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Research Article

Functional Outcome Following Knotless Tendoachilles Repair and FHL Augmentation

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Abstract

Introduction: The achilles tendon is the strongest and largest tendon of the human body and can be exposed to forces six to eight times body weight. The spontaneous ruptures of the achilles tendon are relatively common and are frequently missed.

Materials and Methods: We present a prospective case series of 11 patients of spontaneous tendoachilles rupture treated with speed bridge technique and augmented with flexor hallucis longus tendon transfer from a period of January 2019 to April 2020 operated by a single orthopaedic surgeon.

Results: The mean FAOS score before surgery was 56.5 ± 7.7 (42 -66) and improved to a mean score of 88.2 ± 5.7 (78-96) postoperatively.

Conclusion: Speed bridge reconstruction technique combined with FHL transfer allows stable re- construction and early mobilisation of the patient with good to excellent results.

Keywords: Tendoachilles; Tendoachilles Rupture; Knotless Tendoachilles Repair

Introduction

The achilles tendon being the conjoined tendon of gastrocsoleus complex is the strongest and largest tendon of the human body and can be exposed to forces six to eight times body weight during jumping or cycling and 12.5 times body weight during sprinting activities [1,2]. The vascularityof the tendon varies throughout its length with the poor supply to the mid part of the tendon with 2 to 6 cm from insertion being the poorest area of vascularity and corresponding to the most commonsite of rupture due to hypo-vascularity which may lead to reduced healing of the micro ruptures due to overuse predisposing to degeneration, decreased tensile strength and spontaneous rupture [3-7].

The spontaneous ruptures of the achilles tendon are relatively common and are frequently missed and more difficult to detect with some authors reporting 23 percent of ruptures initially misdiagnosed by the primary physician [8]. This can further lead to issues like retraction, scarformation, calcification and collagen degeneration [9,10]. Diabetes mellitus has not only been implicated as one of the risk factors for early onset of tendinopathy by inducing notable vascular and inflammatory changes within the tendon predisposing to rupture but also a poor treatment prognostic risk factor [11]. Other conditions like inflammatory disorders, genetic collagen disorders, neuro-logical conditions and additional contributions due to decreased blood flow with increasing age have been implicated [12-15]. Corticosteroid injections have been found to increase the risk by causing collagen necrosis and may result in weakening of tendon for as many as 2 weeks [15,16]. Tobacco use can be detrimental for post-surgical wound healing in spontaneous ruptures [17]. All these factors contribute poor tissue quality environment and reduced healing capacity of the tendon thereby making the treatment of spontaneous achilles tendon ruptures demanding. The treatment of spontaneous ruptures is often demanding and requires extensive approaches and meticulous technique with strict adherence to soft tissue preservation. We present a prospectivecase series of 11 patients who were operated for chronic Tendoachilles tears with speed bridge technique and augmented with flexor hallucis longus tendon transfer.

Materials and Methods

We present a prospective case series of 11 patients of spontaneous tendoachilles rupture treated withspeed bridge technique and augmented with flexor hallucis longus tendon transfer from a period of January 2019 to April 2020 operated by a single orthopaedic surgeon. The demographic characteristics of all the patients were noted and the patients were evaluated in terms of clinical features, co- morbidities, addictions (if any) and the time of reporting to the operating surgeon. There were 7 males and 4 females in the study. 8 patients had the rupture on right side. All the patients had spontaneous rupture of the tendon with no history of trauma. 4 patients had hagelund deformity, in addition. 5 patients had a habit of smoking and rest were non smokers. Out of 11 patients, five were diabetics. Three of the patients had received corticosteroid injections. None had any other evidence ofsystemic diseases on history. All the patients had difficulty in walking and pain with activity. One lady patient had pain at rest also. Physical examination was done with patient prone and feet hanging from the examination table and area of tenderness, gaping was noted. Ankle was moved throughfull range of motion passively and strength of plantar flexion was evaluated in all the patients. X- rays and MRI were ordered in all the patients and pre anaesthesia checkup was done. All the patients were treated by speed bridge technique and flexor hallucis longus tendon transfer. The resultswere evaluated by preoperative and postoperative FAOS scoring, done in all patients.

