ORIGINAL

VOLUME 73 | ISSUE 1 | JANUARY - MARCH 2022

Patient-reported joint status, quality of life, and activity level with the end-stage hindfoot and ankle osteoarthritis

Tim Žlak ,[1] Nik Žlak, [2,3] Matej Drobnič [2,3]

[1]*Department of orthopedic surgery, General hospital Celje, Celje, Slovenia*

[2]*Department of orthopedic surgery, University Medical Centre Ljubljana, Ljubljana, Slovenia*

[3]*Chair of Orthopedics, Faculty of Medicine, University of Ljubljana, Ljubljana, Slovenia*

ABSTRACT

Purpose: To evaluate and associate the preoperative hindfoot/ankle radiographs and the patient-reported outcome measures - PROMs (subjective joint status, quality of life, activity level) prior to hindfoot and/or ankle fusions due to an end stage osteoarthritis (OA).

Methods: In this retrospective analysis, the hospital records of patients admitted for a hindfoot and/or ankle surgery over a 5-year period were reviewed. Inclusion selection identified 144 adults (161 feet) who underwent ankle (ATC), subtalar (ST), talonavicular (TN), and calcaneocuboid (CC) fusion or a combination of thereof. Patients' Foot and Ankle Outcome Score (FAOS), European Quality of life in Five-Dimensions and visual analogue score (EQ-5D-TTO and EQ-VAS), Tegner Activity Scale (TAS) and their preoperative standing radiographs were analyzed and compared across the following subgroups: (a) isolated ATC fusion (ATC_F); (b) isolated ST fusion (ST_F); (c) ATC fusion with concomitant ST fusion (ATC_ST_F); (d) ST fusion with concomitant TN or CC fusion (ST_CONC_F); (e) complete hindfoot (ST + TN ± CC) and ATC joint (ATC_ST_CONC _F) fusion. The patients' PROMs were additionally compared to the general population values.

Results: There was a marked subjective ankle dysfunction (average FAOS cumulative – 40) decreased quality of life (average EQ-5D-TTO – 0.41, average EQ-VAS – 56) and activity level (mean TAS – 2) across all the patients' subgroups in comparison to the general population (FAOS cumulative – 87, EQ-5D-TTO – 0.81, EQ-VAS – 80, and TAS – 5). Analysis within the subgroups revealed a significant difference between: ATC_F and ST_CONC_F in FAOS Symptoms (36 vs. 55); ATC_F and ST_F in EQ-5D VAS (61 vs. 50) and TAS (2 vs. 3). Multivariate linear regression models revealed a significant negative correlation between older age, female gender, higher levels of radiographic OA in ATC and Chopart joints, and longer symptom duration toward some of the preoperative PROMs

CORRESPONDING AUTHOR, GUARANTOR

Prof. Matej Drobnič, MD, PhD
Department of orthopedic surgery, University Medical Centre Ljubljana
Zaloška ulica 9, SI-1000 Ljubljana, Slovenia / EU
matej.drobnic@mf.uni-lj.si

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

Conclusion: Patients suffering from an end-stage hindfoot or ankle OA experience a profound deterioration in subjective ankle function, quality of life, and activity levels. Older age, female gender, longer symptoms duration, and higher levels of radiographic OA in ATC or Chopart joints were the negative predictors for their preoperative PROMs.

KEYWORDS: Ankle; Hindfoot; Osteoarthritis; Fusion; Subjective joint status; Quality of Life; Activity level

Introduction

Hindfoot and ankle injuries are among the most common musculoskeletal injuries in the population, with an incidence of 1/10.000 per day (1). In approximately 40% of cases, chronic dysfunction develops (2), leading to posttraumatic osteoarthritis (OA) in the long term. Posttraumatic OA accounts for nearly 70-90% of all hindfoot and ankle OA cases, followed by rheumatoid arthritis (12%) (3). Primary OA is rare and accounts for only 7% of all hindfoot and ankle OA (3). OA of the hindfoot and ankle results in significant impairment of joint function (4), quality of life (4), and physical performance (5).

