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Original Article

Decompression of peripheral nerve trunks in leprosy prevents the development and progression of deformities?

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Peripheral nerve involvement results in deformities formation in leprosy. High doses of (40-60 mg) steroids along with the anti-leprosy drugs is preferred even though the 70-75% cases develop deformity with the above treatment. 772 ulnar nerves, 120 median nerves and 108 posterior tibial nerves not responding to above medical treatment in 12 weeks, were undertaken for external and internal nerve trunk decompression. These cases were followed-up for 5-20 years at various intervals. The pain in nerves (neuritis) recovered in all cases of ulnar, median and posterior tibial nerves. Full sensory recovery with pin prick/feather or cotton wool touch was seen in 50% cases of all the three nerves. 20% cases maintain the pre-operative levels of sensory status. Plantar ulcers healed within 6 months after decompression of posterior tibial nerve. Only 6 cases showed reoccurrence. Overall motor recovery in ulnar nerve was seen 89% and 70% in median nerve. The sensory recovery restores protective sensation which prevents secondary injuries. The improvement of motor power gave better functional hands and improved the appearance which in absence of surgical intervention was not possible.

Key words : Deformity, Disability, Ulnar , Median, Posterior Tibial Nerve

Introduction

Leprosy is a disease of nerve and is known for its deformities. The peripheral nerve involvement in leprosy is common and results in damage leading to various deformities. Commonly involved nerves in upper limb are ulnar and median and in lower limbs are posterior tibial and lateral poplitial in that order (Cochrane and Davey 1964).

It is known that even in non leprosy situations and conditions, nerves are known to get entrapped at various anatomical sites clinically manifesting in paresthesia and paresis. It is also known that inflamed swollen nerves due to any cause are more prone to entrapment (Husain et al 1998, Husain et al 1997, Husain et al 1998, Pandya 1978, Parikh et al 1968).

In multibacillary leprosy, nerve thickening occurs following invasion of bacilli in nerve tissue or following lepra reactions in the nerve, while in paucibacillary leprosy, hypersensivity reaction leads to sudden inflammation. Swollen edematous nerves passing through tunnel-like structures suffer by getting compressed (entrapment neuropathy). Sensory loss is the most commonly reported symptom followed by motor loss. The autonomic function loss leads to dryness, fissures

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etc. Motor loss manifests in the form of paresis or paralysis in different parts (claw hand, drop foot, lagophthalmos etc) sensory loss in the form of burn blisters, trophic ulcers. In India 25-30% of leprosy cases develop deformities (Srinivasan 1993).

Early detection and diagnosis of nerve damage can be done by regular and periodic nerve function assessment (sensory by pin prick and cotton wool/feather touch motor status by Medical Research Council (MRC) muscle power grading) of all susceptible nerves on every visit. If the patient is developing nerve damage, steroids must be started in adequate doses; 60 mg daily for first fortnight followed by a tapering of 5 mg every two weeks is the protocol of choice. If there is no improvement in first 8-12 weeks as evident by decrease in pain and tenderness over nerve, reduced paresthesia or if one observes worsening/deterioration in motor power, then such cases should be considered for nerve decompression (Pandya 1978, Parikh et al 1968).

Surgical intervention in the form of epineurotomy by multiple longitudinal incisions and external decompression to relieve the internal pressure throughout the involved segment is considered the treatment of choice after steroids failure. Here we share the experiences of nerve decompression of various nerve trunks in leprosy.

Materials and Methods

Ulnar nerve

The ulnar nerve can be entrapped by medial intramuscular septum under deep fascia of anterior medial compartment of upper arm, in the distal fibro-osseous tunnel, and between the tendinous fibers of origin of two heads of flexor carpi ulnaris. All these structures compress the nerve and cause ischemia, venous obstruction, capillarystasis, intrafunicular hypoxia, edema and increased intrafunicular tension. The net result of entrapment/ischemia leads to initial slowing of conduction velocity and later full conduction block ultimately leading to paralysis. Peripheral nerve trunks become thick and swollen in leprosy and this increases the risk of entrapment neuropathy. The diseased and thickened ulnar nerves can get damaged further due to physical trauma related to above mentioned anatomical factors. We decompressed ulnar nerves not responding to steroids treatment of 12 weeks or more.

