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ORIGINAL ARTICLE

Management of Neglected Achilles Tendon Ruptures with Flexor Hallucis Longus Transfer

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ABSTRACT

From July 2000 to July 2012, we have treated 48 cases with neglected Achilles tendon ruptures in Government General Hospital, Kurnool, India, with modified flexor hallucis longus (FHL) transfer. Thirty-three patients had achillodynia and 29 had local steroid infiltration. Thirty-six patients presented with ruptures in hypovascular zone II and, in 31, repair was after 3 weeks, graded as late (Inglis). The patients were managed based on a standardized evaluation and surgical protocol. The technique of FHL transfer was simplified by anchoring the tendon in a vertical transcalcaneal tunnel. The results were evaluated by Quigley's method, 100 point scoring system of Leppilahti, and recently updated with AOFAS hind foot score. The follow-up ranged from 2.5 to 12.2 years. The follow-up suggested that patients with FHL transfer showed significantly lower mean wound healing times and weight-bearing time and functional recovery times when compared with patients who had peroneal transfer, for neglected ruptures. The results are presented, analyzed and discussed.

Keywords: Achilles tendon, Peroneus brevis, Flexor hallucis longus, Tendinosis, Tendon transfer.

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INTRODUCTION

Achilles tendon despite being the strongest tendon in the body is vulnerable to spontaneous rupture due to overload and local pathology. The difficulties in management of neglected ruptures make it one of the challenging problems of present day orthopedic practice.

Treatment of neglected ruptures ranges from conservative management, percutaneous suture and open surgical repair to tendon transfers. The choice is dictated by the type of injury, delay in presentation, tendon condition and surgical expertise. Flexor hallucis longus transfer can overcome many of the problems associated in the surgical technique and postoperative complications and stands as the procedure of choice. The Wapner technique[1,2] is modified and simplified with a transcalcaneal tunnel with no added complications.

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MATERIALS AND METHODS

From July 2000 to July 2012, 48 patients presented with neglected ruptures of Achilles tendon to Government General Hospital, Kurnool. Twenty-nine patients received local steroid infiltration for a painful hind foot, within 1 year from the episode leading to spontaneous rupture. All the patients were subjected to clinical examination, ultrasonographic evaluation and prepared for tendon transfer (6, 10, 11 and 20). The surgical technique consists of transfer of flexor hallucis longus (FHL) tendon as described by Wapner. The Achilles tendon is exposed with slightly medial direct incision. The tendon morphology is studied, the end is debrided. Flexor hallucis longus (FHL) tendon is isolated on the medial side of the foot and is retrieved through the posteromedial Achilles tendon incision. The FHL tendon is interlaced through Achilles tendon as many times as possible, anchoring with 2-0 vicryl sutures. The tendon is centralized in the Achilles tendon stump and is passed in a conical vertical transcalcaneal tunnel to exit out of the middle of the heel, anchored over a gauge bundle with the ankle in 5 to 10° of plantar flexion. A below knee back slab is applied after insertion of suction drain.

The postoperative protocol consists of suture removal at 2 weeks, pull out suture retrieval and full weight-bearing at 6 weeks and gradual return to full function by 12 weeks.

The follow-up period ranged from 2.5 to 12.2 years.

The results were evaluated by Quigley's method[3] and Leppilahti 100-point scoring system[4,5] and from 2004, the American Orthopedic Foot and Ankle Society (AOFAS) hind foot score.[4]

RESULTS

The common cause of rupture was spontaneous associated with some causal activity in 93.75% of patients. Three patients (6.25%) had direct blunt trauma due to hit with a stick over the back of the heel.

The age distribution of the patients is shown in Table 1 and most patients (54.17%) were in the age group of 51 to 60 years. We had only one patient of 26 years age with a neglected rupture.

The common causal activity that led to rupture was stumbling as in 60.14% of patients. Review of the literature suggests that the rupture due to trivial trauma occurs in a tendon which is unconditioned having intrinsic pathological changes.[7,8] Nine patients felt snap at the back of the ankle while jumping down from a low height. The causal activity that led to rupture is shown in Table 2.

The evaluation showed skin changes in 23 (47.92%) patients. The condition of the skin is important for planning the incision and to some extent influences the wound healing. In patients who received local steroid infiltration, the skin was hypopigmented and appeared to have thinned out. Tendon gap was not always palpable and a clear gap of over 3 cm as palpated (32 cases) from outside is indicative of the real gap left in the tendon after debridement and this is one of the reason we feel is a clear indication for tendon transfer in preference to direct suture. The other clinical indicators like increased dorsiflexion at the ankle, weak plantar flexion and a difference of over 20% of calf circumference are indicative of the chronicity of the problem and dictate the need for a dynamic transfer for early functional recovery. The clinical evaluation results are shown in Table 3.

