

Review

A literature review of the complications following anterior and posterior ankle arthroscopy



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ABSTRACT

Introduction: There is a wealth of studies reporting the complications of anterior and posterior ankle arthroscopy. The aim of this study is to summarise and review the complication rate(s) associated with both anterior and posterior ankle arthroscopy, as described in the literature.

Material and methods: The authors carried out a comprehensive review of the literature up until March 2018. An extensive search of the MEDLINE, Cochrane library and EMBASE databases was undertaken using the following keywords: complications of ankle arthroscopy, anterior ankle arthroscopy, and posterior ankle arthroscopy.

Results: A total of 107 papers were identified and 55 were deemed appropriate for analysis. The overall complication rate of ankle arthroscopy was found to be between 3.4– 9%.

Conclusions: No life threatening complications were identified in the literature with both anterior and posterior ankle arthroscopy. The commonest complication after anterior and posterior ankle arthroscopy is superficial peroneal nerve injury and temporary Achilles tendon tightness, respectively.

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1. Introduction

Ankle arthroscopy is a procedure with increased popularity among foot and ankle surgeons. As indications for ankle arthroscopy increases, complications associated with this procedure must be re-evaluated [1]. In 1931, Burman was convinced that arthroscopy of the ankle joint is impossible because of the limited space and close relationship of the delicate anatomical structures [2]. In 1939 a standard technique of ankle arthroscopy was published by Takagi in Tokyo, Japan [3].

Complications are defined in the medical literature as “impairment(s) of a normally manageable illness or surgical intervention caused by unpredictable circumstances” [4]. The rate of complications following ankle arthroscopy had been cited in the pre-distraction era as up to 24.6%, this dropped dramatically to 13.6% after the introduction of invasive distraction [5]. Non-invasive distractors include a disposable clove-hitch-type device wrapped over the midfoot and the heel that can be either attached to an ankle distractor or a waist band for variable distraction [6,7]. Surgical techniques have evolved as practice of ankle arthroscopy has matured. Anteromedial and anterolateral portals are the most commonly used portals for anterior ankle arthroscopy [6]. In 2000, Van Dijk et al. introduced the concept of a two portal posterior ankle arthroscopy with the patient in a prone position – with portals placed just laterally and medially to the Achilles tendon [8] (Fig. 1). The purpose of this literature review is to identify the complication rates of both anterior and posterior ankle arthroscopies as documented in the literature.

2. Material and methods

The authors carried out a comprehensive review of the literature up to March 2018. An extensive search of the MEDLINE, Cochrane, and EMBASE databases was undertaken using the following keywords; complications of ankle arthroscopy, anterior ankle arthroscopy, and posterior ankle arthroscopy. Non-English language literature without English translation was excluded. The studies from these searches were evaluated to segregate literature that described therapeutic studies investigating the outcomes of ankle arthroscopy.

3. Results

A total of 107 papers were identified and 55 were deemed appropriate for analysis. Fig. 2 shows the strategy of the literature search. The largest studies assessing the complications of ankle arthroscopy are listed in Table 1.

4. Complications

4.1. Neurological injury

Neurological injury is the most common complication post ankle arthroscopy. Ferkel et al. published a comprehensive analysis of complications of ankle arthroscopy in 612 patients citing an overall complication rate of 9%, with neurological injury accounting for 49% of those complications [9]. In 2011, Young et al. found that after 294 ankle arthroscopies, they saw a complication rate of 6.8%, with 80% of those being made up of neurological injury [10].

4.1.1. Superficial peroneal nerve (SPN) and its branches

The SPN is the most commonly injured nerve in anterior ankle arthroscopy [1,9,10]. In 1989, Ferkel et al. reported SPN injury rate of 8.3% with 40% of those patients going on to have a permanent sensory deficit [11]. In a multicentre study, that included 260 anterior ankle arthroscopic procedures, of the 3.46% neurological complications, 1.92% involved the SPN [1]. Ferkel et al. reported a 56% SPN injury rate from the 49% neurological injuries in total [9]. In a study including 79 patients, Amendola et al. reported a 1.2% permanent loss of sensation in the SPN territory [12].

