

# TREATMENT OF CHRONIC INJURIES CALCANEAL (ACHILLES) TENDON

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## Abstract

From 2015 to 2019 32 patients (14 men, 18 women), aged 15-65 years, underwent surgical treatment for old Achilles tendon rupture. In all cases correct diagnosis was made not earlier than 1 month after injury and sonographic examination for diagnosis of Achilles tendon rupture is underlined. For the restoration of Achilles tendon V-Y plasty was used. Surgery was performed in a period of 1 to 13 months in patients with subcutaneous Achilles tendon ruptures. Follow-up results of patients in the postoperative period ranged from 6 months to 10 years (mean follow-up 1 year 7 months). Date of observation in the postoperative period ranged from 6 months to 19 years. Marginal necrosis wound occurred in 3 (10%) patients, re-rupture of the Achilles tendon to tendon suture zone - in one patient, even in one patient on day 14 became infected. Violations of the foot innervation were no detected.

## Keywords

rupture of the Achilles tendon,  
ultrasound examination, V-Y plasty

## Өкше (Ахилл) сіңірінің ескі зақымдануларын емдеу

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## Аңдатпа

2015-2019 жж. аралығында 32 науқасқа операция жасалды: ахилл сіңіріндегі ескі зақымдануларға байланысты 15-65 жас аралығындағы 14 ер адамға және 18 әйелге. Барлық жағдайда дұрыс диагноз жарақаттан кейінгі бір айдан ерте емес мерзімде қойылған және барлық жағдайда ультрасонография әдісі арқылы нақтыланған. Ұшын-ұшына тігу арқылы ахилл сіңірін V-Y-ұзарту хирургиялық техникасы қолданылды. Ахилл сіңірінің тері астындағы үзілулері бар науқастарға 1 айдан 3 айға дейінгі мерзімде операциялық араласу жүргізілді. Отадан кейінгі кезеңде науқастарды бақылау мерзімі 6 айдан 10 жылға дейінгі мерзімді қамтыды (орташа бақылау мерзімі 1 жыл 7 ай). Отадан кейінгі кезеңде бақылау мерзімі 6 айдан 19 жылға дейінгі мерзімді құрады. 3 (10%) науқаста операциядан кейінгі жараның шеткі некрозы дамыды, бір науқаста сіңір тігісінің аймағында ахилл сіңірінің қайталама үзілуі орын алды, тағы бір науқаста 14 тәулікте инфекциялық асқину дамыды. Табан иннервациясының бұзылысы анықталған жоқ.

## Түйін сөздер

ахилл сіңірінің үзілуі,  
ультрадыбыстық зерттеу,  
V-Y-пластика

## Лечение застарелых повреждений пяточного (Ахиллова) сухожилия

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## Аннотация

С 2015 по 2019 г. прооперировано 32 пациента: 14 мужчин и 18 женщин в возрасте от 15 до 65 лет по поводу застарелого повреждения ахиллова сухожилия. Правильный диагноз во всех случаях был поставлен не ранее чем через месяц после травмы и всех случаях был подтвержден методом ультрасонографии. Применялась хирургическая техника V-Y-удлинения ахиллова сухожилия со сшиванием конец-в-конец. Оперативное вмешательство выполнялось в сроки от 1 до 13 месяцев у больных с подкожными разрывами ахиллова сухожилия. Сроки наблюдения за пациентами в послеоперационном периоде составили от 6 месяцев до 10 лет (средний срок наблюдения 1 год 7 месяцев). Сроки наблюдения в послеоперационном периоде составили от 6 месяцев до 19 лет. Краевой некроз послеоперационной раны развился у 3 (10%) пациентов, повторный разрыв ахиллова сухожилия в зоне шва сухожилия - у одной пациентки, еще у одного больного на 14-е сутки развилось инфекционное осложнение. Нарушений иннервации стопы выявлено не было выявлено.

## Ключевые слова

разрыв ахиллова сухожилия,  
ультразвуковое исследование,  
V-Y-пластика.

