sulphetrone for 4 years. Skin lesions subsided, but all fingers of both hands became deformed. Took Neustab and Rimiform on medical advice hoping that deformities would be corrected by these drugs, but without any improvement. After our treatment for about a year and a half both thumbs and left index and ring fingers became straight and other fingers less bent. Patient could write, take food, and dress himself, which he could not do previously.

CASE 4318 (K.D.P.) L2. Both ulnars, 1+. Deformity of all fingers of left hand. Took sulfone treatment for 5 years. No improvement occurred. Patient became intolerant to sulfones. We gave him Isonex by mouth and oil injections intradermally for 2 years. Fingers of left hand became almost straight, opening at 160° angle. Return of strength and function.

CASE 4189 (N.M.) T2. Right ulnar, 3+. Deformity of right little and ring fingers; slight deformity of right middle finger. After our treatment for 2 years right middle finger became straight, and right little finger almost straight; right ring finger was less bent. Considerable return of strength and function.

CASE 4822 (S.P.) L2. Both ulnars, 2+. Deformity of all fingers of left hand and right little finger. After DDS and oil treatment for 6 months, left index and middle fingers and thumb and right little finger became straight, and left little finger less bent.

CASE 4328 (S. De.) MA1. Left ulnar, 3+. Deformity of all fingers of left hand for 22 years. Previously patient took oil injections for 9 years; all injections given intramuscularly. Fingers became more deformed. After our treatment for 3 years deformity became much less. Considerable return of strength and function.

CASE 4288 (M.B.) MA1. Left ulnar, 2+. Deformity of all fingers of left hand. Considerable muscular wasting. After DDS and oil treatment for 2 years, deformity became much less. Considerable return of strength and function.

CASE 3531 (B.S.) T2. Right ulnar, 3+, left ulnar, 2+. Deformity of all fingers of right hand and left little, ring, middle, and index fingers (Fig. 5a). Complete loss of function. Treated for reaction. This was followed by DDS and oil treatment for 5 years. All fingers of left hand became straight, and right thumb, and index and middle fingers less bent. Right little and ring fingers became straight (Fig. 5b). Strength and function improved.

Complete correction of deformity.—CASE 2857 (P.C.S.) T1. Tuberculoid lesion of left hand. Left radial, 2+. Slight wristdrop and impairment of function. After DDS and oil treatment wristdrop corrected. Treatment continued for 3 years. Correction maintained.

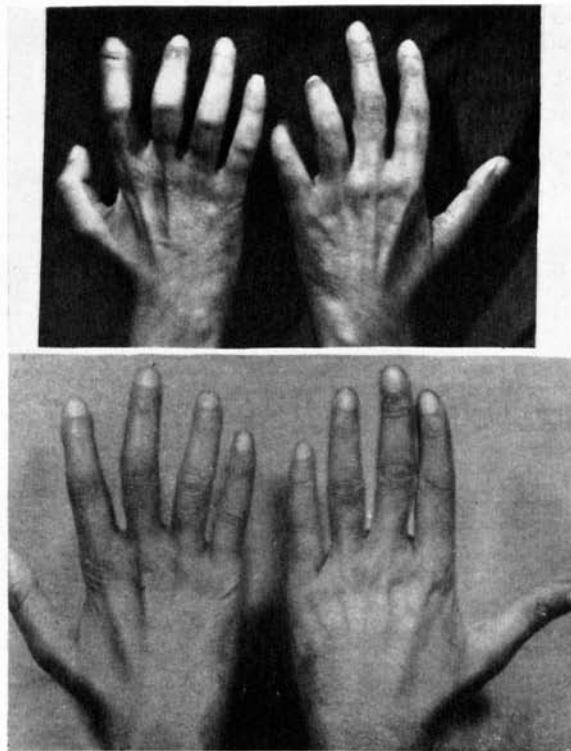


FIG. 5a. Case 3531 (B.S.). Before treatment. Deformity of all the fingers of right hand and of left little, ring, middle and index finger.

FIG. 5b. Case 3531 (B.S.). After treatment for 5 years. Moderate correction. Less muscular wasting.

CASE 2896 (B.L.S.) T1. Left ulnar, 2+ (abscess). Left little and ring fingers bent. Acute nerve pain, not relieved by penicillin, Aureomycin or other drugs. Amputation of left hand advised by two surgeons. Treatment for reaction was followed by DDS and oil treatment for 4 years. Deformity corrected completely and nerve pain completely relieved. Amputation not necessary.

CASE 3021 (G.M.K.) T1. Tuberculoid lesion on right elbow. Right ulnar, 3+. Deformity of right little and ring fingers. Patient took DDS and oil treatment for 4 years. Deformity corrected completely. Right ulnar nerve became less thick. Treatment continued for another 4 years. Correction maintained.

CASE 3341 (G.B.S.) L2 (in reaction). Both ulnars, 2+. Deformity of right little, ring and middle fingers and of left little and ring fingers after an attack of reaction. Treatment for reaction, followed by Isonex by mouth and oil injections for about 2 years. All fingers became straight.

CASE 3437 (T.D.) P1. No visible skin lesion. Left ulnar, 4+. Acute nerve pain. Deformity of left little and ring fingers. Treatment for nerve pain, followed by DDS and oil treatment for 2 years. Deformity corrected and nerve pain relieved. Thickening of left ulnar nerve reduced to 2+.

CASE 3935 (S.K.B.) B2. Right ulnar, 3+. Deformity of right little finger since boyhood, said to be due to injury while playing. Took DDS and oil treatment for 3 years. Deformity corrected with return of function. Treatment continued for another 2 years. Correction maintained.

