Arthroscopic versus open ankle fusion: early and late results

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Background
Open ankle arthrodesis has been the standard operative treatment for any case of advanced osteoarthritis ankle, but the arthroscopic technique is gained popularity.
Patients methods
This study was conducted retrospectively reviewing surgeries undertaken between January 2010 and June 2012 for ankles with osteoarthritis. The authors performed 42 ankle arthrodesis procedures on 42 patients. A total of 20 patients were included in group A (arthroscopic ankle fusion), and the other 22 patients were in group B (open anterior ankle fusion). Patients of each group were assessed using preoperative Ankle Osteoarthritis Scale (AOS) score; both the pain and disability components were used to calculate the total score.
Results
In group A, all the cases were united, with the average time for union being 12.8 ±1.19 weeks. Of 20 ankles, 65% showed signs of clinical and radiological union by 12 weeks. The early results showed major decrease in AOS from 116±8.6 preoperatively to 19.4±2.3 postoperatively. This shows that the arthroscopic fusion was able to decrease the score by an average of 97.7±10.2 points. Long-term follow-up was 71.8±8.6 months and showed that the early postoperative results did not change significantly: 55% of patients still had excellent outcome, and four patients (20%) develop subtalar osteoarthritis. In group B, 21 cases (>95%) were united, with an average time to union of 13.3 ±5.6 weeks. The early results showed major decrease in AOS from 114±7.24 preoperatively to 26.68±6.95 postoperatively. This shows that the open anterior fusion was able to decrease the score by an average of 88.2±7.2 points. Long-term follow up was 83.5±12 months and showed that the early postoperative results changed significantly, where nine patients (40.9%) still had excellent outcome, and nine patients (40.9%) developed subtalar osteoarthritis and four of them needed further subtalar fusion.
Conclusion
This was a comparative study that involved two groups with two techniques of ankle fusion, showing early and late results. There was no significant difference between both the groups regarding early results, but long-term follow-up clarifies the advantages of arthroscopic fusion technique.

Keywords:
ankle arthrodesis, ankle fusion, arthroscopic

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Introduction

As there are more than 40 open procedures described for the management of ankle osteoarthritis, in addition to total ankle replacement, external fixation, and arthroscopic ankle fusion, until now, orthopedic surgeons do not have a common consensus about the best method of ankle fusion with no or less complications.

From the early 1950s to the mid-1970s, external fixation for ankle arthrodesis was dominated. In the late 1970s, internal fixation was developed, and in 1983, arthroscopic ankle fusion had been described [1,2]. The open technique is still widely used and specially for ankle arthritis with major deformity, nonunion, bone loss, Charcot arthropathy, or infection. The fusion rate in most recently published studies was 85% or more [3,4]. Although many techniques are available, the current recommendations favor the use of compression fixation using screws and/or plates.

Complications associated with ankle fusion include early and late complications, which vary from wound problems, fracture, nonunion, to late secondary arthrosis of subtalar or talonavicular joints, with an

overall rate of complications of up to 60%, which leads to a continuous search for a better technique [5].

We compared the long-term follow-up results of patients who underwent open or arthroscopic ankle fusion to evaluate whether the better results of arthroscopic fusion in the early period are still better than open methods after long-term follow-up.

Patients and methods

This study was conducted retrospectively reviewing surgeries undertaken between January 2010 and June 2012 for ankles with osteoarthritis. The study was approved by the institutional ethics committee in the Orthopedic Department of Orthopaedic Surgery, Port-Said University, Faculty of Medicine, Suez Canal University, Ismaillia, Egypt. We performed 42 ankle arthrodesis procedures among 42 patients (Table 1). A total of 20 patients were included in group A (arthroscopic ankle fusion), and the other 22 patient were in group B (open anterior ankle fusion). Patients of each group were assessed using preoperative Ankle Osteoarthritis Scale (AOS) score; both the pain and disability components were used to calculate the total score. AOS was assessed again, when fusion was evident both clinically and radiologically. The exclusion criteria were ongoing infection, previous ankle fusion or arthroplasty, malalignment, and Charcot joint.

Statistical analysis

Gathered data were processed using SPSS version 19 (SPSS Inc. Chicago, Illinois, USA). Quantitative data were expressed as means±SD, whereas qualitative data were expressed as numbers and percentages (Table 1).

Table 1 Demographic characteristics of both groups

	Group A	Group B
Sex		
Male	17	18
Female	3	4
Age	31±12.7	32.9±9.5
Etiology		
Post-traumatic	10	11
Postinfection	3	2
AVN	3	2
Rheumatoid arthritis	2	3
Neglected dislocation	1	1
Primary arthritis	1	1
Sciatic nerve Injury	0	2
Total	20	22

AVN, avascular necrosis.

