International Surgery Journal
Viswanathan MS et al. Int Surg J. 2018 Nov;5(11):3520-3526
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20184617

Original Research Article

Tarsal tunnel decompression: an effective method for prevention of foot complications in diabetic patients with compressive neuropathy at tarsal tunnel

Viswanathan M. S.*, Lakshmanan S., R. Anbazhagan

Department of General Surgery, ESIC Medical College and PGIMSR, K. K. Nagar, Chennai, Tamil Nadu, India

Received: 17 September 2018
Accepted: 26 September 2018

***Correspondence:**
Dr. Viswanathan M. S.,
E-mail: msvisw@gmail.com

ABSTRACT

Background: Diabetic foot is one of the most devastating complications of diabetes with 15% lifetime risk of developing ulcer foot. About 80% of diabetic foot is neuropathic in origin, revealing the importance of sensory sensation in preventing the development of diabetic ulcer. This study is aimed to identify the efficiency of tarsal tunnel decompression surgery in diabetic patients in ulcer healing and in the prevention of development of new diabetic related foot complications.
Methods: About 70 diabetic patients with ulcer in one foot, acting as test limb and contralateral foot having no ulcer, acting as control limb was included in the study. Tarsal tunnel decompression surgery was done in the test limb and the status of ulcer in the test limb, in terms of diameter/ progress of ulcer healing was observed. In both the study limb and the control limb foot was examined for onset of any new diabetes related foot changes/complications during the follow up period for 18 months.
Results: Postoperatively, at 6 weeks, 20 patients (28.6%) had their ulcers fully healed. At 3rd month postoperative follow up 90.48% of ulcers in the test limb showed complete healing following decompression surgery and 9.52% of ulcers showed partial healing. Following decompression surgery in the test limb, only 2 patients (3.28%) developed new diabetes related foot changes/complications as compared to control limb, where 15 patients (24.59%) developed new diabetes related foot changes/complications.
Conclusions: Present study firmly proves that following tarsal tunnel decompression surgery, there is improvement in healing of the ulcer with conservative measures and there is a definitive role of tarsal tunnel decompression in prevention of development of new diabetes related foot changes/complications in patients.

Keywords: Diabetic foot ulcer, Foot complications, Nerve decompression, Tarsal tunnel release, Ulcer healing

INTRODUCTION

Diabetic foot is one of the most devastating complications of diabetes and is the leading cause of lower limb amputation. It has a dread of disability, frequent and prolonged hospitalizations, mounting high expenses with the ever-sustained end result of an amputated limb. The prevalence of diabetic foot ulceration in the diabetic population worldwide is 4–10%; the condition being more frequent in older patients.[1,2] About 5% of all diabetic patients present with ulcer foot and the life time risk of diabetic patients developing foot ulcer as a complication is 15%.[3] About 40-70% of non-traumatic amputations of lower limb

occur in diabetic patients and reports from many studies reveal, that foot ulcers precede in around 80% of diabetic people who undergo limb amputation. [4]

Diabetic neuropathy is common accompanying factor in almost 90% of diabetic foot ulcers.[5] About 80% of diabetic foot ulcers are neuropathic in origin and the remaining 20% of ulcers in diabetic patients are neuroischemic in origin.[6] According to the American Diabetes Association, a foot that has lost its protective sensation is considered to be a "foot at risk" for ulceration. [7]

Diabetic patients with peripheral neuropathy with loss of protective sensation sustain repetitive minor injuries from internal or external causes which may consequently lead to foot complications. There is usually development of callosities initially. This may be followed by infection, superficial ulceration, deep infection with osteomyelitis/ cellulitis which may lead on to wet gangrene. This ultimately leads to need for foot amputation. [8] Limb amputations have a major impact on the individual in distorting his body image, loss of productivity, increasing dependency and treatment costs. Sporadic quality research reports that, foot ulceration has a great social stigma, social isolation, loss of social role, and unemployment.[9] Diabetic trophic ulcers are more common in plantar aspect of foot, the reason primarily being loss of sensation. The sensation of plantar aspect of foot is supplied by posterior tibial nerve. So, posterior tibial nerve within tarsal tunnel is of special interest in diabetic ulcer foot.

