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Surgical Decompression of Posterior Tibial Neurovascular Complex in Treatment of Certain Chronic Plantar Ulcers and Posterior Tibial Neuritis in Leprosy [1]

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Plantar ulceration and trophic disturbances in the extremities form a major part of the disability due to leprosy. The importance of changes in the posterior tibial nerve and vessels because of compression in the fibro-osseous tunnel is being increasingly recognized, the subject being well investigated and documented by Carayon ([2, 3]), Bourrel ([1]) and others. We have been using decompression of the posterior tibial nerve and vessels for the treatment of chronic plantar ulcers with posterior tibial neuritis and for chronic refractory posterior tibial neuritis, with encouraging results.

MATERIALS AND METHODS

Material. In 1972 at the Sacred Heart Hospital, Kumbakonam, 77 posterior tibial decompressions were carried out. In four cases the data was inadequate while two were in nonleprosy cases. Seventy-one procedures done in 69 persons form the material for this study. The average age was 33 years, with a range from 15 to 62 years. Twelve were female. In all cases routine methods of treatment, including plaster immobilization for ulcers, were tried first, after treating any underlying pathologic disturbance. Eight cases had tuberculoid leprosy while 30 each were either lepromatous or of the dimorphous type. One case was classified as indeterminate.

Indications for surgery (Table 1). *Chronic refractory ulcers associated with neuritis.* There were 58 cases in this group. These included recurrent ulcers in 31, chronic complicated ulcers in 11, and chronic simple ulcers in 15 cases. One case was of a chronic ulcer with feeble arterial pulsations but no neuritis.

Intractable chronic posterior tibial neuritis. This was the main indication for operation in 13 cases.

Operative procedure. The procedure used has been well described by Bourrel ([1]). The operation is done under 1% xylocain local infiltration anesthesia in a well-sedated patient. The incision is behind the medial malleolus, six centimeters above and six centimeters below it, extending up to the lower border of the calcaneum. The flexor retinaculum is incised, exposing the neurovascular bundle. The sheath surrounding the latter is incised, exposing the vessels and the nerve which are carefully separated from the surrounding fibrous tissue and from each other. Then they are followed distally where the thickened inferior calcaneal bands are seen and incised. In this area many additional fibrous bands are also found going across the vessels. If the nerve sheath is thickened and opaque, this is carefully opened throughout its length up to the division of the nerve. After establishing hemostasis, the wound is closed by approximating the skin edges. The use of a tourniquet facilitates the operation.

RESULTS

Clinical findings (Table 2). *Classification of ulcers.* For this study the plantar ulcers were classified as recurrent ulcers, chronic simple ulcers and chronic complicated ulcers. When the ulcer was restricted to skin and subcutaneous tissue only it was called a chronic simple ulcer. When the ulcer involved deeper tissue like plantar fascia, tendons or bones at some stage, it was called a chronic complicated ulcer. In all of these cases infection and involvement of the deeper tissue was treated and a fair trial given to routine methods of treatment before including the case in the series.

Chronic ulcer cases. Pale, sometimes hypertrophic and edematous granulation tis-

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TABLE 1. *Posterior tibial decompression: indications in 71 cases.*

Nonhealing ulcers with neuritis	Recurrent	31
	Chronic complicated	11
	Chronic simple	15
Chronic posterior tibial neuritis		13
Chronic ulcer with vascular insufficiency		1

TABLE 2. *Clinical findings.*

Findings	Type of ulcer		
	Recurrent ulcers	Chronic complicated ulcers	Chronic simple ulcers
Total no. of cases	31	11	15
Ulcer duration (average)	8 months	2.5 years	1.75 years
Single ulcer incidence	20	4	7
Multiple ulcer incidence	11	7	8
Deformed foot	7	4	4

TABLE 3. *Number and distribution of plantar ulcers.*

Number of ulcers	Distribution[a]			
	Toe	M.T.H.	M.T.B.	Heel
Single	7	20	2	3
Multiple	4	58	2	3

[a]M.T.H. = metatarsal head region; M.T.B. = metatarsal base region.

sue was the characteristic finding in nearly all cases. The concerned foot was anesthetic in all, while it was deformed in 15 cases.

Ulcer distribution (Table 3). Single ulcers were present in 32 of 58 cases, the majority of which were under one of the metatarsophalangeal joints. Multiple ulcers (average three ulcers to a foot) were present in 26 cases, the majority, again, being under the metatarsophalangeal joints. The other locations were, in order of frequency, the big toe, heel and metatarsal base.

Ulcer duration. The average duration was 30 months in the case of chronic complicated ulcers, 20 months in chronic simple ulcers, and 8 months in recurrent ulcers. The total duration on the average was four years for recurrent ulcers, that is, the first ulcer at the site of recurrence occurred on the average four years earlier. The average duration of posterior tibial neuritis was one month in all cases.