## Introduction

Calcaneal (Achilles) tendon ruptures account for 19-32% of the total number of musculoskeletal system large tendon injuries [8, 18].

Recovery after a rupture of the calcaneal (Achilles) tendon with extreme loads, for example, while playing sports, is an intractable and exclusively surgical task. The relevance of its solution increases in connection with the noted increase in injuries caused, in particular, by sports activities [5].

At the outpatient stage, 20 to 58% of calcaneal tendon injuries are not diagnosed [7]. In this regard, it becomes necessary to perform traumatic and time-consuming surgeries aimed at restoring old damage to this localization. Closed and open suture surgeries of the Achilles tendon in the acute period are not difficult, since there are no problems with eliminating the diastasis of the stumps. The ratio of patients operated on for fresh Achilles tendon injuries (up to 10 days) and chronic injuries, according to our data, is 5: 1 [9].

The low level of diagnosis of Achilles tendon ruptures is associated with the lack of doctors's special skills of the outpatient network. It is not difficult to make a correct diagnosis in the vast majority of cases. It is possible to assume an Achilles tendon rupture from the patient's typical complaints. Some compare their sensations with the blow of a whip from behind on the lower third of the lower leg, others note the crunch of a crushed nut, and still others try to find the one who struck them on the leg. In the first hours after the injury, in many victims of the asthenic and normosthenic body type, it is possible to visually and by palpation determine the retraction of the Achilles tendon in the damaged area. In addition, a simple diagnostic test, the Thompson test, helps to establish the diagnosis of "damage to the Achilles tendon" [22]. The patient kneels on the couch, the legs are horizontal, the feet hang freely from the edge of the couch. The doctor alternately on each of the legs sharply compresses the triceps muscle in the transverse direction in its widest part. In response to a healthy limb, plantar flexion of the foot occurs; on the side of the injury, flexion of the foot does not occur. In this case, positive test and tendon rupture should be discussed.

The most accessible method for diagnosing tendon injuries and diseases is considered to be ultrasound examination [2, 20]. Sonography not only helps the clinician to make a diagnosis in a timely manner, but also allows to assess the effectiveness and correctness of the surgical intervention. In addition, with the help of the ultrasound method, it is possible to assess the stages of tendon recovery and timely identify complications that have arisen in the postoperative period. Paying tribute to the

informative value of ultrasound research, it should be noted that there is a rather high frequency of erroneous interpretations of data obtained in the process of echolocation by specialists in ultrasound diagnostics. This leads to an underestimation of the tendon rupture degree and, as a consequence, to the wrong choice of treatment method and an increase in the number of patients seeking help at a later date. Sufficient experience of the researcher and the high class of the equipment used allows avoiding mistakes.

To restore the Achilles tendon anatomical integrity, a number of surgical methods are used, such as cutting out various flaps of the calcaneal tendon proximal stump, transposition of the peroneal muscle tendons, moving the long flexor tendon of the first toe, cutting out flaps from the thigh wide fascia.

One of the methods of Achilles tendon old injuries surgical treatment of is V-Y lengthening with end-to-end stitching. This method was first proposed and used in 1975 and is still widely used abroad [10, 19]. In Russia, the popularity of this method is low. In our country, the plastic of the heel tendon according to A.V. Chernavsky [8], despite a number of described negative parameters and proposed new methods [6].

The aim of the study was to evaluate the effectiveness of using Achilles tendon V-Y plastics with end-to-end stitching in case of its chronic injuries.

## Material and methods

From 2015 to 2019, 32 patients were operated on: 14 men and 18 women aged 15 to 65 years. The average age was 46.6 for men and 50.4 for women. The diagnosis in all cases was confirmed by ultrasonography. The study was carried out on ultrasound scanners iU22 (PHILIPS MEDICAL SYSTEMS) and ALOKA ProSound Alpha 10 (Aloka) using sensors with a frequency of 5-12 MG.