The prevention of diabetic foot is crucial major health problem and its management involves a multidisciplinary approach. Unawareness, non-compliance along with neglect from families make these ulcer bearing patients to lead the worst quality of life. Hence a novel approach is required for prevention and management of diabetic ulcer foot. This study is aimed to identify the efficiency of tarsal tunnel decompression of compressed posterior tibial nerve in diabetic patients, in ulcer healing and in the prevention of development of new diabetic related foot complications.

METHODS

About 70 patients attending diabetic foot care clinic at ESIC Hospital, KK Nagar, were selected randomly by the computer, and included in the study population after consulting with statistician for sample size. These patients were counseled for surgery, by explaining the study and its complications and written consent was obtained. The study was conducted after obtaining Institutional ethical committee approval.

The study population included those diabetic patients who were having, solitary plantar ulcer in one foot (acting as test limb) of Wagner grade-1 and 2, size < 3cm in diameter, and with contralateral non-ulcer foot, acting as control limb. Both limbs were evaluated for absence of vascular insufficiency by ankle-brachial index (<0.7). Also, the study population were confirmed to have sensory loss in the test limb as detected by monofilament testing (three site test) and posterior tibial nerve compression at the tarsal tunnel in the test limb by elicitation of Tinels sign.

Patients excluded from the study were those with other known causes of ulcer foot, associated ischemic component (ankle-brachial index >0.7), actively infected ulcers, presence of neuropathic deformities, uncontrolled diabetic status (HbA1c>8), pregnant mothers, presence of other neurological illness and those with other co -morbid conditions (cardiac/renal disease, immunosupression).

All patients underwent thorough history, physical examination and local examinations of both lower limbs. Site, size, depth, extent and position of ulcer was documented and graded according to Wagner's grading. Peripheral pulses and ankle-brachial index were tested to rule out vascular disease. Sensory examination of both test and control limb was done using

Semmes-Weinstain 10 g force monofilament three site test involving testing the plantar aspects of the great toe, the third metatarsal, and the fifth metatarsals. The test was considered positive if the patient was not able to feel the filament and negative if the patient was able to feel the filament, on plantar aspect of foot at the above sites. A positive test refers to loss of 95% sensation (loss of protective sensation).

Elicitation of Tinel's sign over the course of posterior tibial nerve under tarsal tunnel was done by compression /percussion in disto-proximal direction. The sign was considered to be positive if there was distally radiating tingling sensation on plantar aspect. This indicated presence of focal compression of posterior tibial nerve in tarsal tunnel.

The study population were also subjected to haematological, biochemical and radiological investigations like fasting and postprandial blood glucose levels, HbA1c levels, complete hemogram, Renal function test, Protein profile, X ray chest and foot of affected limb, ECG, ankle brachial index measurement and tissue block specimen for culture and sensitivity. The test/study limb was subjected to decompression surgery at the tarsal tunnel, while the control limb, which had no ulcer was observed for any new sensory loss /new ulcer formation during the study period.

The study limb with ulcer on plantar aspect was prepared for a week with daily hydrogel dressing and debridement. Appropriate antibiotics were given to control infection at the site of ulcer. Patients were taken up for surgery only after ensuring absence of active infection, as determined by type of discharge, absence of cellulitis, absence of systemic signs and symptoms and normal WBC. On the

day of surgery, the study limb with ulcer was prepared with Povidone iodine in ward. The ulcer was through washed, cleaned and walled off with dressing/opsite as appropriate to exclude ulcer and expose the site of incision at ankle before shifting to operating room. Standard prophylactic antibiotics were as per hospital protocol.

Figure 1: Line of incision, 6cm in length perpendicular to the line joining medial malleolus and calcaneum at the midpoint.

