Training Manual for Physiotherapists 2020

National Leprosy Eradication Programme

Central Leprosy Division, New Delhi and Central Leprosy Teaching & Research Institute, Chengalpattu, T.N.

Directorate General of Health Services, Ministry of Health and Family Welfare

GOVERNMENT OF INDIA

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Officer Details with Date

FOREWORD

It gives me immense pleasure to bring out the training manual for physiotherapists engaged in service delivery to the persons with Leprosy. The manual is prepared by Central Leprosy Division, DGHS (MoHFW, GOI) with support of various stakeholders of National Leprosy Eradication Programme (NLEP). It is intended to bring about uniformity in the training imparted by different government and non-governmental organizations to physiotherapists involved in care of person with leprosy.

Physiotherapy is one of the major components of Disability Prevention and Medical Rehabilitation (DPMR). In India, a considerable number of new cases are being detected every year with disabilities and deformities. Even though cured, the person with disability continues to be victim of community stigma. Skillful Physiotherapy services have a critical role in early detection of disability and its effective management to restore functional ability to the maximum possible and prevent further worsening. Physiotherapy care is essential to improve the suppleness of the joints and isolation and strengthening of chosen tendon before reconstructive surgery. During the post-operative period, physiotherapy has a crucial role in isolation & re-education of the transferred tendon. Physiotherapy services have an important role in supporting leprosy cured persons to lead productive personal and social lives as well as in elevating stigma.

I am confident that this manual will also serve as a reference for everyone involved in physiotherapy and DPMR activities to further reduce disability due to leprosy in the coming years.

(.....)

Dr. VINEET K. CHADHA
D I R E C T O R

सत्यमेव जयते

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PREFACE

Physiotherapy is one of the key armamentaria in care of persons with leprosy for prevention, limitation and amelioration of associated disabilities. Therefore, Physiotherapists play a vital role in implementation of activities to identify, minimize and correct the deformities due to leprosy.

The various interventions under the National Leprosy Eradication Programme (NLEP) are delivered in integration with general health care services since the year 2005. However, an increasing trend in Grade II (Visible) deformities among new cases has been observed from 1.87% in 2005 to 4.61% in 2015. This necessitates impetus on identification and management of existing and emerging deformities among person with leprosy, even after cure. Trained personnel are thus required to impart appropriate physiotherapy services. Hence this manual is aimed at imparting necessary skills to physiotherapists for prevention and management of deformities. It is expected that this manual will help the target personnel in identification and assessment of deformities, selection of specific physiotherapy modalities and to render appropriate care in restoration of their day to day activities. Since Leprosy physiotherapists are currently not available in most of the health institutions. This manual stands as a light house for imparting necessary skills to the general physiotherapists in the management of nerve function impairments and disabilities in persons with leprosy. It will also empower the physiotherapists in supporting their rehabilitation as social and economically productive assets to the nation, within the available resources.

I applaud all the experts who contributed to the development of this manual.

Dr. Vineet K. Chadha

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CHAPTER 1
INTRODUCTION OF PHYSIOTHERAPY IN LEPROSY

Learning Objectives

- Will be able to list cardinal signs and criteria for diagnosis of leprosy
- Will be able to understand the basis of leprosy classification and its importance
- Will know the treatment regimen for leprosy
- Will know the importance of reactions in leprosy
- Will know the important epidemiological indicators in NLEP

1.1 Definition

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. Leprosy commonly affects the skin and the peripheral nerves. Rarely it also affects other tissues such as eye, bone and testes etc.

The disease also have specific features such as long incubation period and it is being the only bacterial disease which affects nerves. The disease also has consequences beyond the physical domain affecting social and psychological dimensions.

Mycobacterium leprae is an acid fast bacillus. Transmission of leprosy is considered to take place by droplet infection through nasal mucosa or skin erosions. The organism multiplies in the cooler parts of the body. Hence the skin of face and limbs, major peripheral nerve trunks are involved in leprosy.

1.1.1 Definition of Physiotherapy

Physiotherapy is the system of treatment using physical energies like heat, cold water, sound, electricity and some mechanical forces. This helps in clearing of oedema, relief of pain during movement, preventing deformities during lepra reactions. Secondary deformities can be prevented by simple health education strategies. Physiotherapy techniques required both before and after the reconstructive surgery (tendon transfer) to restore the function of the particular joint. Pre-operative Physiotherapy is needed to prepare the part and provide optimal conditions for corrective surgery. Post-operative Physiotherapy is required to obtain maximum benefit from the surgery. Tendon transfer operation will fail, if it is not preceded and followed by Physiotherapy. In Physiotherapy for management of Leprosy patients some commonly used methods are Wax therapy, massage, exercises and splinting. While the other methods like Electrical Stimulations, Nerve Stimulations, Shortwave Diathermy and Ultrasonic Therapy are also used.

When the patient experiences weakness of muscle, regular Physiotherapy like Wax bath, massage, exercises, splints and electrotherapy can be given to restore the muscle power and prevent deformities. Established deformities can be corrected by Reconstructive surgeries. The treatment modalities employed are hand and foot exercises, wax therapy, oil massage, short wave diathermy, ultra-sound therapy, trans-cutaneous nerve stimulation, infra-red treatment, interferential therapy and electrical stimulation of muscles and nerves.

1.1.2 Aim of Physiotherapy: The physiotherapy techniques are aimed at

i. Prevention and management of Deformities
ii. Overcome the disabilities
iii. Reduce the oedema
iv. Relieve the pain
v. Improve blood circulation.
vi. Providing pre and post-operative management
vii. Health Education to prevent secondary deformities.

1.2 Clinical Features

The incubation period is considered to be two to five years. However periods of few months to more than 10 years have been recorded.

Skin patch

The first clinical sign is a skin patch which is hypo-pigmented. Touch sensation over the patch is impaired or absent. The skin patch may be devoid of hair and sweating. The nature of the skin lesion determines the type of leprosy.

Sensory Loss

If the peripheral nerve trunks are involved, sensory loss may be present over the hand or foot. Corneal sensation may also be affected.

Motor loss

When the peripheral nerve trunks are involved, motor paralysis also may occur in hands, feet and eyes resulting in impairments.

1.3 Diagnosis of Leprosy

Cardinal signs of leprosy

There are three cardinal signs of leprosy

1. Hypo-pigmented anaesthetic skin patch
2. Enlarged thickened nerves – cutaneous and major nerve trunks
3. Demonstration of acid fast bacilli in skin smears

At least one of the three cardinal signs must be present to make diagnosis of leprosy.

Diagnosis of leprosy is based on clinical examination. The presence of at least one cardinal sign will favour a diagnosis of leprosy.

In the field and Primary Health Centres, laboratory investigation of slit skin smear examination is not available. So diagnosis of leprosy on these areas is purely based on clinical examination of skin and nerves.

Diagnostic tests such as slit skin smear examination, skin/nerve biopsy and molecular tests are needed to diagnose difficult cases, for classification and to diagnose relapse and/or drug resistance.

1.4 Classification of Leprosy

The type of leprosy depends on the host parasite relationship. The fundamental basis for this classification is based on the immunity of the host. This classification is named – Ridley Jopling classification.

The spectrum of leprosy has five distinct groups. At the ends of the spectrum are polar types of leprosy and the intervening groups are intermediate groups.

The polar types are Tuberculoid (TT) and Lepromatous (LL). The polar types represent strong host immunity, in case of TT and significantly reduced host immunity, in case of LL.

Based on the levels of host immunity, the intermediate groups lie between the polar types. These are Borderline Tuberculoid (BT), Borderline Borderline (BB) and Borderline Lepromatous (BL).

For operational reasons of implementing Multi Drug Therapy, WHO has classified Leprosy into two groups, Paucibacillary and Multi-bacillary.

Where there are
1. More than five lesions (both skin and nerves) or
2. 2 or more than 2 truncal nerves involved or
3. AFB is demonstrated in the skin smears,

These patients are classified as Multi bacillary.

Where there are
1. Five or less patches
2. One truncal nerve involvement
3. Slit skin smear negative,

These patients are classified as Paucibacillary.

The treatment is based on the WHO classification.

Ridley Jopling -Classification of Leprosy

Tuberculoid Tuberculoid	–	TT
Borderline Tuberculoid	–	BT
Borderline Borderline	–	BB
Borderline Lepromatous	–	BL
Lepromatous Lepromatous	–	LL

WHO Classification of Leprosy

Paucibacillary –	PB
Multibacillary –	MB

Immunological factors determining the type of leprosy

After exposure to *M leprae*, individuals with good Cell Mediated Immunity (CMI) may remain normal, develop skin lesions which heal spontaneously or develop Pauci bacillary leprosy

After exposure to *M leprae*, individuals with weak Cell Mediated Immunity (CMI) develop Multi Bacillary Leprosy. In addition to skin and nerves, eyes, testes, RE system and vascular endothelium may also get involved.

Pure Neuritic Leprosy

This is a form of leprosy where skin lesions are not seen but peripheral nerve trunks at classical sites for leprosy are enlarged. They may or may not present with nerve function impairment.

1.5 Reactions in Leprosy

Reactions in Leprosy occur as a complication when there is a sudden alteration in the immunological status of the host against the living or dead bacilli.

Lepra Reactions can occur before MDT, during MDT or even after the completion of MDT.

- These reactions are the main cause of deformity and disability in Leprosy
- Must detect and treat Reactions before they cause nerve damage, by patient health education/clinical examination
- With early detection and effective treatment of nerve damage, Reaction can be reversed and disability can be prevented
- Reactions occur in approximately 25-30% of leprosy patients
- Patients with MB leprosy, Multiple skin lesions, Smear positive cases, Previous h/o reaction, Previous h/o nerve damage (4 fold increase risk), patch over the face are at increased risk of lepra reactions.
- Reactions can occur before, during or after completion of treatment. It occurs mostly during the 1st six months after starting treatment. The incidence decreases with time, occasionally occurring even several years after Released From Treatment (RFT).
- Reaction primarily affects the skin, nerves and eyes.

  Hence it is very important to examine these organs during each visit for early detection of lepra reactions:

  - *Skin – whole body*
  - *Nerves– Voluntary Muscle Testing (VMT)/Sensory Testing (ST)/Visual Acuity (VA) must be examined (sometimes neuritis is 'silent')*
  - *Eye – redness and loss of VA*

- If loss of function for less than 6 months – can recover with steroids and physiotherapy

There are two types of lepra reactions

Type I reaction

Type I reactions (also known as reversal reaction) occurs due to sudden increase in the specific CMI activity against leprosy bacilli - living or dead. Immunologically, Type I reactions are delayed hypersensitivity reactions. It occurs commonly among the Borderline types of leprosy. It occurs mostly during the first six months after starting MDT.

The skin lesions are inflamed and there may be pain and swelling of the peripheral nerve trunks. There is inflammatory oedema and cellular infiltration of the nerve causing increased pressure within the nerve sheath. This may result in damage to the nerve fibres and compromise the functions of the nerve involved.

Type II reaction

This reaction is also called Erythema Nodosum Leprosum (ENL). This reaction occurs among the multibacillary patients towards lepromatous pole of the disease.

Large number of dead bacilli released (antigen) combine with existing antibodies in the tissues forming antigen antibody complexes which get deposited in various tissues resulting in inflammation. Important organs such as eyes, liver, nerve, kidney and testes may be involved.

Patient usually presents with painful erythmatous subcutaneous nodules. Type II reaction is associated with constitutional symptoms such as fever, malaise and joint pains.

1.6 Treatment of Leprosy

Till 1940s, there was no definitive treatment of leprosy. The advent of sulfones during this period offered hope for treatment of leprosy in the form of Diamino Diphenyl Sulfone (DDS).

With M. leprae developing resistance to DDS, Multi Drug Therapy (MDT) was introduced in the year 1982.

Drugs used in MDT are

1. Rifampicin
2. Dapsone
3. Clofazamine

MDT treatment for MB patients is for 12 months and is called MB-MDT. MDT treatment for PB leprosy patients is for 6 months and is called PB-MDT.

Treatment for MB Leprosy –12 months (To be completed within 18 months)

MB- MDT (Adult)
Rifampicin once a month 600 mg
Clofazimine once a month 300 mg
Dapsone daily 100 mg
Clofazimine daily 50 mg

MB-MDT(Child)-10 to 14 years
Rifampicin once a month 450 mg
Clofazimine once a month 150 mg
Dapsone daily 50 mg
Clofazimine 50 mg on alternate days

Treatment for PB Leprosy- 6 months (To be completed within 9 months)

PB- MDT(Adult)
Rifampicin once a month 600 mg
Dapsone daily 100 mg

PB-MDT(Child)-10 to 14 years
Rifampicin once a month 450 mg
Dapsone daily 50 mg

MDT for child weighing more than 35kg -Adult Blister Calendar Pack should be given.

MDT drug dose for Child –less than 10 years is based on body weight. But duration of treatment is same.

Rifampicin once a month 10 mg/kg
Clofazimine once a month 6 mg/kg
Dapsone daily 2 mg/kg
Clofazimine daily 1 mg/kg

1.7 Advantages of MDT

- MDT is a combination of bactericidal and bacteriostatic drugs. Hence, it helps to prevent complications and relapse.
- MDT renders an infectious patient non-infectious, thereby reducing transmission of leprosy.
- Using more than one drug reduces the chances of drug resistance.
- Treatment duration is reduced, short and fixed. This improves adherence to treatment.
- Available as package in blister form.

1.8 Epidemiology of Leprosy

Leprosy is a historical disease with an uneven distribution and a predilection for crowded and poor socioeconomic conditions. The Agent is *Mycobacterium leprae*, the Host is human and the important environmental factors are over-crowding and lower socioeconomic status.

The route of transmission is not clearly known, but is thought to be either through the nasal mucosa or through the skin. A few studies have shown a reasonably good efficacy of the Vaccine (Mycobacterium Indicus Pranii). BCG vaccination given for tuberculosis is thought to give protection against leprosy to some extent. Host Immunity is the key in developing the disease.

Following indicators are important to assess the elimination of leprosy.

New Case Detection Rate (NCDR)

The new case detection rate is calculated using the number of cases detected during the year per 100 000 population.

Global

During the reporting year **2018**, a total of 208,641 new leprosy cases were detected globally. The new case detection rate was 2.74 per 100,000 population, marginally less (211,182 cases) than the previous year.

India

During the year **2018-19**, 57.67% of the global cases were in India. The NCDR for India was about 8.69 per 100,000 population.

Prevalence Rate (PR)

The prevalence rate (PR) is calculated using the number of patients registered for MDT on the last day of the reporting year per 10,000 population (point prevalence).

Global

At the end of the reporting year **2018**, a total of 184,238 leprosy cases globally were receiving MDT, which corresponds to a PR of 0.24 per 10,000 population, a decrease from 0.67 per 10 000 in 2017-18.

India

The prevalence rate which was 57.60/10,000 population before start of MDT in 1983 reduced to 85,302/10,000 by March 2019.

It has been observed that trend of two important indicators of National Leprosy Eradication Program, India i.e. Annual New Case Detection Rate (ANCDR) and Prevalence Rate (PR) are almost static since 2006 – 2007.

Grade II Disability Rate

Grade II disability rate amongst new cases is an important indicator for the program as it indicates the delay in diagnosis. Grade II disability rate increased from 3.10% (2010 - 2011) to 4.60 (2015-16) and reduced to 2.65 % (2018-19) due to sustained efforts under NLEP.

CHAPTER - 2

RELATED ANATOMY

Learning Objectives

- Will be able to list the main muscles and movements that are affected in leprosy
- Will be able to know the action and nerve supply of these muscles
- Will be able to map out the sensory supply of areas affected in leprosy both in upper and lower limbs

1) UPPER LIMB

The major movements that are affected by leprosy in the upper limb are described in this section.

1.1 Movements of the thumb

Movements of thumb that are affected in leprosy are – Opposition and Abduction at Corpo-Metacarpal (CMC) joint and Flexion at Meta-carpo Phalangeal (MCP) joint when Inter-phalangeal (IP) joint is in extension.

The movement of opposition at CMC joint is brought about by Opponens Pollicis

Origin	Originates from flexor retinaculum and tubercle of the trapezium bone
Insertion	At the shaft of the metacarpal bone of the thumb
Nerve Supply	Median Nerve
Action	Pulls the thumb into opposition

Abduction at CMC joint is brought about by Abductor Pollicis Brevis

Origin	Originates from scaphoid, trapezium bones and flexor retinaculum
Insertion	Inserts into the proximal phalanx of the thumb at its base
Nerve Supply	Median Nerve
Action	Abduction of the thumb which is at right angles to the plane of the palm

Flexion at MCP joint is brought about by Flexor Pollicis Brevis

Origin	Originates from flexor retinaculum
Insertion	Inserts into the proximal phalanx of the thumb at its base
Nerve Supply	Median Nerve
Action	Flexes the Metacarpo phalangeal joint at the thumb

1.2 Movements of little finger

Movement of little finger that are affected in leprosy – Abduction

Abduction of little finger at MCP joint is brought about by Abductor Digiti Minimi

Origin	The muscle originates from the pisiform bone
Insertion	The muscle inserts into the medial side of the base of the proximal phalanges of the little finger.
Nerve Supply	Ulnar Nerve
Action	Abduction of the little finger at the metacarpophalangeal joint

1.3 Movement of fingers

Movements of fingers that are affected in leprosy – Adduction, Abduction and flexion at MCP Joint

Adduction of fingers at MCP joint is brought about by Palmar Interossei (4)

Palmar interossei adduct the index, ring and little fingers toward the median line which runs along the middle finger (no palmar interossei in middle finger)

Origin	1st and 2nd palmar Interosseous arises from the base of the 1st and 2nd Metacarpal on the ulnar side, the other two palmar interossei arise from the anterior surface of the fourth and fifth metacarpal on the Radial side
Insertion	The Interrossei insert into the proximal phalanges of the thumb, index, ring and little fingers and the dorsal digital expansion of each finger
Nerve Supply	Ulnar Nerve
Action	Adduction of the fingers towards the middle finger. They also flex metacarpophalangeal joints and extend the interphalangeal joints on a stabilized MCP joint in the lumbrical position.