The operative technique of Achilles tendon V-Y lengthening with end-to-end stitching is as follows. A large S-shaped incision of the skin and subcutaneous tissue penetrates to the fascia of the triceps muscle of the leg (m. triceps surae) and opens the distal third of this muscle, areas of the small saphenous vein (v. saphena parva) and the sural nerve (n. suralis). This wide access makes it possible to fully verify the anatomical structures and to visually determine the state of the damaged heel tendon ends.

In the zone of gastrocnemius muscle transition (m. Gastrocnemius) into the tendon extension, from the fibers of which the posterior portion of the calcaneal tendon is formed distally, a dissection is made along the edge of this formation (Fig. 1) and parts of individual strands that go into the depth of the muscle. We call this action V-mobilization and we perform it against the background of constant

traction for the proximal end of the tendon towards the calcaneus.

In the anterior part of the calcaneal tendon, as we conventionally believe, fibers coming from the perimysium of the soleus muscle (m. soleus), which does not have such a tendon extension as the digastric muscle, are interwoven, which allows the formation of a "retractable" flap. Sometimes this reduction can be significant (up to 6-7 cm) and extend to the calcaneal tubercle. In four clinical observations of our study (1 man and 3 women), this retraction ended with a transosseous suture. Bearing in mind that the tendon breaks during traction violence and looks morphologically the same as a rope or cable (Fig. 2), which requires the obligatory excision of the fiber ends, the tendon proximal end is cut off transversely until the capillary bleeding, the so-called "bloody dew" (Fig. 3). This is a reliable sign of reaching the blood supply part of the tendon. The distal end is cut off according to the plane of the proximal incision. With transosseous fixation, it is desirable to obtain capillary bleeding from the abrasively destroyed area of the calcaneal tubercle. Measurement of diastasis between the resected tendon ends is performed when the limb is bent at the knee joint to an angle of 160-170 ° (the position of the maximum weakening the triceps of the lower leg). To connect the tendon ends end-to-end, a Kuno or Kessler suture is used with additional separate U-shaped sutures. The area of the sending incision of the tendon stretch is sutured with separate sutures to form a Y-joint (Fig. 4). Such a seam is considered the most optimal for restoring the subsequent function [11]. Additional strengthening by means of tendon transposition was not used. The surgery was completed by closing the skin access using Donati-Algoвери sutures.

Neuraxial anesthesia (SMA) in combination with local anesthesia was used in the operation area, to anesthetize patients during the surgery.

The follow-up period for patients in the post-operative period ranged from 6 months to 10 years (average follow-up period 1 year 7 months).

## Results and discussion

Surgical intervention was performed within 1 to 13 months in patients with subcutaneous Achilles tendon ruptures. Attention is drawn to the high average age of the observed patients. As mentioned above, it was 46.6 years for men and 50.4 for women. This, in our opinion, can be explained by the more common chronic degenerative changes in the Achilles tendon in the age group over 45, for which many patients underwent local injections of hormonal drugs (dipropan, kenalog). In addition, in patients over 55 years of age, motor activity is usually low, as a result of which the requirements for



**Figure 1.** Scheme of a V-shaped incision at the border of the tendon-muscular junction and excision of the tendon stumps

the range of physiological capabilities of the lower leg and foot are reduced. In young active people, the diagnosis of damage to the calcaneus is carried out in a timely manner, the suture is performed in the acute period, and there is no need to use special techniques to eliminate diastasis.