In the operating room in supine position, with strict aseptic precautions, under local anesthetic infiltration containing 1:100000 adrenaline, skin was incised for about 6 cm in length perpendicular to the midpoint of line joining medial malleolus and calcaneum in smooth curve along the tarsal tunnel (Figure 1).

Subcutaneous tissue divided. Flexor retinaculum was identified, delineated and incised. Edges of retinaculum were excised 0.25cm from each leaf de-roofing the tunnel and edges were cauterized to prevent formation of roof and post-operative adhesions.

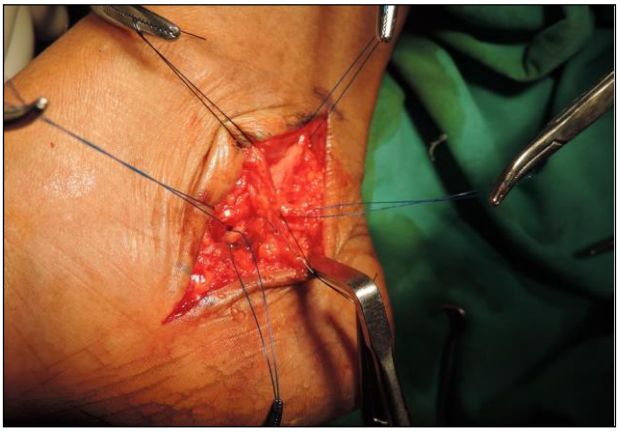

Figure 2: Intra-operative picture, showing posterior tibial nerve branching into medial plantar, lateral plantar and calcaneal nerves. Posterior tibial vessels were superficial to the nerve plane.

Under 4.5x loupe magnification structures within the tunnel were dissected out and properly identified. Posterior tibial nerve was identified deep to posterior tibial vessels. The nerve was carefully separated from posterior tibial vessels. The nerve was inspected for compression and proximal neuroma formation. Careful neurolysis was done releasing the epineurium.

The branches of posterior tibial nerve medial plantar, lateral plantar and calcaneal nerves were identified (Figure 2). These divisions were traced distally up to their entrance into plantar aspect of foot. Fibro-osseous tunnels overlying these corresponding nerves were released.

Epineurium of these nerve divisions were also opened up. Wound was washed, and hemostasis was obtained with bipolar cautery. Finally, the skin was closed with non-absorbable interrupted sutures and dressed. External compression dressing was applied, and patient was advised leg elevation post operatively.

In the peri-operative period patients were managed with leg elevation and analgesics. Dressings were changed on 2nd postoperative day and patients were discharged. They were reviewed on 7th post-operative day for suture removal. Care for the trophic ulcers was continued as per standard with offloading, appropriate dressings, with address to nutrition, glycemic control, and rehabilitation.

The follow up was scheduled on 6 weeks, 3 months, 6 months, 9 months and 18 months from the time of surgery. During follow up, both the lower limbs were examined for adequate decompression of posterior tibial nerve at the tarsal tunnel by elicitation of Tinel's sign and sensory improvement by Semmes-Weinstein 10 g force monofilament sensory test.

Status of ulcer in the study limb, in terms of diameter as progress of ulcer healing was noted and recorded at 6 weeks. Both test limb and the control limb foot were examined for onset of any diabetic related foot changes/complications at end of 18 months.

The foot changes looked for was new callosities, superficial ulcerations (wagner 1), deep ulceration with without abscess/osteomyelitis (Wagner 2), Deep ulcer with abscess, osteomyelitis, or joint sepsis (Wagner 3) and Gangrene localized to portion of forefoot or heel (Wagner 4). The results were documented systematically and statistically analysed using SPSS EXCEL software

RESULTS

About 70 patients with ulcer in one foot acting as test limb and the contralateral non-ulcer foot acting as control limb were included in the study.

