Anterior ankle arthroscopy. Early complications without joint distraction

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ABSTRACT

Introduction: Arthroscopy has become an important tool to treat various conditions of the ankle. The use of anterior and posterior portals, with or without mechanical distraction, allows for a complete exploration of this joint. Like all surgical techniques, it is not without complications. **Objectives:** To evaluate the early complications of anterior ankle arthroscopy with or without joint distraction, and to compare them with those described in the international literature. **Materials and Methods:** A retrospective study that evaluated 198 patients undergoing anterior ankle arthroscopy for various pathologies. All were operated on by a single surgeon, in two health centers, during a period of 6 years, with a postoperative follow-up of at least 12 months. Patients were evaluated by AOFAS score and early and postoperative complications were recorded. **Results:** 34 women and 164 men were evaluated (average age: 37.5 years). There were 23 complications (11.61%): local cellulitis (6 cases), transient paresthesia of the superficial peroneal nerve (4 cases), permanent paresthesia of the superficial peroneal nerve (1 case), residual pain in the portals (4 cases), septic arthritis (2 cases) and one case of other complications. **Conclusions:** Most complications can be avoided by a precise knowledge of the anatomy and the aseptic techniques, as well as an adequate surgical approach and intra-operative management of the instrumentation. Anterior ankle arthroscopy without joint distraction through standard antero-lateral and antero-medial portals is a safe technique, having a low rate of complications and a very low morbidity for the patient.

Key words: Anterior arthroscopy; ankle; complications.

Level of evidence: IV

Artroscopia anterior de tobillo. Complicaciones tempranas con técnica sin distracción

RESUMEN

Introducción: La artroscopia se ha convertido en una importante herramienta para tratar diversas afecciones del tobillo. El uso de portales anteriores y posteriores, asociados o no a distracción mecánica, permite una completa exploración de esta articulación. Como toda técnica quirúrgica, no está exenta de complicaciones. **Objetivos:** Evaluar las complicaciones tempranas de la artroscopia anterior de tobillo, sin distracción articular, y compararlas con las descritas en la bibliografía internacional. **Materiales y Métodos:** Estudio retrospectivo que evaluó a 198 pacientes sometidos a artroscopia anterior de tobillo por diversas patologías. Todos fueron operados por un único cirujano, en dos instituciones de salud, durante un período de 6 años, con un seguimiento posquirúrgico mínimo de 12 meses. Los pacientes fueron evaluados mediante el puntaje de la AOFAS y se consignaron las complicaciones intra y posoperatorias tempranas. **Resultados:** Se evaluó a 34 mujeres y 164 hombres (edad promedio 37.5 años). Hubo 23 complicaciones (11,61%): celulitis local (6 casos), parestesias transitorias del nervio peroneo superficial (4 casos), parestesia permanente del nervio peroneo superficial (1 caso), dolor residual en los portales (4 casos), artritis séptica (2 casos) y un caso de otras complicaciones. **Conclusiones:** Un conocimiento preciso de la anatomía, una asepsia y una técnica quirúrgica correctas, y los cuidados de manejo intraquirúrgico del instrumental permiten evitar la mayoría de las complicaciones. La artroscopia anterior de tobillo sin distracción por medio de los clásicos portales antero-lateral y antero-medial es una técnica segura, con un bajo índice de complicaciones y una muy baja morbilidad para el paciente.

Palabras clave: Artroscopia anterior; tobillo; complicaciones.

Nivel de evidencia: IV

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INTRODUCTION

In a cadaver study conducted in 1931, Burman[1] concluded that the ankle joint was not suitable for an arthroscopy procedure on account of its narrow anatomical structure. However, he further concluded that "something" could be accomplished in a living patient using a smaller arthroscope. In 1939, Takagi[2] reported for the first time using arthroscopy exploration of this joint. However, it was not until the 1970s that any further key developments in arthroscopy took place when Watanabe[3] published a series of 28 ankle arthroscopies in 1972. Over the past two decades, ankle arthroscopy has become a key element to treat various conditions, and numerous scientific papers have been published on its approach and results. Ankle arthroscopy is considered a technically challenging procedure and requires great expertise in working in narrow spaces. However, through improving its technique and the understanding of relevant anatomic considerations, ankle arthroscopy has become the gold standard for treating several conditions of the ankle joint These procedure advantages in treating bone and soft tissues include minimal invasion and relatively easy anterior and posterior access. Compared to open ankle surgery (arthrotomy), arthroscopy is a technique characterized by low surgical trauma which allows for outpatient surgery with minimal bleeding and short rehabilitation time. This factor also accounts for a decrease in morbidity and potential complications, mainly in soft tissues. There are many indications for this procedure, the most common involve the anterior ankle region, anterior friction syndrome involving soft tissue, bone or combined structures, osteochondral lesions, and the excision of loose bodies,[4] among others. Absolute contraindications include severe ankle joint degeneration.

