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Indicators of Return to Sports at Preinjury Levels Following Surgery for Chronic Ankle Instability

Comparison of ALR-RSI, AOFAS, and Karlsson Scores

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Investigation performed at Clinique du sport, Paris, France

Background: While there are several scales for measuring patients' outcomes after chronic ankle instability (CAI) surgery, a study comparing the predictive ability of these scores with regard to return to sports (RTS) at the preinjury level is lacking.

Purpose/Hypothesis: The purpose of this study was to compare the Ankle Ligament Reconstruction–Return to Sport After Injury (ALR-RSI), American Orthopaedic Foot and Ankle Society (AOFAS), and Karlsson scores in predicting 2-year RTS outcomes after arthroscopic treatment of CAI. It was hypothesized that ALR-RSI would be superior in predicting 2-year RTS outcomes after CAI surgery and that a quantifiable increase in this score would significantly improve RTS outcomes.

Study design: Cohort study; Level of evidence, 2.

Methods: This prospective cohort study analyzed patients who underwent surgery for CAI at a sports surgery center between 2016 and 2018. The inclusion criteria focused on adult patients undergoing their first surgery for CAI with a minimum 2-year follow-up. The primary outcome was RTS at 2 years. The study evaluated 3 scores at 1 year postoperatively to predict RTS at the same level as the preinjury level at 2 years—ALR-RSI, AOFAS Ankle-Hindfoot Scale, and Karlsson score. The most predictive score, with its corresponding optimal threshold, was determined using the receiver operating characteristic (ROC) curve. This threshold signifies the score value above which the likelihood of RTS at the preinjury level is significantly increased. Once identified, the secondary outcome evaluated the impact of a 10-point increase in this score on RTS, after adjusting for confounding factors.

Results: A total of 159 patients (age, 35.7 ± 11.4 years) were included. Two years after surgery, 40.25% of patients returned to their preinjury level of sports. ROC curve analysis of the tested scores at 1-year postoperatively showed the ALR-RSI score had the best predictive ability for RTS (area under the curve [AUC], 0.70 [95% CI, 0.6-0.77]), whereas Karlsson and AOFAS scores were less predictive (AUC, 0.53 [95% CI, 0.43-0.63] and 0.61 [95% CI, 0.52-0.70], respectively). The optimal threshold for the ALR-RSI score was identified at 83 (Youden index = 0.35, sensitivity = 63%, and specificity = 71%). Confounder identification revealed earlier surgery and arthroscopic techniques were associated with higher RTS rates. A 10-point increase in the ALR-RSI score correlated with increased odds of RTS (1.27 [95% CI, 1.12-1.46]; $P = .0004$) in univariate analysis and (1.29 [95% CI, 1.06- 1.61]; $P = .01$) in multivariate analysis.

Conclusion: This study showed that none of the scores were great predictors of RTS after surgery for CAI. The ALR-RSI score was a stronger predictor of RTS to the same preinjury level after CAI surgery than AOFAS and Karlsson scores. The ALR-RSI optimal threshold identified was 83. A 10-point increase in the ALR-RSI score boosted the odds of RTS by 1.29 times.

Keywords: ankle; ankle ligament reconstruction; ankle ligament reconstruction–return to sport after injury score; ankle ligament repair; ligaments; modified Broström-Gould; return to sports

by internal rotation and plantar flexion.^{7,8} Although most of these sprains heal usually after 3 months with conservative treatment and rehabilitation, about 30% of patients will develop chronic ankle instability (CAI), which may require surgical treatment.^{21,34} This population suffers from high rates of recurrence and episodes of giving way, persistent impairments (eg, pain and deterioration of functional ankle capacity), and reduction of range of motion (ROM).^{12,21,39} Therefore, it is recommended to manage this instability promptly to avoid posttraumatic ankle osteoarthritis.^{10,40,41}