Clinical examination along with native weight bearing and radiographs in anterio-posterior, lateral, and Mortice views are sufficient to evaluate OA of the hindfoot and ankle (6). Patient-reported outcomes (PROMs) can provide additional insight into subjective hindfoot and ankle status (7-9). Routine physical examination includes careful inspection of the entire hindfoot and ankle, assessment of alignment and stability, and measurements of range of motion (10). Clinical examination of the OA of the hindfoot and ankle often reveals pain, stiffness, limited range of motion, chronic swelling, alignment deformities, etc (3). The ankle joint (articulatio talocruralis - ATC), subtalar joint (ST), talonavicular joint (TN) and calcaneocuboid joint (CC) are considered separately and assessed using OA criteria on native weight bearing radiographs (11,12). The modified Kellgren-Lawrence score is most commonly used to assess ATC osteoarthritis, whereas osteophyte formation and joint space narrowing are more appropriate for assessing ST, TN, and CC joint OA (10,12).

The aim of this study was to evaluate and correlate the preoperative radiographs with the subjective ankle joint-specific dysfunction, general quality of life, and activity level in patients with the end-stage ankle or hind-foot OA prior to the surgical intervention (fusions of ankle, subtalar, Chopart joints, or the combination of thereof). The gathered PROMs were additionally compared to the values of the general population.

Materials and Methods

Study design

The study was designed as a retrospective analysis of patients' data collected from adults, who were scheduled for an ankle or hind-foot fusion due to an end-stage OA at a national university orthopedic center. The investigational plan was approved by the National Medical Ethics Committee (No. 0120-99/2019/4). Hospital records of 275 patients admitted for elective hindfoot and/or ankle surgery between January 2015 and December 2020 were reviewed. In a further selection, 144 patients, 18 years or older, with ATC, ST, TN and/or CC OA and subsequent fusion were included in this study. Concomitant procedures such as corrective osteotomies, ligament repair, and Achilles tendon lengthening and tendon transfers were allowed and recorded. All included patients had clear clinical and radiological evidence of high-grade OA of the ankle or the hind-foot. Previous conservative treatment attempts had been exhausted and had led to unsatisfactory results.

Patient data

Of the 144 patients, 17 had bilateral surgery. Each

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

A) Subtalar fusion

PreOP radiographs
KL_ATC: 1
Osteophy + JSN ST: 4
Osteophy + JSN Chopart: 2

Preoperative PROMs
FAOS Cumulative: 45
EQ-5D-TTO: 0.32
EQ-VAS: 40
TAS: 4

B) Ankle fusion

PreOP radiographs
KL_ATC: 4
Osteophy + JSN ST: 2
Osteophy + JSN Chopart: 2

Preoperative PROMs
FAOS Comulative: 42
EQ-5D-TTO: 0.41
EQ-VAS: 65
TAS: 2

Figure 1. *Standing ankle/hindfoot radiographs and PROMs of two representative patient cases. One was scheduled for ST fusion (A) and the other one for ATC fusion (B).*

OA, osteoarthritis; PreOp, preoperatively; PostOp, postoperatively; KL_ATC, ankle Kellgren-Lawrence criteria; Osteophy, Osteophyte formation; JSN, joint space narrowing; ST, subtalar joint; FAOS, Foot and Ankle Outcome Score; EQ-5D, EQ-5D-3L-TTO, European Quality of Life in Five Dimensions; TTO, 3-level time-trade-off; VAS, visual analogue scale; TAS, Tegner activity scale.

foot was considered as a separate entity, therefore 161 cases (feet) were included in the study. Five groups were formed according to the procedures performed: (a) isolated ATC fusion (ATC_F); (b) isolated ST fusion (ST _F); (c) ATC fusion with concomitant ST fusion (ATC_ST_F); d) ST fusion with concomitant TN and/or CC fusion (ST _CONC_F); e) complete hindfoot (ST + TN ± CC) and ATC joint fusion (ATC_ST_ CONC _F). Patients' demographic data (age, gender, BMI), medical history (smoking

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

TABLE 1.

Patient demographics, medical history, symptoms durations and radiographic OA parameters.

	ATC_F (N = 40)	ST_F (N = 42)	ATC_ST_F (N = 19)	ST_CONC_F (N = 60)	ATC_ST_CONC_F (N = 0)
Gender (male/female)	27 / 13	25 / 17	13 /6	21 / 39	n.a.
Age (years)	53 (14)	51 (15)	60 (10)	55 (14)	n.a.
BMI (kg/ m2)	30 (6)	29 (4)	29 (5)	30 (5)	n.a.
Symptoms duration (years)	11 (9)	10 (9)	6 (5)	9 (8)	n.a.
Smoking (yes/no)	11 / 29	12 / 30	3 / 16	15 / 45	n.a.
OA_ATC (Modified KL)	4 (1)	2 (1)	4 (0)	2 (1)	n.a.
OA_ST (Osteophytes + JSN)	2 (1)	3 (0)	2 (1)	3 (0)	n.a.
OA_TN_CC (TN + CC Osteophytes + JSN)	1 (0)	2 (1)	3 (2)	2 (1)	n.a.