Surgical technique

All the patients were taken under combined spinal epidural anaesthesia in a modified semi-prone in which the upper torso was positioned lateral and the limbs were positioned prone with the affected lower limb prepped and draped in the sterile field under tourniquet control. After marking the skin incision with a sterile skin marker, a 10 to 15 cm posterolateral incision was made and care was taken to preserve the sural nerve, the paratenon was incised in cases where scarring was low, in cases with scarring the paratenon may need to be excised. The tendon was debrided meticulously with removal of diseased tissue visible to the naked eye. After debridement, the tendon was released superiorly with blunt dissection to make it free to reach the insertion footprint and to get an idea whether V-Y Plasty was required or not. In cases with hagelund deformity the bony prominence wasexcised. The Flexor Hallucis Longus tendon was harvested through the same single incision only after identifying and incising longitudinally the fascia of the posterior compartment and by holding the ankle and great toe in maximum plantar flexion, the tendon was harvested as distal as possible as it courses under the sustenculum tali, in a direction away from the neurovascular bundle.After harvesting the tendon a suture with number 2 fibre wire was applied to the distal end of the cut tendon and the diameter of the tendon was measured. A 2.4 mm tenodesis guidewire was insert- ed into the dorsomedial aspect of the calcaneus and reaming was done with a reamer 0.5 to 1mm larger than the tendon diameter. The cut tendon was tensioned and marked at the level of bony tunnel and then another marking was done 25mm distal to the first mark. The remaining tendon was cut and whip stitch was applied to the tendon with fibre loop. The tendon along with suture loop was passed into the tunnel over a bioabsorbable screw inserted flush with the bone. After tenodising the FHL, the achilles tendon was prepared for speed bridge fixation and VY plasty if needed was done. The bone was prepared for insertion of 4.75 mm bio composite swive locks by drilling down to the laser line when using the drill guide and two holes were created about 1 cm proximal to the insertion of achilles tendon. The holes were prepared for swive lock by using the tap. The swive locks loaded with fibre taps were inserted into the proximal holes and the fibre tapes were passed through the achilles tendon proximal stump on each side. The same steps were repeated for drilling and taping the distal holes. Fibre tapes from each proximal anchor was retrieved and preloaded through the distal swive locks and the anchor was inserted when the anchor body contacts bone. After insertion of the distal swive locks, the tails of the tapes were cut flush with the anchor. The paratenon if incised and not excised, was sutured with interrupted sutures and the wound closed in layers after putting suction drain. Below knee slab in plantar flexion was applied and limb was elevated to minimise post operative swelling. The first dressing was done after 48 hours and drain was removed and slab reapplied. The sutures were removed at 2 weeks along with the slab and removable boots applied in neutral position with gentle range of motion exercises started intermittently.

The patients were mobilised with partial weight bearing at 4 weeks and full weight bearing by 6 weeks. The FAOS scores were assessed at 12 weeks post operatively.

Results

There were 7 males and 4 females in our case series with a mean age of 52.7 ± 8 years (39 to 68 years). 5 of our patients had diabetes mellitus and five of our patients were chronic smokers. Four of our patients had hagelund deformity and three had received corticosteroid injections locally, one of them had received two injections two months apart. The mean follow up period was 35.5 ± 6.6 weeks (25 to 47 weeks). The mean FAOS score before surgery was 56.5 ± 7.7 (42 -66) and improvedto a mean score of 88.2 ± 5.7 (78-96) postoperatively. All our patients reported good functional results. One of our cases, a 55-year-old male presented with a surgical site infection which was treatedwith antibiotics and collagen dressings and healed uneventfully. He had nicotine addiction and alsohad received one steroid shot locally before rupture. We delayed weight bearing in this patient for 3 more weeks and he was followed till 34 weeks and was doing well walking full weight bearing and doing all activities of daily living.

S.No.	Age	Sex	Comorbidity And Other Issues	Addiction	Hagelund deformity	Local Steroid Injections	Followup weeks	Pre op FAOS	Post op FAOS
1	39	Male			Present		47	63	90
2	46	Male		Smoker			39	55	88
3	68	Male	Diabetes		Present	Two	43	42	79
4	50	Female	Diabetes				36	58	88
5	56	Male		Smoker			41	62	90
6	47	Female	Diabetes		Present	One	33	51	86
7	49	Female					30	63	95
8	61	Male	Diabetes	Smoker			28	57	88
9	58	Male		Smoker			25	66	96
10	51	Female	Diabetes				35	59	92
11	55	Male		Smoker	Present	One	34	45	78

Table 1

	Mean ± SD (Range)	Median (IQR)
Age	52.7 ± 8 (39-68)	51(47-58)
Follow up (weeks)	35.5 ± 6.6 (25-47)	35 (30-41)