Several surgical techniques are available for the treatment of CAI—including ligament repair or reconstruction.²³ Return to sports (RTS) at the same level as the preinjury level is the main concern in young, athletic patients. Surgical treatment results in markedly improved postoperative ankle stability and a satisfactory rate of RTS.^{9,11,13,16,17,20,22,35} Several scales are used for measuring the patient's outcome to assess the effectiveness of surgical CAI treatment and analyze the readiness for RTS at the preinjury level. The American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score is widely used,¹⁴ although its accuracy in quantifying postoperative results varies across studies.^{4,19,31,38} Also, the Karlsson Scoring Scale offers another method of evaluation, focusing on physical ability.^{29,35} In addition, the Ankle Ligament Reconstruction–Return to Sport After Injury (ALR-RSI) score assesses psychological readiness for returning to sport, an aspect crucial for a full recovery.^{27,32} While the correlation between these scores may have been tested,^{4,27} studies comparing the predictive ability of these scores with regard to RTS to the same preinjury level are lacking. In their systematic review, Hunt et al¹³ highlighted a significant shortfall in the literature regarding a consistent timeline for RTS after lateral ankle ligament repair or reconstruction, with only a small fraction of studies providing detailed RTS timelines.¹³

This study aimed to compare the ability of these 3 scores (AOFAS, Karlsson, and ALR-RSI) to predict RTS after the surgical repair of CAI. The secondary aim was to assess the impact of a 10-point increase in the most predictive score on RTS outcomes, while also determining the optimal threshold value for this score and controlling confounding factors. These timelines were selected to evaluate initial scores by the 1-year mark, where a substantial recovery is expected, and then use these scores to assess RTS sustainability and long-term outcomes at 2 years. This is also especially important for patients who did not RTS by

the 1-year mark. We hypothesized that the ALR-RSI would be superior in predicting 2-year RTS after CAI surgery and that a quantifiable increase in this score would significantly improve RTS outcomes.

METHODS

Study Design

This was a monocentric, prospective cohort study, targeting patients who were operated on for CAI at a sports surgery center in Paris between 2016 and 2018. The regional ethics committee reviewed and approved the study protocol (approval number IB00010835). Moreover, informed consent was obtained from each patient before participation.

Inclusion and Exclusion Criteria

The inclusion criteria involved adult patients operated on for the first time for CAI. Patients were excluded if they did not practice any sport or had any cognitive or neurological deficits, in case of revision surgery, or if they refused the study. In addition, patients who did not complete the 2-year follow-up by the time of analysis were excluded. Similarly, those lost to follow-up before the 2-year mark were categorized as lost to follow-up and not included in the analysis.

Surgical Indication, Techniques, and Rehabilitation Protocol

The indication for surgery was set for patients who experienced persistent pain and/or instability symptoms despite undergoing 6 months of conservative treatment.^{1,5,18,37} The diagnosis was confirmed by magnetic resonance imaging (MRI) in all cases. All patients were operated on by the senior surgeon (A.H.). Depending on the lateral ligament evaluation on MRI, a decision was made to do an arthroscopic Broström or arthroscopic anatomical reconstruction of the anterior talofibular ligament (ATFL) and the calcaneofibular ligament.^{1,5,18,37} This decision adhered to the recommendations of the French Society of Arthroscopy, which suggests a Broström repair for stage 1 (ATFL distension with normal thickness) and stage 2 (ATFL avulsion with normal thickness), and recommends reconstruction for stage 3 (thin ATFL with no resistance during the

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Ethical approval for this study was obtained from Ramsay Sante (IRB00010835).

hook test) and stage 4 (absence of ATFL, with a bald malleolus).³⁷

The rehabilitation protocol after surgery was uniform for all patients. This begins with a short period of immobilization for 10 days, followed by an early rehabilitation phase focused on increasing lower extremity strength, ROM, and foot and ankle strength, and improving balance and proprioception. Gait training is also incorporated to restore symmetrical walking patterns. In the later stages of rehabilitation, activities are intensified to enhance balance on unstable surfaces and functional performance, with exercises such as single-leg activities and various hopping exercises.

RTS was gradual, and its timeline varied according to the sport's nature, with noncontact/nonpivot sports (eg, cycling and swimming) allowed at 3 months and pivot/contact sports at 6 months after surgery. The clearance to RTS was provided by the orthopaedic surgeon.