ATC_F, ankle joint fusion; ST_F, subtalar joint fusion; ATC_ST_F, ankle and subtalar joint fusion; ST_CONC_F, subtalar, talonavicular and/or calcaneocuboid joint fusion; ATC_ST_CONC_F, complete fusion of the hindfoot and ankle joint,; BMI, body mass index; KL, Kellgren-Lawrence; OA_ATC, osteoarthritis of the ankle; OA_ST, subtalar joint osteoarthritis; OA_TN_CC, osteoarthritis of the talonavicular and calcaneocuboid joint.

habits) and duration of their symptoms were recorded, details given in Table 1. Two representative cases of pre-operative radiographs and PROMs are demonstrated in Figure 1.

Patient evaluation and radiological analysis

Three patient-reported outcome measures (PROMs), Foot and Ankle Outcome Score (FAOS), European Quality of Life in Five Dimensions (EQ -5D) and Tegner Activity Scale (TAS), were distributed and completed before the surgery on admission to the hospital. FAOS and TAS have been double translated and have been used in several previous studies for the Slovenian population (18,19). EQ -5D has been validated for the Slovenian population (14).

1) Foot and Ankle Outcome Score (FAOS): The Knee Injury and Osteoarthritis Outcome Score (KOOS) was modified to capture problems related to the foot and ankle. The FAOS assesses 5 patient-related subdomains; Pain (9 items), Symptoms (7 items), Activities in daily living (ADL) (17 items), Sport/Recreation (5 items) and quality of life related to foot and ankle (QoL) (4 items). Combined, they form the FAOS Cumulative score. The score for each subdomain and the FAOS Cumulative score are calculated and normalized to a scale of 0 to 100, where 100 indicates no foot- or ankle-related symptoms (7). The mean (SD) FAOS scores determined by Golightly et al. (13) in a community-based study are as follows: FAOS Cumulative 87 (11), FAOS Symptoms 87 (16), Pain 86 (20), ADL 95 (10), Sport 74 (34), and QoL 83 (23).

2) European Quality of Life in Five Dimensions (EQ -5D): consists of a descriptive system (EQ -5D-3L) and a vertical visual analogue scale (EQ-VAS). The descriptive system is comprised of 5 domains

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

TABLE 2.

Pre-operative patient reported joint-specific patient outcome measures sorted according to surgical procedure and intercompared using a one-way ANOVA with Turkey post-hock correlation test.

	ATC_F (N = 40)	ST_F (N = 42)	ATC_ST_F (N = 19)	ST_CONC_F (N = 60)	ATC_ST_CONC_F (N = 0)	p
FAOS Cumulative	43 (17)	42 (13)	32 (17)	42 (17)	n.a.	0.119
FAOS Pain	42 (18)	44 (15)	36 (18)	43 (21)	n.a.	0.578
FAOS Symptoms	36 (10)*	46 (15)	37 (21)	53 (19)*	n.a.	0.000*
FAOS ADL	55 (20)	51 (17)	39 (21)	48 (20)	n.a.	0.057
FAOS Sport	24 (28)	19 (19)	10 (16)	18 (19)	n.a.	0.190
FAOS QoL	25 (18)	17 (13)	12 (12)	20 (18)	n.a.	0.059
EQ-5D-3L-TTO	0.44 (0.11)	0.36 (0.17)	0.42 (0.13)	0.43 (0.17)	n.a.	0.275
EQ-5D VAS	63 (21)*	50 (17)*	57 (16)	52 (18)	n.a.	0.049*
Tegner Activity Scale	2 (0-5)*	3 (0-5)*	2 (0-7)	2 (0-5)	n.a.	0.008*

*FAOS, Foot and Ankle Outcome Score; ADL, Function, activities of daily living; QoL, quality of life; EQ-5D-3L, European Quality of Life in Five Dimensions; TTO, 3-level time-trade-off; VAS, visual analogue scale; ATC_F, ankle joint fusion; ST_F, subtalar joint fusion; ATC_ST_F, ankle and subtalar joint fusion; ST_CONC_F, subtalar, talonavicular and/or calcaneocuboid joint fusion; ATC_ST_CONC_F, complete fusion of the hindfoot and ankle joint. Statistically significant differences between procedures by Tukey post-hock test are marked with *.*

