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Diagnosis, management and post-surgical rehabilitation of an Achilles tendon rupture: a case report

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Chiropractors, as primary contact practitioners, assess a wide variety of musculoskeletal related complaints. Among these, a certain percentage of patients, generally small, will present for assessment and treatment of extremity injuries. Spontaneous Achilles tendon rupture (ATR), although a relatively common extremity injury, can sometimes present as a clinical diagnostic challenge. Failure to establish an early diagnosis and immediate referral for further assessment and appropriate rehabilitation can impair recovery, decrease functional capacity and increase the rate of re-rupture. The author presents the case of a 25-year-old male presenting to a chiropractic office for assessment, treatment and rehabilitation of an acute left ATR. Physical examination characteristically reveals swelling, tenderness, loss of true gastrocnemius and soleus resisted plantar flexion, weak or absent Achilles reflex, a palpable gap in the tendon and a positive Thompson test. The challenge associated with the diagnosis of an ATR is discussed. The debate surrounding surgical versus conservative management of this condition is compared. Chiropractic treatment, case management and rehabilitation protocols are reviewed and highlighted.
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KEY WORDS: Achilles, tendon, rupture, rehabilitation, chiropractic.

Les chiropraticiens, étant des praticiens de premier contact, évaluent une grande variété de symptômes musculosquelettiques. Un certain pourcentage, généralement faible, des patients ayant ces symptômes se présente pour l'évaluation et le traitement d'une blessure aux extrémités. Le diagnostic de la rupture spontanée du tendon d'Achille (RTA), bien qu'il s'agisse d'une blessure relativement fréquente, peut parfois être difficile en clinique. L'échec de l'établissement d'un diagnostic précoce et de l'orientation immédiate du patient vers un spécialiste pour obtenir une évaluation plus poussée et un programme de réadaptation approprié peuvent nuire à la récupération, diminuer la capacité fonctionnelle et augmenter le taux de nouvelle rupture. L'auteur examine le cas d'un homme de 25 ans qui se présente dans le bureau d'un chiropraticien pour l'évaluation, le traitement et la réadaptation d'une RTA aiguë au pied gauche. L'examen physique révèle les traits caractéristiques suivants : œdème, sensibilité au toucher, absence de flexion plantaire lors de la pression du complexe soléaire-gastrocnémiens, absence ou faiblesse du réflexe achilléen, trou perceptible dans le tendon et manœuvre de Thompson positive. Le présent article décrit la difficulté de poser un diagnostic de RTA. On y fait la comparaison entre le traitement chirurgical et le traitement conservateur de cette blessure. De plus, on examine et met en valeur les protocoles de traitement chiropratique, de prise en charge et de réadaptation.
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MOTS CLÉS : Achille, tendon, rupture, réadaptation, chiropratique.

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Introduction

Kelner et al. found that the average chiropractor in practice was exposed to 5.5% of extremity complaints with respect to their entire practice.[1] The National Board of Chiropractic Examiners, in their 1994 Job Analysis of Chiropractic, reports that Achilles tendon rupture (ATR) are a frequently seen extremity injury.[2] It is estimated that approximately 25% of ATR's may be overlooked at first presentation.[3,4] Early, accurate diagnosis and subsequent referral for prompt medical management improves the likelihood of complete recovery. As such it is important that patients presenting to chiropractors with signs and symptoms associated with ATR be managed quickly and properly. The medical treatment of ATR's continues to be a source of controversy. This case study will describe the risks and benefits associated with both the surgical repair and conservative treatment of ATR's. Furthermore, great importance should be placed on a rehabilitation program that is designed with proper protocols and transition stages.

We present the case of a 25-year-old male who attended a chiropractic clinic with a chief complaint of left leg pain. The significant aspects of the history and physical examination that assist the practitioner in the diagnosis of acute ATR's will be reviewed. The role of the chiropractor in the diagnosis, treatment, rehabilitation and case management will be discussed.

