

Leprosy – Prosthetic implications

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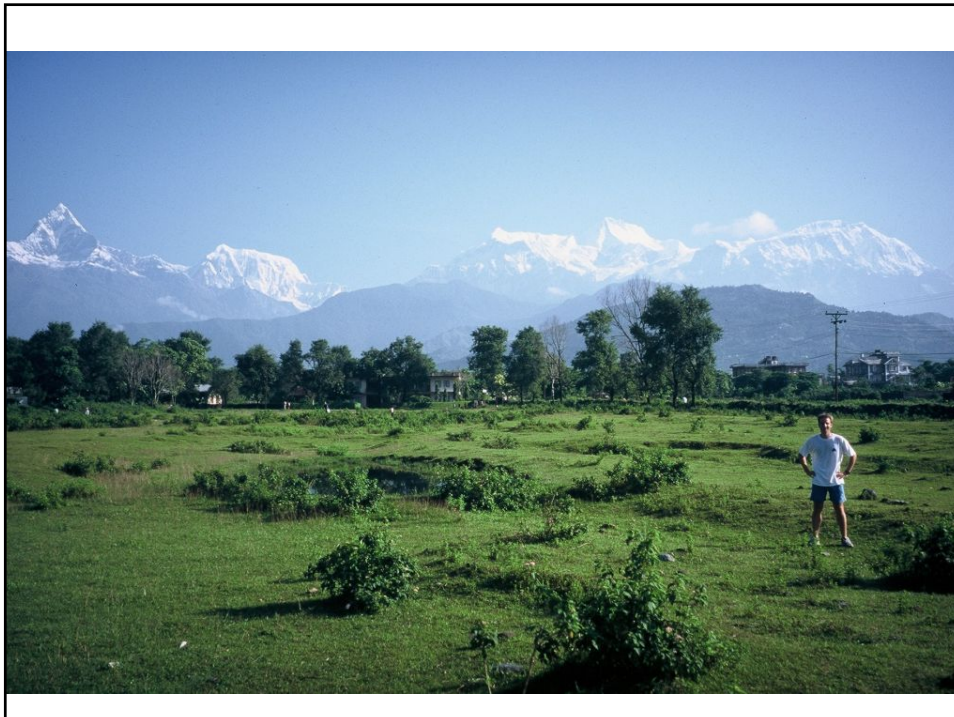


- *"Leprosy work is not merely medical relief; it is transforming frustration of life into joy of dedication, personal ambition into selfless service"*

Mahatma Gandhi

Objectives

- A couple of cases
- Infectious agent
- Presentation
- Impact on nerves, bones
- Look at Cases in Toronto
- Prosthetic devices
- Mention of the Foot
- Case quiz
- Encourage a field trip



Case 1. 38 M from Viet Nam.



- Left BKA – old prosthesis, choked, swollen.
- Note skin lesions and hand involvement

Case 2 – 40 M from Gambia



- Age 20 presented with ulceration over lateral malleolus. Subsequent foot drop due to peroneal nerve neuropathy. No other findings.

Why this subject in 2006

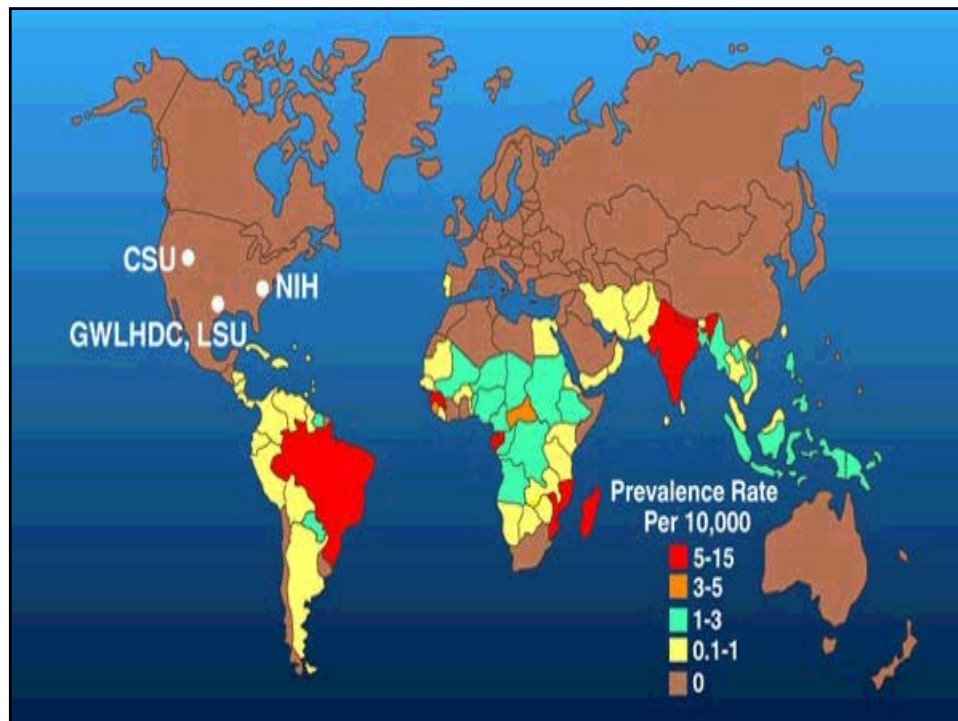
- We do have patients with leprosy.
- Multicultural society
- Long history for P & O