Anterior and posterior portals provide excellent access for complete joint exploration. However, like all surgical techniques, arthroscopy is not without complications. Numerous scientific papers have been published on the complications of anterior arthroscopy, most of them include complications related to arthroscopy procedures performed using invasive joint distraction with bone traction or non-invasive mechanical distraction with "sling traction" of soft tissue. The goal of our study is to evaluate the early and intraoperative complications of anterior ankle arthroscopy with or without joint distraction, and to compare them with those described in the international literature.

MATERIALS AND METHODS

We conducted a multicentre retrospective study in two health centers located in the province of Buenos Aires, Argentina. The study included 198 operated patients that had undergone anterior ankle arthroscopy for various conditions, between April 2011 and April 2017. All the considered arthroscopies were performed using the standard portals: anteromedial and anterolateral ankle portals. No distraction system (neither invasive nor non-invasive) was required during the procedure. A blood pressure cuff was placed on the thigh during procedure. In all cases, a 4-mm, 30-degree arthroscope was used, with the foot pointing up, and image enhancement on the ipsilateral hemipelvis. The ankles rested on the edge of the operating tables, and the surgeon pushed the foot into dorsiflexion without difficulty. The arthroscope was always inserted with the foot in dorsiflexion so as to relax the anterior tibiotalar structures. The procedure always began through the anteromedial portal. Then the antero-lateral portal was established using transillumination and under arthroscopy vision with a 21G x 2" needle as guidance, while taking care to preserve the superficial peroneal nerve (SPN). A superficial skin incision is made, and blunt instrumentation was used to access the join.

All patients were operated on at both health centers by the same surgeon, who is experienced in arthroscopy surgery. This factor was taken into account to minimize any alterations due to a learning curve.

All procedures were outpatient surgeries and had an average recovery period of 2 hours. Patients were called in for the first postoperative follow-up at an average of 7 days (6-8 days).

The study protocol required a complete preoperative work-up and a firm diagnosis before the intervention. This case series did not include diagnostic arthroscopies. The follow-up period was of no less than 12 months and allowed for the study of early complications.

Participant inclusion criteria included: 1) patients undergoing anterior ankle arthroscopy without joint distraction; 2) procedure involving only the two standard portals (antero-lateral and antero-medial portals), both as an independent procedure or in conjunction with other procedures.

Participant exclusion criteria included: 1) patients who required accessory portals; 2) patients without adequate follow-up; 3) patients who underwent a non-anterior approach arthroscopy (e.g., posterior).

Follow-up consisted of periodic examinations and a digitalized medical chart where health professionals recorded the complications detected in the procedure and in the subsequent consultations (history and physical); thus

every event was logged in the health center electronic medical record. A complication was defined as "every event that arises as an additional problem during or following the procedure and is secondary to it."[5] All patients were called in for a final evaluation after a period of time as long as was possible for each case, and all final evaluations were performed at least 12 months after surgery. Patients were asked about the presence of residual pain related to the procedure, any limitations concerning their activities, the use of orthotic support for walking, their ability to walk on uneven surfaces, and their self-perception of ankle stability. The physical exam included the evaluation of any gait anomalies, the range of sagittal movement, the range of subtalar joint movement, ankle alignment, muscle force, and objective ankle-hindfoot stability. The results were used to calculate the AOFAS (American Orthopaedic Foot and Ankle Society) score for ankle and hindfoot. Findings were added to the medical records under study standards.

RESULTS

From the total 198 arthroscopy cases, 17.17% (34) were women and 82.83% (164) were men. The average age of the interviewees was 37.5 years (between 7 and 78). Procedures were performed on 103 left ankles and 95 right ankles. There were 23 complications (11.61%) reported associated with the procedure: portal-adjacent local cellulitis (6 cases), which were treated with oral antibiotic; SPN transient paresthesia (4 cases), which disappear after an average 5-month period; SPN permanent paresthesia (1 case), which was treated with vitamin B complex, without improvement; residual pain in portals (4 cases), which were locally treated with physical therapy and corticosteroid infiltration; postoperative septic arthritis (2 cases). The two patients with septic arthritis underwent an arthroscopic joint lavage (2 in one patient, and 3 in the other) in addition to the pertaining antibiotic therapy as indicated by culture results (identified agent). In both cases, the cure of the infection was verified with the disease clinical course, and negative test results for humoral immune response, culture, and histopathology, which samples were collected at the end of treatment (Figure).

There was one case detected of each of the following complications: complex regional syndrome, deep venous thrombosis, long toe and ring toe extensor tendon deficiency, intra-articular instrument breakage (removed during the same procedure), postoperative hemarthrosis, and remainder extensor tendonitis.

