The American Journal of Sports Medicine
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Am J Sports Med 2012 40: 419 originally published online October 7, 2011
DOI: 10.1177/0363546511423739

The online version of this article can be found at:
http://ajs.sagepub.com/content/40/2/419

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Osteochondral Lesion of the Talus

Could Age Be an Indication for Arthroscopic Treatment?

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Background: Several studies have addressed the issue of the feasibility of arthroscopic surgery in older patients, usually by choosing an arbitrary age limit.

Hypothesis: Patient age is not associated with poor clinical outcome after arthroscopic surgery for osteochondral lesion of the talus (OLT), and other patient variables are the major determinants of clinical success/failure.

Study Design: Cohort study; Level of evidence, 3.

Methods: Between 2001 and 2008, 173 ankles underwent arthroscopic marrow stimulation treatment for OLT and were stratified into 6 age groups (<20, 20-29, 30-39, 40-49, 50-59, and ≥60 years). Bivariate and multivariate analyses were performed to determine the effect of age on clinical outcome.

Results: There were no significant differences among the 6 age groups in the preoperative and postoperative visual analog scale (VAS) for pain or the American Orthopaedic Foot and Ankle Society (AOFAS) score. There was a significant increase in the duration of symptoms ($P < .001$) and a significant decrease in the incidence of trauma ($P = .01$) in the older group. Both the size of the osteochondral defect and the number of associated intra-articular lesions independently predicted a poor clinical outcome ($P < .001$).

Conclusion: In contrast to some of the previous studies on this topic, we found that increased age was not an independent risk factor for poor clinical outcome after arthroscopic treatment for OLT. We did find that older patients were less likely to have a history of trauma and had a longer duration of symptoms, had smaller osteochondral defects, and had more associated intra-articular lesions.

Keywords: ankle; osteochondral lesion; age; clinical outcome

Osteochondral lesions of the talus (OLT) are common injuries that are often found in patients with chronic disabling pain after ankle sprains.[1,3] The technique of arthroscopic marrow stimulation is an established procedure for this condition. While OLT is becoming increasingly prevalent in the older population, there is disagreement among surgeons about the outcomes of arthroscopic surgery in older patients. Several recent studies have indicated that older patients seem to do well with arthroscopic treatment for OLT,[6,10,14,24] while others have reported less favorable outcomes in older patients.[7,11,17]

Most of these studies used an arbitrary age limit as a cutoff to define "older" patients (50, 55, 60, or 65 years) and evaluated patient outcomes comparing these patients with their younger counterparts. The lack of consistency between studies in defining what is an older patient and the inconsistent findings in general make these studies difficult to compare and critically evaluate.

The goals of this study were to examine trends in patient characteristics, clinical outcomes, and arthroscopic findings that occur with increasing age in a large series of patients divided into 6 different age groups. We used a multivariate analysis to determine the independent effect of age on clinical outcome after controlling for other important covariates.

MATERIALS AND METHODS

We analyzed 170 patients (173 cases) who had a diagnosis of OLT and were treated with arthroscopic marrow stimulation between January 2001 and December 2008. We obtained approval from the Institutional Review Board to perform a retrospective review of patients who had localized defects on the talar dome with symptoms of ankle pain and/or functional limitations despite a minimum of 6 months of nonsurgical management. The study was further limited to primary cases with no previous surgical treatment, and patients with diffuse arthritic changes or associated ankle fractures were excluded.

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The authors declared that they have no conflicts of interest in the authorship and publication of this contribution.

The American Journal of Sports Medicine, Vol. 40, No. 2
DOI: 10.1177/0363546511423739

Clinical Analysis

Patients were divided into 6 age groups: <20 years, 20 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, and $\geq$60 years. All analyses were performed with these categorical age groups. Bivariate and multivariate analyses (see statistical methods below) were used to determine the effect of age on the following outcome measures: (1) visual analog scale (VAS) for pain and (2) American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score.[15] All patients were asked to fill out a questionnaire composed of questions regarding the duration of their symptoms and the intensity of pain during daily activities and exercise before surgery; 6 weeks, 6 months, 1 year, and 2 years after surgery; and at final follow-up. The clinical results at the final follow-up were graded according to the criteria of Saxena and Eakin[25] (excellent, 90-100; good, 80-89; fair, 70-79; and poor, <70). Treatment was designated as successful if patients did not require osteochondral transplantation and in those with an AOFAS score of 80 or greater, while clinical failure was defined as patients having fair or poor outcomes (AOFAS score <80) or needing osteochondral transplantation.