What is Leprosy?

- Chronic infectious granuloma forming disease caused by *Mycobacterium Leprae* (a bacillus similar to TB)
- A disease of peripheral nerves and skin, only bacillus to target nerves.
- Upper Respiratory Tract, eyes, testes, organs and bone.

History of Leprosy- Hansen's Disease

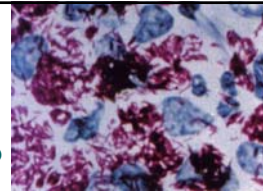
- First written records in 600 B.C.
- Hansen - *M. leprae* 1st bacterium described- 1873
- Untreatable until 1940's with sulpha antibiotics
- Epidemic in Europe in 12-13th century.
- Today 1.2 million mostly, Asia, Africa, S.America.



In North America

- 136-187 cases per year in U.S.
- Endemic in Texas and Arkansas in armadillos.
- Leper colony in Canada 1891-1957
- We will look at Toronto

M leprae – Can I catch it?



- Spread in aerosolized droplets, or direct skin.
- Slowest known reproduction - 2 weeks (most 2 minutes)
- Exposure – 2-4 years for effects.
- Incubation weeks--> 30 years!
- Never cultured in vitro

Presentation

- Infects skin and peripheral nerve fibres of dermis.
- Multiply best in cool regions, face, limbs. Superficial nerves
- Presents as a solitary macule, hypopigmented, alteration of sensation, due to bodies inflammatory reaction to the infection.
- **Indeterminate** - Africa 70% heal.

Wide spectrum of effect, no immunity to violent response.

- Tuberculoid – Very active immune response, few bacilli left (not detectable levels)
 - Affects a few peripheral nerves, adjacent skin, tuberculoid granuloma
- Lepromatous - host lacks resistance, all tissues affected, forms granulomas. 10^9 bacilli/g tissue
- Borderline - between tuberculoid and lepromatous