In our study, an ultrasound study was used to diagnose the Achilles tendon injury. This method was used in all patients. The diagnosis of "chronic rupture of the Achilles tendon" was correctly established in all cases. The difference in the size of diastasis of the damaged tendon ends revealed during sonography and surgical intervention, amounted to 1 cm. Thus, we can confidently state that ultrasound

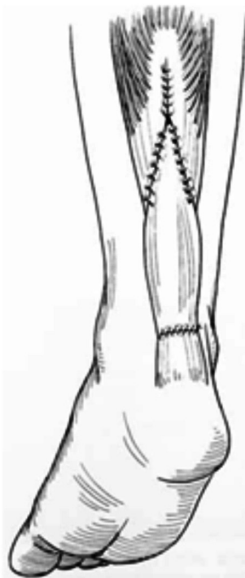


**Figure 2.** Determination of the tendon defect after damaged part excision; the tendon of the plantar muscle and the Achilles tendon stump is visible



**Figure 3.** Tendon stumps are excised to bleeding tissue

**Figure 4.**  
Scheme of the state after  
the tendon lengthening  
and suturing its ends



**Figure 5.**  
Sonogram: Achilles tendon  
chronic damage. In the  
diastasis area (diastasis is  
about 4 cm), scar tissue is  
visualized in the form of a  
heterogeneous hypoechoic  
structure (arrows)



examination is a high-precision diagnostic method for Achilles tendon injuries, and it can be successfully applied at the prehospital stage in patients with suspicion of this type trauma. We admit that in non-specialized clinics, the indicators of ultrasound diagnostics of Achilles tendon injuries may not be so accurate, so we will share our experience.

In order to avoid possible errors in chronic Achilles tendon injuries, the researcher should pay attention to the following features. The tendon ends are degeneratively changed, often thinned, the damaged tendon loses its characteristic fibrillar striation, its echogenicity is reduced, which determines poor differentiation from the surrounding tissues (Fig. 5). In addition, in the zone of injured Achilles tendon diastasis, the intact tendon of the plantar muscle is often visualized, which is mistaken for an intact portion of the Achilles tendon, and sometimes for the tendon itself. To avoid misinterpretation of the received ultrasound image, it is imperative to perform a test with passive plantar flexion of the foot. Even with old injuries, despite the cicatricial process in the diastasis zone and around the tendon ends, the damaged ends will

diverge during the test, the distance between them will increase, and it will be easier for the researcher to understand the ultrasound picture. In addition, it is useful to conduct a sonography with a transverse location of the transducer from the point of attachment of the Achilles tendon to the calcaneal tuberosity to the tendon-muscle junction. In this projection, the difference between the structure of the damaged tendon ends and the structure of the scar tissue located in the diastasis zone is more clearly visible. The plantar tendon is always located along the medial edge of the tendon and must also be traced proximally in a transverse view. The Achilles tendon in the lower third of the leg passes into the gastrocnemius muscle, the tendon-muscular junction of the plantar muscle is located much higher - at the level of the upper third of the leg. In addition, the researcher should alert the revealed unchanged tendon structure with clinical symptoms of the Achilles tendon pathology.

For successful surgical treatment, let us note some of the features of the anesthesiological aid used by us during the surgery. Traditionally, spinal anesthesia (SA) is used to anesthetize patients during surgery using isotonic anesthetic solutions. A significant drawback of this technique, in our opinion, is an unreasonably extensive and unclaimed sympathetic and motor block of the lower extremities from the pelvic level. In addition, SA has a short period of effective postoperative pain relief. To reduce the area of anesthesia and increase its effectiveness, we use SA with the use of Marcaine Spinalheavy 0.5% at a dose of  $12.5 \pm 2.5$  mg. The position of the patient is on the side of the operated limb with an exposure of 5 minutes.

Modern postoperative anesthesia of patients is carried out multimodal, which makes it possible to influence the blockade of pain impulses at different levels [4, 23].

To potentiate and prolong the analgesic effect in the postoperative period, local infiltration of the wound edges should be performed after the end of the operation [12]. For this purpose, ropivacaine 0.75% was used at a dose of  $30 \pm 10$  ml or markain 0.5%  $25 \pm 5$  ml. Infiltration was performed with the obligatory aspiration test. Dexamethasone 4–8 mg was added to the anesthetic solution to relieve postoperative edema. Immediately after the end of the operation, NSAIDs (ketoprofen 200 mg / day) were used in the absence of individual contraindications. Narcotic analgesics (promedol) were prescribed at the request of the patient. Our experience shows that the need for narcotic analgesics is more than halved, which demonstrates the opioid-saving effect and a decrease in the toxicity of opioid use [1, 3].