Intractable neuritis cases. The average duration of neuritis in these cases was six months. All had anesthesia of the foot. Nine of these had either ulcers or old ulcer scars. The follow-up period ranged from six months to one year, the average being ten months. Treatment with splintage, ultrasonic treatment and drugs were given before including the case in the series.

Operative findings. *External compressing factors* (Tables 4 and 5). The neurovascular bundle was found compressed in all cases. In some a continuous fibrous roof was found, formed of the flexor retinaculum proximally and the inferior calcaneal bands distally. In others, these two structures were distinct. Gross thickening of the flexor retinaculum was noted in 64 cases; of the inferior calca-

TABLE 4. *Posterior tibial decompression: compressing factors in 71 cases.*

Flexor retinaculum	64 cases
Inferior calcaneal bands	43 cases
Neurovascular sheath	59 cases
Nerve sheath	48 cases

TABLE 5. *Posterior tibial decompression: operation findings: compressing agent.*

Compressing agent (abnormal thickening) of:	No. of cases	% incidence
Flexor retinaculum, neurovascular sheath and inferior calcaneal bands	29	40.9
Flexor retinaculum and neurovascular sheath	22	30.0
Flexor retinaculum and inferior calcaneal bands	9	12.7
Neurovascular sheath and inferior calcaneal bands	5	7.0
Flexor retinaculum alone	3	4.2
Neurovascular sheath alone	1	1.4
No external compressing agent found	2	3.0

TABLE 6. *Operation findings: nerve and artery (posterior tibial decompression).*

Condition of nerve		Condition of artery
Thickened & fibrosed	18 cases	Thrombosed in 3 cases
Thickened (enlarged) only	32 cases	Narrowed with thick walls in 3 cases
Appeared normal	21 cases	Blood flow restored after operation in 8 cases

TABLE 7. *Results: posterior tibial decompression for chronic plantar ulcers.*

Type of ulcer	Healing period (average) (weeks)	% healed
Chronic simple	3	100
Recurrent	5	96
Chronic complicated	8	63

neal bands in 43 cases; and, of the neurovascular sheath in 59 cases. The nerve sheath was thickened in 48 cases. All of the fibrous structures were found thickened in 29 cases while only the retinaculum and calcaneal bands were found thickened in 22 cases. In five cases the calcaneal bands and the neurovascular sheath were the compressing agents, while in one case the neurovascular sheath alone was found to be thickened. In two cases all of these were normal but, the nerve being grossly thickened, the normal protective roof became the compressing factor.

Artery (Table 6). The posterior tibial artery was found thrombosed in three cases while it was narrowed with thick walls in another three. The pulsations of the artery were feeble before the operation and returned to normal after decompression in eight cases.

Nerve. The nerve was found thickened in 50 cases; in 18 there being marked fibrosis.

Pain relief. The pain of the neuritis was relieved in all of the cases without any recurrence in the follow-up period.

Ulcers (Table 7). In 53 of 58 cases all of the ulcers healed. The healing period after operation was, on the average, five weeks. The recurrent ulcers healed within five weeks while the chronic complicated ulcers took nearly eight weeks to heal. The chronic simple ulcers healed, on the average, in three weeks. The healing of ulcers was not found to have any relation to their number or location. The percentage of ulcers healed in the three groups is shown in Table 7. In five cases the ulcers did not heal, the reason being inadequate care and/or deep-seated bone infection.

Recurrence of ulcers (Table 8). The nutrition of the foot being only one of the many factors in ulcer recurrence, one cannot expect nonrecurrence of all ulcers after posterior tibial decompression. However, our

TABLE 8. *Ulcer recurrence.*

	Chronic simple ulcers	Chronic complicated ulcers	Recurrent ulcers
Total no. of ulcers	15	11	31
Ulcers healed after decompression	15	7	30
Incidence of recurrence in the above (average 10 months follow-up)	8 (53%)	3 (43%)	14 (45%)
Overall recurrence rate (47%)			

findings are as follows. Four of 11 chronic complicated ulcers did not heal. Of the seven cases in which ulcers had healed, they recurred in three (43%). All chronic simple ulcers healed, but 8 of 15 recurred (53%). Only in one case of recurrent ulcer was there a failure to heal. In 14 cases the ulcers recurred (45%). Thus, the overall recurrence rate was 47%. The recurred ulcers healed within the follow-up period in all but one case. The follow-up period averaged ten months.