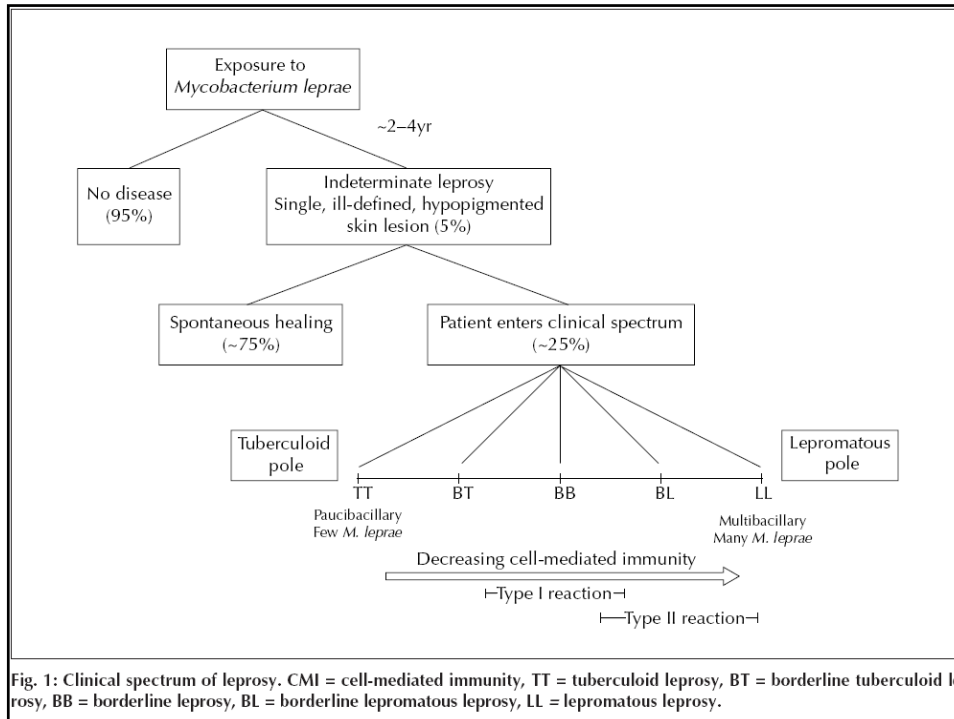


Fig. 1: Clinical spectrum of leprosy. CMI = cell-mediated immunity, TT = tuberculoid leprosy, BT = borderline tuberculoid leprosy, BB = borderline leprosy, BL = borderline lepromatous leprosy, LL = lepromatous leprosy.

Tuberculoid - Well developed cell mediated immunity.

- Usually a few areas of skin and Large Nerves often solitary and well defined
- N. thick from infiltrate, anesthesia,
- Wasting from motor n,
- Autonomic damage, cyanotic and impaired sweating.
- **May heal spontaneously**

Presentation

- Usually, **skin lesion**, may have for years with no change dry skin.
- **Gradual numbness**, don't know until burn, cut
- **Weakness**, ie, ulner palsy, foot drop, facial palsy, wasting and weakness.
- **Pain** – Neuritis, single nerve first
- **Eyes** - iridocyclitis (uveitis)
- **Nose** – epistaxis



Lepromatous – Host Overwhelmed

- Chronic
- No cell mediated immunity
- Enormous bacilli growth.
- Not localized, blood to all areas, skin nerves, URI, nose, testes, organs.
- Starts as a small macule then symmetrical lesions all over body.

Presentation of Lepromatous

- Sensory loss to extensor surfaces, muscle weakness, intrinsic first.
- Waxy skin, folds of skin lion-like eyes (Leonine)
- Nasal stuffiness, epistaxis, perforation,
- Impaired sweating
- Feet and fingers, osteoporosis, #, edema



Bones & Nerves affected

- Phalanges, replaces marrow.
- Cortical - osteoporosis and #'s
- Lose pin prick, pain and temp. **Glove in stocking**
- later light touch-->deep p-->tot. anesth.
- Ulnar, median, radial, posterior tibial and facial
- Eventually motor is affected

Superficial sites, nerve trunks are cooler, traumatized, anatomically constricted

- ulnar nerve - medial epicondyle of the humerus,
- median nerve at the wrist,
- superficial peroneal nerve at the neck of the fibula,
- posterior tibial nerve behind and inferior to the medial malleolus, - claw toe
- radial nerve in the humeral groove posterior to the deltoid insertion – loss of extensors.

Lepromatous damage

- Invades the eye. Hazy cornea, keratitis.
- acute iridocyclitis
- severe glaucoma
- 5th N. anesthetic cornea, 7th lagophthalmos, and intrinsic m. weakness.



Nose and throat

- Muscle wasting and weakness.
- **Bones and Cartilage**
- Us. nasal bones and phalanges
- Collapse of nose, alveolar process, teeth (**maggots**)
- **Invades larynx**
change in voice - feminization



Table 2: Current World Health Organization²⁵ recommendations for multidrug treatment of leprosy

Classification of disease	Drug	Dosage	Duration
Paucibacillary (I, TT, BT)	Rifampin	600 mg <u>once monthly</u> , supervised	6 mo
	Dapsone	100 mg daily, self-administered	6 mo
Single-lesion, paucibacillary	Rifampin	600 mg	Once
	Ofloxacin	400 mg	Once
	Minocycline	100 mg	Once
Multibacillary (BB, BL, LL)	Rifampin	600 mg once monthly, supervised	12 mo
	Dapsone	100 mg daily, self-administered	12 mo
	Clofazimine	300 mg once monthly, supervised	12 mo
		or 50 mg daily, self-administered	