CASE 4524 (N.B.) T2. Left ulnar, 2+. Deformity of left little, ring, and middle fingers. Complete correction after treatment for 26 months, but patient was still unable to adduct left little finger. Treatment continued 2 years more, after which he was able to adduct the left little finger.

CASE 2739 (H.P.) T1. Right ulnar, 4+ (abscess). Deformity of

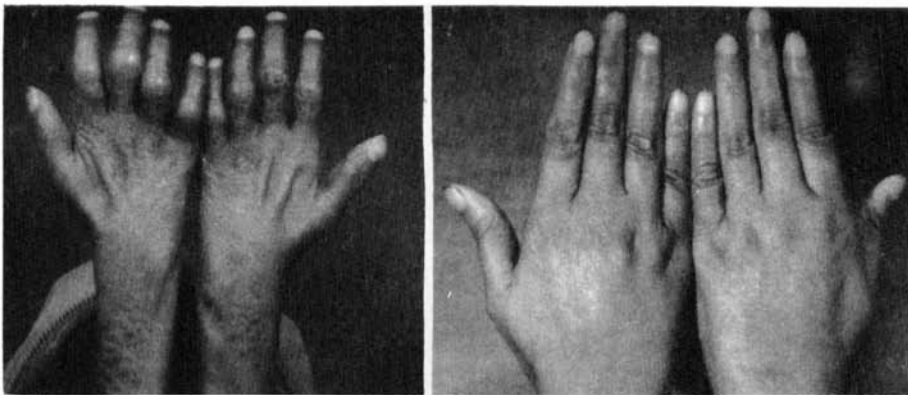


FIG. 6a. Case 4205 (H.H.). Before treatment. Deformity of all the fingers of both hands.

FIG. 6b. Case 4205 (H.H.). After treatment for 2 years. Complete correction.

right little, ring, middle, and index fingers developed during previous chemotherapy. After our treatment for 4 years deformities were corrected completely. Sensation returned. Reduction in thickening of the nerve to 3+. The nerve abscess absorbed.

CASE 4205 (H.H.) L2 (in reaction). Both ulnars, 2+. Previously patient had injections of streptomycin and Avlosulfone tablets by mouth, which induced reaction. All fingers of both hands became deformed. She depended completely on others for taking food, dressing, and other personal necessities. She became intolerant to DDS. Treatment for reaction was followed by small doses of Sulphetrone by mouth and oil injections for about 2 years. All fingers of both hands became straight (Figs. 6a, 6b). Complete return of strength and function.

Results of tendon transplantation in 3 cases that came under observation.—CASE 3911 (G.A.) MA2. Left ulnar, 1+. No deformity of left hand. DDS and oil treatment advised. Patient took injections of oil for 2 months only, but continued DDS by mouth for 2 years. After 2 years he noticed inability to pinch with left thumb and index finger, but experienced no difficulty in gripping. Tendon transplantation carried out by orthopedic surgeon to correct inability to pinch. After tendon transplantation patient was able to pinch but unable to grip (Figs. 7a, 7b), and therefore incapacity was greater than before.

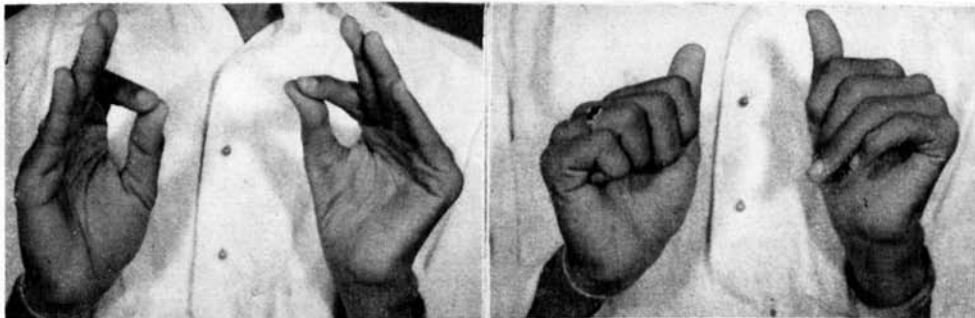


FIG. 7a. Case 3911 (G.A.). After tendon transplantation. Able to pinch with his left thumb and index finger.

FIG. 7b. Case 3911 (G.A.). After tendon transplantation. Unable to grip with his left hand.

CASE 4712 (B.B.) T2. Both ulnars thickened (2+). Increasing weakness in both hands. No deformity. Decapsulation of right ulnar nerve carried out by writer to correct weakness and prevent development of deformity in right hand. Weakness in right hand corrected. After that he was under treatment of another physician who stopped oil treatment and gave DDS for 2 years. Gradually all fingers of left hand became deformed. Tendon transplantation in left hand by orthopedic surgeon, followed by physiotherapy for 7 months. Deformity of left hand corrected. DDS treatment and physiotherapy continued for 6 years more. Gradually fingers of left hand became deformed again, to greater degree than before (Fig 8). No deformity of right hand.



FIG. 8. Case 4712 (B.B.). Deformity of right hand was prevented by decapsulation and oil treatment. Deformity of left hand, developed during DDS treatment. Corrected by tendon transplantation, but not maintained.

CASE 4102 (S.B.) T2. Both ulnars, 4+. Previously patient took Neustab for 2 years. All fingers of both hands became deformed, with loss of function and strength in hands. After our treatment for 2 years deformities became less and there was some return of strength in hands (left grip from 47 to 62). After that he preferred to have tendon transplantation in left hand. There was further correction of the deformity of the left hand (not complete), but strength of left hand was reduced (left grip from 62 to 46).