DISCUSSION

The neurovascular tunnel behind the medial malleolus is one site where the collateral artery of the nerve is the main artery of the limb in nearly 60% of cases. The physiopathology of these structures in leprosy was well investigated by Carayon ([2, 3]) using anatomical, operative, and contrast radiographic (of nerve, vessels, and lymphatics) observations. His main findings were:

1. There is severe constriction of the neurovascular bundle behind the malleolus, the blood flow in the posterior tibial and internal plantar arteries being restored after decompression in many cases.
2. There is venous congestion in the same area.
3. The inferior calcaneal bands and retinaculum also cause diminution of the distal blood supply to the nerve.
4. Opening of vascular shunts leads to further diminution of the distal blood supply in some cases.

The irritation and later paralysis of the sympathetic nerve supply to the vessels of the foot further affects the distal blood supply. Our operative findings corroborate many of the above observations.

A nonhealing ulcer with pale granulation, the presence of a tender and often thickened posterior tibial nerve, and sometimes the observation of diminished pulsations of the posterior tibial artery behind the medial malleolus, seem to be the three cardinal signs in the presence of which surgical decompression of the posterior tibial neurovascular bundle will help in healing the ulcer and will better the nutrition of the foot. The relief of chronic neuritis in all, and the healing of long duration refractory plantar ulcers in most of our cases after decompression, confirms the value of this procedure in selected cases. Further detailed investigations and studies are required to evaluate the prophylactic value of this procedure in prevention of plantar ulcers and posterior tibial nerve paralysis.

SUMMARY

Seventy-one cases of posterior tibial neurovascular surgical decompression in leprosy are analyzed and reviewed. Thirteen had chronic refractory posterior tibial neuritis while 58 had chronic nonhealing plantar ulcers. The plantar ulcers were associated with posterior tibial neuritis and/or vascular insufficiency. The clinical and operative findings together with the results are presented and the physiopathology of neurovascular compression is discussed. The operative procedure is described. The presence of pale granulation tissue in a nonhealing ulcer seems to be a characteristic finding in these cases. Neurovascular compression in the tunnel, behind and also below the malleolus, was present in all. In operative procedures, the importance of incising the inferior calcaneal bands is stressed. The results show that the neuritis was cured in all cases, while in 53 of 58 cases the plantar ulcers healed in a short period after the decompression. This stresses the value of this procedure. The prophylactic potential of this procedure needs to be evaluated.

RESUMEN

Se analizan y revisan setenta y un casos de decompresión quirúrgica neurovascular tibial posterior en lepra. Trece tenían neuritis tibial posterior crónica, refractaria, mientras que 58 tenían úlceras plantares crónicas no cicatrizadas. Las úlceras plantares estaban asociadas con neuritis tibial posterior y/o insuficiancia vascular. Se presentan los hallazgos clínicos y quirúrgicos y se discute la fisiopatología de la compresión neurovascular. Se describe el procedimiento operatorio. La presencia de tejido de granulación pálido en una úlcera no cicatrizada parece ser un hallazgo característico en estos casos. En todos los casos se encontró compresión neurovascular en el tunal, por detrás, y también por debajo, del maléolo. Se destaca la importancia de incidir las bandas calcáneas inferiores durante el procedimiento quirúrgico. Los resultados muestran que la neuritis se curó en todos los casos, mientras que 53 de los 58 casos de úlcera plantar curaron en un período corto de tiempo después de la decompresión. Esto destaca el valor de este procedimiento. El potencial profiláctico del procedimiento debe ser evaluado.

RÉSUMÉ

On a passé en revue et analysé les protocoles de 71 cas de décompression chirurgicale neurovasculaire au niveau du tibia (postérieure) chez des malades de la lèpre. Treize de ces cas présentaient une névrite tibiale postérieure chronique et réfractaire, tandis que 58 souffraient d'ulcères plantaires chroniques incurables. Les ulcères plantaires étaient associés avec une névrite tibiale postérieure, avec une insuffisance vasculaire, ou avec néphrite et insuffisance vasculaire à la fois. Ces observations cliniques, ainsi que celles faites au moment de l' opération, de même que les résultats, sont présentés. On discute la physiopathologie de la compression neuro-vasculaire. Les techniques opératoires sont décrites. La présence de tissus granulaires et pâles dans les ulcères refractaires, semblent être une observation caractéristique chez ces cas. Dans tous les cas, on a noté une compression neuro-vasculaire au niveau du tunnel, au-delà et également en-dessous de la malléole. On souligne l'importance d'une incision au niveau des ligaments inférieurs du calcanéum, pour la procédure opératoire. Les résultats montrent que la névrite a été guérie dans tous les cas, alors que 53 des 58 cas d'ulcères plantaires ont disparu rapidement après la décompression. Ceci témoigne de la valeur de ce procédé chirurgical. Il faudrait également évaluer dans quelle mesure cette technique est dotée d'une action préventive.

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