Radiological Analysis

We also sought to determine the relationships between defect size, associated intra-articular lesions, and age and clinical outcome after arthroscopic treatment. In each patient, we obtained anteroposterior and lateral weightbearing radiographs and magnetic resonance imaging (MRI) scans to assess the size of the osteochondral defect and the associated intra-articular abnormality. The size of the osteochondral lesion was measured by preoperative MRI as described in our previous study.[6] To avoid potential bias, an independent observer who was not involved in the care of the patients and blinded to the intention of this study evaluated the magnetic resonance images. The location of the lesion was described as medial or lateral on coronal images and anterior, center, or posterior on sagittal images.

Surgical Technique

The arthroscopic procedure was performed in a standardized manner in every case. The procedure consists of the accurate debridement of all unstable and damaged cartilage in the lesion, including the calcified layer down to the subchondral bone plate. A microfracture awl (Linvatec, Largo, Florida) was then used to make multiple holes in the defect, 3 to 4 mm apart in areas where the subchondral bone was intact. For areas with subchondral bone loss, chondroplasty was performed with a ring-shaped or curved curette. Associated lesions, including the presence of ankle instability, subchondral cysts, impingement syndrome, and distal tibial plafond lesions, were checked, and treatment modalities were also noted. After the operation, we recommended tolerable weightbearing for patients with lesions smaller than 1.5 cm^2. Those with larger lesions were restricted to partial weightbearing for 3 weeks.[6,13] For 37 patients with lateral ligament reconstruction, a postoperative short leg walking cast with partial weightbearing for 4 weeks was followed by joint motion and muscle strengthening exercise for 8 weeks.[5,12,21,22,24] Sports or high-impact activities were limited for at least 3 months.

Statistical Analysis

The outcome measures of interest were compared among the 6 age groups. χ^2 analysis was used to compare proportions for all categorical data. The reported χ^2 *P* values represent an overall test for differences between the 6 groups, and pairwise comparisons were not performed. The actual data are shown so that the readers could see where the differences exist. All means are reported as mean $\pm$ standard deviation. The Kruskal-Wallis test was used to compare means among the 6 age groups for all continuous variables. *P* values represent an overall test for any differences among the 6 groups. Significance was accepted at $P < .05$. Multivariate logistic regression models were used to assess the independent effect of age on clinical outcome. All multivariate models were controlled for differences in demographic factors, duration of symptoms, history of trauma, size of the osteochondral defect, location of the lesions, and associated intra-articular lesions among the 6 age groups. For the logistic regression models, we reported odds ratios and 95% confidence intervals (CIs) relative to a chosen reference group. All statistical analyses were performed by a statistician using SPSS statistical software (version 12.0.1, SPSS Inc, an IBM Company, Chicago, Illinois).

RESULTS

The demographic data, duration of symptoms, history of trauma, the size and location of the osteochondral defect, and the number and type of associated intra-articular lesions are listed in Table 1. Patients were divided into 6 age groups for the analysis. Patients younger than 20 years of age made up 11.6% of the patient population (n = 20), while 26% (n = 45) were 20 to 29 years of age, 17.3% (n = 30) were 30 to 39 years of age, 22% (n = 38) were 40 to 49 years of age, 16.2% (n = 28) were 50 to 59 years of age, and 7% (n = 12) were 60 years of age or older. Female patients accounted for 30.1% of the population (n = 52). The mean duration of symptoms was 27.7 months (range, 6-120 months), and the average total follow-up time was 70.3 months (range, 24-120 months). The majority of the patients had a history of trauma (75.8%), and the remaining patients reported the onset of ankle pain without any injury or inciting event. More than 80% of the lesions were smaller than 150 mm^2 according to the preoperative MRI measurement. The most commonly affected sites were the medial talar dome, which accounted for 75.7% (131/173) of the cases, and the lateral talar dome, in the remaining 24.3% (42/173). Associated intra-articular lesions included soft tissue impingement (70.8%, 122/173), subchondral cyst (27.8%, 48/173), chronic lateral ankle instability (21.7%, 37/173), and chondral lesion in the tibial plafond (13.6%, 23/173). Debridement was performed for all intra-articular lesions, and removal of loose bodies