	3/29/60	7-11-61	4-4-62	11-23-62	3-5-63
Right grip	41	54	53		63
Left grip	47	58	62	Tendon trans- plantation in left hand	46

(3) *Muscles of the foot and leg.*—Forty cases with footdrop were selected for treatment. One discontinued. In 25 (64.1%) out of the remaining 39, improvement occurred. Slight to moderate correction occurred in 17 (11 tuberculoid and 6 maculo-anesthetic). Nerve thickening was slight in 2, 1+ in 4; 2+ in 3; 3+ in 5, and 4+ in 3. The period of treatment was 6 months or less in 2; 1 year in 2; 2 years in 4; 3 years in 1; 4 years in 3, and 5 years or more in 5. In 8 cases (20.5%), all tuberculoid, correction was complete. Nerve thickening was 1+ in 1; 2+ in 3; and 3+ in 4. The period of treatment was 6 months or less in 2; 1 year in 2; 2 years in 2; and 5 years in 2. No improvement of footdrop, but some return of function was seen in 14 cases (35.9%) out of the 39.

Illustrative Cases

Partial correction of footdrop.—CASE 1910 (B.M.R.) T2. Right lateral popliteal, 3+. Right footdrop. After our treatment there was some correction of footdrop. Patient could walk better.

CASE 3204 (K.C.B.) T2. Both lateral popliteal nerves very slight-

ly thickened. Bilateral footdrop. Patient took DDS in big doses, which made his condition worse. Inability to walk and cycle. After injections of oil, exercise, massage, and small doses of DDS for 7 years, he could walk and cycle.

CASE 3396 (M.N.M.) T2. Very slight thickening of left lateral popliteal. Left footdrop. Patient unable to run or carry loads on head. After treatment there was considerable correction of footdrop. He could walk better, run, and also carry loads.

CASE 3899 (M.R.) MA. Left lateral popliteal, 4+ (abscess). Left footdrop. Abscess aspirated and patient given DDS and oil treatment for 3 years and a half. Lesion subsided, nerve thickening became less, and there was less footdrop. He could walk better.

CASE 3793 (N.C.C.) T2. Right lateral popliteal, 4+. Footdrop developed during sulfone treatment for 2 years. After oil injection, exercise, massage and DDS in small doses for 4 years, footdrop became less marked. He could use slippers while walking and also run a short distance.

CASE 4503 (H.D.) MA2. Left lateral popliteal, 3+. Previously patient took Siocarbazone for 2 years. Left footdrop developed. Inability to walk and cycle. After our treatment for a year and a half footdrop was reduced from a 120° to a 90° angle. He could walk 2 miles at a stretch and cycle long distances.

Complete correction of footdrop. CASE 202 (P.N.) T1. Left lateral popliteal, 3+. Left footdrop. After treatment for 8 months footdrop corrected. Observation and treatment continued for 8 years. Correction maintained.

CASE 1445 (C.L.P.) T2. Left lateral popliteal, 3+. Left footdrop. After treatment for 1 year footdrop corrected. Observation and treatment continued for 13 years. No relapse.

CASE 4031 (D.K.L.) T2. Duration 20 years. Both lateral popliteal nerves, 3+. Previously patient took 100 mgm. daily DDS. His condition became worse and he suffered from repeated reaction. Bilateral footdrop developed. After treatment for reaction, followed by injections of oil, exercise, massage, and small doses of Sulphetrone for 1 year, the bilateral footdrop was corrected.

CASE 4215 (A.B.) T2. Left lateral popliteal, 2+. Tuberculoid lesion on left great toe. Dropping of left great toe and inability to dorsiflex it. Corrected after treatment for 4 months and correction maintained for 1 year.

(b) *Trophic ulcers in soles.*—Seventy-nine cases were selected for treatment. Antiseptic footbaths, DDS by mouth, and injections of oil around the ulcers were given. Dead bones and dead skin were scraped when necessary. Improvement was seen in 77 cases (97.5%); this was slight in 13 (16.5%), but complete healing occurred in 64 cases (81.0%). In 8 cases, there was relapse due to various causes. In 56 cases no relapse occurred. Of these, 17 cases healed in 6 months, 21 in 1 year; 9 in 2 years; 5 in 3 years; 3 in 4 years, and 1 in 6 years. In

11 cases, after the ulcers healed, the patients did not turn up again. The remaining 45 cases were under further observation and treatment for 6 months to 5 years. There was no relapse.

Illustrative Cases

No improvement. CASE 3015 (S.J.K.) L2. Ulcer on plantar surface of left great toe. Routine treatment advised. Patient was afraid to take injections. Took DDS only for 2 years.

CASE 4668 (J.K.K.) MA2. Ulcer on right sole. Routine treatment advised. Patient took oil intramuscularly instead of subcutaneously in right sole. No improvement. After that he took intramuscular injections of Sulphetrone, without improvement.

Slight improvement. CASE 3245 (J.C.S.) T2. Bilateral footdrop. Ulcers on both soles. After routine treatment for one year, the ulcer of the right sole became smaller. Right footdrop lessened.

CASE 3255 (G.C.C.) T2. Ulcer on right sole, which had been treated surgically, without healing. After our treatment for 1 year the ulcer became smaller.