Abduction of finger at the MCP joint is brought about by Dorsal Interossei (4)

Dorsal interossei move the fingers away from the median line along the middle finger. The index finger, the middle finger and ring finger have dorsal interossei. Little finger has its own abductor in abductor digiti minimi (there are two dorsal interossei in middle finger)

Origin	Adjacent sides of shaft of the I, II, III, IV and V Metacarpal Bones
Insertion	Base of proximal phalanges of the index, middle and ring fingers and the dorsal digital expansion
Nerve Supply	Ulnar Nerve
Action	Abduction of the index finger and middle finger towards radial side, and abduction of ring finger towards ulnar side

Flexion of fingers at the MCP joints is brought about by the Lumbricals

The lumbricals primarily flex the metacarpophalangeal joints of the four fingers

Origin	Tendons of the Flexor digitorum profundus
Insertion	Inserts into the extensor expansion of four fingers on the medial side
Nerve Supply	The 1st and the 2nd (lateral lumbricals) by the median nerve, the 3rd and 4th (medial lumbricals) by the ulnar nerve
Action	Flexes metacarpophalangeal joints and extend the inter phalangeal joints of fingers (stabilization of MCP joints)

Flexion of fingers at PIP joint is brought about by Flexor Digitorum Superficialis (sublimus) – **not affected in leprosy**

Origin	Humero-ulnar head from the medial epicondyle of humerus and the coronoid process of ulna, the radial head from the shaft of radius on the anterior surface
Insertion	Middle phalanx of medial four fingers
Nerve Supply	Median Nerves
Action	Flexes the middle phalanges and assists in the flexion of proximal phalanges of the medial four fingers

Flexion of fingers at the Distal Inter Phalangeal (DIP) joint is brought about by Flexor Digitorum Profundus – **commonly not affected in leprosy.**

Origin	Anterior and medial surface of the shaft of ulna
Insertion	Into the distal phalanges of the medial four fingers
Nerve Supply	Ulnar (little & ring finger) and median nerve (index & middle finger)
Action	Flexes the distal phalanges and assists in the flexion of the middle and proximal phalanges of the medial four fingers

Extension of the fingers at the MCP joint is brought about by Extensor Digitorum– **commonly not affected in leprosy.**

Origin	From the humerus at its lateral epicondyle
Insertion	At the medial four fingers at the middle and the distal phalanges
Nerve Supply	Radial Nerve
Action	Finger extension at MCP joint

1.4 Movements of the wrist

Extension of the wrist is brought about by ECRL and ECRB – **commonly not affected**

Extensor Carpi Radialis Longus (ECRL)

Origin	From the lateral Supracondylar ridge of the humerus
Insertion	Base of the 2nd metacarpal bone on the posterior surface
Nerve Supply	Radial Nerve
Action	Extension and abduction of the hand at wrist joint

Extensor Carpi Radialis Brevis (ECRB)

Origin	From the humerus at the lateral epicondyle
Insertion	Base of the 3rd metacarpal bone on the posterior surface
Nerve Supply	Radial Nerve
Action	Extension of the hand at wrist joint

Flexion at the wrist is brought about by FCR, PL and FCU. FCR and PL are supplied by median nerve (not affected). FCU is supplied by ulnar nerve and affected in high ulnar palsy.

Flexor Carpi Radialis (FCR)

Origin	From the humerus at the medial epicondyle
Insertion	Second and the third metacarpal bones at their bases
Nerve Supply	Median Nerve
Action	Flexion and abduction of the hand at the wrist joint

Palmaris Longus (PL)

Origin	From the humerus at the medial epicondyle
Insertion	Gets inserted into the flexor retinaculum and the palmar aponeurosis
Nerve Supply	Median Nerve
Action	Flexes the hand at the wrist joint and tightening the palmar fascia

Flexor Carpi Ulnaris (FCU) - Affected in High Ulnar Nerve Involvement

Origin	The humeral head originates from the Medial epicondyle of the humerus and the ulnar head from the olecranon and posterior border of ulna
Insertion	Hamate, Pisiform and the 5th metacarpal bone
Nerve Supply	Ulnar Nerve
Action	Flexion and adduction of the hand at the wrist

2. LOWER LIMB

The major movements that are affected in the lower limb in leprosy are described in this section.

2.1 Movements at the Ankle

Plantar Flexion of the ankle is brought about by Gastrocnemius and Soleus – **not affected**

Gastrocnemius

Origin	Lateral and Medial head from the lateral and medial condyle of femur
Insertion	Joins together with the soleus muscle to form the tendo calcaneus and inserts into the posterior surface of the calcaneum
Nerve Supply	Tibial Nerve
Action	Plantar flexes foot at the ankle joint

Soleus

Origin	From the Tibia and the Fibula shafts
Insertion	Joins together with the Gastrocnemius muscle to form the tendo calcaneus and inserts into the posterior surface of the calcaneum
Nerve Supply	Tibial Nerve
Action	Plantar flexes foot at the ankle joint

Dorsiflexion at the ankle is mainly brought about by Tibialis Anterior – **can be affected**

Origin	Originates from the lateral surface of the shaft of Tibia and the interosseous membrane
Insertion	Into the base of the 1st metatarsal bone and medial cuneiform
Nerve Supply	Deep Peroneal Nerve (lateral Popliteal Nerve)
Action	Dorsiflexion of the foot at ankle joint and inversion of the foot at the transverse tarsal and subtalar joints

Dorsiflexion of ankle and toes is brought about by EDL and EHL **- can be affected**

Extensor Hallucis Longus (EHL)

Origin	Shaft of the Fibula on the anterior surface
Insertion	Base of Distal phalanx of great toe
Nerve Supply	Deep Peroneal Nerve
Action	Extension of the great toe along with the extension of the foot at the ankle joint

Extensor Digitorum Longus (EDL)

Origin	Lateral condyle of Tibia and upper three fourth of the medial surface of the Fibula
Insertion	Via the dorsal digital expansion into the base of distal and middle phalanx of the lateral four toes
Nerve Supply	Deep Peroneal Nerve
Action	Extension of the lateral 4 toes.

Eversion of the foot is brought about by the Peronnei - **can be affected**

Peroneus Longus (PL)

Origin	From the shaft of the Fibula on the lateral surface
Insertion	Base of the 1st metatarsal and the medial cuneiform
Nerve Supply	Superficial Peroneal Nerve
Action	Plantar flexion of the foot at ankle joint and eversion of the foot at the transverse tarsal and subtalar joints

Peroneus Brevis (PB)

Origin	From the shaft of the Fibula on the lateral surface
Insertion	Base of the 5th Metatarsal bone
Nerve Supply	Superficial peroneal Nerve
Action	Plantar flexion of the foot at ankle joint and eversion of the foot at the transverse tarsal and subtalar joints

Inversion of the foot is brought about by Tibialis anterior and Tibialis posterior

Tibialis Posterior – not affected

Origin	From the posterior aspects of the Tibia and the Fibula shafts and the interosseous membrane
Insertion	Tuberosity of the Navicular Bone
Nerve Supply	Tibial Nerve
Action	Inversion of the foot in plantar flexion at the transverse tarsal and subtalar joints

2.2 Movements of the Toes

Flexion of toes at IP joints is brought about by FDL and FHL - not affected

Flexor Digitorum Longus (FDL)

Origin	Posterior Surface of shaft of tibia
Insertion	The distal phalanx base of lateral four toes
Nerve Supply	Tibial Nerve
Action	Flexes distal phalanx of lateral four toes, plantar flexes foot at ankle joint along with Flexor Hallucis Longus (FHL)

Flexor Hallucis Longus (FHL)

Origin	Posterior Surface of shaft of fibula
Insertion	The distal phalanx base of great toe
Nerve Supply	Tibial Nerve
Action	Flexes distal phalanx of great toe, plantar flexes foot at ankle joint along with Flexor Digitorum Longus (FDL)

Flexion at MTP joints of toes is brought about by Lumbricals - **can be affected**

Lumbricals

Origin	Originates from the tendons of the flexor digitorum longus
Insertion	Inserted into the dorsal expansion of the corresponding tendon of extensor digitorum longus, they are also attached to the lateral four toes into the proximal phalanges
Nerve Supply	The 1st Lumbrical by the medial plantar nerve and remaining 3 lumbricals by the lateral plantar nerve
Action	Flexion of the toes at the metatarsophalangeal joints while the flexor digitorum longus tendons flex the toes

Adduction of toes is brought about by Plantar Interoessei - **can be affected**

Origin	The three muscles arise from the inferior and medial aspect of the 3rd, 4th and 5th metatarsal bones
Insertion	Medial side of the bases of the proximal phalanges and the dorsal expansion of the corresponding toes
Nerve Supply	Lateral plantar nerve
Action	Adducts the toes towards the centre at the metatarsophalangeal joint and it also helps in flexing the metatarsophalangeal joints and extending the interphalangeal joints

Abduction of toes is brought about by Dorsal Interoessei - **can be affected**

Origin	The four muscles arise from the sides of the adjacent metatarsal bones
Insertion	Into the bases of the proximal phalanges and the first is inserted into the medial side of the second toe and the other three are inserted into the lateral sides of the 2nd, 3rd and 4th toes
Nerve Supply	Lateral plantar nerve
Action	Abducts the toes away from the centre at the metatarsophalangeal joint and it also helps in flexing the metatarsophalangeal joints and extending the interphalangeal joints. It also helps in stabilizing the forefoot

3. Movements of the Eye

Closure of Eye is brought about by Orbicularis Oculi - **can be affected**

Origin	Palpabral Part: Fibers arise from the medial palpabral ligament and arches across both the lids, some more fibers arise from the lacrimal bone and from the fascia covering the lacrimal sac. Orbital Part: Arises from the medial end of the medial palpabral ligament and from the adjoining bone.
Insertion	Inserts into the lateral palpebral raphe and forms the eye lids.
Nerve Supply	Temporal and Zygomatic branch of facial nerve.
Action	The palabral part closes the eye lids and dilates the lacrimal sac. The orbital part pulls the skin of the forehead, temple and cheeks like a string and draws it towards the medial angle of the orbit.

Sensory Distribution
Hand Palmar Aspect

- Lateral three and half fingers (thumb, index, middle and later half of ring finger) is supplied by the median nerve.
- Palm that corresponds to lateral three and half fingers is supplied by the median nerve.
- Medial one and a half fingers (Medial half of ring finger & little finger) is supplied by the ulnar nerve.
- Palm corresponding to the medial one and half fingers is supplied by the ulnar nerve.

Foot

Plantar Aspect

Medial three and half toes (Great toe, 2^{nd}, 3^{rd} and medial half of 4^{th} toe) and corresponding plantar aspect - sole are supplied by the medial plantar nerve branch of posterior tibial nerve.

Lateral one and half toes (lateral half of 4^{th} toe and little toe) and corresponding plantar aspect - sole are supplied by the lateral plantar nerve a branch of posterior tibial nerve.

Heel - Plantar aspect is supplied by the calcaneal branches of posterior tibial nerve.

Dorsal Aspect

- Outer border of the foot and lateral malleolar part are supplied by the Sural nerve.
- Inner border of the foot and the medial malleolar part are supplied by the Saphenous nerve.
- The first web space is supplied by the cutaneous branch of deep peroneal nerve.
- The rest of the dorso-lateral aspect of the foot is supplied by the cutaneous branch of superficial peroneal nerve.

Eye

Corneal sensation is supplied by the ophthalmic branch of the trigeminal nerve.

CHAPTER – 3

NERVE INVOLVEMENT IN LEPROSY

Learning Objectives

- Will be able to list the factors influencing nerve involvement in leprosy
- Will be able to list the major peripheral nerve trunks involved in leprosy
- Will know the importance of nerve function assessment in leprosy
- Will be able to perform motor assessment both in the field and at the hospital
- Will be able to perform sensory testing both in the field and at the hospital

Factors influencing nerve involvement in leprosy

i) Superficiality

The leprosy bacillus has a predilection for cooler temperatures. So it tends to localize in the nerve where it is superficial in its course. The classical example is of the involvement of the ulnar nerve as it lies subcutaneously below and behind the medial epicondyle of the humerus.

ii) Potential Constriction

It is seen that nerve in leprosy is involved where the it passes through fibro osseous anatomical canals which can potentially constrict the nerve. The classical example would be the median nerve as it courses through the carpal tunnel.

iii) Angulation stresses

The nerve is subject to angulation stresses as it passes across, anterior or posterior of a hinge joint. The repetitive trauma of flexion and extension can aggravate inflammation in a nerve. Again, the classical example would be the ulnar nerve as it passes behind the elbow. It is observed that the ulnar nerve subluxate over the crest of the medial epicondyle during elbow movement which makes the angulation stresses worse.

iv) Bony Bed

The nerve in leprosy is involved in that part of the course of the nerve that lies against a bony bed. Repeated friction of the nerve against the bony bed may be responsible for the external trauma.

Nerves involved in Leprosy

Both trunks and superficial nerves are commonly affected in leprosy. The nerves supplying the hands, feet and face are frequently affected. It is the reason why these parts are often the sites of impairments and deformities there by causing disability.

When a nerve trunk is damaged, the nerve supply to the muscles and the skin may also be affected. The muscles initially become weak and later gets paralysed, giving rise to paralytic deformities. Paralytic deformity can be prevented by early physiotherapy.

In most leprosy patients, nerve destruction does not occur immediately, it starts as minor damage with minimal loss of function and then progresses to more extensive and more severe loss, ending in complete paralysis of the nerve. Even at this stage (Stage of Nerve Damage), if treated properly, the nerve will recover substantially, not completely. However, no recovery is possible when the nerve has been completely destroyed.

Stage of nerve involvement - no loss of function

Stage of nerve damage - minimum loss of function, incomplete paralysis

Stage of nerve destruction - complete paralysis

Assessment:

The deformity and disability status of the patient must be recorded.

State of hands and feet:

- ✓ Sensation; hand and feet
- ✓ Deformity
- ✓ Muscle power (MRC)
- ✓ Range of joint movements (angle measurements)
- ✓ Ulcers, skin cracks, scars and callosities.

Nerves of the face

Nerves affected by leprosy in the face are Trigeminal nerve and Facial nerve. There is also thickening/involvement of Superficial Nerves like the Greater Auricular nerve, Supra-orbital and Supra-trochlear nerve.

Trigeminal nerve

The Ophthalmic branch of the Trigeminal nerve is affected. This branch supplies sensation to the cornea. Most important effect of involvement of the trigeminal nerve is reduced or loss of sensation of cornea. It affects the blinking of the eye. Hence irregular or infrequent or absent blinking indicates involvement of trigeminal nerve.

Facial nerve

Facial nerve is purely a motor nerve and supplies various muscles of the face. The Zygomatic branch of the facial nerve which supplies the Orbicularis Oculi, is involved in leprosy. This leads to loss of closure of the eyelid. Weakness/paralysis of Orbicularis Oculi muscle affects the closure of the eyelid. Inability to close the eye is called ‘Lagophthalmos’.

It can have grave consequences leading to blindness. There is no sensory loss due to facial nerve involvement.

Nerves of the Upper Limb

Ulnar nerve

Ulnar nerve is affected in leprosy either at the elbow or in the Guyon's canal at the wrist. Ulnar nerve when involved is usually thickened and can be palpated just below and behind medial epicondyle of the elbow.

Its involvement causes sensory loss on the palmar aspect of little finger and medial half of ring fingers and the corresponding areas of the palm. It causes weakness or paralysis of intrinsic muscles of the hand, leading to clawing of the fingers and wasting of hypothenar eminence.

Median nerve

Median nerve is affected in leprosy at the wrist as it passes through the carpal tunnel under the flexor retinaculum of the hand. When enlarged and thickened it may be felt proximal to the wrist deep and lateral to the Palmaris longus tendon.

Its involvement causes loss of sensation on the palmar aspect of thumb, index, middle finger and lateral half of ring finger and corresponding part of the palm.

The motor weakness or paralysis causes paralysis of the thenar muscles, 1st and 2nd lumbricals leading to a) Ape thumb deformity, b) index and middle finger clawing and c) wasting of the thenar eminence.

Radial Nerve

Radial nerve is affected in leprosy in the spiral groove of humerus at the back of the arm.

Damage to the main nerve trunk causes weakness or paralysis of the wrist and finger extensors leading to wrist and finger drop. The radial nerve involvement usually has no sensory component.

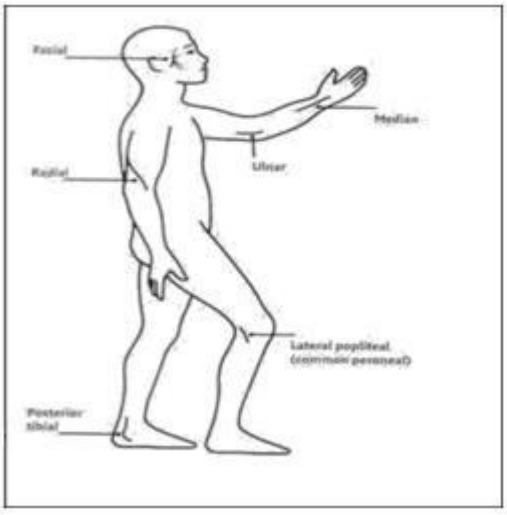


Figure 1: Nerves involved in Leprosy

Nerves of the lower limb

Most commonly affected nerves in the lower limb in leprosy are lateral popliteal nerve which is also known as common peroneal nerve and the posterior tibial nerve.

Lateral popliteal nerve

The lateral popliteal nerve (common peroneal nerve) gets affected in leprosy around the knee, precisely behind the neck of the fibula on the lateral aspect of the leg. The nerve can be palpated at this site.

Involvement of lateral popliteal nerve results in paralysis of dorsiflexors of the foot and leads to foot drop. This may also result in loss of sensation over the dorsal aspect of the foot.

Posterior Tibial nerve

Posterior tibial nerve is involved in leprosy at a site just below and behind the medial malleolus. The nerve can be palpated at this site. It supplies the skin of the entire sole of the foot and the intrinsic muscles of the foot. Posterior tibial nerve involvement results in claw toes and loss of sensation over the plantar aspect of the foot.

Nerve Function Assessment

Nerve Function Assessment is done with the twin objectives of recording of baseline levels of motor and sensory function, as well as monitoring of the nerve function during and after treatment.

The three major functions of a mixed peripheral nerve are:-

- Motor
- Sensory
- Autonomic

Signs and Symptoms of Nerve damage.

1. Absence of sweating in palms and soles.
2. Abnormal sensations in palms and soles.
3. Inability to feel pain sensation in palm and fingers.
4. Inability to feel touch sensation in palm and fingers.
5. Inability to feel heat in palm and fingers.
6. Inability to keep fingers straight and together.
7. Inability to move thumbs all round.
8. Inability to raise toes off the ground.
9. Inability to keep feet lifted up.
10. Inability to close eyes tight.

Motor testing

Voluntary Muscle Testing (VMT)

Motor function testing involves identification of the ability of a muscle to evoke a contraction through a specific action. Grading of the strength of contraction based on overcoming gravity and resisting applied force is done.