The SPN injury rate was 5.4% in a retrospective study including 294 patients using non-invasive distraction for anterior ankle arthroscopy [10]. Preoperative identification and marking of SPN has shown to be effective in minimising iatrogenic injury during portal placement. In a study from the Netherlands that included 1305 ankle arthroscopies, the SPN injury rate was 1.13% of the patients who underwent anterior ankle arthroscopy [13]. In a study, by Suzangar and Rosenfeld, of 96 consecutive patients, 1.04% had loss of sensation in the distribution of the medial branch of the SPN following anterior ankle arthroscopy after being preoperatively marked [14,15].

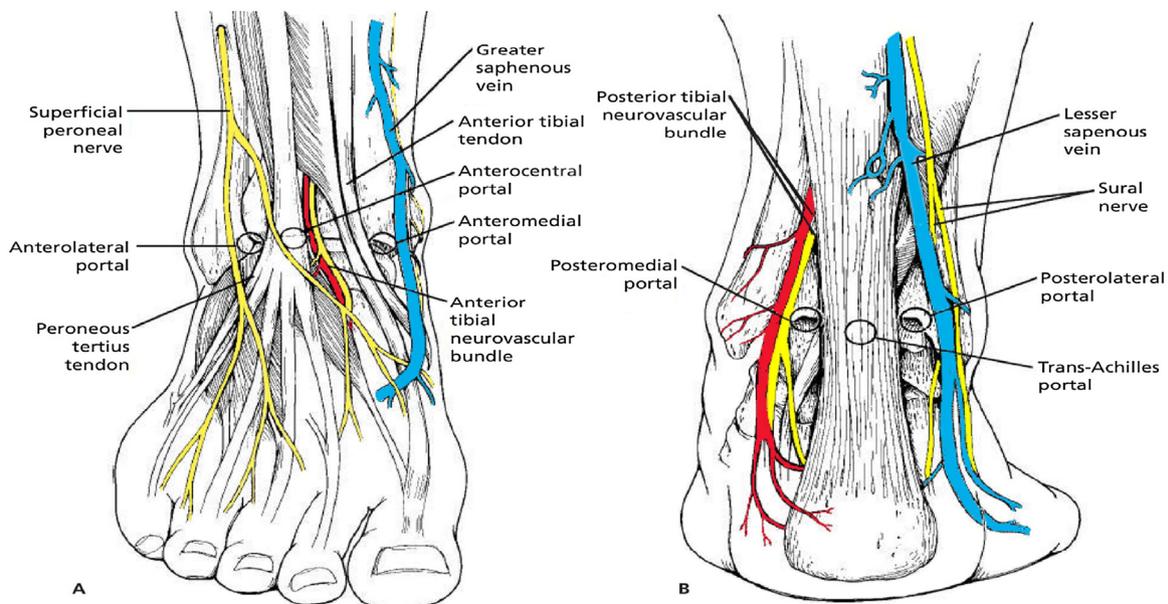


Fig. 1. Ankle arthroscopy portals anatomy.

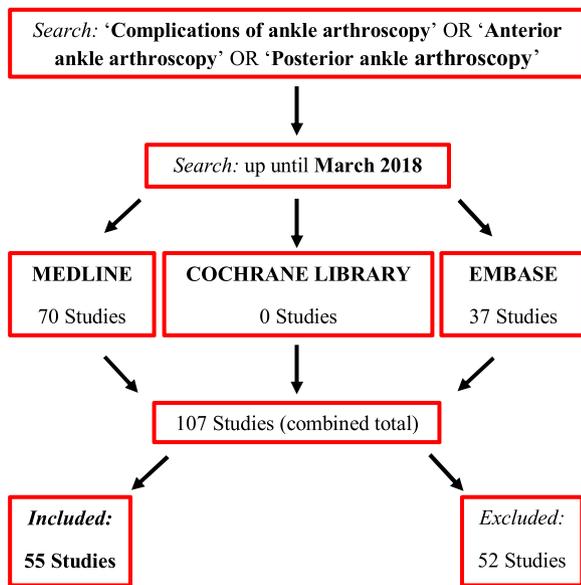


Fig. 2. Flowchart showing literature search.