We lost follow up of 7 patients after the 6th postoperative week and further 2 more patients after 3rd month postoperative follow up. Majority of the patients were in

the age group of 41 -70 years, with males comprising 62.86 % and females 37.14 %.

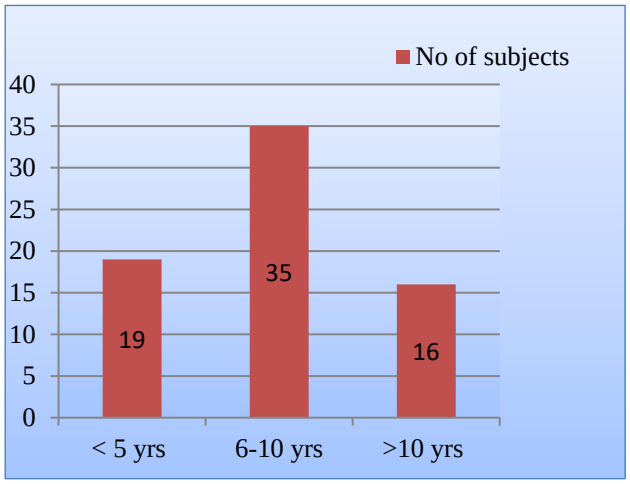

Figure 3: Duration of Diabetes among the study population.

About 50% of study population was known Diabetic for duration of 6-10 years and by conventional criteria, the duration of Diabetes in this study is considered to be not statistically significant (p>0.05) (Figure 3). Following tarsal tunnel decompression surgery on test limb, 65 patients (93%) had sensory gain and 5 patients (7%) had documented no sensory gain on test limb, and by conventional criteria, the association between monofilament testing among the test and control limb during the postoperative period was considered statistically significant (p<0.05) (Table 1).

After de-compressive surgery on the test limb, 69 patients (98.6%) were documented to have resolving of Tinel's sign in the test limb, suggesting adequate decompression and 1 patient (1.4%) was documented to have persistent Tinel's sign suggesting inadequate decompression and by conventional criteria, the association of Tinel's sign positivity between the test and control limb during the postoperative period was considered statistically significant (p<0.05) (Table 2).

Table 1: Sensory monofilament testing- preoperatively and postoperatively.

Monofilament testing	Test limb (n=70)		Control limb (n=70)	
	Pre-operative	Post-operative	Pre-operative	Post-operative
Positive	70	5	65	65
Negative	0	65	5	5

At 6 weeks it was observed that there was significant decrease in size of ulcers with conservative treatment. There were no patients with ulcers of size 2.5 to 3 cm as compared to 29 patients preoperatively. 20 patients had ulcers fully healed at 6 weeks interval. Figure 4 reveals shift towards healing of ulcers with decreasing sizes of ulcers. We lost follow up of 7 patients after the above 6th postoperative week.

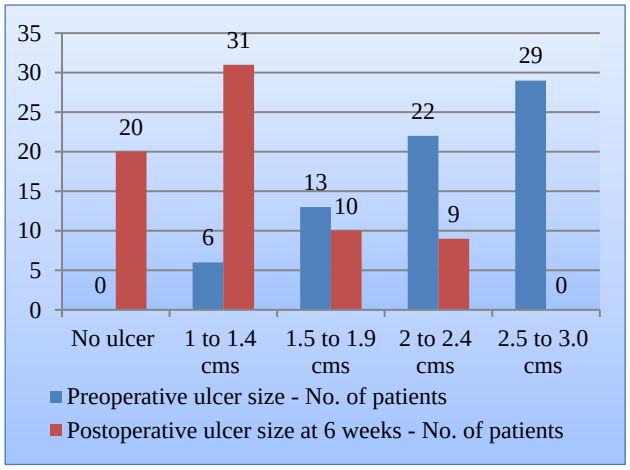

Figure 4: Status of ulcer (diameter) in test limb at end of 6 weeks post operatively based on size of ulcer.