During 1982 to 2010, 1089 ulnar nerve decompressions had been performed. The main indication was the painful neuritis along with the sensory motor weakness. These cases were on 60-40 mg of steroids from more than 12 weeks.

Of 1089 cases, 772 cases were followed up for variable periods following the decompression. 698 cases were males and 74 were females. The youngest patient was 9 year old while the oldest was 76 years. Of 772 cases, 456 cases had PB type, 224 cases MB type 92 cases neuritic (N) type of leprosy. A modern simplified classification was used BB/BL and LL were clubbed together in multibacillary (MB), TT/BT in paucibacillary (PB), and the neuritic cases in N groups. A detailed history was recorded from each patient. This includes the duration of disease, duration of neural symptoms, history of the treatment taken mainly the anti-leprosy drugs and the duration and doses of the steroids intake.

Only 304 patients complained of severe pain in ulnar nerve at elbow which makes them wakeup during night. Detailed clinical examination was carried out. The ulnar nerve was palpated and a detailed record of nerve thickness, tenderness, presence of abscess was made. The sensory functions were examined in ulnar distributed area of palm with pin and feather touch/cotton wool. Complete charting of affected muscles and its

motor power on MRC grading was done. All 386 cases could not respond to pin prick and feather touch stimuli. All these cases were on 40-60 mg of the steroids and did not have any improvement in the neuralgic pain and the sensory loss was more and motor power was deteriorating. At this stage of the disease these cases were under taken for decompression.

Surgical Technique

The decompression was carried out under local anesthesia. The ulnar nerve at the elbow was exposed through a longitudinal incision about 7-10 cm above and 3-4 cm below the epicondyle. The deep fascia of the anteromedial compartment of the upper arm was exposed and deroofing of the fibro-osseous tunnel was done by cutting the overlying fibrous tissue. The fibrous arch between two heads of flexor carpi ulnaris was cut and distal end of tunnel was widened. The entire segment of the exposed nerve was cleared from the surrounding adhesions without lifting the nerve from its bed. This resulted in the complete extra neural release of ulnar nerve. The intraneural decompression done through the medial longitudinal epineurotomy without damaging the vascular network. In some cases medial epicondylectomy was also performed.

Median Nerve

Median nerve involvement is infrequently seen in leprosy but whenever it get damaged, it results in functional loss affecting the pinch and grasp functions. Clinically the median nerve involvement commonly presents as carpal tunnel syndrome, the wrist being the usual site for its involvement in leprosy. Muir (1948) was of opinion that the painful nerve following progressive paralysis is suitable for decompression; splitting of nerve sheath will help to conserve its function.

Of 138 patients who had nerve decompression only, 120 patients (98 males and 22 females) could be followed up. The mean age varied from 14 to 75 years. 66 cases were paucibacillary (PB), 36 cases multibacillary (MB) while 18 were neuritic (N) type. All these had history of pain in lower forearm and wrist region and sensory loss (not able to feel or differentiate pin prick, feather touch/cotton wool sensations) in median nerve innervated were of the hand. 78 cases had motor power +3 (MRC grade), 42 cases had motor power +1 (MRC grade) at the time of decompression. All of them had 40-60 mg of steroids for 12 weeks or more before surgery and with no improvement in symptoms.

Surgical Technique

All the patients were operated under local anesthesia using 1% lignocaine. The nerve was exposed 2 cm above the proximal wrist crease and the adhesions were separated from the surrounding tissues. The flexor retinaculum was cut to its free edge up to origin of abductor pollicis brevis fibers. The adhesions inside the carpal tunnel if any, were surgically released. An epineurotomy was done along the length of the nerve taking care not to injure the blood vessels. The maximum thickening of the nerve was noticed just above the proximal edge of flexor retinaculum.

Posterior tibial nerve

Ulceration of the foot is due to sensory loss in the sole consequent upon the involvement and damage to posterior tibial nerve. The inflamed nerve is usually entrapped and compressed in tarsal tunnel behind medial malleolus. Only steroid therapy to treat the inflammation looks insufficient and entrapment needs decompression (Husain et al 1998, Palande and Azhaguraj 1975 and Oommen 1996).

