INTRODUCTION

Despite being the body's strongest tendon, the Achilles tendon is susceptible to spontaneous rupture because of overuse and local pathologies. Neglected ruptures are one of the complex problems facing current orthopedic practice because of the difficulties in managing them. The largest tendon in the body, the Achilles tendon, is composed of a conjoined tendon from the gastrocnemius and soleus muscles. This triceps surae muscle group contracts explosively, usually leading to an Achilles tendon rupture. The watershed region, which is 5 to 7 cm from the point of calcaneal insertion, is where the rupture commonly happens.

The typical definition of a neglected Achilles tendon rupture (ATR) is a rupture with a delay of more than 4 weeks before assessment or treatment. The treating surgeon must use additional techniques if an end-to-end repair cannot be made by just plantarflexing the foot, regardless of how long it has been since the rupture. Compared to patients with an acute rupture, those with a neglected AT rupture have a higher propensity to experience complications and slightly worse functional outcomes. Achilles tendon rupture is a common tendon injury among both qualified athletes and the general population who occasionally participate in sports due to the rise in sports activities. It occurs most frequently in middle age. However, those who are elderly and inactive may get discrete ruptures. These are typically missed and subsequently develop into chronic conditions. At the site of the chronic rupture, there may be a palpable dell or a palpable bulbous mass, which are clinical findings of the neglected Achilles rupture. Increased dorsiflexion and weakening on the ruptured side can be seen when comparing the ruptured side to the contralateral limb. In the prone position, a side-by-side comparison reveals that the ruptured side is more dorsiflexed at resting tension, similar to an acute rupture. The ruptured side is more dorsiflexed, while the patient is prone with the knee flexed to 90 degrees.

Treatment of neglected ruptures ranges from conservative management, percutaneous suture and open surgical repair to tendon transfers. When more than 50% of the tendon width needs to be removed, tendon transfers provide an effective treatment option for augmentation of the Achilles tendon debridement. In the literature, many different strategies have been reported. The most popular surgical...
technique is the transfer of the flexor hallucis longus (FHL) tendon, which offers several benefits, including anatomical proximity to and alignment with the Achilles, relatively higher tissue strength, and in-phase muscle contraction with the gastrocnemius-soleus complex. The outcomes of an achilles tendon operation depend on some variables, including age, muscle-tendon flexibility, strength, and rupture site. We are particularly interested in muscle-tendon flexibility and calf muscle strength. 

Muscle size and strength in immobilized limbs decrease, although strength per unit of cross-sectional area either stays similar or decreases. The isokinetic strength of the calf muscle typically does not fully recover following surgical repair of an ATR, instead exhibiting an 8% to 20% deficit compared to that of the uninjured leg after mid-term to long-term follow-up. Previous research has demonstrated that the triceps surae muscle has volume atrophy and fatty degeneration.

This case report features a case of a 30 years old female with 3 months of neglected achilles tendon rupture managed operatively by tendon repair with FHL tendon transfer. We present the radiological finding, intraoperative intervention and evaluation during the follow-up of this case.

CASE ILLUSTRATION

A 30-year-old female presented to the orthopedic outpatient of General Hospital Prof. Dr. I.G.N.G. Ngoerah, with the chief complaint of pain in the back of her left ankle and was unable to lower the soles of his left foot. The pain was continuous, getting worse with activity and relieved by rest. The patient said that 3 months before outpatient, she landed in the wrong position while playing badminton. She tried to do a smash while jumping, then landed with the sole of her left foot on the dorsiflexion position and felt like she snapped on the back of her left ankle. Currently, the patient is mobilized with 2 crutches with difficulty moving her left ankle. The patient had no history of systemic illness or other medical problems before. History of getting a traditional massage but showing no improvement.

On physical examination ankle, alignment was normal, the left calf muscle and the Achilles being atrophied with the gap at the Achilles region, while no swelling was found. Their tenderness felt on the back of the ankle and a palpable gap over her left Achilles tendon. Normal sensory function and palpability of artery dorsalis pedis with normal capillary refill time. The active range of movement of the ankle when dorsiflexion was 20° but the patient could not do the downward movement of the ankle with 0° plantarflexion. A special test was done with Simmond and Thompson Test with a negative result on the left ankle.

A left ankle x-ray with AP, lateral and
The patient was then diagnosed with neglected, left Achilles tendon rupture. This patient evaluated by questionnaire with AOFAS score value 50 points and ATRS value 41 points.

The patient in the supine position, then a posteromedial incision of approach to the ankle was done. Fibrous tissue and calcification of the Achilles tendon were found. Excision of fibrosis tissue is carried out, and obtained a Gap of 5.5 cm. Performed tendon transfer from FHL on the Achilles Tendon gap. Followed by suturing the Achilles tendon using Ethibond 2.0 for core suture and repair with the Krakow technique. End to side anastomosis FHL distal to Flexor Digitorum Longus (FDL). The intraoperative evaluation showed that passive ankle movement could reach 10 degrees of dorsiflexion. The patient was then immobilization with casting to prevent dorsoflexion on her left ankle.