TABLE 1
Demographics of the Total Patient Population (N = 173)

	n	%
Age distribution, y		
<20	20	11.6
20-29	45	26.0
30-39	30	17.3
40-49	38	22.0
50-59	28	16.2
≥60	12	6.9
Gender		
Male	121	69.9
Female	52	30.1
Duration of symptoms, y		
<1	88	50.8
≥1	85	49.2
Trauma		
+	131	75.8
–	42	24.2
Defect size, mm^2		
<150	146	85.2
≥150	27	14.8
Location		
Medial/lateral	131/42	75.7/24.3
Anterior/middle/posterior	54/70/49	31.2/40.5/28.3
Associated lesion		
Soft tissue impingement	122	70.8
Subchondral cyst	48	27.8
Ankle instability	37	21.7
Tibial chondral lesion	23	13.6

TABLE 2
Distribution of "Size of Osteochondral Defect" and "Number of Associated Lesions" and AOFAS Score[a]

	n	%	AOFAS Score
Size of osteochondral defect, mm^2			
<100	102	59.8	92.72 ± 11.62
100-149	44	25.4	89.34 ± 5.67
150-199	17	9.5	81.56 ± 5.75
≥200	10	5.3	77.85 ± 4.29
No. of associated lesions			
0	25	14.4	92.16 ± 7.82
1	74	42.8	88.69 ± 9.72
2	64	37.0	83.74 ± 12.16
3	10	5.8	76.89 ± 8.63

[a] $P < .0001$ for differences in AOFAS score by "size of osteochondral defect" and "number of associated lesions." AOFAS, American Orthopaedic Foot and Ankle Society.

and excision of osteophytes and lateral ligament reconstruction were performed for specific lesions. The distributions of "size of the osteochondral defect" and "associated intra-articular lesion" for the overall patient population are shown in Table 2. Both of these variables were negatively correlated with clinical outcome ($P < .0001$). As the size of the osteochondral defect and the number of associated lesions increased, the postoperative AOFAS score decreased.

Demographics, Size, and Associated Lesions by Age Group

The gender distribution differed by age group, with a higher percentage of female patients in the oldest groups ($P = .04$), as shown in Appendix 1 (available in the online version of this article at http://ajs.sagepub.com/supplemental/). The duration of symptoms increased with each increasing age ($P < .0001$): a mean duration of symptoms was 16.7 months for patients younger than 20 years and 39 months for patients 60 years or older. On the other hand, a history of trauma, including a fall, sprain, or motor vehicle accident, was less common in older patients ($P = .01$): 78.9% of patients younger than age 20 years, 87.1% of patients 20 to 29 years, 75.8% of patients 30 to 39 years, 72.7% of patients 40 to 49 years, 67.9% of patients 50 to 59 years, and 66.7% of patients 60 years or older. Older patients were also less likely to do outdoor activities than their younger counterparts, suggesting they may have had fewer chances to get injured.

The distributions of "size of the osteochondral lesion" and "associated intra-articular lesion" differed among age groups ($P < .0001$) (Appendix 1, available online). For the "size of osteochondral lesion," the distribution shifted toward the smaller lesions as age increased. The relationship between age and "associated intra-articular lesion" is complex. Patients in the oldest group were more likely to have soft tissue impingement and a chondral lesion in the tibial plafond, while patients in the youngest group were more likely to have chronic lateral ankle instability. Subchondral cysts were most common in patients aged 30 to 39 years ($P < .0001$).

Clinical Outcomes by Age Group

The mean preoperative AOFAS score was 61.38 ± 16.74, and the score increased to 85.37 ± 10.82 postoperatively. The VAS improved from 7.03 ± 1.70 to 2.53 ± 1.97 ($P < .0001$). However, no differences were noted among the 6 groups (Table 3). According to the criteria by Saxena and Eakin,[25] successful outcomes (excellent or good) were observed in 75.0% of patients younger than 20 years old, 73.3% of patients 20 to 29 years old, 83.3% of patients 30 to 39 years old, 73.6% of patients 40 to 49 years old, 75.0% of patients 50 to 59 years old, and 91.7% of patients 60 years or older. There were no significant differences among groups in the percentage of patients who had a successful outcome ($P = .21$).