Voluntary Muscle Testing (VMT) is a reliable tool to assess and monitor strength of muscles supplied by major peripheral nerve trunks. Quantitative assessment of motor function, using tools like the dynamometer can also be used. Dynamometer will however measure combined strength of a group of muscles performing a similar action.

Purpose of VMT

1. To establish baseline motor function of a nerve.
2. To monitor the progression or deterioration of nerve function while on treatment.
3. To identify muscles that can be used for tendon transfers in reconstructive surgery.

The following factors are important in accurate testing of VMT

1. Patient position
2. Fixation of part to be tested
3. Test position
4. Joint movement
5. Angle of pressure and resistance
6. Prevention of trick movements

Method of Voluntary Muscle Testing

1. The patient is seated and positioned comfortably.
2. Demonstration of the muscle movement is done by the therapist on his/her hand.
3. The patient is told to perform the same movement in a gravity eliminated plane.
4. If the muscle is able to perform the action over the full range, then the muscle is tested for its function both against gravity and resistance.
5. The manual resistance is applied in a direction opposite to the desired movement.
6. The results of the Voluntary Muscle Test are then recorded in the patients chart.

Standard Method

The standard method of grading muscles is according to the Medical Research Council (MRC) Grading criteria given below

Grade 0 – No movement (completely paralyzed)
Grade 1 – Flicker of contraction
Grade 2 – Full range of movement possible by eliminating gravity.
Grade 3 – Full range of movement possible against gravity but not against resistance.
Grade 4 – Full range of movement possible against resistance but weaker than normal.
Grade 5 – Full range of movement possible against strong resistance (Normal Power)

Deformity in Leprosy

Deformity is loss or abnormality of structure of the body part. All leprosy patients do not develop deformities and remain free from deformities throughout their life. According to World Health Organization (WHO), only 30% of patients are deformed. These deformities are divided into primary and secondary deformity. The primary deformities are those that are directly related to the disease. The primary deformities are those that can be easily prevented by early diagnosis and physiotherapy. The secondary deformities can be prevented by proper health education.

The following deformities can be observed in leprosy:

1. Madarosis
2. Lagopthalmos
3. Depression of nose
4. Thickening of earlobes
5. Deviation of mouth
6. Gynaecomastia
7. Ulnar claw hand
8. Total claw hand
9. Isolated median claw hand
10. Wrist drop
11. Drop foot
12. Claw toes

Field Method

For ease of testing by grass root health workers, the muscle assessment has been simplified as follows
It is graded as **Strong (S)**, **Weak (W)** or **Paralysed (P)**.

S - Strong	Can perform the full movement and maintain position against strong resistance.
W – Weak	Can do the full movement, but with less or no resistance. There may be some movement of the joint, but the joint does not have full range of movement.
P – Paralysed	No movement of the joint is possible. No contraction of the muscle belly.

Method of testing for Muscles supplied by Specific Nerves

Facial nerve	Ask patient to close eyes lightly, as during sleep. Check for lid gap. A gap of 1 mm may be normal. Record the gap in millimeters on the form. To test for early weakness, ask the patient to close the eyes tightly and try to separate the eyelid with your thumb and index finger. **Do not use excessive force !**
Ulnar nerve	Ask patient to abduct the little finger & apply resistance at the base of the little finger ("little finger out"). Record the strength.
Median nerve	Ask patient to hold the hand flat in a horizontal position and abduct the thumb (point upwards at 90 degrees "thumb up" – Pen test). Resistance is applied at the head of the 1st Metacarpal towards the index finger. Wrist should be slightly extended.
Radial nerve	Ask patient to extend the wrist ("wrist up"). Apply resistance on the dorsum of hand.
Lateral popliteal nerve	Ask patient to lift the foot ("foot up"). Apply resistance on the dorsum of foot.

Table 1: Motor Testing of Muscles

Facial nerve

Orbicularis Oculi muscle

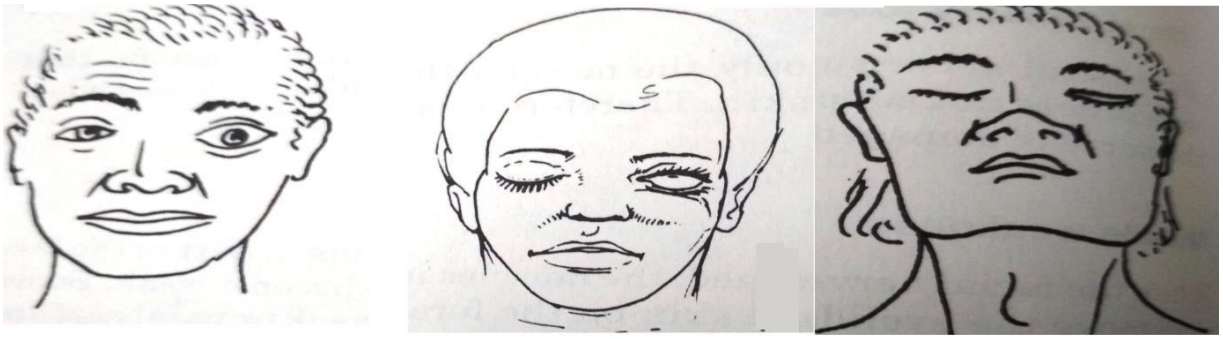
Test lid gap and eye closure

Method

1. The patient is told to gently close the eye. If there is a lid gap present, it is a sign of muscle paralysis. The lid gap is measured with a scale (figure 2). Gapping can also be measured using a graph sheet.
2. If there is no lid gap and the patient is able to close the eye fully, it indicates that the muscle is not paralysed. A gap upto 1 mm may also be normal.
3. The next step is to check whether the muscle is weak or strong.
4. Ask the patient to close the eye as tightly as possible.
5. Gentle pressure is applied by the examiner, who tries to open the eye against the resistance offered by the patient. Assess the muscle power now (figure 3).
6. If the patient is not able to resist opening the eyelid, even with this gentle pressure, the muscle is graded as weak.
7. If the patient is able to maintain the eye closure against this pressure, the muscle is graded as strong.

Figure 2: Measurement of Lid Gap

Figure 3: Testing Orbicularis Oculi



Ulnar nerve

Abductor digiti minimi muscle
Test the movement of abduction of little finger at the MCP joint (figure 4)

Method

1. The hand needs to be supported on a flat surface, with the palm facing up.
2. The patient is asked to take the little finger out, away from the remaining fingers in the same plane as the palm. The little finger should not be extended or bent back. The finger should be straight when this test is being done.
3. If it can be moved full range, then pressure should be given at the level of the base of the little finger by pushing it towards the hand.
4. Grade the muscle power as 'S' 'W' 'P'. If the patient is not able to move the little finger out, it is graded as Paralysed.
5. If the patient is able to move the little finger out, but unable to resist the pressure offered by the examiner to push the little finger in, it is graded as weak.
6. If the patient is able to resist pressure offered by the examiner to push the little finger in, it is graded as strong.

Figure 4: Abductor Digiti Minimi

Median Nerve

Abductor pollicis brevis
Test the movement of abduction and opposition of thumb (figure 5).

Method

1. The hand is supported on a flat surface and the palm is positioned facing up.
2. From this position, the patient is asked to lift the thumb up. If there is no movement possible, the muscle is graded as paralysed.
3. If the patient is able to move full range, pressure is given by the examiner over the base of 1st Metacarpal in an effort to push the thumb down.
4. If the patient is not able to move full range or if the muscle is not able to resist the pressure provided, the muscle is graded as Weak.
5. If the patient is able to resist the pressure and function by maintaining the position of thumb up, it is graded as Strong.

Figure 5: Testing Abductor Pollicis Brevis

Radial nerve

Extensor carpi radialis longus & brevis

Test the movement of wrist extension (figure 6)

Method

1. The wrist should be supported by the examiners hand, with palm facing down and the patient is asked to make the fingers in a light fist.
2. Ask the patient to dorsi flex the wrist If the patient is not at all able to dorsi flex the wrist, it is termed as paralysed.
3. If the patient can be move full range of dorsi flexion, then pressure should be given on the back of the hand by the examiner, pushing the hand down.
4. If the patient is unable to resist this pressure offered by the examiner, it is termed as weak.
5. If the patient is able to resist this pressure offered by the examiner, it is termed as strong.

Figure 6: Testing Wrist Extensors

Lateral Popliteal nerve

Tibialis Anterior, Extensor Hallucis Longus and Extensor Digitorum Longus

Test dorsiflexion of the ankle (figure 7)

Method

1. Ask the patient to lift his foot up at ankle joint. If the patient is not able to lift then it is paralysed. However, if the patient is able to do the full range of movements, then pressure given by the examiner to push the foot down at the ankle joint.
2. If the patient is unable to resist this pressure offered by the examiner, it is termed as weak.
3. If the patient is able to resist this pressure offered by the examiner, it is termed as strong.

Figure 7: Testing Dorsiflexors(drop foot)

2) Sensory Testing

The modalities of sensation that are commonly tested for sensory function assessment are touch/pressure, vibration and temperature. The commonest test employed is to test touch/pressure.

In the Field

In the field, sensory testing of the touch/pressure can be performed using the tip of a ball point pen or 2 gm purple Semmes Weinstein monofilament to test the sensation of the hand and a 10 gm orange Semmes Weinstein monofilament to test the sensation of the foot.

In the Hospital

In a hospital based setting, sensory testing of touch/pressure can be performed with Semmes-Weinstein monofilaments, figure 8 (a) & (b).

Figure 8: (a) Sensory Testing of Hand

Figure 8 (b) Sensory Testing of Feet

Sensory testing of the hand and foot

The sensation on the hand and foot is shown in fig 9 (a) & (b). It can be tested either with the tip of ball point pen or Monofilaments as described above.

The number of points tested in the hands and the feet may vary from one hospital to another. The maximum number of points usually tested in the hands and feet are 10. [figure 9 (c) & (d)]

Documentation

If a ball point pen is used to test the sensation, the test sites on the patients record is marked as ✓ if the sensation is felt. If sensation is not felt, ✗is marked to denote that sensation is absent in the particular area.

In case of Semmes Weinstein monofilaments, the sites are marked with the number specific for the filament used. If no sensation is felt then the site is marked as 0 (zero).

Protective sensation of hands and feet

Protective sensation is the level of sensory threshold which will help to prevent damage to the skin. In other words, protective sensation is the minimal level of sensation that is needed to prevent ulceration. Many patients may have nerve function damage but still retain protective sensation in their hands and feet to prevent them from being damaged.

A person is said to have protective sensation of the palm of the hand if the person is able to feel at least a 2 gm Semmes Weinstein monofilament (purple).

A person is said to have protective sensation of the sole of the foot if the person is able to feel at least a 10 gm Semmes Weinstein monofilament (orange)

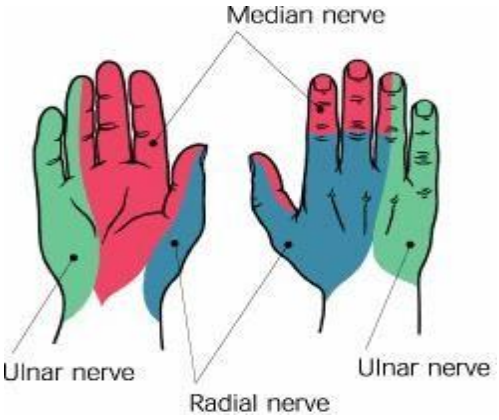


Figure 9 (a): Sensory testing points of hands *Figure 9 (b): Sensory testing points of feet*

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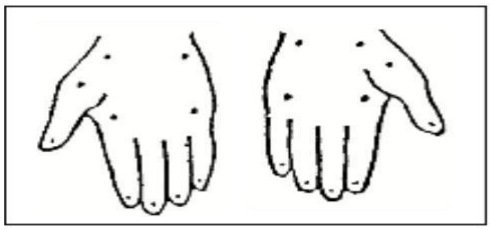


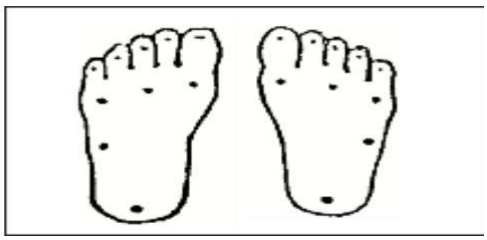


Figure 9 (c): Sensory testing points of hands *Figure 9 (d): Sensory testing points of feet*

Method of testing sensation on the palm or the sole of the foot

- The hand or foot that is being tested needs to be supported and kept still.
- The person needs to be shown how the test is done.
- The monofilament is pressed only once at a perpendicular angle and pressed to make a 'C' shaped curve. If a ball point pen is used, it is pressed to make a slight dimple on the skin.
- Ask the patient to close the eyes. Four to ten sites are then tested on the palm or sole.
- The person is asked to point at the place where the test was done.
- The testing should be done randomly on the various test sites so that the person being tested is not able to guess where the next site would be.
- The person may not feel the sensation when the test is done first time. If this is the case, the test can be repeated one more time to make sure of the result.
- The test results are noted in the appropriate area in the patients' record.
- Care must be taken to avoid too much pressure on the skin when testing with a ball point pen.
- Specialized Leprosy hospitals and research institutes may even use a range of filaments starting from 0.2 gms to 300 gms to test the sensation of the patient and record the findings for research purposes.

3) Autonomic Function Test

Dryness of Skin

While examining for the autonomic dysfunction, one should look for dryness of skin, loss of sweating, cracks and callosities.

CHAPTER - 4

MANAGEMENT OF REACTIONS AND NEURITIS

Learning Objectives

- Will understand the mechanism of nerve damage in reactions of leprosy
- Will be able to list and identify symptoms and signs of neuritis in leprosy
- Will be able to identify type and extent of paralysis by motor and sensory testing
- Will be able to list the goals and methods of treating neuritis including electrical stimulation
- Will be able to apply required splints in neuritis management
- Will be able to teach needed exercises in managing neuritis

Neuritis as part of Reactions

Mycobacterium leprae localizes in the Schwann cells of neurons in a nerve fibre. In the tuberculoid spectrum of the disease, reactions and neuritis develop, when there is antigen and antibody interaction resulting in inflammation of the skin and nerve. Nerve damage can also develop in the lepromatous spectrum, but is usually at a later stage of the disease

Types of nerves affected in leprosy

a) Cutaneous nerves – nerves that supply sensation to a large portion of skin

b) Major Nerve trunks – Nerve trunks which supply sensory, motor and autonomic fibres to large areas of skin and muscles

Pathology of nerve in leprosy

Tuberculoid Leprosy

In the tuberculoid leprosy, the nerve is hyperemic and the nerve sheath is thick and opaque. The nerve sheath is firmly adherent to the underlying fascicles.

The histological picture is of oedema of the nerve. There is inflammatory cell infiltration with lymphocytes and epitheloid cells. Later the axons show segmental demyelination leading to hyaline degeneration. Occasional bacilli are found in the Schwann cells.

Lepromatous leprosy

The nerves show thickening and hyperemia as in tuberculoid leprosy. However the axons are not destroyed until late in the course of the disease. The inflammatory cell infiltrate is mainly made up of macrophages and foamy cells filled with the bacilli.

Nerve abscess

When there is focal necrosis of one or two fascicles in the nerve, it causes caseous necrosis. It results in the formation of an abscess which then tracks along the fascicles, breaks through the perineurium and form an abscess presenting as a fluctuant swelling.

Pathogenesis of Nerve damage

Acute neuritis causes oedema of the intra-neural tissues including endoneurium and perineurium. The acute inflammatory cellular infiltrate together with the oedema cause a rise in the intra-neural pressure. The increase in intra-neural pressure causes compression of the fascicles as well as the vasa nervorum, both of which may compromise the nerve function.

The fact that these nerves pass through fibro-osseous passages, which are narrow and subject to angulation stresses across the joint may cause further trauma to the nerve. The need of the hour would be to reduce the increased intra-neural pressure.

Types of paralysis

Incomplete

- Loss of sensation is limited to certain parts of the skin supplied by the nerve
- Loss of sensation affects only certain modalities of sensation
- Some of the muscles supplied by the nerve are not paralyzed, or there may be presence of only muscle weakness with no sensory deficit

Complete

- Entire skin supplied by the nerve has loss of sensation
- All modalities of sensation are lost in the area supplied by the nerve
- Complete paralysis of all muscles supplied by the nerve

Clinical features of neuritis

Symptoms of neuritis

- Pain along the course of the nerve, which sometimes can be excruciating.
- Tingling and numbness over the sensory supply of the nerve may be seen.
- Sometimes it is possible for the patients to present only with loss of sensation and/or weakness/deformity.

Signs of Neuritis

- Thickening and tenderness of the nerve at specific sites of nerve involved.
- Sensory loss and/or motor weakness of the muscles supplied by the nerve.

Investigations

Electromyograph (EMG) and Nerve Conduction Velocity can be done in centres having such facilities.

Nerve function Impairment

Sensory Loss

The sensory loss in leprosy usually affects modalities like pain, temperature and vibration in the beginning. However, other modalities such as light touch and pressure get involved later. Joint sensation may also be affected leading to neuroarthropathy

Motor loss

When a major nerve trunk is damaged, nerve supply to the muscles also is affected leading to weakness or paralysis.

Joints are normally held in balance by the forces acting across the joint. If this balance is upset by paralysis of one group of muscles, the joints assume positions which are abnormal.

Since each nerve involved in leprosy supplies a distinct group of muscles, damage to a nerve trunk will produce a specific deformity.

Autonomic loss

The supply to the sweat glands is affected in nerves involved in leprosy and this results in loss of sweating leading to dry skin and cracks.

Nerve Function Assessment

Nerve function assessment must be carried out in all patients of neuritis to assess the level of impairment. It is also done to monitor the progress of recovery.

The motor function is tested by Voluntary Motor Testing (VMT) and the Sensory testing (VST) using ball point pen or Monofilaments.

Silent neuritis versus Acute neuritis

	Silent Neuritis	Acute Neuritis
	Signs and symptoms	**Signs and symptoms**
1	Nerve Thickened	Nerve Thickened
2	No Tenderness	Tender
3	No pain	Painful
4	Presence of Nerve function impairment	
	Weakness / paralysis of muscles	
	Diminished / complete anesthesia	
	Lack of sweating	

Table 2: Comparison of clinical features of Silent Neuritis Vs Acute Neuritis

Management of neuritis

The main goal of management of neuritis is to reduce pain in the nerve and enable recovery over functional impairment of nerve.