(mobility, self-care, usual activities, pain/discomfort and anxiety/depression), each with 3 levels: none (1), some (2) and extreme problems (3). Together, the 5 dimensions form a 5-digit number that is converted into a utility index reflecting the individual's level of self-rated health (8). A country-specific, time-trade-off-based EQ -5D 3-level (EQ -5D-3L-TTO) value was established to determine the index numbers corresponding to the 5-digit score of patients' health states (14). EQ-VAS is a vertical scale reflecting patients' self-rated health from worst (0) to best imaginable (100). EQ-5D-TTO is the most commonly used questionnaire to assess quality of life. The average EQ -5D-TTO utility index score in the general Slovenian population is 0.81, and the average VAS score is 80 (15).

3) Tegner Activity Scale (TAS): measures patients' activity on a scale from 0 (disability) to 10 (professional football: national or international level) (16). Recently, it has been proposed to use TAS for evaluation of activities related to foot and ankle and other joints (9). Briggs et al. (17) reported the mean scores of TAS, divided into age groups for the general population. The median value for people aged 46 years and over, which includes the majority of our patients, was 5.

Native foot and ankle radiographs were analyzed for: ankle OA (modified Kellgren-Lawrence criteria, 0-4) (12); ST joint OA (osteophyte formation (0-3) and joint space narrowing, (0-3)) (11,12); and TN + CC joint - Chopart joint osteoarthritis (osteophyte formation (0-3) and joint space narrowing (0-3) - combination of both entities of each joint) (11). The data are shown in Table 1.

Statistical analysis

Descriptive statistics for patients' demographics, medical history and radiological OA status were used for all 161 cases. Numerical data are present-

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

TABLE 3.

Results of the multivariate linear regression models for the correlation between the predictors and the pre-operative values of the patient-reported outcome measures.

Dependent variable	R2	Predictors	B	p	CI Lower	CI Upper
FAOS Cumulative	0.067	Age	-0.260	0.012	-0.566	-0.070
FAOS Pain	0.113	Gender KL_ATC	-0.262 -0.255	0.011 0.013	-17.217 -7.569	-2.270 -0.906
FAOS Symptoms	0.081	KL_ATC	-0.285	0.006	-7.304	-1.271
FAOS ADL	0.131	Age Symptoms duration	-0.322 -0.200	0.002 0.047	-0.784 -0.927	-0.188 -0.006
FAOS Sport	0.121	Age	-0.347	0.001	-0.881	-0.243
FAOS QoL	n.a.	/	n.a.	n.a.	n.a.	n.a.
EQ-5D-3L-TTO	0.079	Symptoms duration	-0.281	0.007	-0.009	-0.002
EQ-5D VAS	0.158	Symptoms duration OA_chop	-0.337 -0.211	0.001 0.033	-1.216 -2.925	-0.330 -0.127
Tegner Activity Scale	0.161	Gender	-0.348	0.001	-1.798	-0.507

FAOS, Foot and Ankle Outcome Score; ADL, Function, activities of daily living; QoL, quality of life; EQ-5D-3L-TTO, European Quality of Life in Five Dimensions 3-level time-trade-off; CI, confidence interval. Only statistically significant predicting variables are reported (p <0.05).

ed as mean values (SD), number of cases is given for categorical variables. TAS is presented as medians (min-max). The T-test for unpaired samples was used to compare the values of patient-reported outcomes before surgery with those of the general population (GP) (13,15,17). A one-way ANOVA and Tukey HSD post-test were used to test for significant differences between the five groups. Associations between predictors and preoperative scores of PROMs were investigated with linear regression models. Statistical analyses were performed using SPSS software (version 23.0; IBM, Chicago, IL, USA). The level for statistical significance was set at $p < 0.05$.

