Isolated Talonavicular Arthrodesis in Patients with Dysfunction of Tibialis Posterior and Rheumatoid Arthritis

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Abstract

Background

The foot is often affected in patients with rheumatoid arthritis. Subtalar joints are involved more frequently than ankle joints. Deformities of subtalar joints often lead to painful flatfoot and valgus deformity of the heel. Major contributors to the early development of foot deformities include talonavicular joint destruction and tibialis posterior tendon dysfunction, mainly due to its rupture.

Methods

Between 2002 and 2005 we performed isolated talonavicular arthrodesis in 26 patients; twenty women and six men. In the preoperative clinical examination we focused on the tendon of the posterior tibial muscle, which is an important stabilizer of the foot. In unclear cases we used an MR examination prior to the surgery. To fix the joint we used screws in eight patients, memory staples (DePuy) in twelve patients and a combination of screws and memory staples in six cases. The average duration of immobilization after the surgery was four weeks, followed by rehabilitation. Full weight bearing was allowed two to three months after surgery.

Results

The mean age of the group at the time of the surgery was 43.6 years. MRI examination revealed a torn tendon in nine cases with no significant destruction of the talonavicular joint seen on X-ray. Eighteen patients had excellent results, six patients had moderate pain of the foot and two patients had severe pain. The AOFAS Hindfoot score was 48.2 before surgery and 88.6 after surgery.

Mild complications included superficial wound infections in two patients and one case developed pseudoarthrosis.
Conclusions

Isolated talonavicular arthrodesis provides excellent pain relief. Early fusion of the talonavicular joint appears to prevent further progression of foot deformities.

Key words:

Rheumatoid arthritis, Tibialis posterior muscle, pes planovalgus, talonavicular arthrodesis
Background

The foot is often affected in patients with rheumatoid arthritis. Subtalar joints are involved more frequently than ankle joint [1]. Deformities of subtalar joints lead to painful flatfoot and valgus deformity of the heel. The entire forefoot turns in valgus deformity and the patient steps down on the medial part of the foot, while the naviculare bone turns medially and plantarly (Figure 1a, 1b). Involvement of the talonavicular joint appears to be one of the earliest of the hindfoot joints to demonstrate involvement in rheumatoid arthritis (Figure 2).

Major contributors to the early development of foot deformities include talonavicular joint destruction and tibialis posterior tendon dysfunction, mainly due to its rupture. In this study we provide data evaluation of patients with rheumatoid arthritis and dysfunction of the tibialis posterior which were treated by talonavicular arthrodesis.

Methods

Between 2002 and 2005 we performed isolated talonavicular arthrodesis in 26 patients with rheumatoid arthritis (twenty women and six men) at the Orthopaedic Clinic of the 1st Faculty of Medicine Charles University in Prague, Motol Teaching Hospital, Czech Republic. The study was permitted by an appropriate Ethics Committee for Multi-Centric Clinical Trials of the Motol Teaching Hospital (reference number: EK464/09). The patients suffered from pain on the dorsomedial aspect of the foot when weight bearing when they stepped down on the inner margin of the foot. All of them had planovalgus deformity of the foot.

The tibialis posterior tendon is an important support of the medial longitudinal arch of the foot. We studied the course, attachment of the tendon and its relation to the talonavicular joint on twenty cadaver specimens at the Institute of Anatomy, Charles University in Prague. Its insertion is divided into three distinct components (distal, medial and proximal). Its main insertion is on the navicular tuberosity traveling distally to the medial cuneiform bone, he
medial part into the cuneiforms, cuboid and the medial three metatarsal bases and the posterior part to the sustenaculum tali of the calcaneus and the plantar calcaneonavicular ligament [2,3,4,5] (Figure 3a, 3b, 3c).

Our clinical examination revealed clinical signs of dysfunction of the tibialis posterior tendons, the valgus position of the heel and the prominence of the medial foot edge. An important test is the heel rise test [6,7] (Figure 4a, 4b). The heel stayed in the valgus position when the patient stood on his tiptoes, revealing no correction into a physiological varus position.