Treatment

Reduce pain

- Non Steroidal Anti Inflammatory Drugs
- Rest to the nerve

Recovery of nerve function

- Steroids
- Electrical stimulation
- Exercises

1) Standard steroid protocol

The steroids have anti-inflammatory action, hence reduce the swelling and revert the cellular processes leading to medical decompression of the nerve enabling nerve recovery.

Weeks of course	*Daily dose of prednisolone*
1 – 2	40 mg
3 – 4	30 mg
5 – 6	20 mg
7 – 8	15 mg
9 – 10	10 mg
11 – 12	5 mg

The total duration of this course is twelve weeks. There may be exceptions to this regimen, which the treating physician/surgeon would prefer for medical reasons.

2) Non steroidal Anti Inflammatory Drugs

Non steroidal Anti Inflammatory Drugs such as ibuprofen, diclofenac or naproxen are used to reduce pain and inflammation.

3) Splint used in Neuritis

Splints are used in the management of neuritis, to immobilize the joint to prevent stretching and to provide rest to the inflamed nerve in resting position like long arm posterior slab, long leg posterior slab.

Ulnar neuritis splint
Purpose

- To rest and give warmth to the nerve.
- To support weak / paralysed muscles.
- To prevent contracture due to over pulling of the weak muscles by the opposite group muscles.
- To relieve pain.

Figure 10: Ulnar Neuritis (long arm posterior slab)

Method

- Measure the length from the lower 2/3rds of upper arm to the palmar crease. The width is measured at the upper and lower ends of the slab.
- Padding is done from the back of the elbow at about 3" above to 5" below the elbow joint. The padding is extended up to the ulnar side of the wrist joint.
- The ulnar neuritis splint can be made excluding the wrist joint or including it.
- It should be made sure that the upper end is wider than the lower end.
- The position of the elbow is at 90 degree flexion. The wrist joint to be maintained in minimal extension. The slab should be extended only up to distal palmar crease so that the fingers from MCP joints are left free.
- The slab should be secured by firm bandaging and the elbow position should be supported with a sling.
- The edges are smoothened to prevent bruises and cuts from the sharp edges of the POP.

Median neuritis splint
Purpose

- To give rest and allow the nerve to heal and regenerate.
- To support weak muscles.
- To prevent contracture due to over pulling of the weak muscles by the opposite group muscles.

Method

Median neuritis splint excluding the thumb

- Measure the length from the upper 2/3rd of forearm to palmar crease of hand. The width is measured from the medial to the lateral side of forearm.
- The POP roll is measured accordingly and the space for the thumb is cut out. Padding is applied over the area where the slab is to be placed.
- The POP roll is then placed in water. Excessive water is squeezed out and placed in position.
- The position in which the median neuritis slab is applied: The hand is fully supported in supinated position (Palm facing up). The slab is placed on the palmar aspect of the forearm and the edges are folded back at the base of the thumb. The thumb and the MCP joints of the fingers must be free.

Median neuritis splint including the thumb

- Measure the length from the upper 2/3rd of forearm to palmar crease of hand. The width is measured from the medial to the lateral side of forearm.
- The POP roll is measured and the space for the thumb is not cut out. After application of padding, the POP is placed in position.
- Since the POP is not cut out for the thumb, the extra length of POP is brought around the side of the thumb to support it on the palmar side (figure 11).
- The thumb is held in full abduction and some opposition till the plaster becomes hard.
- Wrist to be maintained in mild extension.

Figure 11: Median neuritis slab including thumb

Lateral popliteal neuritis slab (Figure 12)

Purpose

- To give rest and allow the nerve to heal and regenerate.
- To support weak / paralysed muscles.
- To prevent contracture due to over pulling of the weak muscles by the opposite group muscles.
- To relieve pain.

Figure 12 : Lateral popliteal neuritis slab

Method

- Padding is done from the back of the mid-calf to mid-thigh at about 6" above to 5" below the popliteal fossa.
- It should be made sure that the upper end is wider than the lower end.
- The position of the knee joint is at 20 degree flexion.
- The patient is made to lie in prone position and the slab is moulded properly.
- The edges are smoothened to prevent bruises and cuts from sharp edges of POP.

Posterior tibial neuritis slab (Figure 13)

Figure 13: Posterior tibial neuritis slab

Purpose

- To give rest and allow the nerve to heal and regenerate.
- To support weak / paralysed muscles.
- To prevent contracture due to over pulling of the weak muscles by the opposite group muscles.
- To relieve pain.

Method

- Padding is done from the back of the neck of fibula to the toes.
- The position of the ankle should be in 90º.
- The patient is made to lie in prone position and the slab is moulded properly keeping the ankle in 90º.
- The edges are smoothened to prevent bruises and cuts from the sharp edges of the POP.

- The neuritis slab could be fabricated either using plaster of Paris or thermoplastic material (figure 14).

Figure 14: Moulded Posterior Slab

4) Electrical Stimulation

Electrical stimulation of the weak or paralyzed muscles will help in maintaining the tone of the muscle by keeping the neuromuscular junctions active.

5) Exercises for nerve function impairment

Facial Nerve – Orbicularis Oculi - Lagophthalmos

Passive Movement for weak Orbicularis Oculi muscle

- Ask the patient to place the index finger on the lateral side at the edge of the eye.
- The person is told to gently pull laterally. This will cause the eye to close (figure 15).

Figure 15: Passive Movement for Orbicularis Occuli

Active exercise for weak Orbicularis Oculi muscle

- The patient is asked to close the eye tight for 3 to 5 seconds.
- Open the eye after about 10 to 15 seconds, the exercise is repeated again (figure 16).
- This exercise will strengthen the Orbicularis oculi muscle.

Figure 16: Active Exercises for Orbicularis Oculi

Ulnar Nerve - Clawing
Passive Movement when lumbicals and interossei are weak or paralysed

- This exercise can also be called as massage.
- The hand is placed on the thigh or on a soft flat surface, with the palm facing up.
- The palm or hypothenar area of the other hand is used to gently straighten the fingers.
- Once one cycle of the exercise is over, the other hand is lifted up and then the exercise is done again.
- This can be repeated about 20 cycles for 4 to 5 times a day. This exercise helps to prevent interphalangeal joint contractures (figure 17).

Figure 17: Passive Movement to release the contracture

Assisted Active Exercise when lumbricals and interossei are weak

- The MCP joints of the affected hand are supported at 90 degrees by the other hand i.e. the lumbrical position.
- From this position of MCP at 90 degrees flexion and wrist in neutral, the interphalangeal joints of all the fingers need to be flexed and then extended through the full range of movement as figure 18 (a) & (b).
- The extension movement is more important and should be done to the extreme range.
- This can be repeated about 20 cycles for 4 to 5 times a day. This exercise helps to strengthen the interossei muscles.

(a)

(b)

Figure 18 (a) & (b):Assisted Active Exercises for the Lumbricals

Active Exercise when lumbricals and interossei are weak

- The hand is placed on a soft padded surface like the thigh or a padded table top.
- The patient is asked to abduct and then adduct the fingers and thumb, as much as it is possible, without lifting the fingers from the ground.
- The other exercise that can be performed is by supporting the elbow on a flat surface and then the hand is made into a fist.
- The elbow is extended and the MCP joint is maintained at 90 degrees.
- From this position, the interphalangeal joints of the fingers are extended and then flexed repeatedly.
- The extension of the fingers to reach the lumbrical position is very important in strengthening the interossei muscles.

Median Nerve – Ape Thumb

Passive movement when thenar muscles are weak or paralyzed

- This exercise can be done by interlocking the thumb webs of both the hands.
- The normal hand is also used to stretch the thumb web of the affected hand.
- The thumb of the affected hand is moved away from the index finger. This will help in stretching the thumb web and prevent thumb web contractures (figure 19).
- This can be repeated about 20 cycles for 4 to 5 times a day.

Figure 19: Passive Movement for thenar muscles

Assisted Active Exercise when thenar muscles are weak

- This exercise can be done by supporting the MCP joint of the thumb with the thumb and fingers of the other hand.
- The abducted thumb of the affected hand is moved to touch the pulp of the four fingers alternatively.
- With the thumb fixed in the above position, the interphalangeal joint of the thumb should be flexed and extended. This will prevent contracture of the IP joints of the thumb.
- This exercise can be repeated about 20 cycles for 4 to 5 times a day.

Active Exercise when thenar muscles are weak

- The hand is placed on a soft flat surface with the palm facing up.
- The extended thumb of the affected hand is moved into opposition with all the other four fingers. The thumb is also actively moved into abduction position and this position is maintained for about 5 seconds.
- This exercise will help in strengthening the abductor pollicis muscle.
- This can be repeated about 20 cycles for 4 to 5 times a day.

Radial Nerve - Wrist drop
Passive Exercise when wrist extensors are weak or paralysed

- The two palms are placed in approximation with each other.
- Extend the fingers and thumb. Repeat it again for about 20 cycles for 4 to 5 times a day.
- From this position, the wrist of the normal hand is flexed to make the affected wrist to move into extension.
- The extension of the paralysed wrist should make it move to the end ranges.
- The other method of exercising the wrist is to place the wrist flat on a surface and the elbow is lifted perpendicular to the wrist joint (figure 20).
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.
- The exercise will prevent a wrist contracture.

Figure 20: Passive Movement for Wrist Extensors

Active strengthening Exercise when wrist extensors are weak

- The forearm is supported over the table top with the forearm in full pronation.
- The palm is facing down and the wrist is placed in such a way that is hangs over the edge of the table.
- The wrist is then extended fully. This exercise will help to strengthen the extensor carpi muscles.
- The muscle can be further strengthened by holding something in the fist and moving the wrist into extension. This movement of the wrist against gravity with a weight acting as resistance to the movement will be able to help strengthen the muscle further.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Lateral Popliteal Nerve – Foot drop

Passive Exercise when extensors of the ankle are weak or paralysed

- The patient is positioned in long sitting (Knee Extended). A towel is placed over the plantar surface over the forefoot and the edges of the towel are held by the patient.
- The towel is pulled towards the patient, so that the ankle is pulled into dorsiflexion. The foot is held in this position for about 10 seconds and then released (figure 21).
- Another exercise that can be performed is by standing about a foot in front of a wall, facing the wall. The person can lean forward by flexing the elbow with the hands placed on the wall for support. This causes the foot to dorsiflex.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Figure 21: Passive Movement for drop foot

Active Assisted Exercise when extensors of ankle are weak

- The paralysed foot is placed over the other leg and the person actively tries to dorsiflex the foot in this gravity eliminated plane.
- When the foot does not move through the full range, the patient tries to dorsiflex the foot through its maximum possible range.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Active Exercise when extensors of the ankle are weak

- The patient is in high sitting with the legs not supported by the ground.
- The foot is dorsiflexed and the position is maintained for about 15 to 20 seconds.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Active Resisted Exercise when extensors of the ankle are weak

- The patient is positioned in high sitting.
- With the foot hanging, a small sand bag or other weights can be added to forefoot.
- The person lifts the foot into dorsiflexion against gravity and the resistance provided by the weight.
- The dorsiflexed position is maintained for about 10 seconds.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Posterior tibial nerve – Claw toes

Passive Movement for Claw toes

The foot is placed over the other thigh with the affected leg in crossed leg position. The toes of the foot are straightened manually. When the toes are straightened, the stretching force will prevent the toes from becoming stiff in the clawed position.

Active exercise

The foot is placed on a flat surface and the tip of toes are pressed firmly against the surface, so that a crawling movement of the toes is produced. This will strengthen the small muscles of the foot.

6) Surgical Nerve Decompression

Indications

- Nerve involvement leading to incomplete paralysis of muscles, not relieved by steroids and conservative treatment.
- Intractable Pain – even if there is no function or hope of function left in the nerve.
- Nerve abscess

It is preferable that at least 3 weeks medical treatment be given for neuritis before nerve decompression is considered.

7) Various splints used in physiotherapy

S. No	Splints	Indications
1.	Cylindrical Splint	Stiff finger contracture
2.	Spiral Splint	Mobile Claw hand to maintain joint mobility
3.	Thumb web Splint	Thumb web contracture to maintain thumb web space
4.	Cock up Splint	Wrist drop
5.	Long arm posterior slab	Rest to inflamed nerves in ulnar neuritis
6.	Gutter Splint	Stiff finger (Injury)
7.	Thumb Sling	To maintain the position of thumb Post operatively (abduction as well as opposition)
8.	Functional position Splint	Hand in reaction – to rest
9.	Anterior slab	To maintain position – post operatively
10.	Posterior Slab hand	To maintain position – post operatively
11.	Hand spica	Triple nerve paralysis
12.	Posterior slab foot	Drop foot – To provide rest and prevent plantar flexion
13.	Below knee plaster	Plantar ulcer – rest to the part
14.	Below knee (Window) plaster	Plantar ulcer with discharge – To prevent walking and window for dressing purposes
15.	Below knee plaster without rocker	Neuropathic foot – to prevent walking
16.	Eye sling	Lagophthalmos
17.	Mouth sling	Facial paralysis

CHAPTER – 5

IMPAIRMENTS IN LEPROSY

Learning Objectives

- Will be able to define various terms relating to nerve function impairment and its consequences
- Will be able to classify impairments in leprosy
- Will be able to list and identify all impairments in leprosy
- Will be able to grade impairments in leprosy according to WHO Disability Grading
- Will be able to score impairment as per EHF Score method and know the significance of this

Definitions

Impairment is defined as a loss or abnormality of a body part (structure) or of a body function (physiological function) or of a mental function (psychological function)

As the definition indicates, any change in the structure (Anatomical) or the function (physiological or psychological) of the body is called impairment.

In leprosy, the major peripheral nerves are affected resulting in motor and sensory loss leading to impairments.

New nomenclature

Impairment (Deformity)

Any loss or abnormality in the structure of the body or physiological or psychological function is called impairment. This was earlier known as deformity.

Activity Limitation (Disability)

As a result of impairment (deformity) some of the activities of daily living cannot be performed or may take more time to perform than a person without impairment. This is called Activity Limitation which was earlier called disability.

Participation Restriction (Handicap)

If a person is unable to perform his/her role in the society as expected from his/her peers because of impairment or activity limitation, it is called Participation Restriction. This was earlier known as handicap.

Classification of Impairments

The impairments in leprosy are classified as Primary impairments and Secondary impairments.

Primary Impairments

Primary impairments are those impairments that result from direct damage due to the *Mycobacterium leprae*. When *Mycobacterium leprae* invades the nerves and causes damage, the resultant sensory and motor loss leads to Primary impairments, (table 3).

Secondary impairments

Secondary impairments in leprosy occur as a result of progress of primary impairments because of neglect.

Primary Impairments

S.No	***Nerve affected***	***Primary Impairment***
1	Facial Nerve	Lagophthalmos
2	Trigeminal nerve	Corneal anaesthesia
3	Ulnar nerve	Ulnar clawing
4	Median nerve	Ape thumb deformity
5	Ulnar and Median Nerve	Palmar and dorsal anaesthesia
6	Ulnar and Median Nerve	Total clawing
7	Radial nerve	Wrist drop / Finger drop
8	Lateral popliteal nerve	Foot drop
9	Posterior tibial Nerve	Claw toes
10	Posterior tibial Nerve	Plantar anaesthesia

Identification of Primary Impairments

Lagophthalmos

When the facial nerve is affected in leprosy, Orbicularis Oculi muscle is paralysed. The function of the Orbicularis oculi muscle is to close the eye lids during blinking. When the muscle is paralysed, it prevents a person from closing the eye. On attempted closure of the eye, the palpebral fissure is open, exposing conjunctiva and cornea [figure 22 (a)]. This is known as Lagophthalmos

Figure 22 (a): Lagophthalmos

Figure 22 (b): Passive exercise

Figure 22 (c) : Closing and opening the eye

Figure 22 (d) : Strapping

Treatments:

- Steroid
- Stimulation
- Exercise [figure 22 (b & c)]
- Passive movement
- Strapping [figure 22 (d)]
- Surgery

Corneal anaesthesia

The trigeminal nerve supplies sensation to the cornea. When this nerve is damaged in leprosy, it causes corneal anaesthesia. Corneal anaesthesia can be identified by the absence of blink reflex in a person.

Difference between inability to close the eye in Lagophthalmos and in Corneal anaesthesia
In Lagophthalmos, the muscle is paralysed and even if the patient wants to close the eye, he will not be able to close the eye fully. On the other hand, in corneal anaesthesia, the muscle is normal. So, if the patient thinks and blinks, he will be able to close the eye, but the usual blink reflex, that causes the blinking of the eye many times every minute is lost.

Clawing of fingers

When ulnar nerve is affected in leprosy, flexor carpi ulnaris, flexor pollicis brevis adductor pollicis, 3rd & 4th lumbricals and all the interossei muscles of the hand are paralyzed leading to clawing of the ring and little fingers. This is called ulnar clawing. When both ulnar and median nerves are involved, all the lumbricals and interossei muscles of the hand are paralyzed leading to clawing of all four fingers. (figure 23).

Figure 23: Total claw hand

Patho-mechanics of clawing

The combined action of lumbrical and interossei muscles is to flex the MCP joints. When these muscles are paralysed, the finger extensors namely the Extensor Digitorum communis and the Extensor indicis cause hyperextension of the MCP joints of fingers. Due to passive insufficiency, the interphalangeal joints are automatically flexed. This produces the characteristic position of clawing i.e. hyperextension at MCP joints and flexion at the interphalangeal joints.

Ape thumb deformity

When median nerve is damaged in leprosy it causes paralysis of the thenar group of muscles leading to loss of the movements of abduction and opposition of the thumb (figure 24). The thumb lies adducted in the plane of the palm and is called “Ape Thumb deformity”.

Figure 24: Ape thumb Deformity

Wrist drop / Finger drop

Radial nerve is not commonly damaged in leprosy. Usually the radial nerve is damaged along with the ulnar and the median nerves. The patient presents with a triple nerve paralysis i.e. wrist/finger drop, claw hand and ape thumb deformity. Very rarely there are instances when the radial nerve can be damaged in isolation.

Physiotherapy for wrist drop

- Cock up splint
- Stimulation
- Eliminated gravity exercise
- Against gravity exercise
- Against resistance exercise
- Passive movement


Cock up splints


Eliminated gravity exercise


Against gravity exercise

Foot drop

The Lateral popliteal nerve is commonly affected in Leprosy. When this nerve is damaged, it causes paralysis of tibialis anterior, extensor hallucis longus, extensor digitorum longus. Such patients are unable to dorsiflex the ankle. It is called as Partial Foot drop. In some case peroneus longus and peroneus brevis are also paralyzed. The involvement of the peroneus longus and brevis along with the other ankle dorsi flexors is called as complete foot drop.