Outcome Measure and Variables

The primary outcome measure was RTS capabilities at the 2-year follow-up, which was measured by RTS rate and quality. The quality of RTS was assessed based on patients' perceptions of their performance. Patients were explicitly asked whether they had returned to the same sport they practiced before their injury and, if so, how they perceived their performance level. Their responses were categorized as "No, I did not return," "Yes, but I returned to training only/lower level," or "Yes, I returned to the preinjury level."

The analysis focused on determining the best predictor of RTS (at 2 years) using the following 3 scores collected at 1 year postoperatively: ALR-RSI,^{27,32} AOFAS,¹⁴ and Karlsson scores.^{29,35} The ALR-RSI scale is a 12-item score that evaluates psychological readiness for RTS based on the patient's assessment. Each item is rated from 0 to 10. The total score is calculated by adding up the values of the 12 answers and dividing the result by 1.2 to obtain a percentage. High scores correspond to a positive psychological response.^{27,32} The AOFAS Ankle-Hindfoot Scale is a 9-item score, including assessments of pain, function, and alignment, ranging from 0 to 100, with higher scores indicating better ankle-hindfoot health and function.¹⁴ The Karlsson score is an 8-item score that evaluates a patient's functional stability, pain, swelling, and stiffness, with a maximum score of 90 points.^{29,35}

To compare the predictive ability of these scores, the study population was divided into 2 groups: (1) Patients who did not resume sporting activities, returned to training only, or returned to a lower level were collectively categorized within the non-RTS group. (2) Conversely, patients who returned to their preinjury level of sport were classified under the same-RTS group. The assessment focused on measuring the scores' discrimination threshold, sensitivity, and specificity in predicting the likelihood of RTS at the preinjury level based on the statistical method detailed below. The score demonstrating the highest accuracy in this context was determined to have the best predictive ability.

Once the best predictor score was identified, the secondary outcome of the study was the analysis of the impact of a 10-point increase in the identified score on RTS outcomes after identifying and controlling for confounding factors.

Data Collection

Data were prospectively collected using Websurvey online software. Surgeons completed sections on medical history, physical examination findings, work-up, and follow-up, while patients provided information through filling out the questionnaires and scores. The dataset encompassed patient characteristics, type and level of sports participation, employed techniques, and predefined outcomes of interest.

Statistical Analysis

All statistical analyses were performed with SPSS software Version 23 (SPSS Inc, IBM) and R software Version 4.2 (R Core Team). Numbers and percentages were used to describe qualitative variables, whereas means and standard deviations were used to describe quantitative variables. Comparisons of quantitative data were made using the Student *t* test or the Mann-Whitney-Wilcoxon test depending on the distribution of the variable of interest. Meanwhile, for qualitative data, comparisons were made using the chi-square test or the Fisher exact test. The ability of the 3 scales (Karlsson, AOFAS, and ALR-RSI) to identify patients who returned to sports at the preinjury level or a higher level was evaluated by receiver operating characteristic (ROC) curve statistics. An area under the curve (AUC) of 0.5 suggests no discrimination, 0.7 to 0.8 is considered acceptable, 0.8 to 0.9 is considered excellent, and >0.9 is considered outstanding.²⁴ The optimal cutoff point for the most effective score was obtained using the Youden index ($J = \text{sensitivity} + \text{specificity} - 1$). The previous calculation of the sample size required to achieve a statistical power of 0.80 and a type 1 error of 0.05, based on an observed mean difference of 18.527 between the 2 groups (RTS versus no RTS), and a standard deviation of the mean score of the ALR-RSI at 27 indicated that at least 66 participants (33 in each group) were needed.²⁷

To evaluate the association between the most effective scale and RTS at the preinjury level, a multivariate logistic regression was performed. The variables entered into this model were initially selected by a series of univariate logistic regression assessing the association of each potential confounding variable and RTS at the preinjury level. Only the variables with $P < .20$ in the univariate models were included in the multivariate model. Choosing a higher alpha level, such as .20, can help reduce the risk of falsely rejecting potentially important variables, which may allow for the detection of potential associations that could be overlooked with a stricter alpha threshold, while also minimizing the risk of overinterpreting the results, particularly in the early stages of exploratory data analysis. Multivariate logistic regression was used to determine whether the chosen variables (ie, only those predictors

with $P < .20$) were associated with the RTS status. Odds ratios (ORs) with their corresponding 95% CIs were reported. The level of statistical significance was set at $P < .05$.