Case report

A 25-year-old male student presented to a chiropractic clinic complaining of left-sided lower leg pain. His symptoms began 24 hours previously, during a vigorous squash game, when he collapsed while lunging for the ball. The immediate pain was characterized as sharp and stabbing and accompanied by a loud snapping sound. The pain, rated at 7/10, was continuous for 24 hours. There was no history of previous trauma or symptoms relating to the lower limbs. Rest, elevation and the local application of cold reduced the patient's symptoms and anxiety. Walking, ascending and descending stairs and any ankle movements aggravated the condition.

On examination, inspection of the left leg revealed mild to moderate swelling and redness about the posterolateral ankle. Palpation demonstrated a palpable gap of one to two centimeters in length, approximately 6–10 centimeters above the calcaneal insertion of the left Achilles tendon. Passive range of motion displayed decreased dorsiflexion and plantar flexion of the left foot due to pain. Inversion and eversion were full and pain free. Resisted range of motion was decreased in all directions, especially plantar flexion. Neurological testing of the left lower limb presented the following: muscle strength testing demonstrated weak plantar flexion, graded 3/5. Achilles reflex testing was not attempted due to intolerable pain. Sensory testing was unremarkable. Orthopedic testing revealed a positive

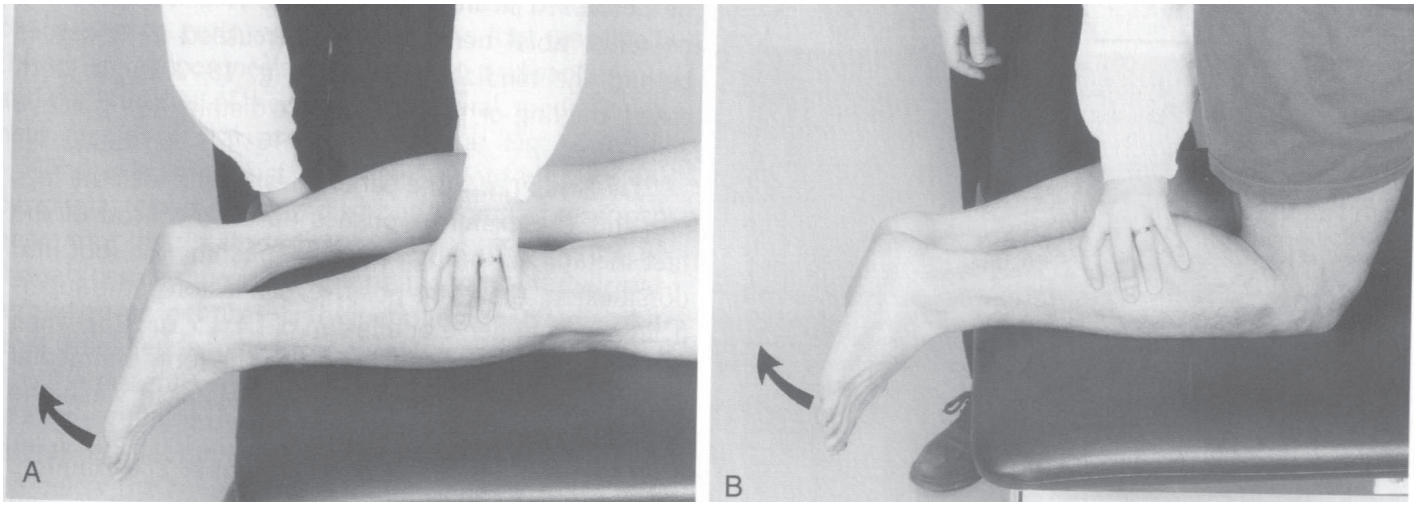

Figure 1 Thompson Test for Achilles Tendon Rupture. (A) Prone lying position. (B). Kneeling position. Foot will plantar flex (arrow) if the test result is negative.

Thompson test on the left (see Figure 1). All other orthopedic maneuvers were unremarkable.