4.1.2. Other nerve injuries

The deep peroneal, saphenous and sural nerves are less likely to be injured during anterior ankle arthroscopy. In 2012 Deng et al. reported the incidence of deep peroneal, saphenous and sural nerve injury to be 0.77%, 0.38% and 0.38% respectively, using anterolateral and anteromedial and posterolateral portals [16]. In 2001 Ferkel et al. found that after 612 ankle arthroscopy procedures, the incidence of deep peroneal, saphenous and sural nerve injury(ies) was 0.73%, 3.3% and 4.04%, respectively [9]. Zengerink and van Dijk reported the incidence of injury to the deep peroneal, saphenous and sural nerve(s) after anterior ankle arthroscopy was 0.2%, 0.16% and 0.08%, respectively. In the same study the incidence of tibial nerve injury after posterior ankle arthroscopy was 0.16% [13].

In the largest study to date to report complications of posterior and hind foot arthroscopy, Nickisch reported that out of 189 procedures, injury to the tibial and sural nerve was reported in 7 cases in total (tibial nerve 4 and sural nerve 3 patients), and from these two failed to resolve [17]. Willits et al. reported no neurological complications post posterior ankle arthroscopy, but did however report a 20% incidence rate of temporary numbness over the scar [18]. Similar results have been published by the Van Dijk series of 146 posterior ankle arthroscopies [19]. Temporary thigh pain, paresis and paraesthesia have been reported with the use of a pneumatic tourniquet [5,9].

Table 1

A list of the largest studies assessing the complications of ankle arthroscopy.

Author (year)	Type of study	Anterior/posterior	Number of procedures
Ferkel et al. (1996) [6]	Retrospective	Anterior	612
Amendola et al. (1996) [12]	Retrospective	Anterior	79
Rasmussen and Hjorth Jensen (2002) [46]	Prospective	Anterior	105
Willits et al. (2008) [18]	Prospective	Posterior	24
Allegra and Maffulli (2010) [40]	Prospective	Posterior	32
Young et al.(2011) [10]	Retrospective	Anterior	294
Zengerink and van Dijk (2012) [13]	Retrospective	Both	1305
Deng et al. (2012) [16]	Retrospective	Anterior	405
Nickish (2012) [17]	Retrospective	Posterior	189
Vega et al.(2014) [53]	Retrospective	Anterior	74
Song et al. (2016) [58]	Prospective	Both	28
Blázquez Martín et al. (2016) [61]	Retrospective	Both	198

Depending on the particular nerve at risk, this of course may have differing levels of impairment for the patient. For example, compromise of the superficial peroneal nerve (sensory) is likely to have less of an impact in comparison to damage to the tibial nerve (with combined motor and sensory components). This is important as it affects how we consent our patients and how we warn them of the possible complications.

4.2. Vascular injury

An overall incidence of 0.008% for pseudoaneurysm formation following ankle arthroscopy has been reported [20]. The antero central portal is seldom used due to its potential for vascular complications [6]. If the antero central portal is ever required, placing it through the extensor tendon can minimise the risk of neurovascular compromise [15]. Anterior tibial artery aneurysm following ankle arthroscopy has been reported in 10 cases using anteromedial and anterolateral portals [20–29].

With the use of Magnetic Resonance Imaging (MRI), Son et al. assessed the anatomic variations of anterior tibial artery and its branches. In 22 out of the 358 cases (6.2%), the two most at risk variants were lateral to extensor digitorum and tibialis posterior tendons which are located near the anterolateral ankle portal [30]. Pseudoaneurysm of dorsalis pedis and peroneal artery post ankle arthroscopy has been described [31,32]. Many individuals have raised concerns about the risk of neurovascular injury during posterior ankle arthroscopy especially with posteromedial portal [33–37]. Equally, several studies have shown that posterior ankle and subtalar arthroscopy is safe, when performed correctly [8,19,38–42]. To date, there has been no reports in the literature of vascular injury during posterior ankle arthroscopy.

4.3. Deep vein thrombosis (DVT)

The occurrence of DVT has been reported in studies by Young and Deng to be between 0.3 and 0.4%, respectively, within two weeks after anterior ankle arthroscopy [10,16]. Zengerink and van Dijk cited a rate of 0.08% for the incidence of nonfatal pulmonary embolism (PE) in 1305 consecutive ankle arthroscopies [13]. Similar to any other lower limb surgical procedure, prophylactic treatment for the prevention of DVT is indicated in those high risk patients [15].