Results

Group A included 20 patients with ankle osteoarthritis with normal or less than or equal to 15° varus or valgus deformity. There were 17 males. The mean age at surgery was 31±12.7 years. Post-traumatic arthritis represented 50% of cases, postinfection arthritis in three ankles, avascular necrosis in two ankles, and primary osteoarthritis in 10% of ankles. The average duration of surgery which includes arthroscopic debridement and screws fixation was 66.05 ±18.4 min. The mean hospital stay was 1.2±0.52 days, and 85% of the patients were discharged within the first 24 h postoperatively. Only one patient was discharged on the third day postoperatively owing to bleeding from incisions, as he underwent posterior tibial nerve release and plantar fascia release at the same session of ankle fusion.

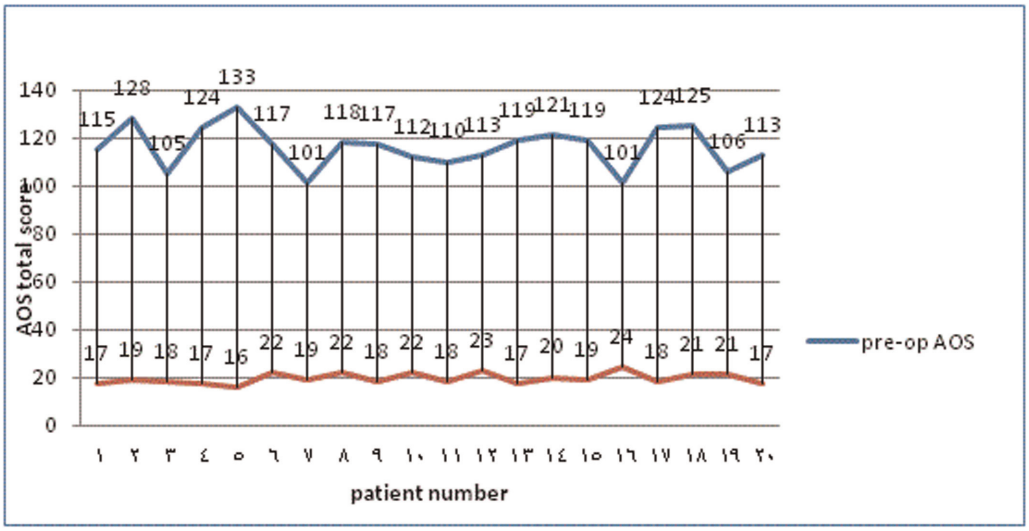
All the cases united with an average time for union being 12.8±1.19 weeks. Of 20 ankles, 65% showed signs of clinical and radiological union by 12 weeks. The early results showed a major decrease in AOS from 116±8.6 preoperatively to 19.4 ±2.3 postoperatively. This shows that the arthroscopic fusion was able to decrease the score by an average of 97.7±10.2 points (Figs 1 and 2). A total of 13 patients showed excellent results within the first year postoperatively regarding pain and disability with no intraoperative or postoperative complications, and only one patient needed to remove the screws because of pain owing to its prominence.

Long-term follow-up (Table 2) was 71.8±8.6 months and showed that the early postoperative results did not change significantly: 55% of the patients still had excellent outcome, four patients (20%) developed subtalar osteoarthritis, and two of them needed further subtalar fusion. Regarding shortening, it was approximately 0.3±0.1 cm which was not noticed by patients or relatives.

Tibiopedal motion is defined as the arc of motion between maximum dorsiflexion and maximum plantar flexion, the angles being those subtended by the long axis of the tibia and foot in the lateral projection. Nine patients (45%) of arthroscopic ankle fusion had 15–20° of tibiopedal motion after about 4 years of follow-up, which is markedly beneficial in walking and talk-off and enhances excellent outcome.