A working diagnosis of partial or complete tear of the left Achilles tendon secondary to trauma was established. The patient was referred for further orthopedic assessment. That same day, the patient was admitted to an area hospital where he subsequently underwent a left Achilles end-to-end (Bunnell-suture) repair.[5,6,7]

Review of the patient's surgical report indicated that the Achilles tendon had undergone complete separation with an "extensive shredded appearance". Separation between the two ends of the tendon was measured at 8 to 10 centimeters. Surgery was conducted free of any complications.

Initial post-surgical treatment, conducted by an orthopedic surgeon and hospital staff, consisted of the following: a) below the knee cast, with foot in 30 degrees plantar flexion and equinus (less than 10 degrees of available dorsiflexion, subtalar neutral and midtarsal locking) b) at four weeks, below the knee cast was changed, the foot was elevated to 10–15 degrees of plantar flexion c) at five weeks, the foot was placed in neutral using below the knee cast d) at six weeks, the patient was provided with a weight bearing cast e) after seven weeks, the cast was removed and the patient was provided with a 1cm heel lift for 7–12 weeks.

Chiropractic care consisted of ultrasound therapy, soft tissue massage, proprioceptive neuromuscular facilitation (PNF), application of ice packs and deep cold analgesic spray. Joint manipulation was implemented, addressing the joint dysfunctions of the lower back and lower limbs. Stretching instructions for the lower back/leg musculature were given as a home exercise program. Patient outcome measures used were the visual analog scale and ankle range of motion.

The passive treatment program was conducted for 3–4 weeks at which time the patient was transitioned into an active exercise program. The active exercise program, conducted for 6–8 weeks, consisted of cardiovascular training on an upper/lower body ergometer, isometrics, sensorimotor training on rocker/wobble boards, and muscle stretching and strengthening (see Table 1). Full active weight-bearing sports were suggested to resume only after a minimum of 4–5 months of rest, exercise and rehabilitation. The patient transitioned into active sport consisting of light jogging, volleyball and ball hockey.

Table 1
Rehabilitation program for an achilles tendon rupture

1. **Cardiovascular Training:**
   a. Upper body/lower body ergometer
2. **Sensorimotor/Proprioception Training:**
   a. balance sandals
   b. rocker board
   c. wobble board
   d. balancing on one foot with lumbar flexion
3. **Passive ROM:**
   a. calf stretches (towel/tubing/step)
   b. foot exercises (tennis/golf ball)
   c. leg stretches (tib. anterior/peronei/hams/quads)
4. **Isometrics:**
   a. ankle flexion/extension
   b. ankle inversion/eversion
   c. quad setting
5. **Active ROM:**
   a. gas pedal (dorsi/plantar flexion)
   b. ankle circles
   c. toe curls/side drag towel (flexion, inversion, eversion)
   d. walking even surfaces
6. **Strengthening:**
   a. resisted dorsi/plantar flexion (theraband or tubing)
   b. resisted inversion/eversion
   c. heel raises (sitting/standing)
   d. wall squats (gym ball)
   e. leg extensions/curls (weights)
   f. floor lunges
7. **Agility/Plyometrics:**
   a. jogging even/uneven surfaces
   b. cutting maneuvers with jogging
   c. jumping on floor (marked X with tape)
   d. jumping on/off stepping box

Discussion

Etiology and epidemiology

Spontaneous rupture of the Achilles tendon is not uncommon. Although initially considered, there have been no demonstrated correlations between weight, size and gender, with the occurrence of ATR. Recent studies have reported a male to female incidence ratio ranging from 2:1 to 12:1.[8] Seventy-five percent of all ATR's occur in athletes between the ages of 30 and 40 years of age.[8] Since most people are right footed and push off with their left foot, there is a corresponding significant predominance of left-sided ruptures.[9] Although no clear precipitating factors have been established, 15% of individuals experiencing ATR report premorbid symptoms of posterior calf or heel pain during or following running sports.[3]

The theoretical mechanism of a self-inflicted acute ATR is under debate; one thought is that an abrupt change in muscle tension occurs[9] when the foot is subjected to a sudden force of dorsiflexion against a maximally contracted antagonistic gastrocnemius muscle, in an extended knee position. Another theory states that it is most likely caused by a combination of vascular insufficiency and mechanical stresses.[6] Regardless of etiology, predisposing factors are thought to be prolonged corticosteroid therapy, overuse of performance enhancing drugs (muscle building steroids) and direct trauma to the area.[10] Interestingly, patients with a history of gout are at increased risk of experiencing ATR's.[8]