In the postoperative period, we used immobilization with an anterior longitudinal bandage "foot - lower leg" for 6 weeks with physical therapy from the 4th week. In some patients, S.V. Russkich functional splint was used for the same purpose, which allows you to gradually bring the foot to the right angle position [7]. The knee joint was not fixed, allowing movement in it from the 2-3 day after the operation. Upon reaching a dorsal flexion of 90 °, the patient began to load the foot.

The follow-up period in the postoperative period ranged from 6 months to 10 years. In the early postoperative period, the marginal necrosis of the postoperative wound should be noted, which developed in 3 (10%) patients, which required free skin grafting in 2 patients. We associate this with the errors of the previously used access, which led to overstrain and disruption of the blood supply to the suture zone after restoration of the tendon. It should be noted that the development of marginal necrosis in the early postoperative period is one of the most common complications in reconstructive operations on the Achilles tendon. In the articles devoted to various methods of restoring the anatomical integrity of this tendon in chronic injuries, information on the incidence of postoperative complications is extremely scarce. However, the authors note that marginal necrosis is often found during reconstructive surgery on the Achilles tendon, and plantar flexion of the foot up to 20 ° is necessary as a preventive measure in the postoperative period, since in this position the vascularization of the surrounding soft tissues is maximal [19]. We also consider this position of the foot to be neutral, not leading to the appearance of areas of tension in the skin and, accordingly, vascular spasm.

Another complication often encountered during reconstructive operations is the repeated rupture of the Achilles tendon in the tendon suture zone in the postoperative period. During the entire observation period, this type of complication was encountered in one patient. Re-injury occurred at the time of a sharp load on the foot, when the patient fell on the operated leg a month after the operation, accidentally slipping. Secondary surgical debridement of the postoperative wound edges was performed with restoration of the integrity of the tendon and skin. Later, the rehabilitation period was successful. The observation period for the patient was 6 months. In our opinion, in order to avoid repeated rupture of the Achilles tendon in the stitching zone, it is necessary to carry out the rehabilitation period with great care and not to rush to move the foot to the position of dorsiflexion up to 90 °. Rehabilitation of operated patients in our study began 1-1.5 months after surgery.

M.R. Carmont [14] reports about 9% of infectious complications after reconstructive operations on the Achilles tendon. In our study, we noted only one such case (3% of the total number of patients), the complication developed on the 14th day after the operation. The patient was operated on 13 months after receiving a subcutaneous rupture of the Achilles tendon. While performing V-Y plasty, an almost complete absence of muscle tissue extensibility was found due to significant fibrous degeneration of the triceps muscle of the leg, which did not have such a long term of contractile function and adequate blood supply. The intervention was performed with technical difficulties, the postoperative scar was formed initially, after the removal of the stitches, the patient was discharged for outpatient treatment. The doctor of the polyclinic during dressing, removing the crust over the skin scar, revised the epithelialization zone using a hemostatic clamp. A month after the first operation, the patient was hospitalized with a developing fistula in the area of the postoperative scar. After a secondary surgical debridement, the wound closed.

In the postoperative period, none of the patients we operated on had any disturbances in the innervation of the foot.

As an example, we give the following clinical observation.