Results

Preoperative PROM scores indicated significant ankle dysfunction, impaired quality of life and activity levels in all patients with the end-stage of hindfoot or ankle OA. All FAOS subscales were significantly below the normative values of the general population: FAOS Cumulative 32 (ATC_ST_F) - 43 (ATC_F) vs. 87 (GP) ($p < 0.000$), Symptoms 36 (ATC_F) - 53 (ST_CONC_F) vs. 87 (GP) ($p < 0.000$), Pain 36 (ATC_ST_F) - 44 (ST _F) vs. 86 (GP) ($p < 0.000$), ADL 39 (ATC_ST_F) - 55 (ATC_F) vs. 95 (GP) ($p < 0.000$), Sport 10 (ATC_F) - 24 (ATC_ST_F) vs. 74 (GP) ($p < 0.000$), and QoL 12 (ATC_ST_F) - 25 (ATC_F) vs. 83 (GP) ($p < 0.000$). Patients with ATC_ST_F had the lowest scores in the majority of FAOS subscales. The one-way ANOVA test revealed a significant difference between ATC_F and ST_CONC_F in FAOS symptoms ($p < 0.001$). The highest suppression of EQ-5D-3L-TTO scores was in ST_F (0.36) and the lowest in the ATC_F (0.44), with no significant differences between groups. The same pattern of value reduction was observed at EQ-5D VAS, amid ST_F (50) and ATC_F (63), with a statistically significant difference between the two ($p < 0.049$). Patients' with ATC_F had the highest scores in EQ-5D-3L-TTO and EQ-5D VAS. All EQ-5D-TTO and VAS values were significantly lower compared to the general population; EQ-5D-TTO 0.36 (ST_F) - 0.44 (ATC_F) vs. 0.81 (GP) ($p < 0.000$), EQ -5D VAS

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

50 (ATC_F) - 62 (ST_F) vs. 80 (GP) ($p < 0.000$). Tegner values were likewise statistically lower in the observed groups compared to the general population, 2 (ATC_F, ATC_ST_F, ST_CONC_F) - 3 (ST_F) vs. 5 (GP) ($p < 0.000$). Additionally, statistically significant difference was noted amongst ATC_F and ST_F ($p < 0.008$), with ST_F patients being the most active. See Table 2 for details.

Multivariate linear regression models revealed a significant negative correlation ($p < 0.05$) between older age, female gender, higher Kellgren-Lawrence ATC values, higher OA of the Chopart joint and longer symptom duration toward certain preoperative PROMs. Older age was negatively correlated with preoperative FAOS Cumulative, ADL and Sports. Longer symptom duration was negatively correlated with FAOS ADL, EQ-5D-3L-TTO and EQ-5D VAS. There was also a negative correlation between higher OA of the Chopart joint and EQ-5D VAS. Higher Kellgren-Lawrence ATC values were negatively correlated with FAOS Pain and Sport, while female gender had a negative correlation with FAOS Pain and Tegner Activity Scale. These data are presented in Table 3.

FAOS, Foot and Ankle Outcome Score; ADL, Function, activities of daily living; QoL, quality of life; EQ-5D-3L, European Quality of Life in Five Dimensions; TTO, 3-level time-trade-off; VAS, visual analogue scale; ATC_F, ankle joint fusion; ST_F, subtalar joint fusion; ATC_ST_F, ankle and subtalar joint fusion; ST_CONC_F, subtalar, talonavicular and/or calcaneocuboid joint fusion; ATC_ST_CONC_F, complete fusion of the hindfoot and ankle joint. Statistically significant differences between procedures by Tukey post-hock test are marked with *.

Discussion

The most important findings of this retrospective study were: a) patients suffering from an end-stage hindfoot or ankle OA experience a profound deterioration in subjective ankle function, quality of life, and activity levels, older age, female gender, longer symptoms duration; b) higher levels of radiographic OA in ATC or Chopart joints were the negative predictors for their preoperative PROMs.

Of all patients included in our study, those with ATC and ST OA had the lowest FAOS scores, followed by isolated ATC osteoarthritis. The statistically significant decline ($p < 0.001$) in relation to the general population was 50-60%. Similar observations were also made in a cross-sectional study by Kolar et al. (18) comparing PROMs from seven different ankle pathologies (osteoarthritis of the ATC, recurrent osteochondral lesion of the talus (OLT), primary OLT, lateral instability, anterior impingement, posterior impingement and combined impingement). They observed a 50% decline in patient-perceived ankle pain, symptoms and daily activities with additional deterioration of nearly 25% in sport/recreational activities and joint-specific quality of life in patients with ATC osteoarthritis compared to the general population. A large reduction (about 50%) in all PROMs in patients with ankle OA was also acclaimed by Waly et al. (20), but using different questionnaires (Ankle Arthritis Score, Ankle Osteoarthritis Scale, Mental Components Score and Physical Components Score). This indicates the great importance of ATC OA for hindfoot and ankle function.