Multivariate Analysis

We used logistic regression models to assess the independent effect of patient age on clinical outcome. The final model, as shown in Appendix 2 (available online), controls for gender, duration of symptom, history of trauma, size and location of the osteochondral defect, and the number and type of associated intra-articular lesions. When compared with patients younger than 20 years of age, age was not an independent risk factor for poor clinical outcome after arthroscopic treatment for OLT ($P = .27$). In contrast, the size of the osteochondral defect was an

TABLE 3
Clinical Outcomes by Age Group[a]

	<20 y (n = 20)	20-29 y (n = 45)	30-39 y (n = 30)	40-49 y (n = 38)	50-59 y (n = 28)	≥60 y (n = 12)	P
VAS							
Preoperative	7.11 ± 1.52	6.38 ± 1.95	6.95 ± 1.55	7.15 ± 1.54	7.38 ± 1.74	7.90 ± 1.37	.06
Postoperative	1.72 ± 1.01	2.61 ± 2.00	2.43 ± 1.97	2.54 ± 1.80	2.84 ± 2.39	3.09 ± 2.50	.71
AOFAS score							
Preoperative	59.78 ± 11.63	64.90 ± 14.40	64.64 ± 16.54	61.36 ± 16.59	53.11 ± 20.93	61.63 ± 19.02	.19
Postoperative	86.31 ± 8.58	84.93 ± 9.79	88.10 ± 7.29	85.86 ± 9.78	82.23 ± 15.43	84.36 ± 15.39	.72
Criteria by Saxena and Eakin[25]							.21
Excellent	10 (50%)	14 (31.1%)	16 (53.3%)	17 (44.7%)	8 (28.6%)	5 (41.7%)	
Good	5 (25%)	19 (42.2%)	9 (30%)	11 (28.9%)	13 (46.4%)	6 (50%)	
Fair	5 (25%)	7 (15.6%)	5 (16.7%)	8 (21.1%)	3 (10.7%)	0 (0%)	
Poor	0 (0%)	5 (11.1%)	0 (0%)	2 (5.3%)	4 (14.3%)	1 (8.3%)	

[a]VAS, visual analog scale; AOFAS, American Orthopaedic Foot and Ankle Society.

independent predictor of clinical failure after arthroscopic treatment ($P < .0001$). When compared with patients with a defect size of <100 mm^2, patients with a defect size of 100 to 149 mm^2 were 1.87 times more likely to have clinical failure after arthroscopic treatment (95% CI, 0.70-4.96). Meanwhile, patients with a defect size of 150 to 199 mm^2 were 6.23 times more likely to have clinical failure (95% CI, 2.55-15.22), and those with a defect size larger than 200 mm^2 were 60.92 times more likely (95% CI, 25.20-147.31). Other than for patients with soft tissue impingement who were 2.23 times more likely to have clinical failure than patients without soft tissue impingement (95% CI, 1.27-2.87), associated intra-articular lesions were not independent predictors of clinical outcome. However, the number of associated lesions was predictive. As compared with patients without associated intra-articular lesions, clinical failure was 1.81 times more likely to be observed in patients with 1 associated intra-articular lesion (95% CI, 1.12-2.93), 2.53 times more likely in patients with 2 lesions (95% CI, 1.53-4.17), and 4.45 times more likely in patients with 3 lesions (95% CI, 2.31-8.57). However, gender ($P = .17$), duration of symptoms ($P = .19$), history of trauma ($P = .07$), and location of lesion ($P = .06$ for coronal plane, $P = .21$ for sagittal plane) did not independently predict clinical outcome.

DISCUSSION

This is the first study to evaluate the effect of age on the long-term outcome of patients after arthroscopic treatment for OLT. In contrast to previous studies that arbitrarily chose a cutoff to define old or older patients,[6,7,10,11,17,24] publishing series as portrayed in Appendix 3 (available online), our study is unique in that it analyzed 6 different age groups. This enabled us to demonstrate distinct age-related trends. In addition, this is the first study that has a sufficiently large study population to allow the use of multivariate analysis to assess the independent effect of age on clinical outcome after arthroscopic treatment for OLT, thereby controlling for multiple covariates that may also influence the same outcomes.

Our study shows that older age is not an independent predictor for clinical failure after arthroscopic treatment for OLT after controlling for gender, duration of symptom, history of trauma, size and location of the osteochondral defect, and the number and type of associated intra-articular lesions. The duration of symptoms increased along with an increase in patient age. Older age independently predicted a lower incidence of trauma, as the incidence of trauma fell from more than 78% in patients younger than 20 years of age to less than 67% in patients 60 years and older. Based on these results, we assumed that patients are less likely to get injured from outdoor activities as they get older. Likewise, the size of the osteochondral defect decreased as patient age increased. As might be expected, the incidence of soft tissue impingement and a chondral lesion of the tibial plafond increased as age increased. A similar pattern was observed with subchondral cysts, with an exception of the 30- to 39-year-old group with the highest incidence among the 6 age groups. However, we could not determine any relationship between patient age and ankle instability.