At 3rd month postoperative follow up 90.48% of ulcers in the test limb showed complete healing following decompression surgery and 9.52% of ulcers in the test limb showed partial healing (Figure 5).

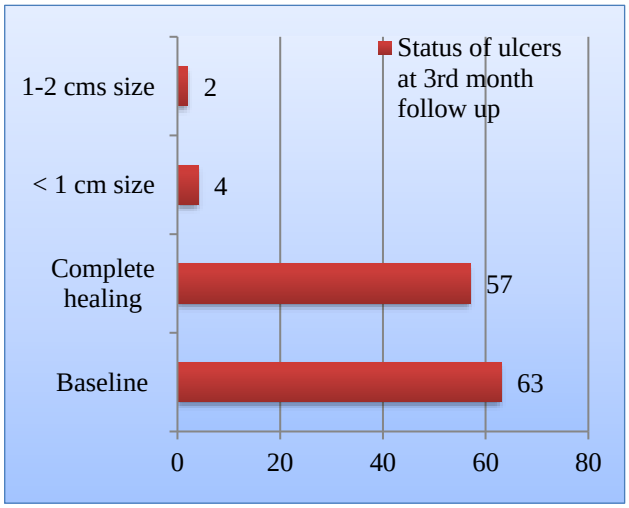

Figure 5: Ulcer progression in the study limb postoperatively at 3rd month follow up.

We lost follow up of 2 more patients after 3rd month postoperative follow up. All the ulcers were healed

completely by 6th month of postoperative follow up with conservative management.

Following decompression surgery in the test limb, only 2 patients (3.28%) developed complication related to diabetes. One patient (1.64%) had new callosity over ball of great toe while other one had superficial skin breakdown (Wagner 1) over the plantar aspect of 1st metatarsal head over the healed index ulcer. In the control limb however, there were 15 patients (24.59%) who developed foot complications ranging from development of new callosities in 8 (13.11%), superficial skin ulceration (Wagner 1) in 4 (6.55%), deep ulcer with osteomyelitis (Wagner 3) in 2 (3.27%) and wet gangrene of great toe (Wagner 4) in one patient (1.64%).

On comparison of test foot undergoing decompression of tarsal tunnel with control limb, there was obvious increase in incidence of diabetes related foot complication in control limb where no decompression was done. The association by conventional criteria was considered statistically significant ($p < 0.05$) (Figure 6).

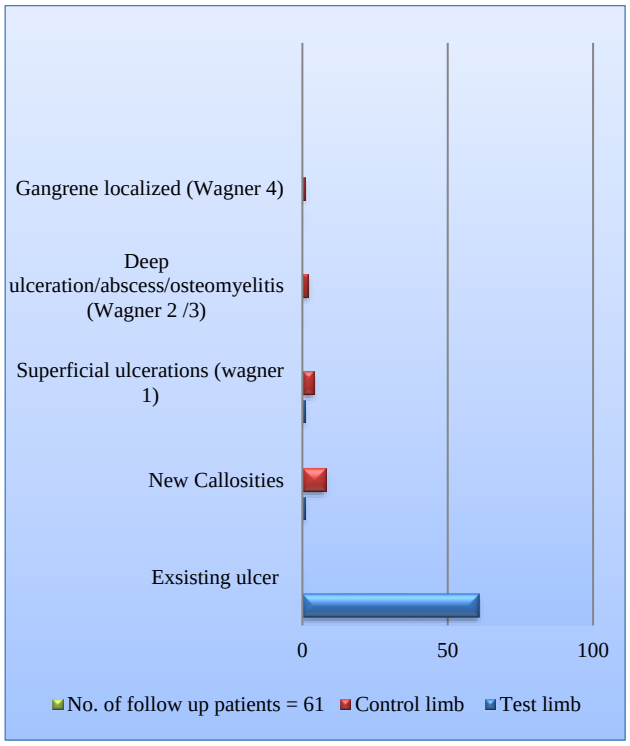

Figure 6: Complications in test and control limb during the 18 months postoperative period follow up.