RESULTS

During the study timeframe, 180 patients underwent surgery for CAI. Of them, 10 were excluded for the following reasons: 6 patients had revision surgeries and 4 refused to participate and fill in the questionnaires. Eleven patients were lost to follow-up. The final study sample size was 159 patients.

Patient Characteristics

The mean age of the population (86 men and 73 women) was 35.7 ± 11.4 years. Of these, 72 patients underwent the arthroscopic Broström procedure, while 87 underwent arthroscopic ATFL and calcaneofibular ligament reconstruction. The baseline characteristics of the patients included are presented in Table 1.

RTS at 2 Years Postoperatively

Less than half of the patients (64 out of 159; 40.25%) fell into the same-RTS group, including 28 women and 36 men, with a mean age of 37.3 ± 12.1 years. The mean time to RTS to the preinjury level was 5.1 ± 2.2 months. Meanwhile, 95 participants (45 women and 50 men; mean age, 34.5 ± 10.8 years) fell in the no-RTS group (23 stopped, 41 returned to a lower level, and 31 changed their sports). The mean time to RTS to any level was 5.5 ± 2.5 months.

Predictive Ability of the Tested Scores

The predictive ability of the tested scores was collected at 1 year and was based on the RTS status collected at 2 years.

ROC Curve Analysis. The mean scores for the entire population were 74.9 ± 27.4 for the ALR-RSI, 37 ± 26.5 for the Karlsson, and 80.9 ± 15.7 for the AOFAS. None of the analyzed scores had excellent predictive ability, as demonstrated by AUC values being interpreted as poor to barely acceptable.

The ALR-RSI demonstrated the best predictive ability in distinguishing between patients who did and did not have RTS at the preinjury level (AUC, 0.70 [95% CI, 0.6-0.77]; acceptable). Conversely, the predictive ability was poor for the Karlsson and AOFAS scores (AUC, 0.53 [95% CI, 0.43-0.63]; AUC, 0.61 [95% CI, 0.52-0.70]), respectively (Figure 1). The threshold ALR-RSI score offering the best sensitivity and specificity was identified at 83 according to the Youden index (0.35) and corresponded to a sensitivity of 63% and a specificity of 71%.

TABLE 1
Baseline Patient Characteristics^a

Variable	No-RTS (n = 95)	Same-RTS (n = 64)	P
Age, y	34.5 (10.8)	37.3 (12.1)	.14
Sex			.8
Female	45 (47)	28 (44)	
Male	50 (53)	36 (56)	
Type of sports ^b			.8
Pivot sport	36 (38)	22 (34)	
Non pivot	59 (62)	42 (66)	
Level of sport			.18
Occasional	12 (13)	5 (8)	
Regular	39 (43)	38 (61)	
Competitive	37 (41)	16 (26)	
Professional	3 (3)	3 (5)	
Delay between initial injury and surgery, mo	31.1 (8.2)	27.7 (8.5)	.01
Type of surgery			.04
Arthroscopic Broström procedure	50 (53)	22 (34)	
Arthroscopic ligament reconstruction	45 (47)	42 (66)	

^aData are presented as mean (SD) or n (%). No-RTS, no return or return to a lower level. RTS, return to sports; Same-RTS, return to the same or a higher level.

^bType of sports (N = 180 patients)—athletics: 2 (1.3%); rowing: 1 (0.6%); badminton: 3 (1.9%); basketball: 10 (6.3%); boxing: 1 (0.6%); running: 33 (20.8%); cycling: 6 (3.3%); dance: 6 (3.8%); horse riding: 2 (1.3%); climbing: 3 (1.9%); fitness: 1 (0.6%); football (soccer): 31 (19.5%); gymnastics: 5 (3.1%); handball: 10 (6.3%); jogging: 1 (0.6%); judo, 1 (0.6%); wrestling: 1 (0.6%); walking: 5 (3.1%); motocross: 1 (0.6%); bodybuilding: 3 (1.9%); swimming: 3 (1.9%); rugby: 3 (1.9%); squash: 3 (1.9%); taekwondo: 2 (1.3%); tennis: 12 (7.5%); table tennis: 1 (0.6%); archery: 1 (0.6%); trail running: 3 (1.9%); triathlon: 1 (0.6%); volleyball: 2 (1.3%); yoga: 1 (0.6%); Zumba: 1 (0.6%).