Ulcer healed but relapsed later. CASE 4401 (P.K.C.) MA2. Patient had had sulfone treatment. Lesions subsided, but trophic ulcers appeared on left sole. Temporary improvement after injections of penicillin. After our treatment the ulcer healed in 6 months. Treatment stopped and ulcers relapsed.

CASE 3892 (M.H.) L2. Patient had had DDS treatment; ulcer appeared. Healed after our treatment for 4 months. Discontinued treatment for a year and a half, and ulcer reappeared.

Ulcer healed without relapse. CASE 2778 (S.N.B.) MA2. Ulcer of right sole for 9 years. Healed after 3 months' treatment, and remained healed for about 3 years.

CASE 2959 (N.B.A.) T2. Ulcers of both soles; had healed but relapsed on several occasions. Healed completely after 6 years. No relapse thereafter.

CASE 2963 (J.R.L.) MA2. Ulcer of left sole, healed after our treatment for 1 year. Remained healed for 6 years.

CASE 3034 (N.L.) MA1. Ulcer of left heel appeared during Neustab treatment for 2 years. Healed temporarily after some local application, but relapsed repeatedly. Healed completely after our treatment for 3 months. Remained healed for 8 years.

CASE 3391 (S.B.) T2. Chemotherapy for 5 years. An ulcer appeared on left heel. After our treatment the ulcer healed in 3 months. Treatment was continued for 4 and a half years, and ulcer remained healed.

CASE 3566 (H.C.) L2. Ulcer on plantar surface of left great toe. Healed after 1 year and 9 months, but a new ulcer appeared, which healed after 1 year. Treatment continued for 1 year more. Both ulcers remained healed.

CASE 3646 (U.D.) MA2. Ulcer on plantar surface of right great toe

for 4 years. Patient took injections of oil around the ulcer, and the ulcer healed. She then stopped treatment for 2 years. X-ray examination showed bony changes, and dead bone was removed by a surgeon. Thereafter the ulcer persisted for 2 years, and she was advised to undergo amputation of the left leg. We recommended that she might wait and gave routine treatment. The ulcer healed in 1 year. Treatment was continued for 14 months, without relapse. Amputation was avoided.

CASE 3767 (S.D.) MA2. Two ulcers on the left sole. X-ray examination showed chronic osteoperiostitis. The patient was unwilling to submit to any operation. We advised routine treatment. Ulcers healed in 2 years and 7 months in spite of bony changes.

CASE 4051 (K.K.L.) L2. Trophic ulcers on left sole which appeared during sulfone treatment and did not heal when the same treatment was continued for another 2 years. These interfered with his work and he was in despair. After our treatment for 7 months the ulcers healed. Treatment was continued 3 years more. No relapse.

CASE 4161 (L.S.) L2. Trophic ulcers on right sole had appeared during Sulphetrone injections. The same treatment was continued for 2 years more, but the ulcers became worse. The ulcers healed after our treatment for 1 year and 9 months. The same treatment was continued for another 2 years. The ulcers remained healed.

CASE 4381 (C.L.) T2. Ulcers on both great toes. Patient applied many drugs without success. He consulted a surgeon, who advised amputation. Patient refused. After our routine treatment for 12 months ulcers healed. No relapse.

3. PATIENTS WHO HAD PATCHES WITH HYPOPIGMENTATION, ANESTHESIA, DEPILATION, ANHIDROSIS, KERATOSIS, AND OTHER ABNORMALITIES

Sixty-three such cases were selected for treatment. In 3 cases (4.8%) there was no return of sensation, but some return of pigmentation. In 60 cases (95.2%) there was return of sensation in varying degrees: (a) partial return of sensation and pigmentation, etc., in 5



FIG. 9a. Case 4193 (R.P.S.). Before treatment. Hypopigmented and depilated patch on right elbow.

FIG. 9b. Case 4193 (R.P.S.). After treatment for 1 year. Some return of pigmentation and growth of hairs.

(7.9%); (b) moderate return of sensation and pigmentation, etc., in 10 (15.9%); (c) slight to moderate return of sensation and complete return of pigmentation, etc., in 13 (20.6%); (d) slight to moderate return of sensation and no return of pigmentation, etc., in 2 (3.2%), and (e) complete return of sensation, pigmentation, hair growth, sweat function, etc., in 30 (47.6%).

Illustrative Cases

Partial return of sensation and pigmentation.—CASE 3114 (S.A.A.) T1. Tuberculoid lesion of the right hand. Patient took treatment for 4 years. Lesion faded considerably. Sensation returned in palmar surface of right hand, but not in the dorsum.

CASE 4193 (R.P.S.) MA1. Hypopigmented patch on right elbow (Fig. 9a). After treatment for 1 year there was some return of pigmentation, sensation and some growth of hairs (Fig. 9b).

Moderate return of sensation and pigmentation.—CASE 2987 (S.C.M.) MA1. Patient took treatment for 1 year. Moderate return of sensation and pigmentation. Prickly heat appeared in the patch, indicating return of sweat function.

CASE 2988 (R.P.B.) L1. Patient took treatment for about 7 years. Moderate return of pigmentation and sensation. Hairs have grown.

CASE 3105 (N.K.B.) T1. Tuberculoid patch on face. Loss of hair on right eyebrow and loss of eyelashes in right upper and lower eyelids. After our treatment for 3 years skin lesion subsided, and growth of hair occurred in eyebrows and eyelashes of right upper eyelid. Sensation returned considerably.

Slight to moderate return of sensation and complete return of pigmentation.—CASE 3055 (B.S.) T1. Treatment for 4 years. Lesion faded and sensation returned moderately.