An imaging evaluation was based on standing AP and oblique X-ray images. These positions showed instability of the forefoot, where the forefoot turned laterally under weight bearing conditions (Figure 5a, 5b). Signs of arthritis of the talonavicular joint were visible on the X-rays in 13 cases, while in the other 13 cases the talonavicular joint showed minimal destruction.

Prior to surgery we conducted an MRI examination of the foot that focused on the tendon of the tibial posterior muscle which (in many cases) may be affected by a rheumatic process in patients with rheumatoid arthritis that may lead to its partial or complete rupture [8,9] (Figure 6a, 6b). In our set we found torn tibialis posterior tendons in nine patients (Figure 5).

We operated on the entire set of patients with rheumatic destruction of the talonavicular joint from the medial longitudinal approach at the level of the talonavicular joint. After opening the capsule of the joint we removed the remainder of cartilage from the head of the talus and naviculare bone with a shaver and chisel. In every case we revised the tibialis posterior tendon (Figure 7). In case of an intact tendon and the presence of synovitis, a synovectomy of the sheath was performed. When a tendon tear was found it was not possible to conduct a suture of the tendon due to the significant shortening and destruction of
the remainder of the tendon. After tendon revision we reduced the gap between the bones and fixed them with two screws in eight cases, two memory staples (DePuy) in twelve cases and with a combination of screw and memory staples in six cases (DePuy) (Figure 8a, 8b).

Following surgery a splint was applied for four to six weeks. Physical therapy followed removal of the splint. Initially ambulation was with partial weight progressing to full weight bearing 2-3 months post-surgery.

Results

The average age of patients at the time of the surgery was 43.6 years. The right foot was operated on in fifteen cases and the left foot in eleven cases during the three years period (2002-2005). We assessed the patients in 2008, after a longer time period had elapsed since their operations (three to seven years after surgery, average 4.5 years).

During the surgery, we found complete ruptures of the tibialis posterior tendon in nine cases, and in seven cases the tendon was significantly weakened and affected by the rheumatic process. The tendon showed no signs of impairment in the remaining ten cases. We followed the patient at regular intervals after the procedure and evaluated the subjective complaints and X-rays photographs. Eighteen patients had excellent results, six patients had moderate pain of the foot and two patients had severe pain. The mean of AOFAS Hindfoot [10] score was 48.2 before surgery and 88.6 after surgery.

Using a standard anteroposterior X-ray we evaluated the healing process of athrodesis and the position of the ostheosynthesis. We focused not only on these parameters, but additionally on whether the arthritis had spread to other foot joints and whether the deformity had progressed. In two patients other joints – the talocalcaenal and the calcaneocuboid – were affected (three and six years after surgery). Mild complications included superficial wound
infections in two patients, treated successfully with oral antibiotics. One patient developed pseudoarthrosis.

**Discussion**

The foot is often affected in patients with rheumatoid arthritis, as stated by many authors [11,12,13,14,15]. Sometimes, this can be the first sign of the disease. The early symptoms include pain and gradual development of forefoot deformity.

In patients with rheumatoid arthritis the talonavicular joint is often the first one to suffer. Many authors [13,16,17,18,19] published good results with isolated talonavicular arthrodesis in patients with rheumatoid arthritis. They quote excellent results in 95% of the cases when patients had no subjective problems and the foot was in a satisfactory position.

Various osteosynthetic materials are used for fixation of the arthrodesis. The authors usually used two screws for fixation (Figure 9a, 9b) while we used two screws or a combination of one screw with one memory staple in the beginning. Later, we used only two memory staples to stabilize the arthrodesis. We believe that these two memory staples provide excellent stability for a quick healing process (Figure 10a, 10b). Some authors use corticospongious iliac bone graft and a screw or plate fixation [11,16,20,21]. Bone grafts were not used in our group of patients.

When focusing on the tibialis posterior tendon, we found a complete rupture in nine patients. During clinical examination of these patients, signs of dysfunction of the tibialis posterior tendon were present [2,3,7,15,22,23]. The rupture was always close to the tendon insertion on the naviculare bone [24]. In all these cases, the talonavicular joint capsule was significantly disengaged. In seven patients the tendon was significantly weakened with signs of synovitis and in ten cases the tendon was intact.