The observed discrepancies between our data and many previous studies are likely because of multiple factors. All of the previous studies were performed with a small number of patients. While many of them reported poorer clinical outcome in older age groups, they lacked the power to demonstrate a statistical difference.[7,10,11,24] For example, Ferkel et al[10] retrospectively evaluated a total of 64 patients. Twenty-seven patients were 32 years of age or younger, and 23 were older than 32 years. The older age group had an AOFAS score of 80, while the younger group had a score of 88. However, this difference was not significant. In addition, the age cutoff in most of the previous studies ranged between 30 to 50 years. On the other hand, some previous studies demonstrated a significant difference in clinical outcome.[16,17,19,26] In a case series of 72 patients who were arthroscopically treated with microfracture for full-thickness chondral defects in the knee, Steadman et al[26] found that patients younger than 35 years of age improved more than those aged between 35 to 45 years. Furthermore, in a randomized controlled trial that compared a group undergoing microfracture and a group undergoing autologous chondrocyte implantation in the knee, Knutsen et al[16] found better clinical results in the younger and more active patients (aged <30 years) in both groups (P = .007).

Through multivariate analysis, we found that age was not an independent predictor of clinical outcome after arthroscopic treatment for OLT. In previous in vitro studies that reported an age-related decline in the number of mesenchymal stem cells (MSCs) in the bone marrow,[2,8,18,20] the majority of the decline occurred before the age of 30 years, with little or no change thereafter. This is in accordance with our hypothesis that MSCs from aged patients maintain normal functional capacity and that there is either no age-related effects on MSCs or even an age-related increase in MSCs.[4,9,20,23]

We used "size of the osteochondral defect" and "associated intra-articular lesion" to control for intra-articular prognostic factors. The use of the 2 risk factors for poor prognosis was validated in a study linking the severity of OLT to clinical outcome.[5,6] The use of these 2 variables as risk factors was further validated in the bivariate analysis in which both "size of the osteochondral defect" and "number of intra-articular lesion" were strongly correlated with AOFAS scores. "Size of the osteochondral defect" was an independent predictor of clinical failure, as clinical results deteriorated as the size of the osteochondral defect increased. However, as the age group increased, patients became more likely to have a smaller osteochondral defect. This should not be because older patients had less trauma history or were more likely to be female, as the model controls for both of these factors (as well as several others, see Appendix 2, available online). We hypothesized that younger patients are more exposed to sports activities than older patients, which in turn causes younger patients to be more likely to have larger osteochondral defects. We also found in our study that the number of associated intra-articular lesions was predictive of postoperative outcome. Interestingly, the presence of each type of intra-articular lesion, including subchondral cyst, chronic ankle instability, and chondral lesion of the tibial plafond, did not correlate with clinical outcome. This suggests that the complexity of the intra-articular abnormality itself was responsible for poor clinical outcomes. On the other hand, soft tissue impingement was found to be associated with higher rates of clinical failure in our study.

The main shortcoming of the present study is its retrospective design. However, given that there are no similar studies published, we believe that these data are important. Furthermore, because this is an ongoing study, this study could be strengthened in the future, as the number of patients in the matched groups will increase with time.

To our knowledge, this is one of the largest studies that evaluated the effects of age on clinical outcome after arthroscopic treatment for OLT. Older age was not found to be an independent risk factor for poor clinical outcome after arthroscopic treatment. For this reason, age alone should not be a contraindication for arthroscopic treatment, and it is important for surgeons to recognize that older and younger patients had similar clinical outcomes. Older patients were more likely to have smaller osteochondral defects, and our data demonstrate that the effect of trauma on the size of the osteochondral defect is greater in younger age groups. It will be important to develop algorithms that can carefully select older OLT patients who are good candidates for arthroscopic treatment and young patients with large OLT for osteochondral transplantation to optimize their outcomes. A more in-depth longitudinal clinical analysis is warranted to further clarify long-term clinical outcomes of osteochondral transplantation in patients with OLT in relation with age.

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