Seven patients complained of diffuse pain in the ankle during the postoperative period. However, they had informed of pre-existing pain in the preoperative consultation, so we considered it as the pre-existing pain natural history added to the surgery trauma and thus not a procedure complication. The mean follow-up period was of 22 months (from 12 to 72).

The performed procedures were: friction syndromes involving bone or soft tissue; osteochondral lesions in talar zones 1, 2, 3, 4, 5 or 6, and in i the anterior tibial pilon; the excision of joint loose bodies; fibrous synovial folds; moderate osteoarthritis; and arthroscopic arthrodesis.

AOFAS mean score during the postoperative period was 93.5 (range 76-100).

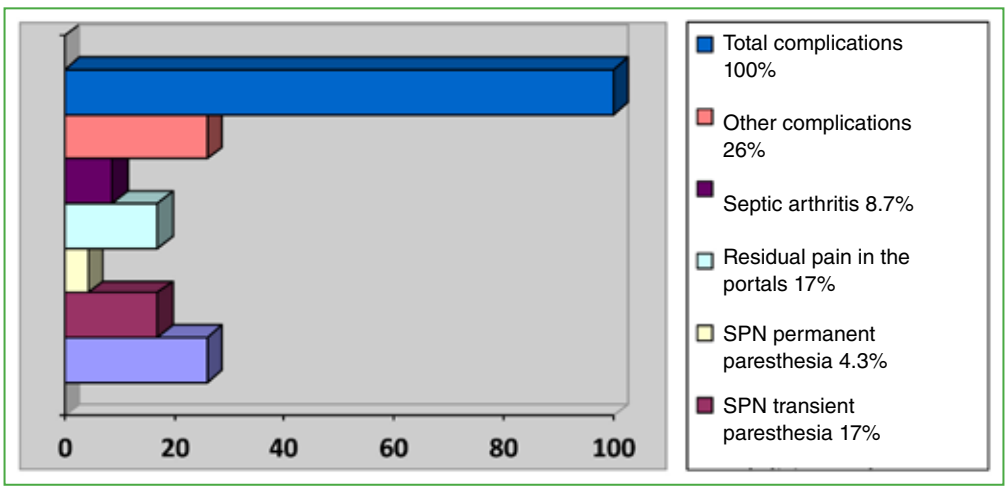

Figure. Anterior ankle arthroscopy complications.

DISCUSSION

Initially, the ankle arthroscopy approach had a high complication rate. Sprague el at.[6] reported a 24.6% rate for complications during the pre-distraction era. The past 20 years have witnessed significant developments in the field of minimally invasive surgery of foot and ankle. In 2012, Zengerink and van Dijk published a complication mean rate of 10.3% for ankle arthroscopy.[5] In our study, we observed a rate of 11.6% for complications associated with the technique, which did not include traction neither of bone nor soft tissues.

Neurological lesions are the most described complications of this approach,[5,7,8] SPN lesion being the most common of them. The SPN is the most at-risk structure in anterior ankle arthroscopy. Anatomical studies on the ankle joint show that most people (52.9%) have two SPN branches: intermediate dorsal cutaneous nerve (also known as Lemont's nerve), and the medial dorsal cutaneous nerve. Another anatomical study found that the number of SPN branches crossing the ankle joint varied from 1 to 5 according to the specimen.[10] Identifying and marking the SPN and its branches before surgery has been proven to be an effective method to decrease iatrogenic lesion. Despite marking the SPN and its branches, in a study with 96 patients treated with anterior arthroscopy and a mean follow-up period of 25.3 months, 1.04% of the patients developed sensory loss localized at the distribution of the medial dorsal cutaneous branch of the SPN.[11] In our study, 2% of the patients developed transient paresthesia of the SPN and 0.5% developed permanent paresthesia. We detect no lesions in the saphenous nerve and the deep fibular nerve.

Lesions to the deep fibular, the sural, and the saphenous nerves are less common. In a case series involving 260 patients, Deng *et al*.[12] reported an incidence of 0.77% for lesions involving the deep peroneal nerve, 0.38% for the sural nerve and 0.38% for the saphenous nerve. Ferkel *et al*.[13] published an incidence of less than 1% for saphenous nerve lesions resulting from an antero-medial portal approach.

There are also complications other than neurological: vascular lesions, pseudoaneurysms,[7,14,15] infections, and synovial fistulas,[8,16] among others. In relation to vascular lesions, there are case reports on pseudoaneurysm of the anterior tibial artery[14,17] and a case report on pseudoaneurysm of the dorsalis pedis artery.[15] Cadaver studies have shown a 4.3% incidence of anatomical variations of the anterior tibial artery and the dorsalis pedis artery.[18,19] Hence the importance to palpate and mark the pulsation of the anterior tibial artery before inflating blood pressure cuff. It is also advisable to work on a dorsiflexed ankle since this position increases the safe working area and helps to avoid complications with the vessels, which can be moved if accidentally touched by a surgical instrument. No vascular lesion or aneurysm was detected in our study.