4.4. Infection and wound complications

Introducing infection is always a concern after any arthroscopic surgery [43]. Wound problems are more likely to occur after anterior ankle arthroscopy due to the limited soft tissue envelope

[9,15]. In a prospective study that included 146 anterior ankle arthroscopies, superficial infection occurred in 1 patient (0.68%) [44]. Ferkel et al. found that after 101 anterior ankle arthroscopies the incidence of infection was 4.0% (2 superficial, 2 deep infection) [11]. In 2001, Ferkel et al. found 8 superficial infections in 612 ankle arthroscopies (0.13%) [9,15]. In the same study, 2 patients (0.03%) developed deep infection which seemed to correlate with lack of preoperative antibiotic. Young et al. reported 0.7% superficial infection after 294 consecutive anterior ankle arthroscopies [10]. In Deng et al.'s multicentre review, the incidence of superficial infection at the portal site following anterior ankle arthroscopy was 3.08% [16]. In the Zengerink and van Dijk series, out of 905 anterior ankle arthroscopies the superficial and deep infection rate was 0.5% and 0.2%, respectively [13]. In the same study the superficial infection after 311 posterior ankle arthroscopies was 0.3%. In the Nickisch study, the superficial infection was 1.05% (2 out of 189 posterior ankle arthroscopies) [17]. To date there are no reported cases of osteomyelitis following ankle arthroscopy.

In a literature review by Patel et al. looking specifically at bone healing, significant differences in time to radiological union were noted in patients who smoked. Within this review, as a secondary measure, it was also noted that smokers were at an increased rate of developing superficial and/or deep infection and/or osteomyelitis over non-smokers [45].

4.4.1. Sinus tract formation

A sinus tract can form from one or more chronically draining ankle portals. The incidence of sinus tract formation is <0.3% post ankle arthroscopy [6,10,13,15]. Out of 105 anterior ankle arthroscopies, it was found that 1 patient developed a synovial fistula which required antibiotics and arthroscopic synovectomy [46].

4.5. Tendon and/or ligament injury

Careless portal placement and excessive debridement can lead to injury to the tendons and ligaments around the ankle joint [15,19]. The use of the trans Achilles portal has been abandoned because of the potential of tendon injury and/or rupture [9,15]. Rupture of the extensor digitorum communis and extensor hallucis longus have been reported after anterior ankle arthroscopy [47–49]. The anterior talofibular and the deltoid ligament can be injured during placement of accessory anterolateral and anteromedial portals [15,50]. Postoperative stress radiographs have shown no evidence of ligamentous injury if distraction is used [51]. Achilles tendon tightness after posterior ankle arthroscopy was reported to be 2.1% and 4.1% in Nickisch and Willits studies, respectively, all of which resolved within the 12 months postoperatively [17,18]. Iatrogenic injury to the flexor hallucis longus (FHL) was recorded as 0.2% after the Ribbans et al. review of 499 posterior ankle arthroscopies [52].

4.6. Articular cartilage injury

Anatomic features of the ankle joint make it more susceptible over other joints to intraoperative cartilage injury [52]. Distraction techniques have reduced the incidence of articular cartilage injury by increasing joint space allowing for better visualisation [9]. Proper portal placement is key to help avoid causing damage to the cartilage during introduction of the arthroscopic instruments [9,16,19]. Vega et al. reported 23 lesions of the cartilage after a review of 74 anterior ankle arthroscopies (31%) [53]. In the same study, the most common location of iatrogenic cartilage injury was anterolateral (zone 3) and central areas (zone 5) of the talus as described by Elias et al. [54] (Fig. 3). The use of bupivacaine intraarticular injection, for postoperative pain control, should be avoided due to the risk of chondrotoxicity [55].