The values of EQ-5D-TTO and EQ-VAS were lowest in patients scheduled for an ST fusion (0.36 and 50, respectively). This implies that quality of life is lowest in patients with ST OA, which contradicts the FAOS results. However, the differences between the five groups were small, not statistically significant in EQ-5D-TTO ($p < 0.275$) and only a weak difference was found in EQ-5D VAS between patients with ATC and ST osteoarthritis ($p < 0.049$). Taking into account that EQ-5D VAS is considered less accurate apropos EQ-5D-TTO in assessing ankle quality of life (21), and the weak statistical significance, we can conclude that the differences between the five groups are negligible. Nevertheless, the absolute preoperative scores (0.36-0.44) show a strong deterioration compared to the general population (15), they are in line with previous studies (22) and are in equivalent with those reported in knee (0.49) and hip (0.52) osteoarthritis (23), demonstrating the severe impact of this pathology on quality of life.

Tegner activity values were statistically significantly decreased in all five groups ($p < 0.001$) to-

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

ward general population. The least profound decrease was in patients suffering from ST OA, who on average were still able to hike or backpack (level 3), while patients in the other four groups were on average only able to take shorter walks on uneven ground (level 2). This intergroup difference was also statistically significant ($p < 0.008$). Patients with ST OA tend to be the most active, but also have the lowest EQ-5D-TTO and EQ-VAS scores. This gives the impression that isolated ST OA is less disabling and allows patients to engage in more demanding activities, which ultimately result in more severe pain and a lower life quality. Low preoperative values of TAS in patient with ATC and hindfoot OA were also reported by Hanna et al (24). The mean value of TAS in 61 patients who had high-grade ATC osteoarthritis was level 1 (sedentary work, walking on even ground). We must emphasize that TAS was primarily designed to assess knee sports injuries and is hence less sensible for other pathologies. There is also a wide discrepancy of mean values in the general population, ranging from level 3 to level 6 (17,25). In view of all this, the values obtained in the hindfoot and ankle must be interpreted with some caution.

Higher age, higher Kellgren-Lawrence ATC scores, higher OA of the Chopart joint, female gender, and longer symptoms duration were negatively correlated with the preoperative PROMs. There are very limited data on the predicting factors for the preoperative scores on patient-reported outcome measures in the current literature. Similar negative predictors of hindfoot and ankle pathology were reported by Brulc et al. (19) in patients with osteochondral lesions of the talus. They found a negative correlation between female gender, higher BMI and higher radiographic ankle OA toward preoperative FAOS scores. While the influence of age and longer symptom duration (chronification of pain) as well as poor cartilage status (OA-related pain) on preoperative ankle subjective status is comprehensible, the influence of gender is less clear. Nevertheless, a similar trend towards lower PROMs in women has been reported in other studies (19,26,27). A partial explanation was provided by Fillingim at al. (28) in a large meta-analysis in which they found higher pre- and post-operative pain scores in women, involving several endogenous and exogenous pain modulation mechanisms that are not yet fully understood.

The following limitations of this study need to be considered: First, it was a non-randomized and unblinded case series, however it represents a real clinical situation of the whole patient series treated over twelve years in a tertiary orthopedic university center. Second, the hindfoot and ankle share loading and function as a whole. Projection of pain is common, so separate assessment of each component may be difficult and less reliable. Moreover, only a preoperative assessment of the hindfoot and ankle was performed with standard ankle-specific and general quality of life questionnaires. Follow-up with the same set of PROMs is essential for a better and more thorough analysis. Thirdly, there is always a possibility of subjective bias when analyzing radiographs. Much emphasis has been placed on standardizing the digital measurement protocols to minimize the variability.

Conclusions

Patients suffering from an end-stage OA of the hindfoot and ankle suffer from profound impairment of joint function, quality of life and activity levels. Impairment of joint function is most severe in patients with ATC and ST joint OA, while quality of life and activity levels are equally impaired in all five groups. Moreover, older age, female gender, higher Kellgren-Lawrence ATC OA scores, higher Chopart joint OA scores and longer symptoms duration are negatively correlated with the preoperative PROMs.