To evaluate the functional outcome of tendon repair and FHL tendon transfer in this patient, we did an objective measurement with a multi-item scoring scale in outpatient follow-up 3 months post-operative. From the objective measurement, we found differences in muscle calf circumference preoperative and post-operative with measured left calf muscle by 28,2 cm preoperatively to 25,6 cm postoperatively and right calf muscle (normal side) by 29,0 cm preoperatively to 28,8 cm postoperatively. There was an improvement in active ROM ankle plantarflexion on the affected side from 0° preoperatively to 30°. We also evaluate calf muscle strength at 3 months post-

![Figure 4. Left Ankle MRI T1 Coronal View](image)

![Figure 5. Left Ankle MRI T1 Axial View](image)

![Figure 6. Intraoperative durante expose of left achilles tendon showed a gap between tendon end](image)

![Figure 7. Performed tendon transfer from FHL Tendon. End to side anastomosis to FDL tendon.](image)
CASE REPORT

operative by single heel raise test with a positive value where the patient can lift the heel 2 cm once while keeping the knee straight above the floor. Another tool we use to evaluate ankle functional outcome was the ATRS questionnaire with a value of 80 points and AOFAS ankle-hindfoot with a value of 91 points. Good compliance of the patient. No pain felt while doing the daily activity, and no support was needed in her mobilization.

DISCUSSION

For most orthopedic surgeons, treating chronic ATR is challenging.\cite{9} Although chronic Achilles tendon rupture is common, it is frequently misdiagnosed. A recent study found that neglected Achilles tendon ruptures can develop clinically at a rate of up to 20–25%.\cite{9, 10} In non-top-level trainees and elite athletes, these injuries usually happen in the third or fourth decade of life.\cite{4} As early as 3 to 4 days, the gastrosoleus muscle complex begins to contract. Reconstruction is recommended if the condition is not treated right away and the tendon defect is greater than 2 cm.\cite{10}

About 20 years ago, FHLT transfer was used to treat chronic Achilles tendon rupture for the first time. It had grown to be used widely in tendon stump reconstruction.\cite{9} The FHL is ideal for Achilles tendon replacement. Additionally, the FHL tendon has a low morbidity rate and is often the largest of the available local tendons in terms of size.\cite{2} There was no difference in pressure beneath the first metatarsophalangeal joint following the transfer of the FHL tendon, nor was there a clinically significant functional change immediately noticeable following harvest.\cite{11} FHL transfers have several advantages. Despite having other tendons, it is the most accessible, has appropriate strength compared to other local tendons, is located in the posterior group, is available by a single incision using a short harvest procedure, and appears to have suffered just a minor loss in first ray strength.\cite{2}

Good results with this technique have been reported in much literature, with AOFAS scores ranging from 86 to 98.3 points.\cite{12} Our case shows an excellent functional outcome after surgery with AOFAS score 91 and ATRS was 80 points. According to a study by Frederick Hanh, the overall results of their patients are equivalent to those of other FHL augmentation studies. The AOFAS score was 92 points on average. The AOFAS score is weighed toward the patient’s pain situation, which is extremely good following FHL augmentation, with a possible 40 of a total of 100 points for pain.\cite{13} In a different study, Raghunandan discovered that after FHL transfer, 80.9% of patients had an AOFAS score of 85 or higher compared to 39.2% after peroneal

Figure 8. Suturing the Achilles tendon using Ethibond 2.0 for core suture and repair with the Krakow technique. Gap repair with tendon transfer approximately 5,5 cm long.

Figure 9. Left calf muscle atrophy with 30° active ankle plantarflexion.

Figure 10. Positive single heel raise test on the left ankle
transfer. Major post-operative issues, including rerupture and serious deep infection were relatively rare. In 6.25% of patients, the most frequent complication was delayed wound healing, which took more than two weeks, along with modest sensory disturbances across the foot. In 4.17% of patients, a superficial infection was treated with antibiotics and local dressings. The same outcome is demonstrated in another study by Benitez, where he used 28 patients who had surgery for FHL transfer and Achilles tendon debridement. The mean AOFAS was 85.3 after a mean follow-up of 37 months; 82.1% of the patients also experienced good or outstanding results. Xu Yangbo et al. report statistically significant improvements in AOFAS and ATRS scores from preoperative to post-operative in 18 patients, with AOFAS scores of 94.4 (87-100) and ATRS scores of 89.6 (72-98) at the last follow-up visit.14

Following an Achilles tendon rupture, patients have reportedly shown a lengthening of the repaired tendon and limitations in joint range of motion (ROM), calf muscle strength, endurance, and tropism. Recent studies on tendon tissue and cells have shown how crucial inflammation and lipid infiltration are to the onset of tendon illness, emphasizing muscle damage. Even years after an Achilles tendon surgery, the gastrocnemius has clinically shown signs of muscular atrophy and fatty infiltration, both of which are associated with poor functional outcomes. Nevertheless, despite several clinical investigations have noted muscle degeneration following ATR, most evaluations place a greater emphasis on tendon regeneration than on the subsequent muscle degeneration.4