Diagnosis

The diagnosis of an ATR in a clinical setting can be challenging at times. Even on complete rupture of the Achilles tendon, some active plantar flexion against resistance remains as a result of the influence of the plantaris, peroneus longus, tibialis posterior and great toe flexors. To assist in the differentiation of the two muscle groups, patients with complete ATR's will be unable to perform a toe walk. A positive Thompson test can often provide corroborating diagnostic information.

When the diagnosis of ATR is uncertain, advanced imaging can be utilized to confirm the diagnosis. Plain film studies provide insufficient radiographic information to assist in the diagnosis of an ATR. Because the Achilles tendon lacks a tendinous sheath, tenography, a useful method for assessing the status of tendon conditions, cannot be employed. Ultrasonography provides a non-invasive and accurate method of localizing tendon tears. Although it's low cost and availability are desirable, it has not been met with widespread acceptance.[11,12] Both CT and MRI (Figure 2) provide ideal soft tissue imaging and, when available, remain the techniques of choice.[13]

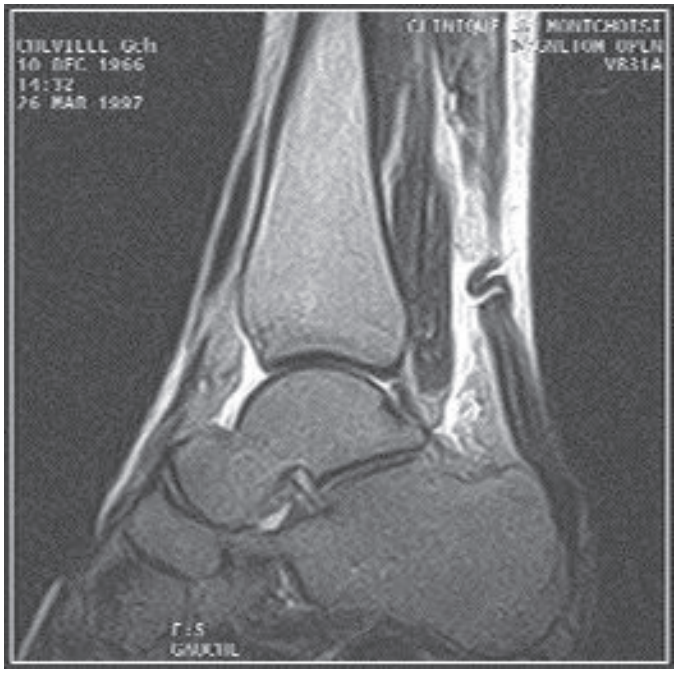

Figure 2 Magnetic Resonance Imaging demonstrating tissue disruption of an Achilles tendon approximately two inches above the calcaneal insertion. Patient unknown. (Courtesy of Dr. Pierre Benedict at ©swissradiology.com)

Conservative versus surgical intervention

The medical management of ATR's continues fraught with debate. Some orthopedic surgeons may advocate the conservative approach through casting of the foot in a plantar-flexed position in allowing the tendon to heal over time. A second group advocates early intervention through surgical repair and subsequent casting. Considerable research has established pros and cons of each treatment protocol.

Regardless of whether surgical or non-surgical methods are implemented, Achilles tendons are still susceptible to re-rupture. Carden et al established that conservatively treated cases have a re-rupture rate of 17.9% compared with a rate of 2.2% in reports of surgically treated cases.[14]

Surgical repair, when compared to non-surgical treatment, decreases the occurrence of re-rupture and enables individuals to maintain pre-injury levels of activity.

