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New method for fixation point of tibialis posterior tendon transfer

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Abstract

Background: The transfer of the tibialis posterior tendon to the dorsum of foot can restore the function of the paralyzed dorsiflexor muscles of the foot and ankle. In order to reduce the wound complication in the insertion site of tendon to bone by a plantar knop we used a new method of fixation by an absorbable screw inserted dorsally.

Methods: we performed this operation on 15 patients in a 3 years period. All patients had drop foot deformity due to irreversible lesions of the peroneal nerve. The inclusion criteria was the peroneal nerve palsy that was not improved after 18 months even by using nerve releasing or nerve repairing. All patients were evaluated after 6 months for ankle function and wound complications.

Result: Of 15 patients one was excluded from study. At 6 month ten patients got excellent score (66%) and 4 good score (26%) further ankle function. There was no wound complication at insertion site.

Conclusion: This simple modification for insertion site fixation had good result in restoring ankle function whiles eliminated the possibility of plantar pressure sores caused by fixation knop.

Keywords: Foot drop deformity, Tibialis posterior tendon, Peroneal nerve palsy.

Introduction

Drop foot deformity is one of the most common lower extremity paresis and usually caused by peroneal nerve palsy or damage of the tibialis anterior muscle (1). Although in nerve injury there is concomitant loss of sensation at the dorsum of the foot, the movement disability has been considered as a curative aim because lack of dorsal skin sensation usually doesn't cause any problems but, the non-regulated gait of patients with deep peroneal nerve pulsy (the steppage gait) needs to be modified by orthopedic interventions. In 1933 in an attempt to compensate for this disability, transferring the posterior tibialis tendon to the dorsum of the foot was introduced by Ober (2). The indication for this operation was drop foot due to isolated loss of tibialis anterior function and the presence of a functioning tibialis posterior tendon (3). Most techniques use the posterior tibialis tendons as tendon donor and transfer this tendon to the dorsum of the foot and then anchor it to the cuneiform or metatarsal bones (4). The tendon is able to provide enough strength for dorsiflexion and also the absence of this tendon at the plantar surface doesn't cause any important disa-

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Fig.1. Plantar ulcer at fixation point.

bility. The transferred tendon is usually pulled out through the metatarsal bones and fixed at the plantar surface. The anchored point will present as a knop on the plantar skin that can cause chronic pressure ulcer (Fig. 1) (5). Given these explanations, we designed our method to provide less complicated surgery without any skin injury.

Methods

We transferred the posterior tibialis tendon to the dorsum of the foot and then fixed it through the second cuneiform bone like other techniques but to anchor the tendon head we used an absorbable transoseous screw instead of pulling out process that could lead to skin lesions. In this article, we present 15 posttraumatic patients who suffered from deep peroneal nerve palsy and were rehabilitated with this new technique.

Ethical approval: This study was conducted in Rasoul-e-Akram Clinical Research Development Center (RCRDC) of Tehran university of medical sciences (TUMS) and financial supports were provided by the related institutional review board. The surgical technique, advantages and probable disadvantages were explained to the patients. The written consent was signed by the patients once they were convinced to enter the study.

Subjects: Since March 2009 till April 2012 all patients with posttraumatic common peroneal nerve pulsy were explained about the aim of the study. The pictures of previous methods of transferring the posterior tibialis tendon to the dorsal side were illustrated to the patients and benefits of the new method mainly lack of any chronic plantar ulcers at the insertion site were explained to them. Regarding to the patients' preferences, the surgery was performed on 15 patients. The inclusion criteria included the peroneal nerve palsy that was not improved after 18 months even by using nerve releasing or nerve repairing. Also the nonfunctional reaction of the injured nerve had to be confirmed by electromyography and neural conductive velocity.

Surgical method: All operations were performed by one orthopedic surgeon, the first author of the article. All patients underwent spinal or epidural anesthesia with inflated torniquet. The procedure was started by an incision made along the medial plantar side starting form tendon insertion and 5 cm long. Then the insertion of the posterior tibialis tendon was released and raised up through another 3 inch incision along the medial side of tibial bone. This incision also was used to make a window in the interosseous membrane of tibia and fibula. Another 5 cm incision was made at the lateral part of the anterior tibialis on dorsum of foot for moving tendon anteriorly and exposing second cuneiform at the middle point of the dorsal site of the foot. After measuring the tendon diameter we made a hole in the middle point of the bone. The transferred tendon was sutured by a fiber wire number 2 and passed through the osseous tunnel. While the fibers were pulled out from the plantar side of the foot by another surgeon and the ankle hold dorsiflexed, an absorbable screw (25×6 mm) was inserted in the hole beside the tendon (Fig. 2). The operation was finished by suturing the skin and as short plaster.