Calf muscle circumference is evaluated to assess changes in muscle trophic properties upon rupture and during recovery. The many methods for measuring this parameter are described. While other authors report circumference values manually measured at specified points related to bone landmarks, some writers suggest CT or MRI measurement technique.15

In this case, we found an improvement of ankle plantarflexion and VAS score, an objective measurement of the calf muscle circumference was carried out to find a difference in the size of muscle atrophy on the affected side compared to the normal side both before and after surgery. The slowness of recovery after immobilization-induced atrophy contrasts with the considerably faster recovery following muscular damage, where muscle fibers regenerate from satellite cells and have greater growth potential. Growth may occur while recovering from immobilization-induced atrophy in mature fibers, which need considerably stronger stimulation to grow back to their initial size. In addition to the functional outcome, a study by Nordenholm discovered that one year after surgical repair, the injured side of 22 patients with chronic Achilles tendon rupture had a smaller calf circumference than the healthy side. The injured Achilles tendon had also elongated. The injured leg showed an 11% to 13% lower triceps surae muscle volume than the healthy leg, according to another study by Heikkiken. The 5% hypertrophy of the FHL partially offsets the atrophy of the soleus and gastrocnemius muscles. Gastrocnemius and soleus muscle atrophy, as well as the difference in Achilles tendon length, all significantly linked with the lack of plantar strength.5

They also discovered a strong association between calf muscle volume and isokinetic plantar flexion strength of the ankle in calf muscle atrophy. A long-term investigation also demonstrated that FHL hypertrophy partially restores plantar flexion strength. However, another study by Moller et al. shows that the relationship between calf muscle circumference and calf muscle strength and endurance following ATR is poor.17 The rehabilitation of calf muscle endurance is probably influenced by some factors, including pain, gender, and physical functioning. An important early indicator of delayed recovery of calf muscle endurance may be poor pain control during early therapy. Last but not least, men might recover differently from women and have a poorer return of calf endurance a year following surgery.18 To evaluate muscle strength in this case, we get a positive result by performing a single heel raise test. However, according to the research by Olsson in 81 patients, the heel-rise test revealed that 49% of patients could not perform a single heel-rise in the 12 weeks following ATR. Additionally, they discovered that at 12 weeks, patients who could complete a heel-rise had greater levels of physical activity, scored higher on the ATRS and all FAOS subscales, and were significantly younger and more frequently male.19

Due to the delay in initial diagnosis and therapy, patients may experience greater atrophy and strength loss in the lower leg muscles than those receiving early treatment. This may result in a prolonged recovery period, and full recovery may not be achieved for one year following surgery. Additionally, the Achilles tendon healing may progress more slowly because to differences in preoperative tendon state, surgical techniques, and post-operative rehabilitation procedures between individuals with chronic and acute cases. As a result, rapid rehabilitation is currently more frequently used in patients with chronic Achilles tendon rupture than it was.16,17

The goal of rehabilitation is to regain muscle size and strength. Muscular and neural adaptation is crucial to this process. Strength training induces adaptive changes in the brain system that result in a bigger increase in force than muscle size. These changes include enhanced prime mover muscle activation, improved coordination, and learning. Early increases in voluntary strength are primarily related to neural adaptation, but later stages of lagging may only be related to muscle adaptation.7,18 Future rehabilitation programs should focus on recovering calf muscle strength early in recovery. It’s important to address any fear of movement and exercise, especially in the beginning phases of the recovery process.19

CONCLUSION
Achilles tendon rupture frequently occurs nowadays due to high-level training and exercise. In some cases, an achilles tendon rupture can be misdiagnosed and then become neglected or chronic achilles tendon rupture, which is more challenging in treatment and patient recovery. FHL tendon transfer is a widespread technique for reconstruction and replacing the achilles tendon, which commonly becomes a gap in chronic or
neglected cases. Unfortunately, some complications are unavoidable because a long immobilization will induce calf muscle atrophy, strength and endurance. Therefore, in managing neglected cases of achilles tendon rupture, a combination of good operative technique and rapid rehabilitation was recommended to gain good functional outcomes for the patient.

ACKNOWLEDGMENTS

The authors would like to thank the Foot and Ankle Division of Orthopaedic and Traumatology Department, General Hospital Prof Dr. I.G.N.G. Ngoerah, Denpasar, Bali for the opportunities and guidance that has been given in writing this research.

CONFLICT OF INTEREST

The authors stated that there is no conflict of interest in writing this article.

ETHICAL CONSIDERATION

The authors had gained consent from the patients to publish his case in an academic journal without revealing any personal identity for academic purposes.

FUNDING

None.

AUTHOR CONTRIBUTION

All authors contributed equally to this article.

REFERENCE