CASE 3055a (S.B.) T1. Treatment for 5 years. Lesion faded and sensation returned almost completely.

CASE 2969 (A.K.G.) MA1. Treatment for 7 years. Lesion faded. Sensation returned considerably. Hairs grew.

Slight to moderate return of sensation but no return of pigmentation.—CASE 2613 (S.K.D.) MA2. Treatment for 9 months. Lesions still hypopigmented. Some return of sensation and growth of hair.

CASE 3024 (N.M.) MA1. Lesion on right hand. Treatment for 7 months. Lesion still hypopigmented. Sensation returned moderately. Blister formation in right hand ceased.

Complete return of sensation, pigmentation, hair growth, sweat function, etc.—CASE 1186 (M.H.) T1. Treatment for 8 years at long intervals. Lesion faded completely. Sensation returned. Married after that. Gave birth to child. No relapse after that.

CASE 2103 (S.M.) MA2. Multiple hypopigmented, anesthetic, depilated patches. Regular treatment for 2 years. Lesions faded. Sensation returned. Considerable growth of hair.

CASE 2609 (U.C.P.) T1. DDS only for 2 years. Lesion subsided,

but remained hypopigmented and anesthetic. After our treatment for 7 years, lesion became hyperpigmented. Sensation returned completely. Hairs grew profusely.

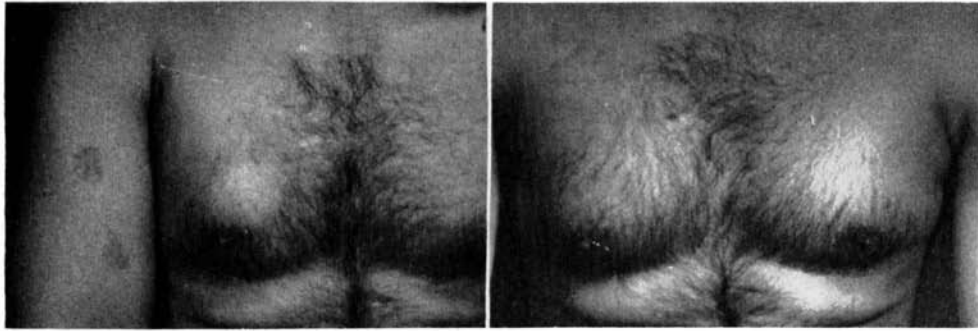


FIG. 10a. Case 2917 (B.K.). Before treatment. Hypopigmented and depilated patch on right side of chest.

FIG. 10b. Case 2917 (B.K.). After treatment for 9 years. Complete return of pigmentation and normal growth of hairs.

CASE 2823 (A.B.) T1. Treatment for 4 years. Lesion faded and sensation returned. Affected part began to sweat.

CASE 2917 (B.K.) T2 (in reaction). Treatment for reaction. Lesions subsided and became hypopigmented. Loss of hair in some patches. Took DDS and oil treatment for 9 years. Lesions faded. Sensation returned. Hair grew (Figs. 10a and 10b).

CASE 861 (K.M.) MA2. Took DDS and oil for 5 to 6 years. Lesions faded. Sensation returned. Profuse growth of hair in patch on left side of back.

CASE 3162 (B.C.) T1. Minor tuberculoid patch with loss of hair on left knee (Fig. 11a). After treatment for 2 years lesion faded and hair grew (Fig. 11b).

CASE 4635 (S.M.) L2. Loss of hair in eyebrows, particularly on left. After treatment for 1 year growth of hair occurred in eyebrows. After another 6 months there was more growth.

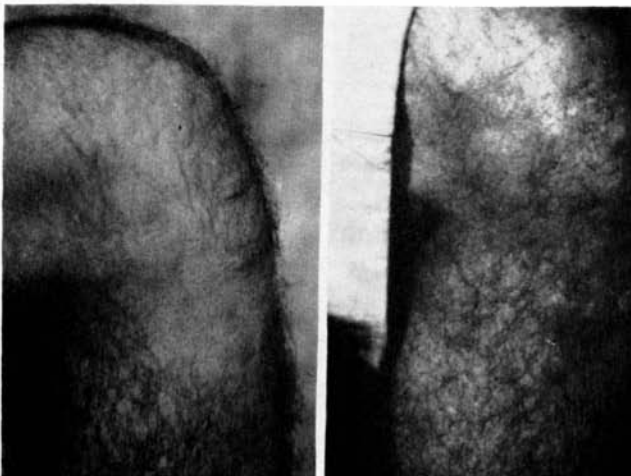


FIG. 11a. Case 3162 (B.C.). Before treatment. Hypopigmented and depilated patch on the inner side of left knee.

FIG. 11b. Case 3162 (B.C.). After treatment for 2 years. Lesions have faded and hairs have grown.

RECAPITULATION

From our previous observations and experimental findings we came to the conclusion that the clinical signs of leprosy have a close relation with diminished blood circulation in the capillaries of the skin lesions and cutaneous nerves supplying them. Muscular wastings, paralyses, deformities, and trophic ulcers also appeared, due to similar changes in the mixed nerves and muscles. Therefore, besides chemotherapy, it was considered desirable to take measures to improve the blood circulation of the affected parts and determine if that treatment would reverse the process of malnutrition in the affected parts of the skin, nerves, and muscles, and thus prevent development of polyneuritic signs or correct these signs when already present. Attempts were made to increase the blood circulation of a deformed hand and thereby its temperature by various measures. It was observed that rise of temperature after injection of hydnocarpus oil in the deformed hand was more lasting, and that a slightly higher temperature persisted for some days as a result of local inflammation and vasodilation. Therefore, injections of oil, once in 3 or 4 weeks intradermally or subcutaneously in the affected parts of the body, were considered best in maintaining improved blood circulation. However, as massage, application of heat, and exercise of the muscles also increased the local blood circulation, though temporarily, we advised daily application of these measures also.