Figure 25:


Right drop foot


Left drop foot strap

Drop Foot exercise:	By doing these exercise
• Step climbing • Ramp walking • Sliding seat • Pushing wall • Sitting and standing without lifting heel • Stationary cycling • Passive movement of dorsiflexion	• Improving dorsiflexors muscle power • Preventing tendo Achilles contracture • Releasing tendo Achilles contracture • Preventing disuse atrophy of calf muscle • Improving calf muscle power • Maintain the ankle joint mobility

Step Climbing

Ramp Walking

Sliding Seast

Pushing Wall

Sitting & Standing without lifting Heel

Stationary Cycling

Palmar anaesthesia

It is the inability to feel the various modalities of sensation such as touch and pressure in the hand.

When the ulnar nerve is involved in leprosy, sensation is impaired or lost on the palmar surface of the hand along the little finger, medial aspect of ring finger and ulnar side of the palm. When median and ulnar nerves are involved then the sensation over the whole palm and ulnar side of the dorsum of hand is impaired or lost.

Claw toes

Damage to the posterior tibial nerve commonly occurs in Leprosy. This can lead to paralysis of the intrinsic muscles of the foot leading to claw toes. The pathomechanics of claw toes is similar to that of claw hand with paralysis of MTP joint flexors and over action of toe extensors leading to hyperextension of the toes at MTP joints and flexion of IP joints.

Plantar anaesthesia

It is the inability to feel the various modalities of sensation such as touch and pressure in the foot.

Damage to the posterior tibial nerve causes sensory impairment over the entire plantar aspect of the foot. There could be a complete loss of sensation in the sole of the foot. The sensory loss could be partial, with the loss being in only some parts of the sole of the foot.

Autonomic function of the nerve

Involvement of the nerve in leprosy results in loss of autonomic function leading to lack of sweating on the surface of the skin that is supplied by the nerve. This results in dryness of the skin. Dry skin can crack very easily leading to fissures.

Secondary impairments

Secondary impairments in Leprosy occur as a result of progress of the primary impairments, because of neglect.

Primary impairments can progress to contractures, ulcers and other deformities which are called Secondary Impairments. The common secondary impairments are listed in the table below.

Secondary Impairment	
a) Cracks and fissures	d) Shortening of digits
b) Joint contractures	e) Disintegration of the bones
c) Ulcers	f) Exposure keratitis, Corneal ulcer and corneal opacity

Table 4: Secondary Impairments in Leprosy

Cracks and fissures

Loss of sweating in leprosy as a result of nerve damage leads to dryness of skin. Dryness of skin will results in cracks and fissures which are secondary impairments

Joint contractures

When impairments of joints are not stretched regularly and mobility in the joint is not maintained, tissues changes set in the joints and soft tissues, leading to contractures over a period of time. Interphalangeal joint contractures in claw hands (figure 26), thumb web contracture in ape thumb deformity and tendoachilles contracture in foot drop are common examples of contractures.

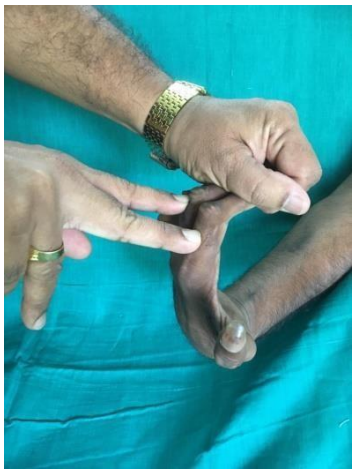


Figure 26: Contracture of Interphalangeal Joints

Plantar or Palmar Ulcers

When the palmar and plantar anaesthesia is present, the hand and the foot are at risk of developing skin breakdown and development of ulcers.

Loss of sensation, deformity and dry skin all predispose to ulceration. Ulcers are caused by common external injuries by sharps, pressure or heat.

Figure 27: Shortening of Digits (absorption)

Shortening

Repeated ulceration or damage and loss of soft tissue, bone and joints may lead to shortening of the toes, fingers and foot. Shortening could also be due to surgical removal of the dead bones from the fingers or toes (figure 27).

Neuroarthropathy (Disintegration of bones)

When the joint sensation in the foot is lost, the joints become disintegrated because of repeated stress. This leads to a clinical situation called hot foot which resembles Charcot's foot. Hot foot presents as gross boggy swelling of the foot. The foot is warm. Crepitus may be felt with the bones within a disintegrated joint grating against each other. The joint involved is swollen and unstable.

Exposure keratitis, corneal ulcer and corneal opacity

Corneal anaesthesia in leprosy places the eye at risk of developing damage. Repeated exposure to dust can lead to exposure keratitis. Rubbing of the dry eye and other damage to the cornea can lead to corneal ulceration. The corneal ulcer can cause corneal opacity and blindness.

Other impairments in Leprosy

Other than the primary impairments due to nerve damage which have been mentioned already, there can be other primary impairments caused by direct infiltration of the Leprosy bacilli in other tissues. These impairments are commonly found in Lepromatous Leprosy. These impairments include madarosis, leonine facies, gynaecomastia, pendulous earlobes and collapse of the nose.

WHO Disability Grading

The World Health Organization has formulated a system to grade disability in Leprosy. The main objective of this Grading is to record a baseline of disabilities that are identified in Leprosy.

The Grading system also helps in monitoring the progression of deformity that may occur over a period of time. WHO Grading system is used to grade the eyes, hands and feet in leprosy.

Grade 2 disability is also used as an important epidemiological indicator for identifying delayed reporting in a specified geographical area

In any patient, the highest or maximum score for eye or the hand or the foot is considered to be the Disability grade for that patient.

WHO disability Grading (1988)

Grading for hands and feet

Grade – 0	No anaesthesia, no visible deformity or damage
Grade – 1	Anaesthesia present, but no visible deformity or damage
Grade – 2	Visible deformity or damage present

Grading for eyes

Grade – 0	No eye problem due to leprosy, No evidence of visual loss
Grade – 2	Severe visual impairment (Vision: worse than 6/60; inability of finger counting at 6m). It also includes Lagophthalmos, iridocyclitis and corneal opacities

Clawing of fingers, ape thumb, wrist drop, foot drop & claw toes, ulcers, shortening, disorganization, stiffness and loss of part or all of hand or foot are all graded as Grade 2. Sensory loss and weakness of muscles without visible deformity are graded as Grade 1. Each eye, hand and foot is assessed and graded separately. The disability grading for the patient is taken as the highest grade noted.

Important points to remember when grading disability

1	Visible impairments are graded as Grade 2, including absorption (digital shortening), burns due to loss of sensation, deep cracks and fissures and presence of ulcers
2	Weakness of a muscle is graded as Grade 1, if there is no visible impairment.
3	Only the impairments in the eyes, hands and feet are graded. Impairments present in other parts of the body are not graded.

EHF Score

EHF Score is another method in which the impairments can be graded.

WHO Grading is used to grade all the deformities in a patient. The sum total of all the grades for each of the eyes, hands and feet is now expressed as EHF Score. Maximum EHF score that a patient can be graded is 12.

An example is provided here.

Right eye has a grade of 0. The left eye has a grade of 2. Both the hands and both the feet have a grade of 1 each. Grade 2 is the maximum WHO grade obtained for this patient.

The EHF score is a sum total of all the impairments for each eye, hand and foot. This total is the EHF Score which is 0+2+1+1+1+1 = 6.

	E		H		F	
	R	L	R	L	R	L
0	✓					
1			✓	✓	✓	✓
2		✓				

WHO Grade 2

The EHF scores are more sensitive to change in the patient's impairment status. For example, in year 1, a patient had an EHF score of 6 and a WHO maximum grade of 2. In year 2, the impairments of the patient had worsened and he developed Grade 2 impairments in both his hands. So, the EHF score has worsened to 8, but the WHO maximum grade is still 2.

Year 1	**Year 2**
WHO Grade = 2	WHO Grade = 2
EHF Score = 6	EHF Score = 8

	E		H		F	
	R	L	R	L	R	L
0	✓					
1			✓	✓	✓	✓
2		✓				
	0	2	1	1	1	1

EHF Score 6

	E		H		F	
	R	L	R	L	R	L
0	✓					
1					✓	✓
2		✓	✓	✓		
	0	2	2	2	1	1

EHF Score 8

Skills Required

- Identify primary and secondary impairments of hands, feet and eye.
- Classify deformities as per WHO grading and EHF score.

CHAPTER 6

PREVENTION AND MANAGEMENT OF IMPAIRMENT IN LEPROSY

Learning Objectives

- Will be able to list the objectives of prevention and management of impairments in leprosy
- Will be able to list the activities needed to prevent or revert nerve function impairment in leprosy
- Will know the principles to correct, protect and prevent deterioration of impairments in leprosy
- Will know the steps to implement a POID camp in the field

Objectives of prevention and management of impairments should be

1. Prevent impairments or reverse nerve function impairment.
2. To correct impairments among eligible patients through Reconstructive Surgery of hands, feet and eyes.
3. To prevent deterioration of the impairments, by maintaining the suppleness of skin and joints and preventing contractures in deformities of hands, feet and eyes.
4. To prevent damage to impairments through self-care and provision of protective appliances.

Prevent or reverse Impairments

Early diagnosis and treatment of leprosy

In order to prevent impairments in leprosy it is important to diagnose leprosy early, initiate treatment early and ensure compliant treatment.

Monitoring of High Risk Group

Among patients diagnosed with leprosy, a certain group of people with specific disease characteristics are more prone to reactions and hence neuritis and nerve damage. These patients need to be monitored closely for development of nerve involvement.

High Risk Group

- Multibacillary Leprosy
- Smear positivity
- Patch over the face
- Patch over major peripheral nerve trunk
- Patients who are pregnant

Early diagnosis and treatment of neuritis

In order to reverse nerve damage and prevent development of impairments, it is essential to diagnose nerve damage early and initiate appropriate treatment.

For early diagnosis of nerve damage, the responsibility lies with the patient as well as the health worker. The patient needs to be educated about early symptoms of nerve damage so that early reporting can be done. This is more so in the High Risk Group. Similarly the onus is on the health worker to regularly monitor the patients who are prone for nerve damage, so that early diagnosis and treatment for nerve damage can be done.

Correct impairments

Leprosy impairments which affect Activities of Daily Living (ADL) or Vocation can be corrected to allow better functioning for ADL and vocation through reconstructive surgery.

Reconstructive surgery can be offered to patients whose impairments are supple and amenable to surgery. The motivation of the patient is also extremely important. In fact the patient has to feel the need for surgery. A number of patients who are eligible, do not consent for surgery because of fear of surgery and its results. Some of the patients have adapted to live with the impairment and hence do not agree for surgery.

It is important to note that the motor function will not return to normal by reconstructive surgery. It will only improve the functional ability. It is also important to educate the patients that the sensory loss will not recover with reconstructive surgery.

A detailed chapter has been assigned for reconstructive surgery.

RCS prevents progress or deterioration of impairments or 'complications / sequela of nerve damage'.

Patients with impairments such as clawing of fingers, Ape thumb, foot drop and claw toes tend to adapt the new anatomical positions as the soft tissues become fixed in this position. Skin, subcutaneous tissues, muscles, tendons, joint capsule shorten and the joints become fixed in that position producing stiffness or even contractures.

In order to prevent development of stiffness and contractures the patient needs to be taught the following set of activities which will prevent soft tissue changes.

- Oil massage
- Passive exercises
- Active exercises
- Usage of splints

All these will be discussed in detail later in the book

Prevent damage to impairments

One of the important impairments in leprosy is loss of sensation. Loss of sensation in the hands, feet and eyes makes them susceptible to external injuries. The injuries occur due to sharps or dust in case of eyes, pressure and temperature.

In order to prevent damage to the impairment of anaesthesia, it is important to teach the patient following activities.

- Health Education
- Self-care
- Life style modifications
- Usage of protective splints
- Foot wear

All these are dealt with in detail later in the book.

Summarizing, it is best to prevent impairments in leprosy. In the initial stages of impairment, early detection and treatment may reverse it. If impairments become irreversible, then a combination of correction and prevention of deterioration have to be put in place, so that the patient will have a supple hands, feet and eyes that can function well.

Prevention of Impairment & Disability Camps

Objectives

- To manage and monitor deformities in leprosy at the field level.
- To validate impairment status and interventions there-of among new patients.
- Provide needed health education and self-care for cases with impairments.
- Provision of MCR footwear.
- Teach home based self-care for patients who need it.
    - At the primary health centre
    - Place of POID camp

Frequency of POID Camp

- Twice a month

Activities

- Provide health education for all patients regarding general messages about leprosy as well as specific messages relating to importance of protecting hands/ feet and eyes.
- Demonstrate Self-Care of feet, hands and eye with participation of persons affected by leprosy.
- Carry out examination of new patients with deformities for baseline assessment and initiate needed interventions.
- Select patients for RCS.
- Fit appropriate footwear and/or protective devices.
- Teach home based ulcer care for simple ulcers.

CHAPTER 7

RECONSTRUCTIVE SURGERIES IN LEPROSY

Learning Objectives

- Will be able to list the objectives, role and scope of reconstructive surgery in leprosy
- Will be able to select, motivate and counsel a patient for reconstructive surgery
- Will be able to assess and preoperatively prepare a patient for reconstructive surgery (RCS)
- Will be able to implement post-operative physiotherapy and follow up patients after RCS

Objective of Reconstructive Surgery

Provide improved function

The main objective of reconstructive surgery in leprosy is to provide an alternative motor to carry out the function of a group of paralyzed muscles either in the hand, foot or eye.

Correct visible impairment

Reconstructive surgery also provides correction of impairment so that a near normal looking anatomical position is restored.

Provide protection

Both in the eye as well as in the limbs, tendon transfers or static procedures protect the eye or the limbs from damage from external injuries.

Role of physiotherapist in reconstructive surgery

- Identify patients for RCS using both general and specific eligibility criteria.
- Implement pre-operative protocols of hands/ feet for reconstructive surgery with reference to joint mobility, selection of motor, isolation of motor and re-education exercises.
- Administer post-operative physiotherapy protocols of tendon transfer towards hand / foot function.

Types of Reconstructive surgery in leprosy

- Tendon Transfer surgeries
- Plastic Surgery to correct deformities of the face
- Orthopaedic surgery to correct bone/joint deformities of hands and feet
- Plastic surgery to cover plantar ulcers

Benefits of Reconstructive Surgery

1. Appearance is improved
2. Social stigma is reduced
3. Function is improved
4. Some secondary deformities are prevented eg. Contractures, pressure ulcers, blindness.
5. The patient regains self-respect and hope for the future.
6. Patient is encouraged to co-operate with self-care.

Selection of patient

All patients who would be benefited occupationally, economically or socially are considered suitable for reconstructive surgery. The employed technique of surgery must have the potential to make a difference to patient's functioning, acceptance in the family, improve the socioeconomic situation and be reintegrated as ergonomically independent member of the society.

The proposed surgical procedure and its positive consequences should be balanced against the consequences of not doing surgery. This should be discussed with the patient and the decision whether to undergo surgery should be taken by the patient. Methods of managing to live with the deformities without causing further damages to the affected parts should be explained to patients who do not want or are not suitable for surgery.

The health worker should motivate the patients requiring reconstructive surgery towards a positive decision, but the patient must take the final decision.

Criteria for referral of cases for RCS

The criteria have been grouped into three categories: Physical, disease related, social and motivational criteria.

Physical criteria

- Age

The best age for referral for tendon transfer is between 15-45 years, but patients younger than 15 years or older than 45 years may be operated depending upon the particular circumstance.

- Duration of paralysis

The muscle paralysis should be present for at least one year and preferably not longer than 3 years. There may be exceptional cases, where there has been muscle paralysis for longer than 3 years and the individual has kept the joints supple through passive exercises.

- Suppleness of the joints

The patient may not remember accurately how long muscle paralysis has been present, so suppleness of the joints may be a more useful criterion. Patients with severe contractures or stiff joints are not suitable, although physiotherapy or surgery can reverse some contractures.

- Status of the skin

There should be no deep cracks, wounds and ulcers or infection of the skin such as scabies at the time of referral.

Disease criteria

- MDT

Patients should have completed the scheduled course of MDT or at least a minimum of 6 months MDT.

- Reactions and steroids

Patients should be free from reactions and symptomatic neuritis for at least 6 months. Patients should not have taken steroids in the immediate past (about 2 to 3 months) unless the surgery is for neuritis. There should be no tenderness of any major nerve trunk in the limbs.

- Social and motivational criteria

Patients must be well motivated and should have demonstrated that they are responsible for their own health and follow instructions on treatment and care of their eyes, hands, and feet before surgery. Patients who are not well motivated in self-care are not likely to be willing to participate in essential pre and postoperative physiotherapy.

Priorities for reconstructive surgery

Operations for lagophthalmos are usually considered as a high priority because of the possibility of secondary damage to the eye leading to blindness. Feet are usually considered the next priority for mobility followed by hands but this may depend on the needs of individual patients.

Common Reconstructive Surgery Procedures
Claw hand correction

The main objective of claw correction is to stabilize MCP joint in flexion for a better grasp of objects. The main indications are two finger clawing or four finger clawing.

Extensor CarpiiRadialis Longus / Palmaris Longus / Flexor DigitorumSublimus tendon transfers – lateral band fixation

Preoperative physiotherapy for ECRL / PL / FDS tendon transfers

Isolation and strengthening of chosen tendon

- Extensor Carpi Radialis Longus (ECRL) : By supporting the hand in pronation and practicing wrist extension without allowing finger or thumb movement. Strengthen ECRL by doing the same action against resistance.
- Palmaris longus (PL) : By wrist flexion and hand cupping to isolate Palmaris Longus tendon. Strengthen PL by doing the same action against resistance.
- Flexor Digitorum Sublimus (FDS): The hand is flat on table in supination. Ask the patient to flex the PIP joint of the long finger only. All other fingers should be relaxed. MCP of long finger should be flat and DIP joint must be relaxed. Strengthen Sublimus by doing the same action against resistance.
- Angle measurement of the claw finger should be recorded to compare the hand post operatively (Dynamograph).