Post-operative wound complications related to surgery were noted in 9 patients (12.8%) who developed edema foot out of whom 3 patients developed mild serous discharge on compression.

One patient (1.42%) developed wound dehiscence of about 0.5 cm after suture removal. All these complications were conservatively managed and at 3 months follow up each of them had been completely resolved. At, 6 months follow up, no further wound complications were recorded.

DISCUSSION

Diabetic foot is one of the most devastating complications of diabetes and is the leading cause of lower limb amputation. Although population-based data are not available, rough estimates indicate that in India approximately, 45000 legs are amputated every year and the number are increasing each year. Almost 75% of these amputations are carried out in neuropathic feet with secondary infection which are potentially preventable.[10] This study was aimed to establish the role of de-compressive surgery of tarsal tunnel in diabetic ulcer healing and its prophylactic role in prevention of new ulcers by comparing the operated test ulcer foot with the non-operated contralateral control foot, over the follow up period of 18 months.

About 70 diabetic patients with ulcer in one foot, acting as test limb and non-ulcer contra lateral foot, acting as control limb, were included in the study. Majority of the patients were in the age group of 41 -70 years, with males comprising 62.86 % and females 37.14 %, with no statistical significance. 50 % of study population was known to be diabetic for 6-10 yrs (Figure 3). It was acknowledged by many studies that the incidence of diabetic foot ulcer and peripheral neuropathy increases with increasing duration of hyperglycemia. Shahi SK et al, found statistical significance of the presence of ulcer foot with the duration of diabetes, 11.5±5.74 years of diabetic duration.[11]

(Table 1) Following tarsal tunnel decompression surgery on test limb, 65 patients (93%) had sensory gain and 5 patients (7%) had documented no sensory gain on test limb, with statistical significance ($p = 0.0000$) (Table 2). Similarly following de-compressive surgery on the test limb, 69 patients (98.6%) were documented to have resolving of Tinel's sign in the test limb, suggesting adequate decompression and 1 patient (1.4%) was documented to have persistent Tinel's sign suggesting inadequate decompression.

Dellon AL in had done a meta-analysis of tibial nerve decompression studies at ankle in diabetic neuropathic patients and concluded that the procedure was leading to sensory recovery which had prevented subsequent ulcerations and amputations.[12] Study conducted by Lee CH et al, had demonstrated high probability of good successful outcome of decompressive surgery in terms of restoration of sensation and pain relief with positive Tinel's sign preoperatively.[13]

(Figure 4): Among the operated ulcer bearing test foot of 70 patients, at 6th week follow up: 20 ulcers were completely healed (28.6%). The rest of the ulcers were improved in dimension towards healing from their pre-operative status.

(Figure 5): There was loss of follow up of 7 patients. In the remaining 63 patients 57 had fully healed (90.4%), 4 patients had ulcer dimension of less than 1cm (6.3%) and 2 had ulcer in dimensions of 1-2 cm (3.2%). All ulcers were noted to be healed at 6 months follow up with conservative treatment. The association of de-compressive surgery on ulcer healing could not be commented here because of the absence of ulcer in the non-operated contralateral control foot to compare with the ulcer in the operated study foot. In this scenario it would be very biased to say that ulcer healing was significantly improved due to sensory recovery in operated limbs. Ideally to study the effect of de-compressive surgery in healing of diabetic ulcer foot, the diabetic patient would be the one who had similar ulcer in both feet at similar location with distal symmetric compressive peripheral neuropathy.