None of our patients was a hospital case. Treatment was recommended, which they followed in their own homes, with return from time to time for periodic examination and further instruction.

Two hundred and eighty-one cases in all were selected for treatment to prevent the development of polyneuritic signs. Forty-eight could not follow our routine for one reason or another. Therefore, 233 patients finally received treatment. Forty-two had lesions on the face, and in 40 (95.2%) lagophthalmos and facial paralysis did not develop. Seventy-nine had lesions on the hand and thickening of the associated nerves, and in 74 (93.7%) deformity did not develop. After treatment, as a rule, reduction in nerve thickening occurred, with return of some sensation, strength and function. This result was of great value to the patients, who were about to lose their jobs because of loss of strength in the hand. Fifty-three patients had lesions on the foot or leg, with thickening of the lateral popliteal nerve, and in 50 (94.3%) footdrop did not develop. Fifty-nine patients had anesthesia in the sole, and in 56 (94.9%) trophic ulcers did not develop. With treatment there was gradual return of pain sensation and to some extent touch sensation also. The likelihood, therefore, of developing ulcers in the future became remote. No one of these patients was confined to bed or supplied with any improvised shoe. They had to walk about to earn their livelihood or to do household work.

Two hundred and seventy-five patients who had polyneuritic signs

in some form or other were selected for treatment. Sixteen of these could not follow our routine. In the remaining 259, improvement was seen in 233 cases (90.0%), with complete correction in 126 cases (54.1%) and slight to moderate correction in 107 cases (45.9%). In 26 cases there was lagophthalmos or facial paralysis or both. Improvement was seen in 25 cases (96.2%), and in 20 cases (69.23%) the correction was complete. Lacrimation ceased in all the cases, with great relief to the patient. In one case of bilateral lagophthalmos canthorhaphy of the left eye was carried out twice by orthopedic surgeons, without success, but the right lagophthalmos was corrected completely by our treatment carried out for 2 years. Difficulties in chewing and defective speech in cases with facial paralysis were corrected, and in 1 case paralysis of the frontal belly of the occipitofrontalis muscle was corrected.

One hundred and fifteen cases had deformity of the hand. After treatment, improvement was seen in 106 cases (92.2%). Slight correction occurred in 38 (33.0%), moderate in 34 (29.6%), and complete in 34 cases (29.6%). In all the cases there was considerable return of sensation, strength and function. The affected hands, which were cold to touch before treatment, gradually became warmer and remained so even in the winter season, when deformed hands usually become icy cold. Possibly this effect was due to the formation of new blood vessels in the affected hands as a result of repeated injections. With return of sensation there was no more blistering of the hands. Because of weakness in the hand some of our patients were about to lose their jobs; these were saved by our treatment. One patient with bilateral deformity, not being satisfied with the slow improvement in our treatment, preferred tendon transplantation in the left hand. After operation there was some correction of deformity of his left hand, but the grip of the operated hand became weaker. That the tendon transplantation may not always give better function to the operated hand will be evident from two other cases illustrated by Figures 7a, 7b, and 8. Deterioration was seen in some of our patients who had reaction and who discontinued treatment. Patients were persuaded therefore to continue treatment for a sufficient length of time, and the dose of the drugs prescribed was such as not to excite reaction. Other causes of reaction were also treated. Thirty-nine cases had footdrop. Improvement was seen in 25 cases (64.1%). In 8 cases (20.5%) the correction was complete. Correction of footdrop was found to be more difficult than correction of other forms of deformity. In seventy-nine cases there were trophic ulcers in the soles. Improvement occurred in 77 (97.5%), and in 64 (81.0%) the ulcers healed completely. Relapse occurred, however, in 8 cases (10.1%), as a result of too early cessation of treatment or improper treatment or subsequent reaction. Patients whose ulcers healed completely were, to a great extent, relieved of discomfort and anxiety due to public attention. Healing of ulcers was sometimes impeded by dead bone at the base of the ulcer and the formation of ex-

cessive fibrous tissue around it. Therefore, dead bone at the base was scooped out with a blunt knife, and the fibrous tissue around the ulcer was scraped from time to time.

Sixty-three patients with hypopigmented, anesthetic, and depilated patches were treated. In 60 cases (95.2%) there was return of sensation in varying degree. In 30 (47.6%) the return of sensation, pigmentation, hair growth, sweat function, etc., was complete, and patients became free from all signs of the disease. In some cases there was hyperpigmentation and excessive growth of hair in the patches.

DISCUSSION

These findings show conclusively that the so-called neural and polyneuritic signs are not always due to degeneration of nerves and not always irreversible. They show also that hydnocarpus oil is not absolutely useless in the treatment of leprosy. When used properly and with discretion it does immense good to patients in various ways. The work here reported was not planned to make a comparative study of the effect of chemotherapeutic drugs and hydnocarpus oil on leprosy bacilli, as the former is well known to be superior. Attempts were made, however, to draw pointed attention to other beneficial effects of hydnocarpus oil in the treatment of leprosy. The reason why no other oil was used is that this and the chaulmoogra oil were found by Muir^(5, 6, 7) to have some therapeutic value in leprosy. Since 1923, and until the introduction of chemotherapeutic drugs, favorable results of oil treatment were published every year by eminent leprologists of India and other countries. From these reports it became clear also that its prolonged use was not harmful to patients. A second reason is that it is cheap, and when obtained from fresh ripe seeds, least irritant. A third reason is that it is readily available in the injectable form.