Impact of a 10-Point Increase in the Identified Score

Confounder Identification. In this analysis, conducted to identify confounders, it was found that patients in the same-RTS group were operated on earlier (27.7 ± 8.5 months) compared with those in the non-RTS group (31.1 ± 8.2 months, 95 patients) ($P = .01$). Moreover, a greater same-RTS rate was observed in patients undergoing arthroscopic ligament reconstruction compared with those with the arthroscopic Broström procedure (66% vs 34%; $P = .04$). Meanwhile, no significant differences were observed between those who did or did not RTS based on age ($P = .14$), sex ($P = .8$), or the type and level of sports ($P = .8$ and $P = .18$, respectively) (Table 1).

When comparing the tested scores, the ALR-RSI was the only test showing a significant difference between the 2 groups (68.4 ± 28 for the non-RTS group vs 84.6 ± 23.7 for the same-RTS group; $P < .01$). No significant differences were found between the groups in the AOFAS ($P = .077$) or Karlsson scores ($P = .288$) (Table 2).

Variables with $P < .20$ were retained for the multivariate analysis, according to the statistical method. This

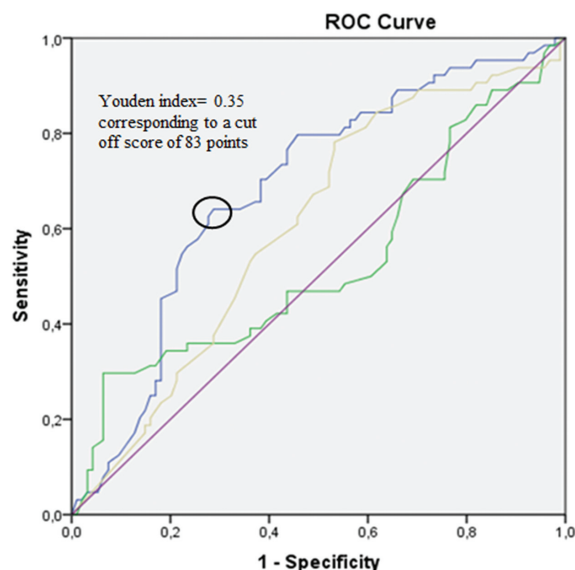


Figure 1. The ROC curve for the ALR-RSI (blue), Karlsson (green), and AOFAS (brown) scores for predicting RTS at the preinjury level. ALR-RSI, Ankle Ligament Reconstruction–Return to Sport After Injury; AOFAS, American Orthopaedic Foot and Ankle Society; ROC, receiver operating characteristic.

included age, AOFAS score, type of surgery, level of sports, and the delay between the accident and surgery.

Odd Ratio of a 10-Point Increase in ALR-RSI. Univariate logistic regression analysis revealed that for every 10-point increase in the ALR-RSI score, the OR of same-RTS was 1.27 (95% CI, 1.12-1.46; $P = .0004$) (Table 3).

After controlling for confounders, the multivariate logistic regression showed that the OR increased slightly to 1.29 (95% CI, 1.06-1.61; $P = .01$) for every 10-point increase in the ALR-RSI score (Table 4).

DISCUSSION

The main finding of this study was that none of the analyzed scores were highly predictive of RTS. Furthermore, compared with the remaining analyzed scores, the ALR-RSI carried the best predictive ability (acceptable ability) to RTS at the 1-year cross-sectional timeline.