(Figure 6): There was loss of follow up of 2 more patients at 18 months follow up. In the remaining study population of 61 patients, only 2 patients (3.2%) had new superficial ulcer formation over plantar aspect of 1st metatarsal head over the healed index ulcer in the operated foot in 18 months follow up period. Among the two, 1 patient was the one for whom there was persistent Tinel's sign and also had documented no sensory gain, post-operatively, suggestive of inadequate decompression of tarsal tunnel. So, excluding that patient, only one patient (1.64%) developed a new callosity over ball of great toe in the operated study foot that had been adequately decompressed, but had documented sensory gain, following surgery. On the other hand, 15 patients (24.59%) had developed diabetes related foot complication in their non-operated control foot in 18 months follow up period. All of the above 15 patients had documented sensory loss in their control foot by monofilament sensory test. Present study shows that new diabetes related foot changes/complications was meaningfully less (11.76%) in study limb compared to control limb (88.24%).

There obviously is real advantage in performing tarsal tunnel decompression surgery in diabetic foot ulcer limbs with signs of compression, which helps in restoration of protective sensation in the foot and thereby likely helps in healing of diabetic foot ulcer. There is further advantage in prevention of new ulcer formation. Present study results have been confirmed from numerous other studies worldwide, which yielded similar results. However, few literatures exists regarding this in India.

Study conducted by Rathur HM et al refers to foot at risk for future ulceration is the foot of the patient having any one of the factors like diabetic neuropathy, peripheral vascular disease, foot deformity, previous history of foot ulceration, presence of other microvascular complication, elderly > 65 years of age, and who are living alone. He also indicated the importance of preservation of sensation.[14] Dellon AL et al, in their tibial nerve decompression studies at ankle in diabetic neuropathic patients had concluded that the procedure was leading to sensory recovery which had prevented subsequent ulcerations and amputations.[15]

Aszmann O et al, had done a retrospective analysis of 50 patients, with a mean of 4.5 years from the date of de-compressive nerve surgery at index limbs and compared the development of ulcers leading to amputations with the non-operated contralateral limbs and concluded that the surgery had prevented irreversible sensory loss leading to ulcer foot and/or amputations. He presented the first report of nerve decompression affecting subsequent foot complications, finding that, in diabetic neuropathic, patients operated on only unilaterally for pain, 30% developed diabetic foot ulcers or underwent amputation over the subsequent 5 years. Each and every complication event in 50 subjects occurred in the contralateral, non-operated leg.[16]

Nickerson DS in retrospectively analysed 75 diabetic feet with previous ulcer that had undergone decompression at peroneal and posterior tibial nerves at their fibro-osseous tunnels respectively for the ipsilateral incidence of ulcer and reported a low annual incidence of ulcer recurrence stressing the importance of surgical nerve decompression.[17]

Knobloch K et al, had done a prospective analysis of surgical decompression of lower limb nerves in three locations that were common peroneal nerve at fibular head, tarsal tunnel with its four tunnels, dorsum of foot and proved reduction of pain, improvement in balance, improvement in sensation with no ulcerations and amputations.[18]

Mazilu G et al, prospectively studied the surgical release of tarsal tunnel in a small group of symptomatic diabetic neuropathic feet and obtained an improvement in plantar sensation, leading to healing of ulcerations with significant improvement in quality of life and suggested that the procedure should be done in all cases of diabetic neuropathy where conservative medical treatment failed.[19]

CONCLUSION

Present study indicates firmly that Decompression of tarsal tunnel in diabetic ulcer foot in patients with features of compression at tarsal tunnel leads to definite improvement in sensation of foot. There is likely improvement in healing of ulcer foot though, the same cannot be proved statistically in the absence of proper control. Present study proves that following decompression surgery there is a significant decrease in new diabetes related foot changes/complications, primarily due to recovery of foot sensation. Health care benefits in preventing foot related complications of diabetes following tarsal tunnel decompression are proven in this study. A properly done decompressive surgery of tarsal tunnel under local anesthesia in around