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

REFERENCES

1. Brooks SC, Potter BT, Rainey JB. Treatment for partial tears of the lateral ligament of the ankle: a prospective trial. Br Med J (Clin Res Ed). 1981 Feb 21;282(6264):606-7. doi: 10.1136/bmj.282.6264.606. PMID: 6781588; PMCID: PMC1504416.
2. Hintermann B, Boss A, Schäfer D. Arthroscopic findings in patients with chronic ankle instability. Am J Sports Med. 2002 May-Jun;30(3):402-9. doi: 10.1177/03635465020300031601. PMID: 12016082.
3. Barg A, Pagenstert GI, Hügle T, Gloyer M, Wiewiorski M, Henninger HB, Valderrabano V. Ankle osteoarthritis: etiology, diagnostics, and classification. Foot Ankle Clin. 2013 Sep;18(3):411-26. doi: 10.1016/j.fcl.2013.06.001. Epub 2013 Jul 24. PMID: 24008208.
4. Buckwalter JA, Saltzman C, Brown T. The impact of osteoarthritis: implications for research. Clin Orthop Relat Res. 2004 Oct;(427 Suppl):S6-15. doi: 10.1097/01.blo.0000143938.30681.9d. PMID: 15480076.
5. McDaniel G, Renner JB, Sloane R, Kraus VB. Association of knee and ankle osteoarthritis with physical performance. Osteoarthritis Cartilage. 2011 Jun;19(6):634-8. doi: 10.1016/j.joca.2011.01.016. Epub 2011 Feb 19. PMID: 21310252; PMCID: PMC3097285.
6. Saltzman CL, el-Khoury GY. The hindfoot alignment view. Foot Ankle Int. 1995 Sep;16(9):572-6. doi: 10.1177/107110079501600911. PMID: 8563927.
7. Roos EM, Brandsson S, Karlsson J. Validation of the foot and ankle outcome score for ankle ligament reconstruction. Foot Ankle Int. 2001 Oct;22(10):788-94. doi: 10.1177/107110070102201004. PMID: 11642530.
8. Rabin R, de Charro F. EQ-5D: a measure of health status from the EuroQol Group. Ann Med. 2001 Jul;33(5):337-43. doi: 10.3109/07853890109002087. PMID: 11491192.
9. Halasi T, Kynsburg A, Tállay A, Berkes I. Development of a new activity score for the evaluation of ankle instability. Am J Sports Med. 2004 Jun;32(4):899-908. doi: 10.1177/0363546503262181. PMID: 15150035.
10. Saltzman CL, Nawoczenski DA, Talbot KD. Measurement of the medial longitudinal arch. Arch Phys Med Rehabil. 1995 Jan;76(1):45-9. doi: 10.1016/s0003-9993(95)80041-7. PMID: 7811174.
11. Menz HB, Munteanu SE, Landorf KB, Zammit GV, Cicuttini FM. Radiographic classification of osteoarthritis in commonly affected joints of the foot. Osteoarthritis Cartilage. 2007 Nov;15(11):1333-8. doi: 10.1016/j.joca.2007.05.007. Epub 2007 Jul 10. PMID: 17625925.
12. Kraus VB, Kilfoil TM, Hash TW 2nd, McDaniel G, Renner JB, Carrino JA, Adams S. Atlas of radiographic features of osteoarthritis of the ankle and hindfoot. Osteoarthritis Cartilage. 2015 Dec;23(12):2059-2085. doi: 10.1016/j.joca.2015.08.008. Epub 2015 Aug 28. PMID: 26318654; PMCID: PMC4663119.
13. Golightly YM, Devellis RF, Nelson AE, Hannan MT, Lohmander LS, Renner JB, Jordan JM. Psychometric properties of the foot and ankle outcome score in a community-based study of adults with and without osteoarthritis. Arthritis Care Res (Hoboken). 2014 Mar;66(3):395-403. doi: 10.1002/acr.22162. PMID: 24023029; PMCID: PMC4211630.
14. Prevolnik Rupel V, Srakar A, Rand K. Valuation of EQ-5D-3l Health States in Slovenia: VAS Based and TTO Based Value Sets. Zdr Varst. 2019 Dec 13;59(1):8-17. doi: 10.2478/sjph-2020-0002. PMID: 32952698; PMCID: PMC7478084.
15. Prevolnik Rupel V, Ogorevc M. EQ-5D-5L Slovenian population norms. Health Qual Life Outcomes. 2020 Oct 7;18(1):333. doi: 10.1186/s12955-020-01584-w. PMID: 33028345; PMCID: PMC7542912.
16. Tegner Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. Clin Orthop Relat Res. 1985 Sep;(198):43-9. PMID: 4028566.
17. Briggs KK, Steadman JR, Hay CJ, Hines SL. Lysholm score and Tegner activity level in individuals with normal knees. Am J Sports Med. 2009 May;37(5):898-901. doi: 10.1177/0363546508330149. Epub 2009 Mar 23. PMID: 19307332.
18. Kolar M, Brulc U, Stražar K, Drobnič M. Patient-reported joint status and quality of life in sports-related ankle disorders and osteoarthritis. Int Orthop. 2021 Apr;45(4):1049-1055. doi: 10.1007/s00264-020-04747-y. Epub 2020 Sep 17. PMID: 32944803.
19. Brulc U, Drobnič M, Kolar M, Stražar K. A prospective, single-center study following operative treatment for osteochondral lesions of the talus. Foot Ankle Surg. 2022 Aug;28(6):714-719. doi: 10.1016/j.fas.2021.08.008. Epub 2021 Aug 26. PMID: 34518042.