Postoperative Physiotherapy for ECRL / PL / FDS tendon transfers

- Splint application in theatre
- Elevation of hand in the ward
- Explanation of care of POP.
- Documentation of surgery date, surgery done and presence of any complications

Post operative Immobilization

Three weeks from the date of surgery

Post operative physiotherapy after removal of plaster

First week

- Isolation and re-education of transferred tendon has to be taught to the patient.
- Post-operatively, attain lumbricals position (MCP flexion with IPs fully extended)
- Prevent damage or misuse of transfer by protection with cylindrical splints and a lumbrical slab.
- Supervision of postoperative exercises.
- Exercises must be closely supervised to prevent mal-utilization of the tendon.
    - Improve skin condition by soaking and oiling, once incisions are healed. Wax therapy, may be used, particularly if the patient has pain, but only if incisions are healed.
    - Control or limit swelling of hand by elevation of hand
    - Exercise other joints

Second week

- Strengthen transferred muscle by increasing duration of exercise - MCP flexion and encouraging controlled PIP extension.
- Continue protection of transfer through splinting - cylindrical splints or anterior slab.
- Continue maintaining skin and joint suppleness by wax bath.
- Repeat assessment at end of 2nd week.

Third Week

- Continue MCP flexion and extension.
- Mobilize PIP joints by allowing flexion.
- Measure angles of PIP joints.
- Continue splinting of PIP joints.
- Cylindrical splints can be discarded by 3rd week. Lumbrical slab is used at night.
- Check to ensure no stiffness is developing in the IP joints.
- Improve co-ordination of transfer by using transfer in different hand positions, in full grasp sequence in finger to thumb pinch action (if thumb is working).
- Repeat assessment at the end of 3rd week.

Fourth Week

- Integrate transfer into daily activities.
- Functional use of the transferred muscle by relating the exercises learnt to every day hand function, when all the above exercises are performed confidently and accurately.

Physiotherapy for 'Lasso Surgery'

In usual practice, the FDS of the long finger is used for Lasso procedure.

Pre-operative physiotherapy specific to Lasso procedure

Follow general principles of pre-operative physiotherapy mentioned for claw correction.

Post-operative physiotherapy specific to Lasso procedure

At the end of 2 weeks, POP and sutures are removed and post-operative assessment of the hand is carried out.

MCP block is given to keep the MCP joints in 55º of flexion.

First week (after suture removal)

- Isolation and re-education of transferred muscle (FDS of long finger).Maintaining MCP joint in 55º (do not extend more than that), flexion of MCP joint and extension of PIP and DIP joints is carried out. MCP block is used when not exercising. No cylindrical splints are used.

Second week

- Continue re-education of transferred muscle.
- Graded exercises to strengthen the motor tendon – longer period of exercise, in different positions, etc.

Third week

- Start co-ordinating exercises
- More extension of MCP joints

Fourth Week

- Daily functional activities with integration of transfer.
- MCP block is removed and spiral splint is given for another 3 months to maintain the MCP joints in flexion.

There may be some variations in the post-operative splint and exercises according to the Surgeon. Often the post-operative cast includes the fingers in the lumbrical position. It is cut at the PIP level to allow flexion and extension of the fingers 3-7 days post-operatively.

Physiotherapy for Opponens replacement

The objective of opponens transfer is to restore thumb abduction / opposition necessary for pinch function.

Indication

Complete median paralysis—"Ape" thumb deformity. Most commonly, ring finger sublimus is transferred to bring thumb abduction and opposition.

Pre-Operative Physiotherapy specific to opponens replacement
Following are the general principles of pre-operative physiotherapy:

- Gain maximum passive extension of thumb IP joint.
- Gain adequate or normal thumb web angle by passive stretching of web and / or splinting.
- Gain isolation and full strength of ring finger FDS.

Post-Operative Physiotherapy specific to Opponens replacement–Immobilization

Postoperatively the thumb is immobilized for three weeks in a plaster cast.

Out of POP cast assessment – Documentation

- Position of MCP and IP joints and any residual contractures.
- General skin condition especially any unhealed incisions or infections.
- Any warmth, pain, swelling.
- Is transfer working or not.

Post-operative Physiotherapy (After suture removal)
First week

- Isolate transferred muscle by asking the patient to perform old action of PIP flexion of ring finger and watching for new action of thumb abduction /opposition.
- Prevent damage or misuse of transfer by applying thumb spica or cylindrical splint to thumb, with thumb sling to hold it in abduction and opposition between treatments.
- Prevent / control swelling by elevation. Give slab if swelling is present rather than cylinder POPs or spica.
- Maintain and improve skin condition by soaking and oiling (once incisions are healed). If infection and swelling are present, antibiotics, rest, splint and elevation will be needed. Stop exercises according to severity of infection.

Second week

Strengthen transferred muscle by progressive exercises. Slowly increase duration of exercise. Start eliminated Gravity exercises.

Third week

Improve co-ordination of transferred muscle by teaching it to work together with fingers for pinch function. Increase the range of movement exercises. Discard POP as good control is gained. Continue anterior slab at night.

Fourth week

Train functional use of transferred muscle by relating exercises learnt to every day hand activities. Activities may include picking up large objects and progressing to smaller ones. Practice games like draughts, ludo and encourage writing.

End of fourth week - Patient usually is ready for discharge.

Physiotherapy for Temporalis transfer

The main objective of temporalis transfer is to obtain closure of the eye lids to cover the cornea and preventing corneal damage.

Indication

Lagophthalmos with or without corneal anaesthesia.

Pre-Operative physiotherapy

1) **Assess**
   1. Face muscles, especially orbicularis oculi.
   2. Corneal sensation.
   3. Inter lid width of the eye – light and tight closure.
   4. Strength of Temporalis muscle.
   5. Other general assessments.
   6. Any eye complications i.e., inflammation, ulcer, etc.

2) **Teach**
   Isolated contraction of temporalis muscle i.e. biting. Check whether the patient has teeth.
3) **Strengthen**
   Temporalis muscle is strengthened by doing biting exercises on a hard substance e.g. a piece of rubber or chewing gum.

Post-Operative Physiotherapy

Patient must not be allowed to bite or chew until the 3rd week.

Diet (After Surgery)

1st week – liquid diet

2nd week – Semi solid diet

3rd week – Normal diet, start biting exercises and measure inter lid width when exercising

4th week – Strong exercises with longer exercise sessions, holding contraction for longer time and biting on a hard substance. Try to close the eye without biting.

This muscle is usually easily re-educatable. Patient may be discharged at the end of 4th week with advice to continue exercises and care for the eye.

Physiotherapy for Foot drop correction

The main objective of foot drop correction is to bring about dorsiflexion of the foot at the ankle joint and to improve gait.

Indication

Paralysis of muscles supplied by the Lateral Popliteal Nerve resulting in a foot drop.

Procedure

Tibialis posterior transfer.

Pre-Operative Physiotherapy

Assessment – Documentation

- Angles of the ankle joint are recorded during rest, at active dorsiflexion, at passive dorsiflexion with Knee straight and with knee bent and also at active plantar flexion and passive plantar flexion.
- Patient's attitude and motivation, co-operation, intelligence
- Duration of foot drop
- Any secondary deformity – Ulcers, Tendo-Achilles contracture
- Functional assessment
    - Isolation of Tibialis Posterior - Sitting with affected foot supported on opposite knee and practicing inversion Resistance may be given to medial side of the foot.

Post-Operative Physiotherapy

Immobilization
Postoperatively the foot will be in a plaster cast for 3weeks.

Assessment – Documentation after removal of plaster cast

- Skin condition
- Condition of incisions
- Any complications i.e., swelling, warmth, pain
- Position of sub-talar joint
- Whether transfer is working or not
- Suture removal done on 21st Post-operative day

Post-operative Physiotherapy
First week (After suture removal)

- Training the transferred muscle to carry out the new action (dorsiflexion) by helping the patient to recall the pre-operative isolated exercises in eliminated gravity position.
- Prevent damage or misuse of transfer by:-
    - Apply a POP back slab in dorsiflexion in between treatments.
    - Allow exercises to be done only under supervision. Patient should not be allowed to weight bear – use only crutches or wheelchair.
- Prevent / control swelling by resting with foot elevated between treatment sessions.

Second week

- Strengthen transferred muscle by progressive exercises – dorsiflexion against gravity.
- Apply a POP back slab in dorsiflexion in between treatments.

Third week

- Gain co-ordination of transferred muscle.
- Apply a POP back slab in dorsiflexion in between treatments.

Fourth week

- On 41st Post-operative day - Partial weight bearing (standing) allowed. It is taught in front of a mirror.
- Gain full weight bearing (walking) on 42nd day by weaning the support of parallel bars. Discontinue the back-slab in the day but continue at night.
- Gain full functional use of transfer by encouraging walking in all situations, progressing to rough ground, slopes, steps and longer distances.
- Patient must wear drop foot strap for a minimum of 3 months.

End of 4th week

Patient is usually ready for discharge. Foot angles are measured and documented.

Follow up advice

- Continue thinking of the way he walks.
- Practice basic exercise briefly every day.
- Use correct footwear.
- Practice foot care during daily activities.
- Return for follow-up after 1 month and again after 6 months.
- Not to walk too far or too fast or run, or play running games for some months.

CHAPTER 8

PREVENT DAMAGE TO IMPAIRED ORGANS

Learning Objectives

- Will know the general principles of protecting impairments from damage
- Will be able to give health education and transfer skills of self-care
- Will transfer skills for home based management of wounds
- Will be able to bring about specific changes in life style to protect impairments from damage

Introduction

- Once the impairments in leprosy become irreversible, the patient will have to take care of these impairments throughout his/her life.

- Self-care practices must be taught to the individual equipping the person with skills to take care of his impairments so that further worsening of the impairments is prevented.

- Self-care has to be performed every single day and the patient must remember to take care of his impairments every single moment. Any neglect of the impairments can cause further damage and worsening of the impairments.

- Self-care has to be participatory and problem based. The patient must be involved in his own planning, ideas need to come from him, involving a family member for support, encouragement, to remind and check if self-care is optimal.

- The patient should be educated to be aware and accept the limitations due to sensory loss.

General principles of self-care

1. Avoiding external injuries to anesthetic hands and feet.
2. Practice daily routine self-care.
3. When injuries occur, ensure quick healing of wounds.
4. Making life style modifications.

Avoiding injuries

As shown in figure 28, the tools can be used to protect hands from external injuries such as friction, heat and pressure.

- Use of insulation by thick cloth, gloves, wooden handles, rubber covering for work tools handles, cycle handles, hot objects etc.
- Use of long stick/ pair of tongs to place coal in fire.

- Use of grip aids and dynamic splints. These may be useful for same patients who are severely deformed or who are unable to have surgery for any reason. Patient will need to be referred to a center, which makes them.

Figure 28: Various impediments used to avoid

Daily routine self-care

Figure 29: Materials used for soaking, scraping and oiling

Inspection

Inspection of early signs of injury – redness, hot spots, blisters, small wounds, cracks, swelling and for the presence of any hard skin or callus.

(a)

(b)

Figure 30 (a):Inspection of feet, (b): Inspection of Eye

Soaking, Scraping and Oiling

Soaking

Soaking using local, easily available utensils (bowl, broken pot), river / pond, hole in ground lined with plastic, wet cloths. Cool clean water (no salt or soap added) should be used for soaking. Soaking should be for approximately 20 minutes.

Scraping

Scraping or rubbing off hard skin using a piece of rough cloth or a scrapper stone should be done to remove the hard skin.

Oiling

Rub oil in to the wet hand / feet for retaining moisture. Take care to avoid rat bites if this is done at night (Avoid edible oils, Add neem oil to Vaseline, if available, to repel insects). Follow by oil massage for the fingers / toes.

(a)

(b)

Figure 31 (a): Soaking of Feet, (b): Soaking of Hands

Quick healing of wounds

- Clean simple wounds with clean water to which salt has been added.
- Cover the wound with piece of clean cloth and minimal bandage to keep it in place.
- Rest – using simple padded splints with a sling or cloth.
- Check daily for healing. If it is not healing or if there is swelling, heat, redness, lymph node enlargement in armpit / groin, foul discharge or fever, the patient should immediately seek medical attention.
- Identify the cause of the wound and avoid recurrence. This is very important because the patient should learn from earlier mistakes and prevent the ulcer from occurring again.

Self-care - Life style modifications

Life style modifications for hand

- Use gloves or adaptations when touching hot objects.
- Cooking with insulated utensils is important.
- Other hot items can also be insulated. Drink coffee or tea from insulated cups.
- People working in fields should have padding on the instruments they use repeatedly.
- Start thinking of what can injure and cause blister of the hand.
- Avoid doing work with hands for a long period of time.
- Avoid work which cause trauma to hands.

Life style modifications for feet

- Taking small steps while walking.
- Avoid walking when there is a possibility to ride.
- Avoid standing when there is a possibility to sit.
- Avoid sitting cross legged.
- Wearing a proper footwear while going out to avoid direct contact with the road.
- When there is a need to stand for a long time, shifting weight from one foot to other.
- Wearing a minimum of 2 pairs of socks while wearing sandals to avoid pressure.

Self-care of Eye

Self-care for impaired corneal sensation

Sensation of the cornea can be lost in leprosy because of trigeminal nerve damage. The patient should be told that he has decreased corneal sensation and that if he develops red eye or has a decrease in vision, he should report to the field worker or to the referral hospital.

'Think Blink': The person must be trained to regularly deliberately close the eye every few minutes. Choosing a reminder to help in remembering to blink is one excellent method of preventing damage to the cornea. Example: Watch when others are blinking or blink when you see a tree on the road.

Self-care for Lagophthalmos

Lagophthalmos is the inability to close the eye due to Orbicularis oculi muscle paralysis caused by facial nerve damage. When the person is unable to close the eye, there is dryness of the eye. Just like a dry leaf breaking easily underneath the foot, the surface of the dry eye is prone for breaking and damage. Self-care of the eye helps in preventing such damage.

Life Style Modifications for Eye

Patient should

- Wear protective glasses during the day.
- Cover his eyes at night either with a cloth or an eyeshade.
- Do passive eye exercises.
- Wash face with clean water to prevent dryness of the eye.
- Should not rub the eyes because of risk of damage to the eyes.
- Perform simple vision testing at home.
- Inspect eyes at least two times a day by looking at a mirror.
- Tear drops may be used to wet the cornea as advised by a medical practitioner.

Home based self-care

Ask patients details of self-care activities such as:

- How often they practice self-care? Where?
- Ask what patient is doing for self-care when s/he is very busy
- Who is assisting with these activities? e.g. family, government health worker etc.
- Observe where bowls, equipment for skin care are kept and how easy they can be found e.g. by asking demonstration of skin care.

Monitoring of Self-Care – Outcomes

- Patients undertaking life style modifications for self-care.
- Reduction of the prevalence of ulcers.
- Healing of new ulcers rapidly.
- Increased use of protective footwear.
- Attitude changed towards wound healing.
- Opportunity to think critically.
- Stimulated to follow up.

Group Self-Care

Participatory Problem based self-care

The criteria for which patients are eligible for self-care training will vary. The most general criterion is that, any patient with any leprosy related impairment is eligible for self-care education.

Methods & Content of self-care training

- The training should be a two-way conversation.
- The trainer should make an effort to give information relevant to the problems the patient experiences.
- Ask what are the problems of the patients? The information provided will be specifically chosen to respond to the needs of that patient.
- The trainer should verify that the patient has understood the instructions.
- There should be demonstration of self-care techniques.
- The patient should practice what is being taught under supervision.

Group based self-care

What is a self-care group?

Group of people affected by leprosy (also can include family members) who share a common purpose of self-care. The group meets regularly and helps one another by interacting, communicating and reacting (Figure 32).

Aims and Objectives of a self-care group

- Create a cohesive group
- Widen their interest in self-care
- Reduce prevalence of ulcers and increase speed of healing new ones
- Problem solving /Application of theory
- Change in attitudes
- Provide feed - back
- Support each other
- Learn from each other
- Prevent any worsening of disabilities

Criteria of a self-help group member

- Leprosy affected person with impairment.
- A person with a recent history of wounds.
- Family members of leprosy affected people.

Criteria of a good leader of the group

Understands and practices self-care, Intelligent, Good listener, Hard worker, Has ambition.

Size of a Group

- 5 to 7 / varies.
- Less than 10 preferred.

Figure 32: Self-Care Group

Guidelines for Self- Care Group Meeting

Background needs to be common
Gender, Age, Language, Vocation

Environment
Suitable room / Open air, Rooms – well lighted, ventilated

Seating
Sit in a circle. Group facilitator sits on equal terms with participants.
Eye contact, Accommodation and Seating is the responsibility of the facilitator.

Time table of meeting
Meet every week or every two weeks.
Facilitator should attend every meeting.
Meeting time should be decided.

Discussion time is between 1.5 hours to 2 hours. (Not more than 2 hours, but not less than 1 hour)

CHAPTER - 9

PREVENT PROGRESSION OF IMPAIRMENTS

Learning Objectives

- Will be able to list the interventions that will prevent progress of impairments in leprosy
- Will be able to teach a patient methods to keep skin and joints of hands and feet supple
- Will be able to teach exercises to patients to prevent development of contractures
- Will be able to advise and apply splints to prevent contractures

Learning Objectives

Patients with impairments such as clawing of fingers, Ape thumb, foot drop and claw toes tend to adapt the new anatomical positions as the soft tissues become fixed in this position. Skin, subcutaneous tissues, muscles, tendons, joint capsule shorten and the joints become fixed in that position producing stiffness or even contractures.

In order to prevent development of stiffness and contractures, the patient needs to be taught the following set of activities which will prevent soft tissues changes.

- Oil massage
- Passive and Active exercises
- Usage of splints

Oil massage

Oil massage using gingelly or neem oil will help in keeping the skin and joints supple. This must be done daily so that oil will prevent dryness of skin and the massage will keep the joints from becoming stiff.

Passive and Active exercises

Passive exercises are done to repetitively correct the deformity by using the other hand.

The following exercises are useful in preventing contractures.

Facial Nerve – Orbicularis Oculi – Lagophthalmos

Passive Movement for weak Orbicularis Oculi muscle

- Ask the patient to place the index finger on the lateral side at the edge of the eye
- The person is told to gently pull laterally. This will cause the eye to close (Please refer figure 15).

Active exercise for weak Orbicularis Oculi muscle

- The patient is asked to close the eye tight for 3 to 5 seconds.
- Open the eye after about 10 to 15 seconds, the exercise is repeated again (Please refer figure 16).
- This exercise will strengthen the Orbicularis oculi muscle.

Ulnar Nerve - Clawing
Passive Movement when lumbicals and interossei are weak or paralysed

- This exercise can also be called as massage.
- The hand is placed on the thigh or on a soft flat surface, with the palm facing up.
- The palm or hypothenar area of the other hand is used to gently straighten the fingers.
- Once one cycle of the exercise is over, the other hand is lifted up and then the exercise is done again.
- This can be repeated about 20 cycles for 4 to 5 times a day. This exercise helps to prevent interphalangeal joint contractures (Please refer figure 17).