DISCUSSION

Achilles tendon has some anatomical peculiarities which make it different from other tendons.

Table 1: Age incidence

Age	*No. of patients (%) (n = 48)*
21-30	1 (2.08)
31-40	6 (12.5)
41-50	11 (22.92)
51-60	26 (54.17)
Over 60	4 (8.33)

Table 2: Causal activity

Causal activity	*No. of cases (%) (n = 48)*
Playing	1 (2.08)
Running	6 (12.5)
Jumping	9 (18.75)
Stumbling	29 (60.42)
Direct blunt trauma	3 (6.25)

Table 3: Clinical evaluation

Evaluation	*No. of patients (%) (n = 48)*
Skin changes	23 (47.92)
Over 3 cm gap	32 (66.66)
Increased dorsiflexion	29 (60.42)
Week plantar flexion	19 (39.58)
Difference in calf circumference by over 20%	27 (56.25)

It is the strongest tendon in the body and has a spiral configuration, deviating from the line of action as it approaches the insertion. It has no tendon sheath and no retinacula. The vascular supply of the tendon is mostly from the anterior paratenon and ruptures are most common in the hypovascular zone II, an area 3 to 6 cm from the calcaneal insertion (5, 6 and 18).

Spontaneous ruptures are most common in unconditioned tendon. Leadbetter[7] has proposed a tendinosis cycle where a repeated microtrauma in a unconditioned tendon associated with local changes at cellular level and adaptive matrix predisposes to loss of structural integrity leading to complete spontaneous rupture.[7,8]

In our series (n = 48), as many as 33 patients had a previous history of achillodynia,[9,8] which encompasses a broad range of insertional and noninsertional tendinoses.[10] Twenty-nine patients had local steroid infiltration, all within one year of the episode that led to rupture. The causal activity that led to spontaneous rupture was stumbling in 29 cases followed by running in 6. There were three cases of rupture due to direct blunt trauma, hit by a stick.

The patients presented at various times after the rupture, the delay in presentation is attributed to misinterpretation and minimal disability experienced by the patient, missed diagnosis and mismanagement on the part of the treating physician.

On evaluation tendon gap of over 3 cm was palpable in 32 cases. When in doubt, ultrasonographic study is advised to rule out partial ruptures. The clinical tests, like Thompson and Doherty test, O'Brien needle test and Matles test[11], are of immense value in doubtful cases. The other observations include increased dorsiflexion at the ankle in 29, weak plantar flexion 19 and a difference of more than 20% in calf circumference in 27, as the patients had some degree of calf atrophy due to delay in presentation and pre-existing painful tendon pathology. Skin changes, like change in the texture, elasticity and previous scars, should be looked into, as they help the surgeon to plan the incision and procedure, both of which are a matter of less concern in FHL transfer surgery even if the Achilles tendon requires liberal debridement.

Inglis[12] has classified the timing of repair as early if within 3 weeks after rupture (n = 17) and late if over 3 weeks (n = 31). The prognostic validity of timing of repair is guarded as most of the patients present with pre-existing tendon disease and the management options are limited to tendon transfer in preference to direct suture as the suture area leaves an adynamic fibrous zone in the tendon. Though there is anatomical continuity, we feel a dynamic tendon transfer would be best suited for full functional recovery in a shortest possible time.[14,15]

In 1998, open end to end tendon repair was the procedure done at our center for every case, irrespective of etiology. This resulted in large number of wound complications, like wound dehiscence, exposure of the tendon leading to loss of the tendon requiring multiple soft tissue reconstruction procedures with poor functional result.

From late 1998 till the year 2000, peroneus brevis transfer[13,16] was the procedure of choice for neglected ruptures (n = 28), with a share of complications like wound problems, insufficient tendon length compromising the reconstruct and having to immobilize the ankle in excessive plantar flexion which later on reflected as delayed mean weight-bearing times and functional recovery times.

Wapner's technique of Achilles tendon reconstruction with FHL addresses most of these problems by virtue of it being the strongest next only to Achilles tendon, line and phase of action similarity with an added anatomical advantage of length which makes the reconstruction easier.[1,2,19]

Since the year 2000, we have been doing FHL transfer for neglected Achilles tendon ruptures with good results. The critical part in Wapner's techniques is a medial curved tendon passage hole in the calcaneum which is technically demanding associated with possible complications, like medial wall rupture, heel widening and heel varus. This step is modified by us by making a cone-shaped transcalcaneal vertical hole through which the pull out suture exits. The tendon is much in anatomical line and allows interlacing through Achilles tendon for a stronger grip. We have encountered no problems with this procedure except soft heel in one case, presumably due to focal aseptic fat necrosis.