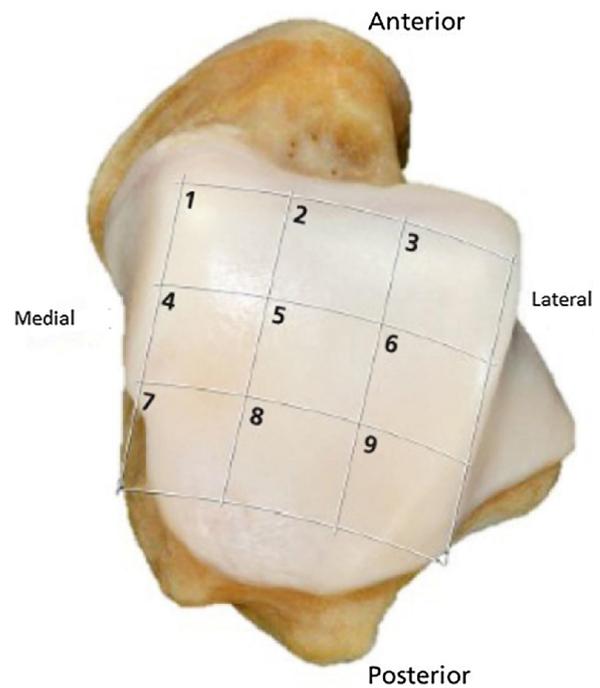


Fig. 3. Talus articular cartilage zones.

4.7. Postoperative swelling

Although postoperative ankle swelling is rare, a haemarthrosis or synovitis are usually the underlying cause [9]. In a study that included 397 anterior ankle arthroscopies, the incidence of haemarthrosis was 0.3% [56]. Ferkel et al. recommends releasing the tourniquet and assessing for bleeding, and if a vessel cannot be found it is advised to insert a drain [9]. Postoperative synovitis occurred in one patient in the Zengerink and van Dijk study that included 311 posterior arthroscopic procedures (0.32%) [13].

4.8. Complex regional pain syndrome (CRPS)

The diagnosis and management of CRPS can be challenging and labour intensive [57]. CRPS is characterised by pain out of proportion to a stimulus, with associated swelling, calor and vasomotor symptoms [15]. CRPS after anterior and posterior ankle arthroscopies has been reported as 0.1% and 1%, respectively [13,17], and, similarly to a diagnosis of CRPS elsewhere, a multidisciplinary team approach is advocated for the management of this condition [15].

4.9. Other

The prospective study by Song et al. demonstrated a novel method for treating dual anterior and posterior ankle impingement using anterior medial, anterior lateral and a posterior lateral portal [58]. And although no significant difference in function was found between patients who had this procedure (in comparison to the conventional anterior and/or posterior arthroscopy), there was a significant reduction in operative time. This technique, however, has been shown in to cause injury to the tibial nerve, and so of course this is not without its own potential additional complications [59].

Less common complications have been reported in the literature including failure of procedure due to difficult access, instrument breakage and iatrogenic distal fibula excision [12,9,15,60,61]. The complications of anterior and posterior ankle

Table 2

Complications following anterior and posterior ankle arthroscopies.

Neurovascular	Anterior ankle arthroscopy	Posterior ankle arthroscopy
SPN and branches of	1.04–8.3%	–
Deep peroneal nerve	0.2–0.77%	–
Saphenous nerve	0.16–3.3%	–
Sural nerve	0.08–4.04%	1.50%
Tibial nerve	–	0.16–2.1%
Pseudoaneurysm	0.008%	–
DVT	0.3–0.4%	–
Nonfatal PE	0.08%	–
Infection		
Superficial	0.13–3.3%	0.13–1.05%
Deep	0.03–3.3%	–
Sinus tract formation	0.3–0.9%	–
Tendon injury		
Extensor hallucis longus rupture	3 case reports	–
Extensor digitorum communis rupture	1 case report	–
Flexor hallucis longus injury	–	0.20%
Temporary Achilles tendon tightness	–	2.1–4.1%
Other		
Articular cartilage injury	31%	–
Postoperative swelling	0.30%	0.30%
CRPS	0.10%	1%

arthroscopy are summarised in Table 2. With these complications in mind Buckingham et al. described a medial midline portal (between the tendons of extensor hallucis longus and tibialis anterior), which, from cadaveric dissection, proved to offer a safer alternative to the anterocentral portal when considering the risk of nerve and/or vessel compromise [62].

One of the limitations of this study is that a comparison of the type of procedure performed and relative risk of a complication developing was not investigated. Although this in itself has not been reported, we feel that this is a separate study in its own right, and was beyond the scope of our work

5. Conclusion

No life threatening complications were identified in the literature both with anterior and posterior ankle arthroscopy. The commonest complication after anterior and posterior ankle arthroscopy is superficial peroneal nerve injury and temporary Achilles tendon tightness, respectively. The use of non-invasive distraction, preoperative identification of the SPN and careful portal placement will all help to reduce the rate of complications following ankle arthroscopy.

Declarations of interest

None.

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