Surgical intervention has been shown to delay return to work when compared to conservative care. Nistor found that the period of morbidity, defined as length of absence of work, varied dependent on the type of work. Generally, absenteeism averaged thirteen weeks (range of 0–30 weeks) in the surgically treated group and nine weeks (range of 0–44 weeks) in the group that was not treated surgically.[15]

Of concern are the associated complications of any surgical intervention. Generally, the risk of any operative intervention is estimated to be as high as 5% with infection and wound breakdown being the predominant concerns.[8] Additionally, pulmonary embolism and sensory deficits associated with injury to the sural and other cutaneous nerves, can occur.[4] In the case of surgical repairs of ATR's, the surgical complications that can occur are greatly outweighed by slightly improved muscle strength and lower incidence of re-rupture when compared with the conservative treatment. The latter treatment, however, tends to lead to a shorter period of morbidity and minimizes costs associated with hospital stays. The conservative approach is utilized in most cases with the elderly, chronic ruptures, patients with sedentary lifestyles and possibility of re-ruptures, whereas surgical intervention is important when dealing with young adults, athletes and active older adults that seek continued activity.[16,17]

Irrespective of the treatment protocol, early diagnosis and subsequent intervention are important in achieving optimum therapeutic benefit. In 1987, Carden et al. reviewed the consequences of early versus delayed treatment. If treatment was initiated within 2–3 days of injury then satisfactory results were obtained in both surgical and non-surgical rehab groups. If treatment was delayed for more than 7 days because of misdiagnosis or late presentation, then the results were significantly poorer, especially within the conservatively managed group.[14]

Inglis et al. found that a delay in diagnosis and surgical treatment of greater than one month will downgrade the result of surgical repair by at least 20 percent as assessed by reduction in muscle endurance, although the muscle strength and power may return to normal.[18] The risks and benefits of surgical versus conservative management of ATR are presented (Table 2).

Table 2
Risks and benefits of surgical versus conservative treatment of ATR's

Factors	Surgical	Conservative
Motor strength	maintained	decreased
Morbidity	13 weeks	9 weeks
Complications	infection, decreased cutaneous nerve sensation Pulmonary embolism	decreased ankle range of motion
Post-treatment Function	normal activity resumed	possibly decreased activity
Cost	relatively high	relatively low
Age	utilized in younger or active older patients	older or sedentary
Re-rupture Rate	low risk	low to moderate risk

Chiropractic treatment and rehabilitation

Once the cast has been removed, passive interventions such as cryotherapy, ultrasound, proprioceptive neuromuscular facilitation (PNF) and joint manipulation may be useful adjuncts in the recovery and repair of healing tissues.[19] Initial stages of treatment should focus on reduction of pain and inflammation, and increasing range of motion. Common applications used are PNF stretching techniques, like contract-relax, the resisted isotonic contraction of the involved muscles followed by relaxation and movement (stretch) into the increased range of motion.[20] Chiropractic manipulation, primarily of the hip, knee and ankle mortise/talocrural joints, are also used to improve joint movement and correct biomechanical dysfunctions. Home exercises are prescribed to increase functional range and aid in reorganizing scar tissues along the lines of stress. Exercise programs are designed based on the SAID principle (specific adaptation to imposed demands) and Davis' Law, stating that specific external forces or demands are applied to certain muscles to allow for optimal collagen and muscle fibre remodeling.[19]

To promote rapid healing in the acute phase, proper nutritional support is recommended. This will increase the rate of healing following surgery and minimize scar tissue formation.[21] Nutrients that promote healing include Vitamin A, B-complex, C, zinc and copper. Nutrients that reduce scar formation and adhesions include Vit. E and flavonoids. Proteolytic enzymes are recommended immediately after surgery, for one week, to reduce pain and inflammation.[21] The nutritional program was recommended to the patient to begin two weeks pre-surgery and four weeks post-surgery.