Assisted Active Exercise when lumbricals and interossei are weak

- The MCP joints of the affected hand are supported at 90 degrees by the other hand i.e. the lumbrical position.
- From this position of MCP at 90 degrees flexion and wrist in neutral, the interphalangeal joints of all the fingers need to be flexed and then extended through the full range of movement [Please refer figure 18 (a) & (b)].
- The extension movement is more important and should be done to the extreme range.
- This can be repeated about 20 cycles for 4 to 5 times a day. This exercise helps to strengthen the interossei muscles.

Active Exercise when lumbricals and interossei are weak

- The hand is placed on a soft padded surface like the thigh or a padded table top.
- The patient is asked to abduct and then adduct the fingers and thumb, as much as it is possible, without lifting the fingers from the ground.
- The other exercise that can be performed is by supporting the elbow on a flat surface and then the hand is made into a fist.
- The elbow is extended and the MCP joint is maintained at 90 degrees.
- From this position, the interphalangeal joints of the fingers are extended and then flexed repeatedly.
- The extension of the fingers to reach the lumbrical position is very important in strengthening the interossei muscles.

Median Nerve – Ape Thumb.
Passive movement when thenar muscles are weak or paralyzed.

- This exercise can be done by interlocking the thumb webs of both the hands.
- The normal hand is also used to stretch the thumb web of the affected hand.
- The thumb of the affected hand is moved away from the index finger. This will help in stretching the thumb web and prevent thumb web contractures (Please refer figure 19).
- This can be repeated about 20 cycles for 4 to 5 times a day.

Assisted Active Exercise when thenar muscles are weak

- This exercise can be done by supporting the MCP joint of the thumb with the thumb and fingers of the other hand.
- The abducted thumb of the affected hand is moved to touch the pulp of the four fingers alternatively.
- With the thumb fixed in the above position, the interphalangeal joint of the thumb should be flexed and extended. This will prevent contracture of the IP joints of the thumb.
- This exercise can be repeated about 20 cycles for 4 to 5 times a day.

Active Exercise when thenar muscles are weak

- The hand is placed on a soft flat surface with the palm facing up.
- The extended thumb of the affected hand is moved into opposition with all the other four fingers. The thumb is also actively moved into abduction position and this position is maintained for about 5 seconds.
- This exercise will help in strengthening the abductor pollicis muscle.
- This can be repeated about 20 cycles for 4 to 5 times a day.

Radial Nerve - Wrist drop
Passive Exercise when wrist extensors are weak or paralysed

- The two palms are placed in approximation with each other.
- Extend the fingers and thumb. Repeat it again for about 20 cycles for 4 to 5 times a day.
- From this position, the wrist of the normal hand is flexed to make the affected wrist to move into extension.
- The extension of the paralysed wrist should make it move to the end ranges.
- The other method of exercising the wrist is to place the wrist flat on a surface and the elbow is lifted perpendicular to the wrist joint (Please refer figure 20)
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.
- The exercise will prevent a wrist contracture.

Active strengthening Exercise when wrist extensors are weak

- The forearm is supported over the table top with the forearm in full pronation.
- The palm is facing down and the wrist is placed in such a way that is hangs over the edge of the table.
- The wrist is then extended fully. This exercise will help to strengthen the extensor carpi muscles.
- The muscle can be further strengthened by holding something in the fist and moving the wrist into extension. This movement of the wrist against gravity with a weight acting as resistance to the movement will be able to help strengthen the muscle further.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Lateral Popliteal Nerve – Foot drop

Passive Exercise when extensors of the ankle are weak or paralysed

- The patient is positioned in long sitting (Knee Extended). A towel is placed over the plantar surface over the forefoot and the edges of the towel are held by the patient.
- The towel is pulled towards the patient, so that the ankle is pulled into dorsiflexion. The foot is held in this position for about 10 seconds and then released (Please refer figure 21).
- Another exercise that can be performed is by standing about a foot in front of a wall, facing the wall. The person can lean forward by flexing the elbow with the hands placed on the wall for support. This causes the foot to dorsiflex.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Active Assisted Exercise when extensors of ankle are weak

- The paralysed foot is placed over the other leg and the person actively tries to dorsiflex the foot in this gravity eliminated plane.
- When the foot does not move through the full range, the patient tries to dorsiflex the foot through its maximum possible range.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Active Exercise when extensors of the ankle are weak

- The patient is in high sitting with the legs not supported by the ground.
- The foot is dorsiflexed and the position is maintained for about 15 to 20 seconds.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Active Resisted Exercise when extensors of the ankle are weak

- The patient is positioned in high sitting.
- With the foot hanging, a small sand bag or other weights can be added to forefoot.
- The person lifts the foot into dorsiflexion against gravity and the resistance provided by the weight.
- The dorsiflexed position is maintained for about 10 seconds.
- Repeat the exercise again for about 20 cycles for 4 to 5 times a day.

Posterior tibial nerve – Claw toes

Passive Movement for Claw toes

The foot is placed over the other thigh with the affected leg in crossed leg position. The toes of the foot are straightened manually. When the toes are straightened, the stretching force will prevent the toes from becoming stiff in the clawed position.

Active exercise

The foot is placed on a flat surface and the tip of toes are pressed firmly against the surface, so that a crawling movement of the toes is produced. This will strengthen the small muscles of the foot.

Usage of Splints

A splint is a supportive device that is used to immobilize a body part. It helps in preventing unwanted movement, protection of a part of the body and maintaining function. Removable splints are called as Slabs. A complete splint is called a cast. Splints can be broadly classified into Dynamic splints and static splints.

Static splints

Static splints are those that will immobilize a joint and help in preventing movement. They do not allow any movement in the immobilized area.

Dynamic splints

Dynamic splints immobilize a part of the body, but allow selective movement to maintain function.

Indications for Splints

- To prevent movement and reduce pain in a person with acute neuritis.
- Maintain suppleness in deformities like claw hand, wrist drop and foot drop.
- Immobilize a body part in ulcer care.
- In reconstructive surgery – pre-operative and post-operative splints to maintain the desired position.
- In the treatment of fractures, pain, deformities and wounds.

Materials used to make splints

Any material that is comfortable to the patient, maintains position and is cost effective can be used to make a splint. Some of the commonly used materials for making a splint are: Metal, Cork, Bamboo, Coconut shell, Plaster of Paris (POP) and Plastic including thermoplastics.

Types of splints used in Leprosy for various conditions

Splints used for the healing of wounds, ulcers and cracks

Below knee cast, Moulded Double Rocker Shoe, Gutter Splints and Cylindrical splints.

Splint used in Neuritis

To immobilize joint and to rest involved part, so that nerve and muscles are not stretched and the nerve can heal. Ulnar neuritis slab (long arm posterior slab), median neuritis slab, long leg posterior slab for lateral popliteal neuritis and below knee posterior slab for posterior tibial neuritis and casts are used for neuritis.

Splints used to prevent further deformity.

A gutter splint, spiral splint, functional slab and 'Coconut splint' can be used.

Splints used to maintain position - Pre and Post reconstructive surgery

Cylindrical splints for fingers, thumb spica, lumbrical slab and below knee POP cast are used.

CHAPTER 10

MANAGEMENT OF PLANTAR ULCERS

Learning Objectives

- Will be able to list the predisposing and causative factors of planter ulcers in leprosy
- Will know about the pre ulcerative conditions and the distribution of plantar ulcers and their importance
- Will know the classification of plantar ulcers and will be able to diagnose different type of ulcers using clinical examination
- Will know the principles of plantar ulcer management
- Will be able to apply POP casts for offloading plantar ulcers
- Will be able to provide health education for prevention of plantar ulcers

Plantar Ulcer

Plantar ulcer is the discontinuity in the skin on the plantar surface. It is one of the major problems in leprosy due to non-healing and recurrence.

Predisposing factors for plantar ulceration

a. Loss of Sensory component of nerve:

Involvement of sensory component of the posterior tibial nerve causes anaesthesia. Because of anaesthesia, patient will not be aware of any external injuries sustained until it becomes infected and inflamed.

b. Loss of Motor component of nerve:

Involvement of the motor component of the posterior tibial nerve results in paralysis of small muscles in the sole of the foot. This produces clawing of toes. When there is wasting of the small muscles of foot, the thickness of the sole gets reduced and the added clawing causes abnormal bony prominences particularly in the region of the metatarsal heads increasing the pressure in these areas.

The high shear pressures over the bony prominences in the metatarsal region causes necrosis of the skin due to compression of the skin between the bone and hard floor leading to ulceration.

c. Autonomic neural dysfunction:

Involvement of autonomic component of the posterior tibial nerve causes dryness in the foot leading fissures and callosities. These areas also become prone to ulceration.

Causative Factors

- Sharps
- Heat
- Pressure
    - Continuous
    - Repetitive
    - Shear

Pre ulcerative conditions

- Callosities
- Fissures
- Blisters
- Haematoma
- Abscess

Distribution of plantar ulcers

Forefoot	75%
Lateral border	10%
Heal	10%
Other areas	5%

Types of ulcers

- Simple ulcer
- Complicated ulcer

The classification into simple plantar ulcer and complicated plantar ulcer helps in deciding the management of plantar ulcers.

Simple ulcers

Superficial ulcer with no involvement of deeper tissues

- Skin
- Subcutaneous Tissue.

Complicated ulcer

Ulcer with involvement of deeper tissues such as

- Synovial sheath – Tenosynovitis
- Tendon – suppurative tenosynovitis
- Joint – septic arthritis
- Bone – osteomyelitis
- Deep sinus – calcaneal osteitis
- Malignancy

Treatment of pre-ulcerative conditions

- Blister and haematoma – rest to the foot for 4 – 5 days
- Fissures – Foot soaks/ Scraping/ Oil massage
- Deep infected fissures – Rest and antibiotics
- Callus – Foot soaks/ Scraping / Oil massage/ Trimming
- Abscess –Incision and drainage / Antibiotics

Examination of Ulcer

Plantar ulcers are examined for the presence of the following

Discharge from the Wound

- Quantity – In simple ulcers the quantity of discharge is very minimal. On the other hand if the discharge is copious, it indicates that it has become complicated and the discharge may be synovial or purulent.
- Colour - Generally the discharge from the ulcer may be colourless or slightly straw coloured. Sometimes it may be greenish tinged due to infection by pseudomonas pyocyanea or it may be greyish in complicated ulcers.
- Smell – normally the discharge from a simple ulcer is odourless. When the discharge has a bad odour, it indicates a complication.

Swelling

Usually there is no swelling in the simple plantar ulcers. Presence of swelling denotes inflammation in the deeper portion of the foot indicating a complication.

Warmth

In foot with simple ulcer, there is no warmth. Presence of warmth is a sign of inflammation in the deeper tissues and indicates a complication.

Lymph Node Enlargement

In simple ulcers usually there is no significant enlargement of inguinal lymph nodes. On the other hand, in complicated ulcers there will be enlargements of lymph nodes, with or without pain.

Fever

Generally in simple ulcers there is no fever, but in complicated ulcers there may be fever according to the severity of infection.

Presence of ulcers with copious discharge, swelling, warmth, lymph node enlargement and fever are indications of complicated ulcer, while most of them will not be seen in simple ulcers.

Management of Simple ulcers

Principles

1. Rest to the ulcer
2. Dressings

Rest to the ulcer

Rest to the ulcer can be provided, if the patient does not bear weight on the affected foot by using crutches or walker. Since the time taken to heal the ulcer may be about four weeks, this method of resting may not be feasible.

Other methods of resting the ulcer are called 'off loading' devices. Presently POP casts are the most affordable and effective methods to heal simple plantar ulcers.

Dressings

The wound has to be kept clean by changing the dressing daily. Any of the external applications - different solutions can be used. Even ointments can be used.

For offloading generally two types of plaster cast are applied.

- Moulded Double Rocker Shoe (MDRS)

The Moulded Double Rocker shoes is prescribed for simple plantar ulcers in the meta tarsal region and over the tip of the toes (figure 33). The POP is applied for a period of 4 weeks and then the plaster is removed and the foot is reviewed for assessing the condition of the wound. MDRS should not be applied in the presence of a foot drop.

Figure 33: Moulded Double Rocker Shoe

Figure 34: Bohler Iron

The Below Knee plaster cast is applied for ulcer in the heel and lateral border with Bohler Iron (figure 34) or a Double Rocker according to the convenience of the patients for a period of 6 weeks. A Double Rocker is used for in slightly elderly patients for the sake of balance. The plaster cast is then removed and the condition of the wound is assessed.

Management of Complicated ulcers

Convert complicated ulcer into a simple ulcer and manage as a simple ulcer.

Principles

1. Debridement and drainage
2. Antibiotics
3. Daily dressings
4. Rest

Immobilization providing rest to ulcer

In early tenosynovitis

When patient comes with an deep ulcer over a joint and has synovial discharge, there will be a need for immobilization of the foot and the affected toe apart from the dressing.

Initially, below knee posterior slab is applied for immobilization. After the swelling reduces, a non-weight bearing below knee plaster cast with a window over the ulcer area is applied.

In suppurative tenosynovitis

When the ulcer with early tenosynovitis is neglected, the tendon gets infected as the synovial sheath is open. The discharge may become purulent. The ulcer then needs to be laid open and the necrotic tissue removed. The foot should be placed in a posterior slab in order to provide rest to the joint.

In septic arthritis

When the joint gets involved there will be synovial discharge, which requires immobilization to heal the joint.

Initially, the below knee posterior slab is applied to reduce the swelling and subsequently a POP cast with window needs to be applied till the synovial discharge stops.

Dressing in Wound Management

Solutions used for dressing

- **MSGA** is used for superficial ulcers.

MSGA contains - **Magnesium sulphate** reduces oedema by its hygroscopic action and decreases the swelling. **Glycerine** maintains the moisture and prevents drying of the dressing and **Acriflavin** acts as an antiseptic.

- **Dakin's solution** is used for infected ulcers.

The solution helps in separating necrotic tissues and helps in formation of granulation. This is used in infected and deeper wounds.

- **Acetic Acid Solution:** 5% acetic acid is used in wounds infected with pseudomonas pyocyanea. Pseudomonas pyocyanea multiplies and grows well in an alkaline medium. When the medium of ulcer is converted from alkaline to acidic, it creates

unfavourable environment and prevent multiplication and growth of the organisms, there by bringing the infection under control.

Frequency of dressing

Based on the extent of infection and quantity of discharge from the wound, the frequency of the change of dressing is decided.

- If the discharge is copious, patient may need dressing twice a day.
- If the discharge is moderate to mild, dressing can be applied once a day.
- If the discharge is very minimal, then dressing can be applied once in two days.

Prevention of plantar ulcers

- Inspection of feet everyday by the patient..
- Protection of anaesthetic plantar skin by appropriate footwear
- Early and adequate treatment of pre-ulcerative conditions
- Protection of scarred deformed foot by appropriate shoe with moulded insole
- Surgery to correct deformities which pre-dispose to ulceration

CHAPTER 11

FOOTWEARS IN LEPROSY

Learning Objectives

- Will know the objectives of footwear in leprosy
- Will know how to examine a foot with reference to foot wear prescription
- Will know the features of simple foot wear and the type of foot that requires simple foot wear
- Will know the types of feet that need specialized foot wear
- Will be able to educate the patient about foot wear and its usage

Every foot needs protection, especially from exposure to heat, pressure and sharps. This is more so in the case of patients affected by leprosy because of loss of sensation in their feet.

An anaesthetic foot is exposed to any of the above insults, can be injured leading to abrasion of the skin. Since no pain is felt by the patient, he or she continues to walk on the injured foot causing further damage leading to plantar ulcers.

In order to protect anaesthetic feet, patients must be provided with MCR footwear.
The objectives of provision of footwear are:

- Protection from external injuries.
- Soften the impact of body weight.
- Spread pressure over the sole of the foot evenly.

Examination of the feet

Every patient who is fitted with a foot wear needs to be examined and the following details noted:

Details of the foot

- Sensory loss
- Shape
- Size
- Deformities
- Ulcers
- Extent of scarring
- Presence of claw toes

Simple Foot wear (Figure 35)

All patients with feet that are not shortened, not badly scarred or deformed may be fitted with a MCR sandal with the following features:

Figure 35: MCR footwear

Insole

MCR insole / Soft insole – To compensate for the loss of padding and help in redistribution of weight.

Under sole

Protection: Hard outer sole – to prevent penetrating injuries from sharps – Tyre or hard sole.

Heel counter – Back strap

To prevent the foot from slipping and reduces shearing stress.

Straps

- Wide well-fitting straps to prevent shearing stress.
- Length of all the straps should be adjustable with Velcro.
- The buckles should be large enough for the straps to move freely and can be easily worn by the patient having severe deformity.
- The front strap should have adequate length to be able to increase the circumference of the forefoot by 1 ½ inches to accommodate swellings & bandages.

Frequency of changing footwear

All leprosy-affected with plantar anesthesia should receive footwear at least once a year. If the old footwear can be shown to have worn out, it is changed more frequently.

Educating the patient regarding need for footwear

- Ask patient what she/he knows about effects of anesthesia.
- Ask patients what they think characterizes a 'good' footwear.
- Ask questions such as, what shoes they wear when they go to the market or visit friends in town and how many pairs of shoes they have at home.
- Inspect shoes for signs of being worn out and ask when they received that particular pair of protective footwear.

- Observe the footwear the patient is wearing during an unannounced visit.
- Educate the patient correcting wrong notions about protection of foot.

Specialized Footwear prescription

- Anaesthetic foot with claw toes or forefoot scarring – MCR footwear with Arch Support and / or Metatarsal Pad.
- Anaesthetic foot with heel or lateral border scarring – Moulded Shoes.
- Anaesthetic foot with neuro arthropathy – Fixed Ankle Brace.
- Anaesthetic foot – Shortened and scarred– Patellar Tendon Bearing Brace.
- Anaesthetic foot with ulcer at the base of first metatarsal area – Scooping at the ulcer area

Measurement techniques for appropriate footwear

Careful assessment and due consideration should be given while selecting the footwear based on the size of foot, type of foot (small, long), deformities of the foot (anaesthetic, amputated, swollen, ulcerated, flat foot, high arched foot, etc...).

The fit of the shoe will be based on the length and the breadth of the foot or the last.

Length of the foot

Horizontal distance between the anterior end of the most prominent toe and most prominent posterior part of the heel, measured with the subject standing with equal distribution of the weight of the body on both feet.

Width of the foot

The horizontal distance between vertical lines in contact with the first and fifth metatarsophalangeal joints, measured with the subject standing with equal distribution of the weight of the body on both feet.