In our series, the observation of mean wound healing times (time for a stable scar) of 1.2 weeks is partly due to medial incision over AT, avoiding excessive equinus position of the ankle due to good tendon length, which would prevent crimpling of skin, a major factor for focal ischemic necrosis of skin. Some of the criteria that serve as prognostic factors for a good outcome, suggested by Turco[13] are suturing the shredded tendon, prevention of lengthening, debridement of ischemic ends, secure fixation and eliminating cast disease. Almost all the criteria are better met in reconstruction with FHL.

Major postoperative complications, like rerupture, severe deep infection, were uncommon. The common complication was delayed wound healing (over 2 weeks) and minor sensory disturbance over the foot in three patients (6.25%) after FHL transfer. Two patients (4.17%) had superficial infection which resolved with antibiotics and local dressings (*see* Table 1). In our earlier patients who had peroneus brevis transfer (n = 26), the figures are slightly higher, superficial wound infection in four (14.28%) and wound healing delayed in eight (28.57%) patients. The complications are shown in Table 4.

Though we had a short series of 28 patients who had reconstruction with peroneus brevis, the mean weight bearing time was shorter, i.e. 6 weeks with FHL transfer when compared to peroneal transfer (7.2 weeks), with early functional recovery. About 78% of the patients with peroneal transfer could bear weight at 6 weeks as against 100% with FHL. Other criteria examined, like walking at 6 weeks, heel lift of 4 cm at 12 weeks and brisk walk at 16 weeks, were all consistently in the range to 80 to 98% in cases with FHL as against 68 to 70% in cases with peroneal transfer. The results of FHL transfer (Table 5) were analyzed by three scoring systems, a objective scoring system by Quigley, 100-point scoring system by Leppilahti modified by Conochi and recently from 2002, by AOFAS hind foot scoring system. We did not have a Cybex dynamometer to test the strength of gastrocsoleus complex. In the AOFAS system, the scores of over 85 were taken as excellent, 70 to 85 were taken as good, 50 to 75 were taken as fair and below 50 was taken as a poor result, for comparison with other scoring systems.

Accordingly, 80.9% of patients after FHL transfer were having over 85 score (AOFAS) as compared to 39.2% with peroneal transfer. However, 48.2% of the patients who had peroneal transfer were in the range between 70 and 85 (n = 28). One patient in either procedure had deep infection which required debridement and secondary procedures like sural flap and the result was graded as poor, much of it is attributed to poor surgical technique in both and poor diabetic control in one patient. We have not encountered any other case of wound dehiscence with FHL transfer and the AOFAS scores were in the range of 100-70 in 90.4% of the patients in present series (n = 48). In a series of

Table 4: Complications

Sl. no	*Complication*	*No. of cases*
1	Rerupture	0
2	Deep infection	0
3	Sensory problems	3
4	Superficial infection	2
5	Delayed healing	3
6	Granuloma	0
7	Scar problems	2
8	Soft heel	1

Table 5: Outcome

Result	*Assessment method*		
	Quigley	*Leppilahti*	*AOFAS*
Excellent	N = 38	27	37 (85-100)
Good	N = 6	12	7 (70-85)
Fair	N = 3	7	3 (50-75)
Poor	N = 1	2	1 (<50)

11 cases treated with FHL transfer, J Wegryn et al from Lyon, France[19], reported the results as improvement in pre- operative AOFAS scores from 64 to 98 in all patients at the latest follow-up at 79 months.

We believe modification of the technique with a vertical transcalcaneal tunnel and attention to some surgical details like generous debridement of the end of Achilles tendon (AT), preserving the anterior paratenon, isolation of FHL after severing the slip to FDL, good interlacing of the tendon through AT, centralization of the tendon in AT, careful closure of the paratenon and minimizing the postoperative ankle equinus are important factors which play a major role in successful outcome.[17]

SUMMARY

Spontaneous ruptures in unconditioned AT are common in zone II,[18,20] an area associated with wound complications. In our institute, FHL is favored over peroneus brevis in gap reconstructions since FHL, by virtue of its anatomical and technical advantages offers the best replacement for neglected ruptures of Achilles tendon. The Wapner's technique is modified to make the tendon passage easy through the calcaneum. In the present study, the functional results are better with FHL than peroneal transfer as measured by various indicators. Newer parameters, like histological studies of excised tendon end to study the structural integrity, ultrasonographic measurements to know the length of tendon and study of the morphological patterns to suggest guidelines for selection of procedure and a comprehensive simplified outcome protocol, are the current working fields at our institute to redefine strategies in management of these complex injuries.

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