Before commencing a rehabilitation program, the practitioner should address the biomechanics of the entire locomotor system, and not only the surgically repaired area.[22] Evaluation of the patient's knee, ankle, and foot mechanics may warrant the necessity of orthotics or foot/ankle bracing. While there is still controversy regarding the usefulness of orthotics, there is solid empirical evidence of their benefits to runners. Since most Achilles tendon problems develop from poor foot and ankle biomechanics, the control of pronation is needed to prevent injuries and reoccurrences.[23,24]

Treatment protocols concerning frequency of care and transitioning of the patient are based on patient progress and outcome measures.[22,25] Outcome measures for lower limb injuries, primarily the gastroc/soleus muscle group are very limited. The practitioner can employ the visual analog scale (VAS), the pain drawing diagram, ankle range of motion testing, and gastrocnemius/soleus muscle girth measurement. Comparisons and progression can also be drawn from an ankle flexibility score,[26] the ankle grading questionnaire by Mazur et al.[27] and the Lido Active dynamometer for strength and endurance.[28] Horstmann et al.,[28] with the use of the dynamometer, discovered that 63 post-surgical ATR patients (10 years later) had selective atrophy of slow twitch fibers and weakened calf musculature in the strength endurance test. The study concluded that early mobilization should be chosen after ATR and more strength and endurance training is essential in rehabilitation.[28] Saw et al.[29] found that early mobilization after an ATR will allow for full recovery of ankle range of motion and dorsi/plantar strength measurements.[29]

Although the chiropractor can play an important role in passive care, the chiropractic practitioner with an interest in rehabilitation procedures can be involved in the rehabilitation of the patient. Following an appropriate period of time, an active programme consisting of cardiovascular training, sensorimotor training, muscle strengthening and stretching programmes can be implemented to restore pre-injury functional status.

Cardiovascular conditioning is an important aspect of rehabilitation of an athletic injury. Higher fitness levels have been associated with decreased risk of injury, speedier rehabilitation and healing at a cellular level.[30] Deconditioning occurs rapidly with the cessation of exercise, especially in post-surgical patients, due to their restriction of activity.

Sensorimotor training is especially important in post-surgical lower limb candidates, primarily to correct any faulty movement patterns, compromised balance and damage to joint kinesthesia.[31] Wobble and rocker boards are used as peripheral stimuli to elicit a response by the CNS. Proprioceptive quality and kinesthetic awareness are very important for lower limb function. Equally effective is the enhancement of muscular strength in promoting joint stability and maintaining balance.[32]

Muscular strength training typically proceeds in the following order: isometrics, then non-weight bearing isotonics, then weight-bearing isotonics. Although non-weight bearing (open chain) exercises, like exercise bands/tubing are the safe choice,[33] the patient will gain more

benefit from weight-bearing (closed chain) exercises. Closed chain techniques can increase the effectiveness of rehabilitation protocols because they allow more normal physiological activations and biomechanical motions.[34,35] Isotonic weight training for the lower limb is performed in the later stage, using the Zinovieff (beginner), Delorme-Watkins (hypertrophy), and MacQueen (strength) order of protocols, with a starting point of 50% of 1RM (repetition maximum).[19]

Late stage rehabilitation like squatting, jumping, running and lifting should meet the demands of the patients' activities of daily living (ADL's). This will allow the patient a smooth transition into his/her normal daily movement patterns.

Conclusion

This case highlights the diagnostic challenges associated with ATR's. Since active plantar flexion against resistance often remains as a result of the influence of the plantaris, peroneus longus, tibialis posterior and great toe flexors, the chiropractor should not consider this a sign of the integrity of the Achilles tendon. In those cases where the diagnosis remains uncertain, the patient should be referred for further diagnostic imaging. When the diagnosis is confirmed either clinically or by imaging, chiropractors can expect their patients to undergo either surgical or conservative intervention. The type of treatment provided often depends on the preference of the practitioner or other key features associated with the case. Chiropractors can engage the patient in passive and active treatment programmes shortly after cast removal.

In the case presented, the chiropractic practitioner accurately diagnosed the presence of an ATR and initiated early referral for medical treatment. Following surgical intervention without complication, further casting and subsequent passive treatment and rehabilitation performed by the chiropractor, the patient experienced a full recovery. Chiropractic rehabilitation has become vital in the continuum of patient care and prevention of injury. Early intervention, chiropractic treatment and rehabilitation, in this specific case, have likely reduced the risk of re-rupture for nine years after the initial injury.

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