In a study, Son *et al*.[17] used MRI to assess the anatomical variations near the antero-lateral portal. They found two at-risk variants in the anterior tibial artery and its branches, which were lateral to the extensor tendon of the toes or in the safe zone for antero-lateral portals. These two anatomical variants occurred in 22 of the 358 cases (6.2%).

Infections are potential complications to any surgical procedure. Ferkel *et al*. reporter 8 superficial infections from a total of 615 ankle arthroscopies (0.13%) There infections associated with the lack of cannula for instrumentation, the use of adhesive sutures to close the wound, and the lack of early joint mobilization after surgery. The most common complication of our study was superficial or deep infection: 3.03% of portal-adjacent superficial infections, and 1% of septic arthritis.

Postoperative hemarthrosis is an adverse event that is rarely reported. A study published that it is the third more common minor complication (0.3%).[21] Hemarthrosis was considered a minor complication since all the cases were resolved without adverse long-term effects at least 12 months following surgery. In our study, we had only one case (0.5%). Our approach includes the routine practice of deflating the blood pressure cuff to ensure adequate hemostasis, which may help to avoid hemarthrosis.

In a systematic revision consisting of 8 publications, Schade *et al*.[22] reported an incidence for deep venous thrombosis in ankle injuries associated with conservative management of 5.9% and with postoperative manage of 3.3%. However, 85.6% of the conservative management patients and 92.9% of the postoperative management patients were asymptomatic. It is also worth mentioning that the normal postoperative course may mimic the symptoms of deep venous thrombosis owing to the postoperative unilateral swelling and potential calf pain. In our study, deep venous thrombosis was diagnosed using venous Doppler ultrasound and its incidence was 0.5%. Identifying high-risk patients before performing the ankle arthroscopy may guide the surgeon in deciding to prescribe antithrombotic prophylaxis for the postoperative period. High-risk patients are defined as any patient who has sustained a deep venous thrombosis, who is taking oral contraceptives, who suffers from venous stasis or hypercoagulability, or who has a cancer history.

Fistula formations also may constitute an early complication. In 1305 ankle arthroscopies, Zengerink and van Dijk[5] reported 7 patients developed synovial fistulas at portal sites. In a consecutive series including 105 patients,

Rasmussen and Hjorth Jensen[23] reported a single synovial fistula, which responded to arthroscopy synovectomy and intravenous antibiotics. The cause of the fistula was not mentioned; however, the careful closure of portals with persistent drainage therapy may help prevent its formation. This complication was not detected in our study.

Rupture of the extensor hallucis longus and extensor digitorum communis tendons have been published.[24,25] The aggressive use of radiofrequency or shaver debridement has been considered as causes for the iatrogenic rupture of extensor tendons. As a precaution measure, bear in mind the importance of the shaver cutting edge position; the sharp part must always be oriented towards the joint and never towards the skin. We diagnosed a complication related to a partial lesion to the extensor digitorum longus in an ankle with osteoarthritic degeneration and major osteophytes. This situation resulted in a very narrow operative field associated with the need for major debridement during surgery, which we consider led to the tendon lesion.

Carlson *et al*.[26] described lesions produced in the anterior talofibular ligament and the deltoid ligament when creating accessory antero-lateral and antero-medial portals. In our study, an exclusion criterion was the need for accessory portals, which may account for the absence of this complication in our study.

The limitations of our study should be addressed. First, our choice of study design prevented us from objectively comparing our results with those of studies that included arthroscopy approaches with joint distraction. Second, we failed to identify all the significant risk factors that led to complications. A third limitation was the wide age range of the participants and of their diagnoses for the same procedure.

CONCLUSIONS

Detailed knowledge of the foot and ankle anatomy, as well as the intra-articular anatomy is crucial to avoid neurological lesions, tendon and ligament injuries, wound complications, infections and instrument breakage. The location of the portals is a decisive factor, since most nerve complications are the result of direct lesions, thus they should be considered a preventable complication. In addition to anatomical knowledge, the correct use of the procedure technique prevents many of the previously mentioned complications.

We believe there are crucial aspects to bear in mind: identifying the structures more susceptible to lesion before surgery, marking them, accessing the joint through blunt dissection and with a dorsiflexed ankle, so as to move away vital structures and increase the safe working area. Anterior ankle arthroscopy without joint distraction through standard antero-lateral and antero-medial portals is a safe technique, having a low rate of complications and very low morbidity for the patient.

Conflict of interest: Authors claim they do not. have any conflict of interest.

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