Medicine is not only a science but also an art in healing. It is our duty to see that patients do not develop deformities, trophic ulcers, etc., while under our treatment. Too much reliance on chemotherapy does not help the patient in this respect.

Although chemotherapy is very good in leprosy, it has to be continued for years. There is no harm if injections of oil, exercise, massage, etc., are continued at the same time.

In view of the fact that polyneuritic signs also can be corrected in many cases, it is not proper to refer such a case to an orthopedic surgeon without a fair trial of all other measures known to benefit the patient. After our treatment polyneuritic signs were corrected in a large number of cases, and the patients did not require surgical help, tools, gadgets and improvised shoes. Correction of lagophthalmos by operation has become possible, but no operation has yet been devised to correct the paralysis of the other muscles of the face, which may result in impairment of speech and difficulty in eating and drinking. Besides that, in competent hands, surgery may be a boon, but in in-

competent hands it may lead to misery, as well, to the patient.

Anesthesia also persists after the operation. So long as the anesthesia persists, and no improvement in blood circulation occurs in the anesthetic sole, the chance of developing blisters and trophic ulcers will remain. No amount of padding with cotton can save the life and limb of an undernourished child, unless its nutrition is improved at the same time. Only a handful of competent orthopedic surgeons are available, but there are thousands of cases with polyneuritic signs in one form or other. To this number many more are added every year. In how many cases can surgeons cater to their needs? Tools, gadgets, and other appliances may be advantageous to the patient in one way, but in his social life they will be most disadvantageous, for on account of them he will remain marked as a case of leprosy. Use of improvised shoes may have the same disadvantages. Besides that, these appliances may be beyond the means of patients. Considering all these points, it is far better to give an all around treatment, which we have suggested, in order to prevent the development of polyneuritic signs and correct these signs when they are already present, thus enabling patients to mix freely with others. By this method the burden on orthopedic surgeons and the load of rehabilitation can be reduced considerably, and the sufferings of patients can be minimized to a great extent in most cases.

SUMMARY

It is usually held that the so-called neural signs of leprosy are due to degeneration of affected nerves, and that they are inevitable and irreversible. We hold the view, on the other hand, that the neural signs are due more to vascular than neural changes, and that they are not irreversible.

In our treatment of leprosy cases, besides chemotherapy, various measures were adopted to increase the blood circulation of the affected parts. Of these measures, periodic injection of hydnocarpus oil in the affected parts was found to be better. However, as massage, daily compress, and exercise of the affected muscles, are known to improve blood circulation, we advised all these measures besides chemotherapy.

The work was planned to prevent the development of polyneuritic signs in cases where such a development was apprehended, to try to correct polyneuritic signs when they were already present, and to make residual signs, like hypopigmentation, anesthesia, depilation, keratosis, etc., disappear. The results were encouraging.

Two hundred and thirty-three cases were treated to prevent the development of polyneuritic signs. In 220 (85.9%) of these, polyneuritic signs did not develop.

Two hundred and fifty-nine patients with polyneuritic signs received our treatment. Improvement was seen in 233 cases (90.0%), and in 126 (48.6%) of these there was complete correction.

Sixty-three patients with hypopigmented, anesthetic and depilated patches were under our treatment. In 60 (95.2%) return of sensation occurred in varying degrees. In 30 (47.6%) of these the return of pigmentation, sensation, hair growth, sweat function, etc., was complete.

To render so much good to so many patients was not possible by any single method. In the treatment of leprosy the pathologic changes leading to physiologic disturbance should be kept in mind and instead of holding to one treatment we should apply our full knowledge for the benefit of the patient. If the line of treatment we advocate is used judiciously, immense good can be done to the patient. But the treatment must be continued for sufficient length of time to obtain and maintain the desired results. If our patients could have been treated under strict personal supervision, the percentage of success would have been much more.

Furthermore, since the development of polyneuritic signs can be prevented in a large number of cases, and correction is possible in many cases, the number of cases requiring the help of orthopedic surgeons may be reduced greatly by this method. Also a smaller number of cases will require rehabilitation. Therefore, besides chemotherapy, we should use all available methods of treatment at the same time to fight the disease that cripples the patient physically, mentally, and socially.

RESUMEN

Comunmente se sostiene que los denominados signos neurológicos de la lepra son debidos a la degeneración de los nervios afectados, y que ellos son inevitables e irreversibles. Nosotros sostenemos por el contrario, de que los signos neurológicos se deben mas a los cambios vasculares que a los cambios neurológicos, y de que ellos no son irreversibles.

En nuestro tratamiento de los casos de lepra, a mas de la quimioterapia, varias medidas fueron tomadas para aumentar la circulación sanguínea de las partes afectadas. De estas medidas, se encontro que la mayor fué la inyección periódica de aceite de *hydnoearpus*. De cualquier manera como el masaje, la compresa y el ejercicio de los músculos afectados, son bien conocidos como mejoradores de la circulación sanguínea, nosotros aconsejamos todas estas medidas a mas de la quimioterapia.

El trabajo fué planificado para prevenir el desarrollo de signos polineuríticos en casos donde tal evolución fué temida, para tratar de corregir los signos polineuríticos cuando ellos estaban presentes y para hacer desaparecer signos residuales, tales como la hipopigmentación, anestesia, depilación, queratosis, etc. Los resultados fueron alentadores.