Patient R., 67 years old, was injured 4 months before going to the clinic. She stumbled on the street, felt a sharp pain in the lower leg. I compared it with an electric shock to the leg. In the clinic, the diagnosis was made: a partial rupture of the left Achilles tendon. Was treated functionally in an elastic bandage with limited load for 6 weeks. 2 months after the injury, she stumbled again, felt pain in the same leg. The next day, a massive bruise appeared in the lower third of the lower leg. The clinic again diagnosed a partial rupture of the Achilles tendon, prescribed physiotherapy, there was no immobilization. Then, for two months, periodically, against the background of a constant pain syndrome, smaller bruises appeared, which was accompanied by swelling of the lower leg and lameness. I applied for a consultation on my own. On examination, the strength of the injured leg is reduced, there is moderate edema and retraction in the zone of rupture of the calcaneal tendon. Thompson's symptom is positive. Active movements in the ankle joint are reduced. Operated 4.5 months after injury. The tendon defect after excision of scar tissue was 5 cm. Under conditions of adequate anesthesia and muscle relaxation, V-Y plasty of the left Achilles tendon was performed with an end-to-end suture. The anterior plaster cast was applied in the equinus position of the foot. Primary wound healing, the sutures were removed on the 14th day after

the operation. Classes with an instructor began 5 weeks after the operation, the immobilization was finally removed 2 weeks after the start of exercise therapy. She was discharged for work 2 months after the operation. Control examination 13 months

after the intervention: there is no edema, the zone of the tendon regenerate is thickened, painless, the range of motion in the ankle joint is comparable to the intact limb, as well as muscle strength. Able to stand on toes, no limp.

## References

1. Krasnov A.F. Shoulder dislocations / A.F. Krasnov, R.B. Ah-medzyanov. - M.: Medicine, 1982. -- 160 p. (in Russian)
2. Lazko F.L. Treatment of patients with traumatic and degenerative-dystrophic pathology of the knee and shoulder joints using a holmium laser for arthroscopy: Author's abstract. dis ... Dr. med. sciences. - M., 2004. - 35 p. (in Russian)
3. The use of holmium laser in the surgical treatment of habitual dislocation of the shoulder: Study guide / Comp.: N.V. Zagorodny and others - M.: RUDN, 2004. -- 22 p.
4. Benedetto K.P. Arthroscopic Bankart procedure by suture technique: indications, technique, and results / K.P. Benedetto, W. Glotzer // Arthroscopy. - 1992. - Vol. 8, N 1. - P. 111-115.
5. Russkih S.V. Lechenie povrezhdenij ahillova suhozhilija (Kliniko-funkcion. issledovanie) [Avtoref. dis. ... kand. med. nauk]. N. Novgorod; 1998. 24 s.
6. Travmatologija: nacional'noe rukovodstvo. M.: GJeO-TAR-Media; 2008. 804 s.
7. Ključevskij V.V. Hirurgija povrezhdenij. Jaroslavl': DIA-press; 1999. 646 s.
8. Abraham E, Pankovich A.M. Neglected rupture of the Achilles tendon: treatment by V-Y tendinous flap. J Bone Joint Surg. Am 57:253-255, 1975.
9. Ademoglu Y, Ozerkan F. Reconstruction of skin and tendon defects from wound complications after Achilles tendon rupture. J. Foot Ankle Surg. 2001;40(3):158-165.
10. Barouk L.S. Forefoot reconstruction. 2nd ed. Springer; 2006. 360 p.
11. Calhoun J.H. Delayed repair of the Achilles tendon. In: Johnson K.A. Master techniques in orthopaedic surgery. 1sted. New York: Raven Press, 1994.
12. Carmont M.R., Maffulli N. Less invasive Achilles tendon reconstruction. BMC Musculoskelet. Disord. 2007;8:100.
13. Hattrup S.J., Johnson K.A. A review of ruptures of the Achilles tendon. Foot Ankle. 1985;6:34-38.
14. Inglis A.E., Scott W.N., Sculco T.P., Patterson A.H. Ruptures of the tendo achillis. An objective assessment of surgical and non-surgical treatment. J Bone Joint Surg. Am. 1976;58(7):990-993.
15. Justis E.J. Jr. Traumatic disorders. In: Crenshaw A.N., ed. Campbell's operative orthopaedics. 7th ed. St. Louis: CV Mosby; 1987. Vol. 3: 2226-2233.