Elboar et al. [11] also assessed the effects of this isolated arthrodesis on the development of changes in other joints of the foot. They did not find any relation between
talonavicular joint arthrodesis and progression of changes in the other joints of the foot. In our set of patients we recorded the progression of deformities and changes in neighbouring joints in two patients – three and six years after the operation. Subtalar joint arthrodesis is planned in both cases.

Using cadaver specimens, Suckel et al. [25,26] measured pressure distribution in the ankle joint after triple-desis and talonavicular arthrodesis. After triple-desis, pressure in the ankle joint increases. This may lead to the development of degenerative changes.

Early isolated talonavicular arthrodesis prevents further deviations of the forefoot and deformities of other joints. It is necessary to perform it in the early stages, while the deformity is flexible and the foot can be returned to the neutral position. In case of a fixed deformity, a triple-desis of the subtalar joint is necessary [1].

According to the literature, pseudoarthrosis occurs in 3-5% [12,13]. Development of pseudoarthrosis is more frequent in the case of talonavicular arthrodesis than in the case of talocalcaneal arthrodesis. In talocalcaneal arthrodesis the removed surface is larger and it is perpendicular to the load direction. On the contrary, in the talonavicular joint the situation is worse – the contact surface is much smaller and unfavourable shearing forces act there. In our set of patients we recorded only one case of pseudoarthrosis (3.8%).

**Conclusions**

Isolated talonavicular arthrodesis is an effective method of treatment of talonavicular arthritis regarding pain relief and functional improvement. Early fusion of the talonavicular joint appears to prevent further progression of foot deformities.

In nine cases among our set of patients we encountered rupture of the m. tibialis posterior tendon. This deteriorates the biomechanical situation in the talonavicular joint while increasing the shear load of the joint and destabilizing the Chopart’s joint.
Reference


Figures

**Figure 1a, 1b Photographs during clinical examination**
Left picture shows the medial view of the right flatfoot and on the right a posterior view of the feet with valgus deviation of left heel.

**Figure 2 - Lateral X-ray of a foot**
Lateral X-ray of the foot shows destruction of the talonavicular joint with narrowing of the joint space.

**Figure 3a, 3b, 3c – Photographs of dissected cadaver of left foot**
Three photographs of the left foot from the inferomedial aspect; Medial maleolus (MM), Tibialis posterior tendon (TP), Navicular tuberosity (N), Sustentaculum tali (ST), Flexor hallucis tendon (FHL), Spring ligament (SL); Attachment of the tendon with posterior slip (p), which is attached to the anterior margin of the sustentaculum tali, medial slip (m) to themidtarsus and distal slip (d) to the first cuneiform bone.

**Figure 4a, 4b – Photographs shows clinical examination by heel rise test**
Left photograph shows the posterior view of the feet with right flatfoot. The right one shows dysfunction of the tibialis posterior tendon during a heel-rise test. The right heel stays in the valgus position on tiptoe position.
**Figure 5a,5b – Anteroposterior X-rays of left foot**

Left X-ray shows the standing anteroposterior view of the left foot with instability and subluxation of the talonavicular and the calcaneocuboid joints and on the right an X-ray without weight-bearing.

**Figure 6a, 6b – MR examination of the left foot with torn tibialis posterior tendon**

Left picture shows the frontal section of the left foot and on the right a sagittal section of it. The torn tendon of the tibialis posterior muscle (TP) is highlighted by the arrow.

**Figure 7 - Photographs of medial surgical approach to a torn tibialis posterior tendon**

Pean points to the torn tibialis posterior tendon in medial longitudinal surgical approach of the right foot.

**Figure 8a, 8b - Photographs during the procedure of talonavicular arthrodesis**

Left photographs shows instability of the hindfoot before fixation and the right one after the talonavicular arthrodesis.

**Figure 9a, 9b –X-rays of the left foot four years after the talonavicular arthrodesis**

Left X-ray shows the lateral view and the right one an anteroposterior view of the left foot four years after the procedure with healed talonavicular arthrodesis.

**Figure 10a, 10b –The fixation of arthrodesis by two memory staples**

Left picture shows the fixation of the arthrodesis during the surgery by two memory staples and the right one the healed arthrodesis three years after the procedure.
Additional files provided with this submission:

Additional file 1: ethics committee approval.pdf, 735K