While the ALR-RSI has been validated by Sigonney et al³² as a tool to quantify psychological readiness for returning to sports after ankle ligament reconstruction, it was not compared for superiority against other tests. Our study aids clinicians in choosing the most effective score for assessing RTS predictability and capability in a time-efficient manner. Our results add to the growing body of evidence supporting the fact that psychological factors play a major role in successful RTS after sports injury.^{2,27,28,32} The superiority of this psychological aspect, compared with other patient-reported outcomes, has been examined in the knee and shoulder by analyzing the respective equivalent scores: ACL-RSI for the knee and Shoulder Instability–Return to Sport After Injury (SIRSI) for the

TABLE 2
PROM Scores Between the 2 Groups After Surgery^a

Variable	No RTS (n = 95)	RTS (n = 64)	P
ALR-RSI score, range	68.4 ± 28	84.6 ± 23.7	<.01
Karlsson score, points	35 ± 24	39.8 ± 30	.288
AOFAS score, points	79 ± 15.5	83.6 ± 15.7	.077

^aData presented as mean ± SD. ALR-RSI, Ankle Ligament Reconstruction–Return to Sport After Injury; AOFAS, American Orthopaedic Foot and Ankle Society; PROM, patient-reported outcome measure; RTS, return to sports.

TABLE 3
Univariate Logistic Regression Analysis Results for ALR-RSI Score on RTS at Preinjury Level^a

	OR [95% CI]	P
Age, y	1.02 [0.99-1.05]	.13
Sex	1.16 [0.61-2.20]	.65
ALR-RSI scores	1.27 [1.12-1.46]	.0004
Karlsson scores	1.07 [0.95-1.21]	.24
AOFAS scores	1.20 [0.98-1.51]	.09
Accident, surgery delay	0.95 [0.92-0.99]	.01
Type of surgery (reference = Broström procedure)	0.47 [0.24-0.90]	.02
Pivot sport (reference = no)	0.86 [0.44-1.66]	.65
Competitive athlete (reference = no)	0.58 [0.29-1.13]	.11

^aALR-RSI, Ankle Ligament Reconstruction–Return to Sport After Injury; AOFAS, American Orthopaedic Foot and Ankle Society; OR, odds ratio; RTS, return to sports. Bold indicates significant values.

TABLE 4
Multivariate Logistic Regression Analysis Results for ALR-RSI Score on RTS at Preinjury Level^a

	OR [95% CI]	P
Age, y	1.01 [0.98-1.05]	.37
ALR-RSI scores	1.29 [1.06-1.61]	.01
AOFAS scores	0.90 [0.63-1.28]	.55
Accident, surgery delay	0.96 [0.92-1]	.07
Type of surgery (reference = Broström procedure)	0.67 [0.32-1.39]	.3
Competitive athlete (reference = no)	0.71 [0.34-1.49]	.4

^aALR-RSI, Ankle Ligament Reconstruction–Return to Sport After Injury; AOFAS, American Orthopaedic Foot and Ankle Society; OR, odds ratio; RTS, return to sports. Bold indicates significant values.

shoulder, which are analogous to the ALR-RSI for the ankle.^{6,30} Specifically, Faleide et al⁶ found that psychological readiness (measured by ACL-RSI) and age were significant predictors of returning to preinjury sports levels at 2 years after anterior cruciate ligament reconstruction, while functional scores were not.⁶ Similarly, Rossi et al established that the SIRSI score is a critical predictor of

psychological readiness and RTS after glenohumeral stabilization surgery, surpassing traditional functional outcome measures such as the Rowe, and Western Ontario Shoulder Instability Index scores. They noted that an SIRSI cutoff of ≥ 55 significantly increases the likelihood of returning to sports and preinjury sports levels.³⁰

Our findings are also particularly relevant, as they can assist clinicians in anticipating the patient's chances of returning to their preinjury level. This allows them to benefit from psychological counseling and preparation to enhance their likelihood of RTS, as evidenced by 29% increased odds of returning to the preinjury level for every 10-point increase in the ALR-RSI. Moreover, these findings can inform the decision-making process for allowing RTS in the context of the limited literature supporting objective RTS criteria after surgical stabilization.^{36,41} In other words, the scores at 1 year are particularly helpful for the subgroup of patients who had not returned to sports by this time, enabling surgeons to predict the chances of RTS of their patients at 2 years.