Table 2

	Number of patients (n = 11)	Percent (%)
Gender		
Male	7	63.6
Female	4	36.3
Comorbidities	5	45.4
Addiction	5	45.4
Hagelund deformity	4	36.3
LOCAL STEROIDS		
One	2	18.2
Two	1	9.11
None	8	72.7

Table 3

	FAOS			P- value
	Pre-op.	Post-op	Difference Post-Pre op	
Mean ± SD (Range)	56.5 ± 7.7 (42-66)	88.2 ± 5.7 (78-96)	31.7 ± 2.9	<0.0001
Median (IQR)	58 (51-63)	88 (86-92)	32 (30-33)	0.003

Table 4

Figure 1: Incision.

Figure 2: Ruptured tendon.

Figure 3: Defect measurement.

Figure 4: Hagelund removal.

Figure 5: FHL harvest.

Figure 6: FHL diameter.

Figure 7: FHL transfer.

Figure 8: Swive Lock insertion.

Figure 9: Passing of fibertapes.

Figure 10: Preparation of second row.

Figure 11: Final construct.

Figure 12: Dorsiflexion at 6 weeks.

Figure 13: Plantar flexion at 6 weeks.

Discussion

The treatment of spontaneous ruptures is often demanding and requires extensive approaches and meticulous technique with strict adherence to soft tissue preservation and includes primary repair with defects less than 2 cm, augmentation with either fascia V-Y Plasty or tendon transfers, synthetic or allograft reconstruction. The tendon transfers like peroneus brevis transfer and FDL transfer have been reported in literature with good to excellent results but with peroneus brevis transfer lateral ankle stability and foot eversion can get compromised [18,19]. The flexor hallucis longus tendon transfer was popularised by Wapner., *et al*, who reported good to excellent results in six out of seven patients, and is currently the workhorse of Tendoachilles tendon transfers [20]. The strength of plantar flexion of flexor hallucis tendon is second only to gastrocsoleus with action vector and neuromuscular activation similar to that of tendoachilles which allows good synchronisation in plantar flexion during push off phase of gait cycle while the strength of FDL is 50% and peroneus brevis is 70% that of FHL [21,22]. Patients rarely perceive any loss of hallux flexion strength with flexor hallucis longus sacrifice [23]. The FHL tendon is harvested either by separate distal incisionor through the same incision technique. The separate incision does give an additional length of ten- don but with single incision technique adequate length of tendon for tenodesis can be obtained and it prevents morbidity associated with two incisions. The speed bridge technique has been documented to have good to excellent results in achilles tendinopathy and insertional tendinosis in various studies. The limited incision speed bridge technique has been used to treat tendoachilles tears with promising results and these authors have further recommended to use limited incision techniques for acute tears and those who are not having insertional rupture or tendinopathy [24,25]. In our case series, we have tenodesed FHL tendon anterior to the insertion of tendoachilles and reattached the proximal stump of tendoachilles with the bone using knotless speed bridge system. The combined speed bridge and FHL transfer leads to a strong reconstruction construct, which allows early mobilisation, as it has been documented that early mobilisation and rehabilitation improves the outcome of surgical repair including reduced calf muscle atrophy and earlier return to normal activities, minimise post operative complications and improve outcomes [26-29]. Evidences supporting early rehabilitation protocol imply that repair should be strong enough to win the race between healing and gap forming forces during the process of healing. Cadaveric studies have found speed bridge suture anchor augmented repair biomechanically stronger construct than suture only repair with ability to start early rehabilitation and improved outcomes with suture anchor con- struct withstanding forces of 303.5 ± 102.8 compared to 209.1 ± 48.1 for suture only repair beforefailure [30]. They also hypothesised that knot was the most vulnerable point of failure of suture in repairs, so knotless repair improves biomechanics performance in suture anchor augmented repairs [30]. However, they also suggested that decreased bone mineral density could lead to slippage of construct at the suture bone interface at a lower load [30]. We didn't do a Dexa scan in our patients,neither we encountered such an issue during our follow up. We believe that their findings in cadavers were not found in our patients because cadavers have a demineralised bone mass upto greater extent. The limitations of our study are small sample size and a short follow up period. Further longterm follow up studies are required to understand long term complications of the procedure.

Conclusion

Speed bridge reconstruction technique combined with FHL transfer allows stable reconstruction andearly mobilisation of the patient with good to excellent results.

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