184 Cases in Toronto

- TGH - 1979 –2002, 80% of Canada
- Symptoms mean 4.8 years before presenting
- 1/3 had sensory nerve involvement
- ¼ had motor
- Origin, India, Philippines, Viet Nam



Motor involvement

Ulnar 15/80 8.3%

Median and Ulnar 12/180 6.7%

22% had lower extremity motor involvement

Common Peroneal 16.2%

Nerve involvement	All patients				
		TT	BT	BL	LL
<i>Upper extremity</i>					
Motor	→ 43 (23.4)	1 (0.5)	18 (9.8)	8 (4.3)	13 (7.1)
Sensory	→ 59 (32.1)	2 (1.1)	18 (9.8)	16 (8.7)	12 (6.5)
<i>Lower extremity</i>					
Motor	→ 40 (21.7)	1 (0.5)	18 (9.8)	9 (4.9)	8 (4.3)
Sensory	→ 60 (32.6)	2 (1.1)	21 (11.4)	17 (9.2)	14 (7.6)

Table 3: Delay to diagnosis according to nerve dysfunction

Dysfunction	Mean lag time,* yr (and no. of patients)				
	All patients	TT	BT	BL	LL
Upper extremity					
Motor	8.3 (43)	2.0 (1)	2.9 (18)	4.5 (8)	14.8 (13)
Sensory	7.9 (59)	3.0 (2)	2.9 (18)	4.6 (16)	12.9 (12)
Lower extremity					
Motor	6.6 (40)	4.0 (1)	2.1 (18)	3.0 (9)	13.8 (8)
Sensory	6.9 (60)	0.5 (2)	2.5 (21)	4.0 (17)	16.4 (14)

*Mean number of years between onset of symptoms and diagnosis.

Finally to Prosthetics

- Usually in poorest places in the world.
- Using common, cheap material.
- Much of the diabetes technology is thankful.



A technician (wearing a below-knee Jaipur prosthesis) reinforcing the rubber in the Jaipur Foot mould before vulcanization.

Upper Extremity

- Loss of hand function is more common
 - Very gradual compared to other neuropathy
 - Digit absorption is slow – very adaptable
1. Direct injuries
 2. Ischemia,
 3. Repetitive stress and
 4. Mechanical force on open wound (Douglas)

Breakdown

- Most common grip is a lateral pinch.
- Skin breaks down at maximal stress point.
- Clawed Stump calluses will worsen.
- Infected wounds.

Approach to hand

- Arora et al Indian J. Occupational Therapy
- N=10
- >50% absorption of thumb, and >2 fingers.
- Compared 3 grasps and 3 pinches.
- Fitted – partial hand prosthesis
- Used GPAS Scale.





- Easy fit thermoplastic
- Thumb – post & base
- Base over thumb base and thenar muscles.
- Anchored with Velcro.



Results

- Before Prosthesis
- All ten, side pinch & hook, 2 – cylindrical.
- Post
- 7 pulp pinch, 9 tripod, all cylindrical, 5 spherical

*CHANGE IN ACTIVITIES AS GRADED BY GPAS
(MEAN + SD)*

S.N.	Activities	Pre intervention	Post intervention	Improvement
1.	Dressing	9+1.25	8.5+1.5	5.6%
2.	Eating	8.6+0.52	6.1+2.1	29.1%
3.	Caring for yourself	2.5+0.53	2.4+0.6	4%
4.	Preparing meals	8.9+0.57	8.7+1.02	23%

Modulan Grip Aid by Ciba Geigy

- Epoxy two resins – rapid, cheap individual
- Patient present, molded to handle or tool
- Grasps device to shape – 12 hours.





Care of the foot in Leprosy

- Too broad for this talk.
- Anesthesia.
- Motor paralysis foot drop, claw toe
- Charcot foot
- Auto-amputation
- Absorption, bony changes and fractures.
- Impaired sweating – dry cracked.



A few castings.....



Lower Extremity Amputation

- Leg and foot spared at all costs.
- Do not believe it will be better without it.
- Anesthetic patient with poor hand function.
- Compared to traumatic amputees, much more difficult, often discarded.
- Goal is to preserve stump with foot wear, orthoses as long as possible.