This assertion is also supported by recent recommendations suggesting the incorporation of self-reported functional questionnaires and patients' psychological readiness when deciding on RTS.³³ A noteworthy application of this is the study by Picot et al,²⁶ who developed a composite score that included the ALR-RSI to guide practitioners in decision-making for returning to sports after lateral ankle sprains. The authors validated the score at 2 months postinjury, finding that an Ankle-GO score of < 8 points was associated with a lower chance of returning to sports at the same or higher level by 4 months, with an AUC of 0.77 (95% CI, 0.64-0.88). Compared with our study, and at a later timeline (1 year), we found that the ALR-RSI level had an AUC of 0.70 (95% CI, 0.6-0.77). This highlights the ALR-RSI effectiveness in predicting RTS after ankle stabilization surgery and the importance of conducting further studies to create an Ankle-GO score—including the ALR-RSI score—for patients who have undergone surgery.

In our study, a cutoff of 83 was found to best discriminate between the same-RTS and no-RTS groups. Conversely, although the AOFAS and Karlsson scores are commonly utilized to assess patients after foot and ankle surgery, we are not aware of any studies that have established their validity for determining the RTS timeline after lateral ankle ligament repair. Furthermore, the AOFAS scale was described as an underrepresentative score to detect the change across physical activities from easy to difficult, which requires a high level of ability to quantify patient outcomes.^{3,13,21,25} On the other hand, our findings are not too surprising given that the AOFAS and Karlsson scores look at a variety of factors, whereas the ALR-RSI is specifically looking at readiness to RTS.

In this population, the rate of RTS at the preinjury level after surgical treatment of CAI was 40.25%, which was slightly lower than that reported by Krips et al¹⁵ (42%), May et al²² (54%), and Maffulli et al²⁰ (58%). Reasons for not returning to sports at the preinjury level were out of the scope of this study. However, this might be explained by differences in surgical techniques, variations in

population motivation, and the method of RTS outcome collection in our study, which was purely independent of the surgeon and not influenced by their presence, where patients filled the questionnaire discreetly.³ Another reason could be the length of the follow-up period. For instance, the study of Maffulli et al²⁰ showed the highest rate given their long follow-up period of 9 years as compared with the reports of May et al²² (follow-up of 6 years) and Krips et al¹⁵ (follow-up of 5.4 years).

Limitations

Despite our novel findings and insights, the lack of documentation of the preoperative examination to assess the level of ankle instability was the main limitation of this study. Other limitations include the employment of 2 surgical techniques in the treatment of included patients; this may have caused a selection bias based on the surgeon's preference. However, we attempted to overcome this by employing multivariate analysis to control for confounding factors, which confirmed that the technique is indeed a confounding factor. Nonetheless, the inclusion of 2 different surgical approaches can also be considered a strength of the study. It enhances the generalizability of our findings, demonstrating the applicability of our results across different surgical interventions for CAI. Another limitation of this study was the reliance on subjective patient perceptions to evaluate the quality of RTS, without the inclusion of objective performance metrics—such as minutes played, game-winning ratios, or points per game. Furthermore, scores were obtained at 1-year postoperation. By this time, many patients who successfully RTS likely did so, potentially biasing the responses on the ALR-RSI toward higher scores. This is because the ALR-RSI specifically measures readiness to RTS, whereas the AOFAS and Karlsson scores evaluate a broader range of functions beyond just readiness. In addition, while the study suggests that the ALR-RSI may be more useful than AOFAS or Karlsson scores in predicting RTS at the same level, the ROC AUC is not very high. This highlights a broader issue in the limited predictive value of the current patient-reported outcome measures for RTS at the same level, suggesting a critical need for developing more precise, objective metrics to assess this important outcome.

CONCLUSION

This study showed that none of the scores were great predictors of RTS after surgery for CAI. The ALR-RSI score at 1 year postoperatively was a stronger predictor of RTS to the preinjury level after CAI surgery than the AOFAS and Karlsson scores. The ALR-RSI optimal threshold identified was 83. Conversely, the discriminatory value of the AOFAS and Karlsson scores was found to be poor. A 10-point increase in the ALR-RSI boosted RTS odds by 1.29 times.

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