108 patients having plantar ulcers of not more than 6 months duration were included in this study. 62 patients had history of recurrent nerve pain in last 4 months. The age group varied from

17 -50 years. There were 82 males and 26 females. All were free from diabetes or any other associated problem. All of them were not able to feel the pin prick and feather touch/cotton wool sensation in plantar surface of fore foot mid foot and heel.

Surgical Technique

The posterior tibial nerve was exposed by L shaped incision just behind the medical malleolus. Flexor retinaculum was incised and the neurovascular bundle was cut and posterior tibial nerve was carefully separated from the posterior tibial vessels. Distally thickened inferior calcaneal bands were also incised. The epineurotomy was done on the exposed nerve.

Results

Ulnar nerve

Of 772 ulnar nerves decompressed and followed up at different times showed that there was no pain in ulnar nerve at elbow. Patient allowed touching or pressing the nerve. The recovery of pain perception in patients occurred in almost 100% while sensory recovery was noted in about 50% of all the cases (Table-1). The patients were able to feel the touch. Subjective sensory improvement was noticed in some cases as early as four weeks, though the usual recovery to pin prick and feather touch took maximum 24 weeks to all cases. The improvement gradually progressed to complete recovery and maximum benefits were observed at the end of the first year after nerve decompression.

The improvement in motor function was slow and first seen at about 24 weeks. It was more gradual and in some cases it took about 50 weeks to obtain maximum recovery. The motor recovery in relation to their pre-operative MRC grading in different type of leprosy patients is shown in Table-2. We noted that the ulnar supplied muscles retain their functional ability to prevent the development of deformity up to MRC grade 3. Hence we grouped the muscle strength in to three viz: improved, remained same with usual muscle power and deteriorated for our post operative evaluations. It was observed that out of 772 nerves decompressed the majority 692 were able to manage to retain the useful muscle function. Only 52 cases deteriorated while 28 cases retained the same motor status. It was noted that the cases with motor power 3 or more (MRC grade) for 6 months or less are more likely to recover where as others did not improve (Table-2).

Median nerve

The pain and paresthesia were the first symptom to reduce as per the perception of the patients after the decompression and completely disappeared in 2-4 weeks after surgery. Full sensory recovery for pin prick and feather touch was seen in 27 cases. While other 33 cases were able to feel pin prick sensation but cotton wool and feather

Table 1 : Results of decompression of ulnar nerve for pain and sensory loss

Type of disease	Total no. of cases with sensory loss (to pin prick and cotton wool/feather touch)	Sensory recovery (%) to pin prick and cotton wool/feather touch	Total no. of cases with pain	Pain recovered
PB	456	180 (39.47)	304	304
MB	224	124 (55.35)	52	52
N	92	72 (78.26)	72	72
Total	772	376 (48.70)	428	428

Table 2 : Motor functions of ulnar nerve in different types of Leprosy (pre-operative and post operative evaluations)

Total No of case	Motor power			
	Pre-operative MRC grade	Post operative MRC grade	No. of Cases	Comment
	0-1	3	128	Improved
			PB-64	same with No
156			MB-52	useful power
PB-80			N-12	
MB-60	0-1	0-1	28	
N-16			PB-16	
			MB-8	
			N-4	
432	>1-3	4-5	220	Improved
PB-244			PB-120	
MB-136			MB-72	
N-52			N0-28	
	>1-3.	>3	172	Same with useful
			PB-100	power
			MB-56	
			N-16	
	>1-3	0	40	
			PB-24	
			MB-8	
			N-8	Deteriorated
184	>3-5	5	172	improved
PB-132			PB-124	
MB-28			MB-28	
N -24			N-20	
	>3-5	0	12	Deteriorated
			PB-8	
			N-4	

touch sensation was poor. In 18 cases motor power improved from grade 3 to grade 5. 9 cases improved from grade 1 to grade 3 while 15 cases remains grade 3 post-operatively. All these cases had fully functional hands. 12 cases had grade 1 power and 6 cases deteriorated to grade 0 and developed the deformities. (Table-3)

3. Posterior tibial nerve

The results of posterior tibial nerve decompression were very promising. The subjective sensory recovery (the patient perception or feel towards the touch) took place 2-3 weeks post-operatively while pin prick and cotton wool/ feather touch sensations took place 6-8 weeks.