Indications for amputation

- Flail Leg
- Fixed deformity
- Cancerous conversion
- Non-healing ulcers
- Majority are BKA



Wound Care Guide for People affected by leprosy. A guide for low resource situations. Hugh Cross, ALM

The \$28 Foot - Jaipur

- World's poorest countries cannot afford imports
- 1971 by Sethi and Chandra.
- Light weight, for multiple usage in bare footed or sandaled individual.
- Climb trees, ride bikes, squat.
- Made of local materials, quick.
- Multi-axial.



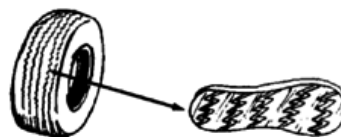
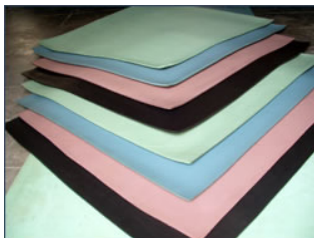
The Jaipur Limb.



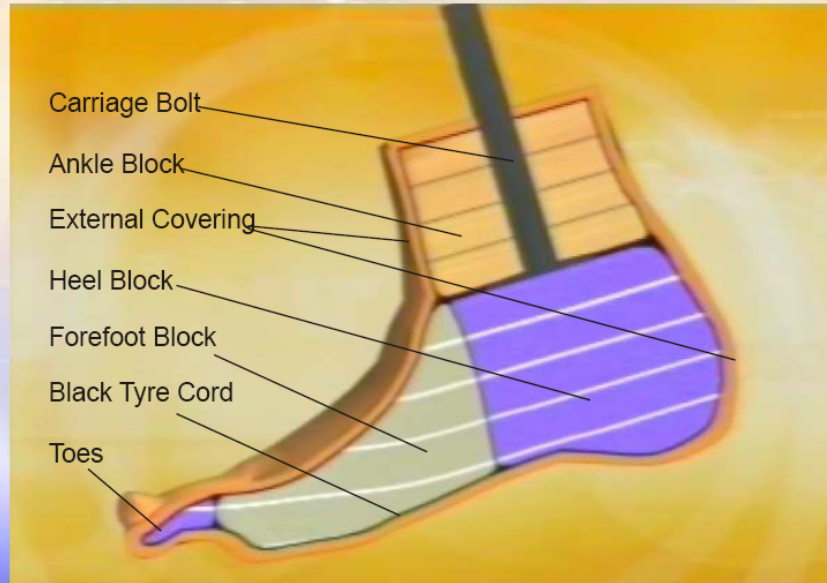
- Most similar to a SAFE (stationary ankle flexible endoskeleton)
- 12–15 cm high
- Very flexible keel
- multi-axial foot ankle system allows for ankle, mid-foot, and forefoot motion.
- Made from a wood supramalleolar block attached to a prosthetic shank
- “Microcellular rubber calcaneal, midfoot, and phalangeal “bones” secured with adhesive cord or tape...encased in rubber vulcanized in premade foot molds.”

Prosthetic feet for low-income countries. Craig. JPO 2005

Microcellular Rubber – Or a Car Tire



Structural Components of Jaipur Foot:



The Jaipur foot manual.

http://www.mobility-india.org/download/Jaipur_Foot_manual.pdf

- Ankle block. Short wooden keel allows for dorsiflexion and plantarflexion.
- MCR heel block allows torsion and deflection for squatting and uneven ground. Absorbs shock.
- Forefoot block stiff MCR to allow natural toe movements. Toes each separate MCR
- External cover, vulcanized rubber, natural look, durable water proof.

Jaipur Limb

- Made of high density polyethylene and pipes (often PVC)
- Once open to contain different size stumps
- Now total contact thermoplastics.
- Endoskeletal with nylon knee joint.



Case Number 1

- West Africa, presented with infected malleolus.
- Skin changes
- One large nerve and numbness
- Treated quickly.
- Diagnosis?



Tuberculoid

Case 2



- Male from Viet Nam
- Skin lesions, shortened phalanges.
- Waxy skin
- BKA
- Diagnosis

Lepromatous

Summary

- Not so rare
- Wide spectrum of disease
- You are not at risk for infection
- Prosthetist is a great friend
- \$60 BKA prosthesis!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
- Volunteer at a leprosy hospital.