VOLUME 74 | ISSUE 1 | JANUARY - MARCH 2023

20. Waly FJ, Yeo EMN, Wing KJ, Penner MJ, Veljkovic A, Younger ASE. Relationship of Preoperative Patient-Reported Outcome Measures (PROMs) to Postoperative Success in End-Stage Ankle Arthritis. Foot Ankle Int. 2020 Mar;41(3):253-258. doi: 10.1177/1071100719893334. Epub 2019 Dec 9. PMID: 32045278.
21. Maher AJ, Kilmartin TE. An analysis of Euroqol EQ-5D and Manchester Oxford Foot Questionnaire scores six months following podiatric surgery. J Foot Ankle Res. 2012 Jul 9;5(1):17. doi: 10.1186/1757-1146-5-17. PMID: 22776703; PMCID: PMC3489846.
22. Kamrad I, Carlsson Å, Henricson A, Magnusson H, Karlsson MK, Rosengren BE. Good outcome scores and high satisfaction rate after primary total ankle replacement. Acta Orthop. 2017 Dec;88(6):675-680. doi: 10.1080/17453674.2017.1366405. Epub 2017 Aug 16. PMID: 28812410; PMCID: PMC5694814.
23. Jansson KÅ, Granath F. Health-related quality of life (EQ-5D) before and after orthopedic surgery. Acta Orthop. 2011 Feb;82(1):82-9. doi: 10.3109/17453674.2010.548026. Epub 2010 Dec 29. PMID: 21189112; PMCID: PMC3230002.
24. Hanna M, Whicker EA, Traub B, Allam E, Labib SA. Sport activity levels following ankle fusion. Int Orthop. 2021 Sep;45(9):2347-2354. doi: 10.1007/s00264-021-05100-7. Epub 2021 Jul 6. PMID: 34228148.
25. Matheny LM, Gittner K, Harding J, Clanton TO. Patient Reported Outcome Measures in the Foot and Ankle: Normative Values Do Not Reflect 100% Full Function. Knee Surg Sports Traumatol Arthrosc. 2021 Apr;29(4):1276-1283. doi: 10.1007/s00167-020-06069-3. Epub 2020 May 28. PMID: 32468128.
26. Enderlein D, Nielsen T, Christiansen SE, Faunø P, Lind M. Clinical outcome after reconstruction of the medial patellofemoral ligament in patients with recurrent patella instability. Knee Surg Sports Traumatol Arthrosc. 2014 Oct;22(10):2458-64. doi: 10.1007/s00167-014-3164-5. Epub 2014 Jul 10. PMID: 25007722.
27. Žlak N, Kacin A, Martinčič D, Drobnič M. Age, body mass index, female gender, and patellofemoral cartilage degeneration predict worse patient outcome after patellofemoral instability surgery. Knee Surg Sports Traumatol Arthrosc. 2022 Nov;30(11):3751-3759. doi: 10.1007/s00167-022-06986-5. Epub 2022 May 7. PMID: 35524797.
28. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL 3rd. Sex, gender, and pain: a review of recent clinical and experimental findings. J Pain. 2009 May;10(5):447-85. doi: 10.1016/j.jpain.2008.12.001. PMID: 19411059; PMCID: PMC2677686.

READY - MADE CITATION

Žlak T, Žlak N, Drobnič M. Patient-reported joint status, quality of life, and activity level with the end-stage hindfoot and ankle osteoarthritis. *Acta Orthop Trauma Hell* 2023; 74(1): 10-19.