30 minutes of time ethically can be suggested to be included in the preventive programme of diabetic foot complications and adopted as a prophylaxis for non-ulcer neuropathic limbs with compression at tarsal tunnel safety.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Centers for Disease Control and Prevention Lower extremity disease among persons aged ≥40 years with and without diabetes-United States, 1999-2002. MMWR. mortality weekly Rep. 2005; 54:1158-60.
2. Lauterbach S, Kostev K, Kohlmann T. Prevalence of diabetic foot syndrome and its risk factors in the UK. J wound care. 2010;19(8):333-7.
3. Abbott CA, Carrington AL, Ashe H, Bath S, Every LC, Griffiths J, et al. The north-west diabetes foot care study: incidence of, and risk factors for, new diabetic foot ulceration in a community-based patient cohort. Diabetic Med. 2002;19(5):377-84.
4. Moxey PW, Gogalniceanu P, Hinchliffe RJ. Lower extremity amputations-a review of global variability in incidence. Diabet Med. 2011;28:1144-53.
5. Tesfaye S, Stevens LK, Stephenson JM, et al. Prevalence of diabetic peripheral neuropathy and its relation to glycaemic control and potential risk factors: the EURODIAB IDDM Complications Study. Diabetol. 1996;39:1377-84.
6. Pendsey S, Abbas ZG. The step-by-step program for reducing diabetic foot problems: a model for the developing world. Current Diabetes Reports. 2007;7(6):425-8.
7. Boulton A, Armstrong D, Albert S, Frykberg R, Hellman R, et al. Comprehensive foot examination and risk assessment. Endocrine Practice. 2008;14(5):576-83.
8. Alexiadou K, Doupis J. Management of diabetic foot ulcers. Diabetes Therapy. 2012;3(1):4.
9. Harrington C, Zagari MJ, Corea J, Klitenic JA. Cost analysis of diabetic lower extremity ulcers. Diabetes care. 2000;23:1333-8.
10. Pendsey S, Abbas ZG. The step-by-step program for reducing diabetic foot problems: a model for the developing world. Current Diabetes Reports. 2007;7(6):425-8.
11. Shahi SK, Kumar A, Kumar S, Singh SK, Gupta SK, Singh TB. Prevalence of diabetic foot ulcer and associated risk factors in diabetic patients from North India. J Diabetic Foot Complications. 2012;4(3):83-91.
12. Dellon AL. The Dellon approach to neurolysis in the neuropathy patient with chronic nerve compression. Hand Surgery Microsurgery Plastic Surgery. 2008;40(06):351-60.
13. Lee CH, Dellon AL. Prognostic ability of Tinel sign in determining outcome for decompression surgery in diabetic and nondiabetic neuropathy. Ann Plastic Surg. 2004;53(6):523-7.
14. Rathur HM, Boulton AJM. The neuropathic diabetic foot. Nat Clin Pract Endocrinol Metab. 2007;3:14-25
15. Dellon AL. Diabetic neuropathy: medical and surgical approaches. Clinics in Podiatric Medicine Surgery. 2007;24(3):425-48.
16. Aszmann O, Tassler PL, Dellon AL. Changing the natural history of diabetic neuropathy: incidence of ulcer/amputation in the contralateral limb of patients with a unilateral nerve decompression procedure. Ann Plast Surg.2004;53(6):517-22.
17. Nickerson DS. Low recurrence rate of diabetic foot ulcer after nerve decompression. J Am Podiatr Med Assoc. 2010;100(2):111-5.
18. Knobloch K, Gohritz G, Vogt PM. Surgical decompression of the lower leg in painful diabetic polyneuropathy. Operative Orthopadie Traumatol. 2012;24(1):74-9.
19. Mazilu G, Budurcă RA, Graur M, Stamate T. Surgical treatment of tarsal tunnel syndrome in diabetic neuropathy. Medical-Surgical Magazine of the Society of Physicians and Naturalists from Iasi. 2012;116(1):128-34.

Cite this article as: Viswanathan MS, Lakshmanan, Anbazhagan R. Tarsal tunnel decompression: an effective method for prevention of foot complications in diabetic patients with compressive neuropathy at tarsal tunnel. Int Surg J 2018;5:3520-6.