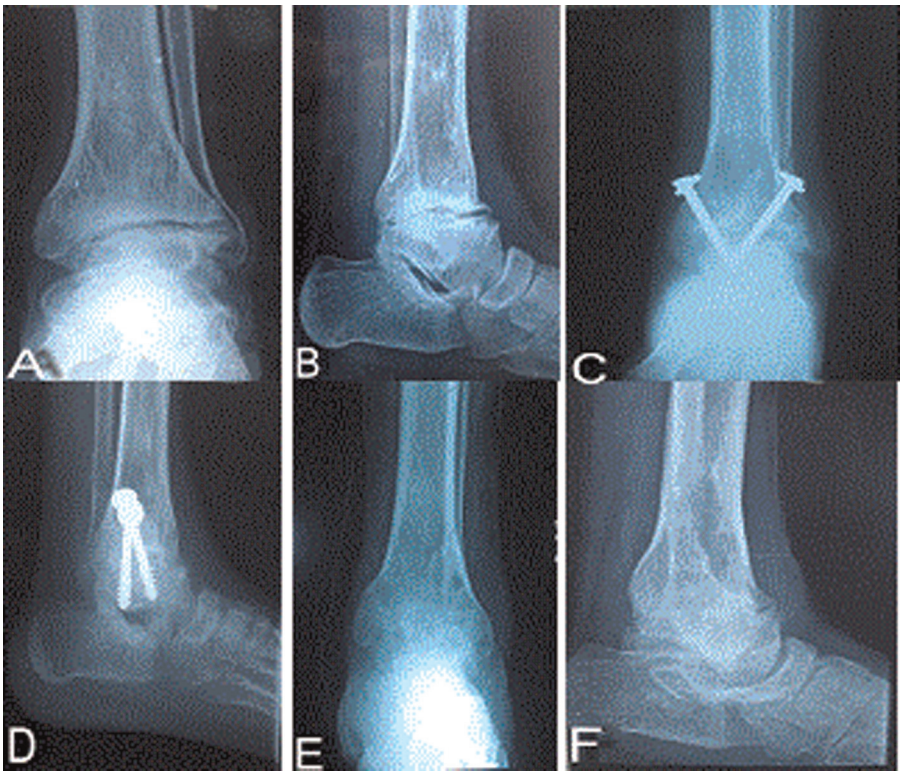
Group B included 22 patients who underwent anterior open ankle arthrodesis. There were 18 men and four women, with an average age of 32.9±9.5 years.

Figure 1



Line chart comparing Ankle Osteoarthritis Scale preoperative and postoperative arthroscopic ankle arthrodesis.

Figure 2



(a and b) Anteroposterior and lateral views of a 23-year-old male patient, presented with postinfection ankle arthritis 5 years ago. (c and d) Anteroposterior and lateral views of 10-week postoperative arthroscopic ankle arthrodesis with good union. (e and f) Twenty-eight-week postoperative anteroposterior and lateral view radiographies showing complete solid fusion.

Post-traumatic arthritis represents 55% of the causes of osteoarthritis of the ankle. Primary arthritis was diagnosed in one patient, and two patients underwent ankle fusion owing to sciatic nerve injury. The average duration of operation was 85±12.7 min whatever the kind of fixation used because some patients were fixed with anterior T plate and others with two or three screws and sliding graft. The mean hospital stay was 3±0.6 days, and splitting of the cast or changing it was needed in most of the patients owing to swelling or soaking. A total of 21 cases (>95%) were united, with an average time to union of 13.3±5.6 weeks. The early results showed major decrease in AOS from 114±7.24 preoperatively to 26.68±6.95

postoperatively. This shows that the open anterior fusion was able to decrease the score by an average of 88.2±7.2 points. Three patients developed wound infection, one patient sustained stress fracture at the proximal tibial screw, and another three patients had screws penetrating the subtalar joint but with no complaint at the early stage. Thirteen patients (59%) showed excellent outcome at the early stage of follow-up.

Long-term follow-up (Table 2) was 83.5±12 months and showed that the early postoperative results changed significantly: 40.9% of the patients still had excellent outcome, nine patients (40.9%) develop subtalar osteoarthritis, and four of them need further subtalar fusion. Regarding shortening, it was about 0.9±0.2 cm. Tibiopedal motion is between 15 and 20° in only five patients at the late follow-up.

The early results between the two studied groups were not different significantly in spite of short hospital stay and minimal swelling postoperatively in group A. A significant difference was found between the two groups regarding the final AOS score, shortening (P=0.00), and developing subtalar arthritis (P=0.04), in favor of arthroscopic ankle fusion technique (Table 2, Fig. 3).

Discussion

Although inflammatory and primary osteoarthritis can occur, post-traumatic arthritis is the most common form of arthritis to affect the ankle joint, which occurs generally in younger, active population. The role and effectiveness of conservative/nonoperative treatment needs to be further determined. Arthrodesis generally has a good outcome, but its limitations have been recognized. These limitations include the extended time required to achieve union, potential for nonunion, arthritis developed in adjacent joints, leg length discrepancy, malalignment, chronic edema, symptoms due to hardware, stress fractures, and persistent pain [6]. The formal goals of ankle arthrodesis are to eliminate pain and deformity of the degenerated ankle joint and obtain a plantigrade foot so as to achieve painless mobilization. This can be achieved through a variety of techniques varying in approach (open, mini open, and arthroscopic) [2,7].