Advice to the Patient

- Avoid using nails when repairing the footwear. Use only stitches or pasting for fixing broken footwear
- Avoid using ill-fitting footwear i.e. it is neither too loose nor too tight
- Always use the heel counter in the footwear

CHAPTER 12

REPORTING FORMS IN NLEP

U.L.F. 01

NATIONAL LEPROSY ERADICATION PROGRAMME (NLEP) PATIENT CARD										
Subcentre				PHC						
Block/CHC		District			State					
Registration Number							SC	ST	Others	
Name							Age	Female	Male	
Address (with mobile No.)										
Duration of signs/ symptom in months	……..Duration of disability, if any……..									
Mode of detection	Voluntary/by ASHA/referred by other/by contact survey/other mode									
Classification	PB	MB	New Case		Other Cases (specify)					
Disability	Gr-I	Gr-II	EHF score							
Date of First Dose										
AFTER ENTERING ABOVE INFORMATION IN THE PHC TREATMENT RECORD, THIS PATIENT CARD IS TO BE TRANSFERRED TO SUB-CENTRE FOR DELIVERY OF SUBSEQUENT DOSES							Signature of Medical Officer			
Date of subsequent doses:										
2	3	4	5	6 (PB final)	7	8	9	10	11	12 (MB final)
Date of Discharge	Date:				RFT/otherwise deleted (specify)					
End Status	EHF score	Follow up required (after RFT) for reaction, deformity, Ulcer or eye care								
THIS CARD IS TO BE MAINTAINED AT SUB-CENTRE AFTER EVERY DOSE UPDATE THE PHC TREATMENT RECORD AFTER ACHIEVEING END STATUS THE MPW SHOULD SIGN THIS CARD AND RETAIN AT SUB-CENTRE FOR FUTURE REFERENCE							Signature of Sub Centre MPW			
CONTACT SURVEY IN MB/CHILD CASE	No. Examined-	Cases Detected: MB- PB-								
Record of Lepra Reaction/Neuritis										
Type – I/II	Neuritis - Yes/No									
Prednisolone doses issued with dates at PHC/District hospital Dates of MCR footwear if issued Date of referral for RCS Contact examination done on …… new cases suspected/confirmed…….										
NB: this patient card is for use for the new cases as well as other cases. In urban situation this card can be used by changing sub-centre/PHC/CHC with appropriate health unit area/region.										

TREATMENT REGISTER FOR NEW CASES

U.L.F. 02/A

PHC _____ Block PHC/CHC _____

Districts _____ State/UTs_____Fiscal Year _____

Reg. No.	Sub Centre	Name	Address with mobile tel. number	Age	Sex M/F	ST / SC	PB / MB	Disability Grade I / II	Date of First Dose	Date of Subsequent doses											Date of RFT
										2	3	4	5	6 (PB Final)	7	8	9	10	11	12 (MB Final)	

TREATMENT REGISTER FOR OTHER CASES

U.L.F. 02/B

PHC _____ Block PHC/CHC _____

Districts _____ State/UTs_____Fiscal Year _____

Reg. No.	Sub Centre	Name	Address with mobile tel. number	Age	Sex M/F	ST / SC	PB / MB	Disability Grade I / II	Date of First Dose	Date of Subsequent doses											Date of RFT
										2	3	4	5	6 (PB Final)	7	8	9	10	11	12 (MB Final)	

*** - Category of case – Relapse, re-entered for treatment completion, referred and changing in classification of MB / PB**

NLEP – LEPROSY MDT DRUG STOCK RECORD

U.L.F. 03

Use separate page for each category of MDT [MB(A) / MB(C) / PB (A) / PB (C)] – Specify category _____

(Same format to be used at PHC/District/State levels – Please specify level with name alongwith next highest level state)

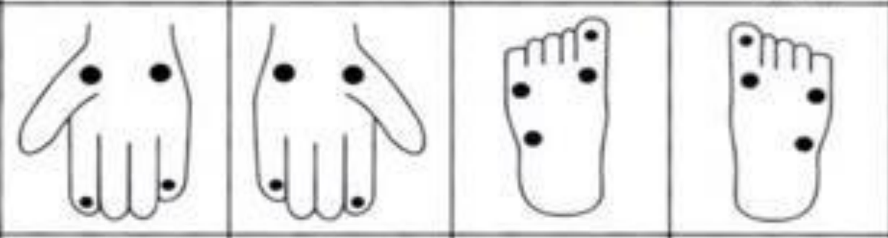
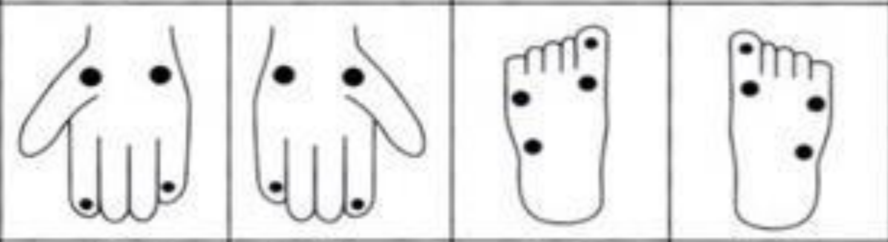
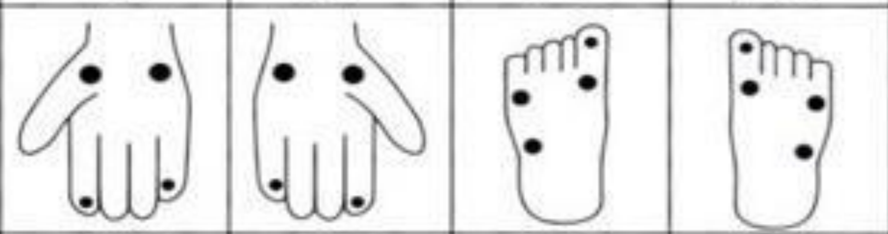
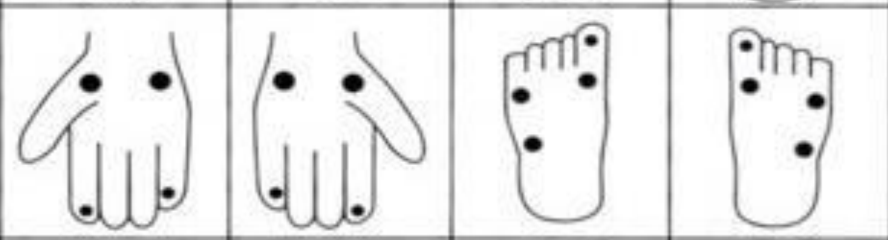
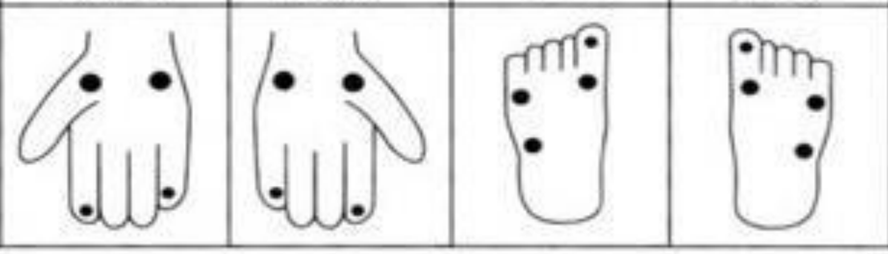
PHC _____ Block PHC/CHC _____

Districts _____ State/UTs_____ Fiscal Year _____

Transaction Date	RECEIPT					EXPENDITURE					Balance in Hand	Stock in Patient Month
	Quantity Received	From Where	Vide Ref. No.	Batch No.	Expiry Date	Quantity Received	From Where	Vide Ref. No.	Batch No.	Expiry Date		

SENSORY ASSESSMENT

U.L.F. 04 (Page 1)

DATE ASSESSOR	PALM		SOLE		Comments
	RIGHT	LEFT	RIGHT	LEFT	
					
					
					
					
					

Key : (Put these mark/icon on the site where lasion is seen)

✓ Sensation Present within 3 cms
X Anaesthesia
Λ Clawing
S Contracture
Wound
Crack
Scar/Callus
Shortaning Level

ASSESSMENT OF DISABILITY & NERVE FUNCTION

U.L.F. 04 (Page 2)

Name_____ Village_____Date of Registration _____

S/O.W/O.D/O_____ Sub-Centre_____ Date of RFT _____

Age / Sex _____ Registration No._____ Referred By _____

Occupation _____ MB/PB _____ Date of assessment _____

RIGHT							LEFT					
						←Date→						
						Vision (0.2)						
						Light closure lid gap in mm						
						Blink Present / Absent						
						Little Finger Out						
						Thumb Up						
						Wrist Extension						
						Foot up						
						Disability Grade Hands						
						Disability Grade Feet						
						Disability Grade Eyes						
On Date												
Max. (WHO) Disability Grade												
EMF Score												
Signature of Assessor												

Muscle Power
S = Strong
W = Weak
P = Paralysed

Score of Vision : Counting fingers at 6 meters
0 = Normal
1 = Blamed Vision
2 = Unable to count finger

(This Form should be filled-in at time of registration and repeated after 3 months (Once in 2 weeks in case of neuritis / reaction)

DISABILITY REGISTER

U.L.F. 05

PHC _____ Districts _____ State/UTs _____

Sl. No.	Name of the Patient	Age / Sex	Address Village / Sub-Centre / PHC with phone number	New / UT / Old Case	MB / PB	New Case (NC) / UT Case / RFT	Disability Gr.III	Site of Disability					
								Eye		Hand		Foot	
								Gr-0	Gr.II	Gr.I	Gr.II	Gr.I	Gr.II
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Ulcer Simple / Complicated	EHF Score	Neuritis	Reaction Type I / Type II	DPMR Services Provided				Refer with date				New Disability developed after starting of prednisolone			Referral Services provided / Follow up taken up / Remarks
				Steroid / Dose / Duration	Self-Care Practice	Ulcer Treatment	Other If any	RCS	Complicated Ulcer	Eye	Reaction not responding to Steroid	Eye (Gr.II)	Hand (Gr.I / Gr.II)	Foot (Gr.I / Gr.II)	
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

NLEP MONTHLY REPORTING FORM
PHC/ BLOCK PHC REPORT

U.L.F. 06 (Page 1)

PHC _____ Block _____
District _____ State _____
Reporting Month _____ Year _____

1	No. of balance cases at the beginning of the month		1.1 New Cases		1.2 Other Cases
		PB			
		MB			
		Total			
2	No. of new Leprosy Cases detected in the reporting month		During Reporting Month		
			PB	MB	TOTAL
		Adult			
		Child			
		Total			
	Among new cases – number from other states	Total			
3	Among new leprosy cases detected during the reporting month, number of	Female			
		Disability – Grade – I			
		Disability – Grade – II			
		SC			
		ST			
4	Number of New Leprosy Cases deleted during the month	RFT			
		Otherwise deleted			
		Total			
5	Number of New Leprosy Cases under treatment at the end of the month (1.1+2-4)				
6	Number of "Other Cases" recorded and put under treatment	(I) Relapse			
		(II) Reentered for treatment			
		(III) Referred			
		(IV) Reclassified			
		Total			
7	No. of other cases deleted from treatment	RFT			
		Otherwise deleted			
		Total			
8	No. of other cases / under treatment at the end of reporting month (1.2+6-7)				
9	Total number of cases under treatment at the end of month	New + Others (5+8)			
10	Leprosy Drug Stock at the end of the reporting month (if required use extra sheets)				

Blister Pack	Quantity	Expiry Date	Total Stock	No. of patients under treatment (New & Others)	Patient Months BCP
MB (A)					
MB (C)					
PB (A)					
PB (C)					

NB. Please calculate patient-t Month Blister packs for MB (A), MB (C),PB (A), PB (C) Quantity in the month of March, June, September and December and include the same in that respective Monthly Report.

REMARKS (If any):-

Signature of Medical Officer

NLEP MONTHLY REPORTING FORM
PHC/ BLOCK PHC REPORT

U.L.F. 06 (Page 2)

S. No.	Indicators	During Reporting Month		
		PB	MB	Total
1	No. of New Leprosy cases recorded			
2	No. of reaction cases managed at PHC			
3	No. of reaction cases referred to Dist. Hospital / Other Inst.			
4	No. of relapse cases suspected and referred			
5	No. of relapse cases confirmed at district hospital			
6	No. of cases developed new disability after MDT			
7	No. of patient provided with footwear			
8	No. of patient provided with self care kit			
9	No. of patient referred for RCS			
10	No. of new cases confirmed at PHC out of referred by ASHA			
11	No. of case completed treatment through ASHA			
12	No. of ASHA paid incentives			
13	No. of Contacts examined			
14	No. of cases detected amongst contacts			
15	No. of cases voluntarily reported, out of new cases recorded (Sl.No.1)			

Signature of the Medical Officer

GLOSSARY

Accompanied MDT	:	A strategy proposed by WHO, where people with Leprosy may, if they wish, receive the whole course of treatment at the time of diagnosis or provision of more than 1 BCP of MDT at a time.
Abduction	:	Movement away from anatomical central line of body
Adduction	:	Movement towards the anatomical central line of body
AFB	:	Acid Fast Bacilli
ANCDR	:	Annual New Case Detection Rate
Anaesthesia	:	Loss of sensation
ANM	:	Auxillary Nurse Mid-wife
ASHA	:	Accredited Social Health Activist (volunteer from the community identified to act as a link between the health service and the community)
AWW	:	Anganwadi Worker
B.C.G	:	Bacillus Calmette Guerin
BCP	:	Blister Calendar Pack
Cardinal sign	:	Essential / unique sign
Claw hand/Clawing	:	Deformity of hand where there is hyperextension of joints between fingers and palm and flexion of joints of the fingers
CLD	:	Central Leprosy Division
CLTRI	:	Central Leprosy Teaching and Research Institute
CMC	:	Carpo-Meta Carpal
CMO	:	Chief Medical Officer
Deformity	:	Abnormal appearance, disfigurement
Decompression	:	To relieve from compression/pressure.
Defaulter	:	An individual who fails to complete treatment within the maximally allowed time frame
DIP	:	Distal Inter Phalangeal
Disability	:	A difficulty in carrying out certain activities considered normal for a human being. A disability results from impairment. Activity limitation and restricted participation is included under disability.
DLO	:	District Leprosy Officer
DLS	:	District Leprosy Society
DPMR	:	Disability Prevention and Medical rehabilitation
ECRL	:	Extensor Carpi Radialis Longus
EHF Score	:	Eye, Hand and Foot Score
Endemic	:	Continuous presence of disease
ENL	:	Erythema Nodosum Leprosum – Type 2 lepra reaction characterised by nodules in the skin

Erythematous	:	Red in colour
Exfoliative dermatitis	:	Condition characterized by universal erythema and scaling. Very often seen as drug reaction (e.g. Dapsone)
Exposure keratitis	:	Damage to cornea due to constant exposer.
FLC	:	Focused Leprosy Campaign
Foot drop	:	Inability to flex foot at ankle due to paralysis
G2D	:	Grade 2 Deformity
GHC	:	General Health Care
GOI	:	Government of India
Haemolytic anaemia	:	Anaemia produced by destruction of red blood cells (can be caused by Dapsone)
Handicap	:	Unable to perform desired normal role in the society.
Hepatitis	:	Inflammation of liver
H/o	:	History of
Ichthyosis	:	Condition where the skin is dry and scaly like that of a fish
IEC	:	Information Education and Communication
Impairment	:	Any loss or abnormality of psychological, anatomical structure or function caused by the disease or injury
Incubation Period	:	Time interval between entry of organism and onset of symptoms
IP	:	Inter phalangeal
Jaundice	:	Condition characterized by yellowness of skin, Mucous, membranes and white of eyes
Keratitis	:	Inflammation of the cornea.
Lagophthalmos	:	Inability to close the eye due to paralysis of eye lid
Leprosy Reaction	:	Acute inflammatory manifestations in skin and/or nerves in leprosy
MCP	:	Meta-Corpo Phalangeal
MB	:	Multi Bacillary (more than 5 skin lesion or more than 1 nerve trunk involvement or bacteriologically positive)
MCR	:	Micro Cellular Rubber for making footwear
MDT	:	Multi Drug Therapy
MO	:	Medical Officer
MPHW/MPW	:	Multipurpose Health Worker / Multipurpose Worker
MPR	:	Monthly Progress Report
MSGA	:	Magnesium Sulphate Glycerine Acriflavin
MTP	:	Meta Tarso Phalangeal
Nephritis	:	Inflammation of the kidney
Neuritis	:	Inflammation of nerve
NFI/NFA	:	Nerve Function Impairment / Nerve Function Assessment
NGO	:	Non-Governmental Organization

NLEP	:	National Leprosy Eradication Programme
Nodule	:	Swelling in the skin
Edema	:	A local or generalized condition in which the body tissues contain an excess amount of fluid
Opposition	:	Bringing together pulp of thumb with pulp of other fingers
Palpate	:	To 'palpate' is to examine by touch
PB	:	Pauci Bacillary.
PHC/APHC	:	Primary Health Centre / Additional Primary Health Centre
PIP	:	Proximal Inter Phalangeal
PL	:	Palmaris Longus
Plantar	:	Referring to the sole of the foot
PMW	:	Para Medical Worker
POD	:	Prevention of Disability
POID	:	Prevention of Impairment and Disability
POP	:	Plaster of Paris
Prevalence	:	Number of cases on treatment per 10000 population [31st March]
RCS	:	Re-constructive Surgery
RE System	:	Reticulo-Endothelial System
Reaction	:	An inflammatory episode that might occur during the course of Leprosy
Relapse	:	Re-occurrence of disease after cure
Rehabilitation	:	Includes all measures aimed at reducing the impact of disability for an individual, enabling him or her to achieve independence, social integration, a better quality of life and self-actualization
RFT	:	Release from Treatment (the end of treatment)
ROM	:	Range of Movement
Scaling	:	Visible shedding of surface layer of skin in the form of scales
S/C	:	Sub-centre
SLO	:	State Leprosy Officer
ST	:	Sensory Testing
Synechiae	:	Adhesions between iris and anterior lens capsule.
Ulcer	:	Discontinuity of the skin or mucous membrane
USIS	:	Upgraded Simplified Information System
VA	:	Visual Acquity
VMT	:	Voluntary Muscle Testing
VST	:	Voluntary Sensory Testing
WHO	:	World Health Organization
Wrist drop	:	Inability to extend wrist due to paralysis of muscles supplied by Radial Nerve

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