Fig.2. Fixation with absorbable screw.

Follow up: The plaster kept for 2 months during which the patients had to walk with toe-touch weight bearing. Then the cast removed and a foot x-ray prepared and physiotherapy protocol initiated. Third visit was scheduled after 3 month and final evaluation of functional improvement done after 6 month because the optimal time expected for recovery was 6 months.

Evaluation criteria: To assess the operation result, we used an objective score table known as the Stanmore system. The system was used by Yeap et al in 2001 to evaluate the result of their surgical method for dropped foot deformity (6). The system included 7 factors: "pain, need for orthosis, wearing normal shoes, activities of daily living (functional outcome), muscle power, degree of active dorsiflexion and foot posture" (Table. 1). Then results were categorized to excellent (scores between 85-100), good (70-84), fair (55-69) and poor (0- 55). The force of the active dorsiflexion measured by Modified British Medical research Council Motor Scale (BMRC) (Table. 2). we applied Stanmore system 6 month after surgery to all patient.

Results

The patients age ranged between 20 and 55 years (mean age 34.3 years), in which 9 were men (60%) and 6 female (40%). Of 15 patients in this study, one patient did not tolerate the plaster in the third week and failed to complete the period of therapy. In the remaining 14th, ten patients (66%) received excellent score (score 86 to score 96) with the average of 91.3 and 4 patients (26%) gained good score (score 72 to score 81) with the average of 76.5. All skin incisions healed without any complications.

Table1. Stanmore system

Modified Stanmore system questionnaire	Points
Pain (15 points)	
No pain at any time	15
Mild pain	10
Moderate pain	5
Severe pain	0
Need for orthoses (15 points)	
No	15
Occasionally (once a week)	10
Frequently (twice a week)	5
Regularly (greater than twice a week)	0
Normal shoes (5 points)	
Yes	5
Yes, but prefers certain types	3
No	0
Functional outcome (10 points)	
Normal daily activity and normal recreation	
Normal daily activity and limited recreation	
Limited daily activity and recreation	
Severe limitation on daily activity and recreation	
Muscle power (25 points) (modified Medical Resea	
Grade 4+ or 5	
Grade 4	
Grade 3	
Grade 2 or less	
Degree of active dorsiflexion (degrees)	
Greater than 6°	
0°–5°	
−5° to −1°	
−10° to −6°	
Less than −11°	
Foot posture (5 points)	
Plantigrade, balanced, no deformity	
Plantigrade, mild deformity	
Obvious deformity or malalignment	

Table 2. Modified British Medical research Council Motor Scale (BMRC)

The patient's effort is graded on a scale of 0-5:
Grade 5: Muscle contracts normally against full resistance.
Grade 4: Muscle strength is reduced but muscle contraction can still move joint against resistance.
Grade 3: Muscle strength is further reduced such that the joint can be moved only against gravity with the examiner's resistance completely removed. As an example, the elbow can be moved from full extension to full flexion starting with the arm hanging down at the side.
Grade 2: Muscle can move only if the resistance of gravity is removed. As an example, the elbow can be fully flexed only if the arm is maintained in a horizontal plane.
Grade 1: Only a trace or flicker of movement is seen or felt in the muscle or fasciculations are observed in the muscle.
Grade 0: No movement is observed.

Discussion

Drop foot has diverse etiologies, traumatic peroneal nerve lesions are the most common cause (7). In our study all drop foot deformities were due to peroneal nerve palsy. The peroneal division of the sciatic nerve is more prone to injury due to its location and has poor regeneration potential compared with the tibial division so a significant percentage of patients with peroneal nerve injury and subsequent drop foot deformity require tendon transfer for restoration of normal gait (8). When compared with other surgical options such as arthrodesis or tenodesis, the golden standard in the treatment of drop foot is tendon transfer (9). An important aspect of this tendon transfer is the type of fixation, pull out sutures may cause skin problems in patients especially those who have sensory problems. The frequency of this problem has been reported differently in different studies (10). In this study we eliminated this possibility by changing fixation method while gaining good result according to Stanmmore system although, there were some limitation in our study such as lack of a control group, the retrospective nature of the study and small number of cases. The second aspect in this transfer was the location of insertion on dorsal foot. We used 2nd cuniform in the middle of foot to control varus and valgus deformity better. Some studies use 2nd metatarsal bone due to longer lever arm but it need a longer length of tendon (11). Different methods have been proposed to evaluate the results of tibialis posterior transfer like Carayon's criteria (three variables), but we used Stanmore system. In this series because it assesses more variable than other system (12).

Conclusion

Given the satisfactory results with this method and the simplicity of the surgical technique and few complication we recommend this modification for tibialis tendon transfer.

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