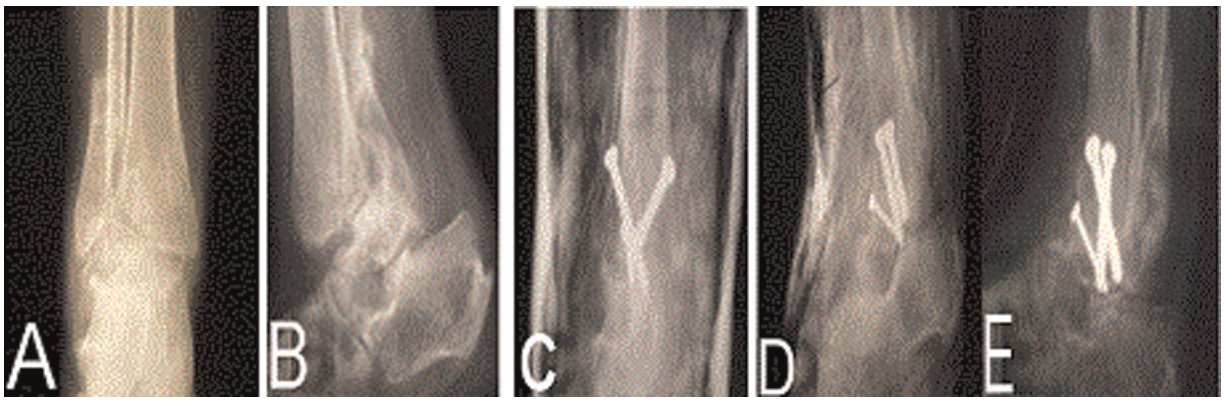
Since its first description in 1983, arthroscopic ankle arthrodesis has gained increasing popularity as it offers many advantages over open technique, being less invasive and having a more rapid recovery with less soft tissue dissection. Improved instrumentation and

Table 2 Clinical rating scale

Rating	Clinical characteristics	Group A		Group B	
		Early F/U	Late F/U	Early F/U	Late F/U
Excellent	Solid fusion, no pain, no limp, no job restrictions, and excellent appearance	13	11	13	9
Good	Solid fusion, mild pain, mild inconstant limp, same job with some restrictions, and acceptable appearance	5	5	4	3
Fair	Solid fusion, moderate pain, constant limp, job change, and poor appearance	1	2	3	6
Poor	Any ankle with fusion failure or severe pain	1	2	1	4

P=0.43 and 0.000, showing significant statistical difference at late follow-up, and regarding early results, no difference.

Figure 3



(a and b) Anteroposterior and lateral view of a 27-year-old female patient presented with osteoarthritis ankle after post-traumatic neglected fracture dislocation ankle 3 years ago. (c and d) Postoperative radiography shows the orientation of the screws and the rigid stability of the tibiotalar contact. (e) Fourteen-week follow-up lateral view radiography shows solid fusion.

greater experience have produced encouraging results, with the most recent studies demonstrating shorter hospital stays and reduced time to solid fusion while maintain fusion rates equivalent to those associated with open techniques [2]. Our study added to the previous arthroscopic advantages that long-term follow-up showed better results more than open ankle fusion regarding adjacent joint degenerative changes and improvement in tibiopedal motion.

Reported ankle fusion healing times vary between 7 and 72 weeks. High nonunion rates have led to an increased use of bone graft and bone graft substitutes. We only use cancellous bone obtained from tibia around the sliding graft, but many other authors encourage use of locally generated bone slurry or recombinant morphogenic protein 2 or porous tantalum to accelerate the time of healing and avoid nonunion in high-risk ankle fusion [8,9]. Only one patient of 42 in both groups developed nonunion in our study, and time of healing was about 12 weeks.

The development of arthritis at the adjacent joints is a major issue when considering treatment alternatives as mentioned by Zwipp *et al*. [10]. They follow up 72 patients for about 5 years. Secondary osteoarthritis of the subtalar joint and talonavicular joints developed during the follow-up period in 17 and 11%, respectively. In our study, we followed up our patients for a longer time (average 10 years), and we noticed that arthroscopic ankle fusion evaluated at late follow-up results in a less percentage of subtalar osteoarthritis cases (20 vs. 40.9% regarding open fusion group). Preservation of soft tissue and blood supply around talus in arthroscopic fusion may be the explanation to this finding.Townshend and his colleagues showed the same short-term results we had in our study, comparing open and arthroscopic fusion methods at 1 and 2 years postoperatively. They also concluded, as in this study, that arthroscopic fusion group showed a shorter hospital stay and less blood loss [11].

Conclusion

Our study is a comparative type involving two groups with two techniques of ankle fusion, showing early and late results. No significant difference between both groups regarding early results, but long-term follow-up clarifies the advantages of arthroscopic fusion technique.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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