Doscientos treinta y tres casos fueron tratados para prevenir el desarrollo de signos polineuríticos. En 220 (85.9%) de estos, los signos polineuríticos no se desarrollaron.

Doscientos cincuenta y nueve pacientes con signos polineuríticos recibieron nuestro tratamiento. En 233 casos (90.0%) fué notada una mejoría y en 126 (48.6%) de estos hubo una corrección completa.

Sesenta y tres pacientes estauvieron bajo tratamiento con hipopigmentación, anestesia y areas depiladas. En 60 (95.2%) hubo retorno de sensaciones en diversos grados. En 30 (47.6%) fué completo el retorno de la pigmentación, sensación, crecimiento de cabello, sudoración. etc.

Para rendir tanto bien a tantos pacientes no fué posible hacerlo con un solo método. En el tratamiento de la lepra las alteraciones patológicas que llevan a las alteraciones fisiológicas, deben ser tenidas in mente y en lugar de ajustarse a un tratamiento, nosotros debemos aplicar todo el conocimiento para el beneficio del paciente. Si la línea de tratamiento que nosotros preconizamos es usado juiciosamente, un inmenso bien puede ser hecho para el paciente. Pero el tratamiento debe ser continuado por suficiente largo tiempo como para obtener y mantener los resultados deseados. Si nuestros pacientes pudieron haber sido tratados bajo una estricta supervisión personal, el porcentaje de éxitos hubiera sido mucho mayor.

Mas aún, desde que el desarrollo de signos polineuríticos puede ser prevenido en un gran numero de casos, y la corrección es posible en muchos casos, el numero de casos que requerirían la ayuda de los cirujanos ortopedistas podría ser reducida grandemente por éste metodo. Tambien un menor número de casos requerirían rehabilitación. Por lo tanto, a mas de la quimioterapia, nosotros debemos usar todos los metodos disponibles de tratamiento al mismo tiempo, para combatir la enfermedad que invalida al paciente física, mental y socialmente.

RÉSUMÉ

Il est généralement admis que les manifestations de la lèpre dite neurale sont dues à une dégénérescence des nerfs affectés, et que ces manifestations sont inévitables et irréversibles. Nous sommes par contre de l'avis que les manifestations neurales sont dues à des altérations vasculaires plutôt qu'à des altérations nerveuses, et qu'elles ne sont pas irréversibles.

Dans notre manière de traiter les cas de lèpre, en plus de la chimiothérapie, nous avons pris diverses mesures pour accroître la circulation sanguine dans les parties affectées. Parmi ces mesures, des injections périodiques d'huile d'hydrocarpus dans les parties affectées se sont révélées être les plus avantageuses. Cependant, puisque les massages, les compresses quotidiennes et l'exercice des muscles atteints sont connus comme moyen d'améliorer la circulation, nous recommandons ces mesures en sus de la chimiothérapie.

On a pris des mesures pour prévenir le développement de manifestations de polynévrite dans les cas où on craignait une telle évolution. On a aussi pris des mesures pour essayer de corriger les manifestations de polynévrite lorsqu'elles étaient présentes, et pour faire disparaître les signes résiduels tels qu'hypopigmentation, anesthésie, alopecie, et kératose. Les résultats ont été encourageants.

Deux cent trente trois cas ont été traités en vue de prévenir de développement des manifestations de polynévrite. Chez 220 (85.9%) de ces cas, les manifestations de polynévrite ne se sont pas développées.

Deux cent cinquante neuf malades avec manifestations de polynévrite ont reçu notre traitement. Une amélioration a été notée chez 233 (90.0%), et parmi 126 de ceux-ci (48.6%) une entière correction de ces manifestations fut observée.

Soixante-trois malades avec macules hypopigmentées, anesthésiques et alopeciques ont été soumis à notre traitement. Chez 60 (95.2%) le retour de la sensibilité est survenu selon un degré variable. Chez 30 (47.6%) de ceux-ci, la récupération de la pigmentation, de la sensibilité, de la pilosité, de la sudation, etc. . . a été complète.

Obtenir des résultats aussi excellents chez tant de malades n'a pu être possible à la suite de l'emploi d'une seule méthode. Il faut, pour le traitement de la lèpre, garder présentes à l'esprit les modifications pathologiques qui mènent aux altérations physiologiques, et dès lors, au lieu de s'en tenir forme à un traitement, il faut utiliser toute notre connaissance pour l'appliquer afin que le malade puisse en tirer le plus grand bénéfice. Si la ligne de conduite que nous recommandons pour traiter les malades est suivie de façon judicieuse, un bien immense peut être fait au malade. Mais le traitement doit être continué pendant suffisamment longtemps que pour obtenir et pour maintenir les résultats désirés. S'il avait été possible de traiter nos malades sous une

supervision personnelle étroite, le pourcentage de succès aurait été beaucoup plus élevé.

De plus, du fait que le développement des manifestations de polynévrite peut être prévenu dans une grande proportion des cas, et que la correction est possible dans beaucoup de cas, le nombre de cas nécessitant le recours aux chirurgiens orthopédistes pourrait être grandement réduit par cette méthode. De même un nombre moins élevé de cas nécessiterait le recours à des méthodes de réhabilitation. Dès lors, en plus de la chimiothérapie, nous devrions utiliser simultanément toutes les méthodes de traitement qui sont disponibles pour combattre cette maladie qui invalide le malade physiquement, mentalement et socialement.

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