Table 3 : Results of decompression of Median nerve

No. of patients, Muscle power MRC grade Pre-operative	Post-operative Muscle power MRC grade-5	Post-operative Muscle power MRC grade-3	Post-operative Muscle power MRC grade-1	Post-operative Muscle power MRC grade-0
PB 42-grade3	12	18**	-	12
24-grade1	-	6	18**	-
MB 24-grade3	18	6**	-	-
12-grade-1	-	12	-	-
N 12-grade3	6	6**	-	-
6-grade1	-	-	6**	-
Total-120	36	48	24	12

** Patients who did not improve the muscle power and remained same as pre-operative state.

Table 4 : Recovery of sensation in plantar of foot

Recovery of sensation	No of cases (54)
Full (Foot) recovery	48
Fore foot only	32
Mid foot	12
Heel	16

The plantar ulcer healed in all the feet within six months duration while recurrence were seen only in 14 cases, 48 feet showed recovery of sensation in full sole where as 32 feet showed recovery in forefoot, 12 in mid foot and 16 in heel only (Table-4)

For ulnar and median nerve the full sensory recovery (perception to pin prick and feather/ cotton wool for touch) was 48% and pain recovery (patient did not complain of any pain at elbow and wrist, allowed to touch or press the ulnar and median nerves) was 100% after decompression. The motor recovery was seen to grade 5 in 392 cases. 300 cases were able to maintain to grade 3 in ulnar nerve, 36 cases improved to grade 5 while 48 cases maintained grade 3 power in median nerve. This helped to retain the acceptable muscle function to enable then to lead a fruitful and socially acceptable life by not developing the hand deformities (Table-5).

Table 5 : Sensory and motor recovery in ulner and median nerve

Ulnar Nerve	Improved	Remain same	Deteriorated
772	392(M.R.C.grade-5)	28 (MRC grade +1)	52(MRC grade- '0')
	300(M.R.C.grade3)	X	X
772	692 (89.63%)	28(3.62%)	52(6.73)%
Median Nerve	36 (MRC grade-5	24 (MRC grade+1	12 (MRC grade '0'
120	48 (MRC grade-3)		
60	84 (70%)	24 (20%)	12 (10%)

Posterior tibial nerve decompression helps in improvement of sensations as well as vascularity of foot and helps in healing of ulcers and prevents its further reoccurrence.

Discussion

The results were evaluated on the basis of subjective improvement and objective findings relating to both sensory and motor modalities and periodic comparison were made with previous assessment values. The follow up period varied from 5-20 yrs. Pain was first symptom to disappear as also reported by Husain et al (1998) and Palande and Azhaguraj (1975). The sensory improvement was noticed in some cases as early as four weeks, though the actual recovery took place in about 20 weeks post-operatively. The improvement gradually progressed to complete recovery and the maximum benefit was noticed in about a year after nerve decompression. 48% cases showed complete sensory recovery while others had improved sensations as compared to pre-operative state. 50% cases retained their motor power to grade-5 while the38% case able to maintain motor power up to grade-3. The improvement in motor function was slow to occur and seen after 24 week time. It was more gradual and in some cases it took about two years to obtain the maximum motor recovery. In accordance with previous studies (Husain et al 1998 and Parikh et al 1968) we observed that the ulnar supplied muscle retain their functional ability up to MRC grade 3 to prevent the development of deformity.

Full sensory recovery was seen in 55% of median nerve cases while rest of the cases showed the partial sensory improvement which helps the patients be safe from secondary problems like burns, injuries etc. (Husain et al 1997, Pandya 1978 and Parikh et al 1968). 35% cases improved to motor power grade-5 and have the normal functional hand while the other 35% were able to maintain the motor power grade-3, a reasonably good functional hand.

Posterior tibial nerve decompression results were very promising. 44% case obtained full sensory recovery in sole while 66% cases recovered the sensations partially. The decompression of posterior tibial nerves helps in release of pressure over the neurovascular complex which overcomes the problem of vascular ischemia and improves the vascular supply of the sole; this helps the healing of ulcers and prevents its further reoccurrence.

Conclusion

The study suggests that along with basic care of hands and feet, the cases not responding to steroid therapy of 12 weeks or more who had nerve decompression showed better functional hands and feet which would not have been possible without timely surgical intervention.

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