CLINICAL ARTICLE

Development and Validation of a Novel Scoring System for Severity of Plantar Fasciitis

Meng-chen Yin, MD, Yin-jie Yan, MD, Zheng-yi Tong, Chong-qin Xu, Jiao-jiao Qiao, MD, Xiao-ning Zhou, MD, Jie Ye, MD, Wen Mo, MD

Department of Orthopaedics, Longhua Hospital, Shanghai University of Traditional Chinese Medicine, Shanghai, China

Objectives: Plantar fasciitis (PF) is the most common cause of heel pain. Though PF is self-limited, it can develop into chronic pain and thus treatment is needed. Early and accurate prognostic assessment of patients with PF is critically important for selecting the optimal treatment pathway. Nevertheless, there is no scoring system to determine the severity of PF and no prognostic model in choosing between conservative or surgical treatment. The study aimed to develop a novel scoring system to evaluate the severity of plantar fasciitis and predict the prognosis of conservative treatment.

Methods: Data of consecutive patients treated from 2014 to 2018 were retrospectively collected. One hundred and eighty patients were eligible for the study. The demographics and clinical characteristics served as independent variables. The least follow-up time was 6 months. A minimal reduction of 60% in the visual analog scale (VAS) score from baseline was considered as minimal clinically important difference (MCID). Those factors significantly associated with achieving MCID in univariate analyses were further analyzed by multivariate logistic regression. A novel scoring system was developed using the best available literature and expert-opinion consensus. Inter-observer reliability and intra-observer reproducibility were evaluated. The appropriate cut-off points for the novel score system were obtained using receiver operating characteristic (ROC) curves.

Results: The system score = VAS (0–3 point = 1; 3.1–7 point = 3; 7.1–10 point = 5) + duration of symptoms (<6 months = 1; ≥1 6 months = 2) + ability to walk without pain (>1 h = 1; ≤1 h = 4) + heel spur in X-ray (No = 0; Yes = 2) + high intensity zone (HIZ) in MRI (No = 0; Yes = 2). The total score was divided in four categories of severity: mild (2–4 points), moderate (5–8 points), severe (9–12 points), and critical (13–15 points). Inter-observer agreement with a value of 0.84 was considered as perfect reliability. Intra-observer reproducibility with a value of 0.92 was considered as perfect reproducibility. The optimum cut-off value was 10 points. The sensitivity of predictive factors was 86.37%, 84.21%, 91.22%, 84.12%, and 89.32%, respectively; the specificity was 64.21%, 53.27%, 67.76%, 62.37%, and 79.58%, respectively; the area under curve was 0.75, 0.71, 0.72, 0.87, and 0.77, respectively. The Hosmer–Lemeshow test showed a good fitting of the score system with an overall accuracy of 90.6%.

Conclusions: Based on prognostic factors, the present study establishes a novel scoring system which is highly comprehensible, reliable, and reproducible. This score system can be used to identify the severity of plantar fasciitis and predict the prognosis of conservative treatment accurately. The application of this scoring system in clinical settings can significantly improve the decision-making process.

Address for correspondence Jie Ye, MD, or Wen Mo, MD, Department of Orthopaedics, LongHua Hospital, Shanghai University of Traditional Chinese Medicine, Shanghai, China 200032. Email: yejie1977@126.com (Ye); mw2218@126.com (Mo)

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[†]Meng-chen Yin, Yin-jie Yan and Zheng-yi Tong contributed equally to this work and should be considered as equal co-first authors.

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Introduction

Plantar fasciitis (PF), occurring in 11% to 15% of adults, is the most common cause of heal pain and manifests as the pain originating from the insertion of the plantar fascia near the medial tubercle of the calcaneus[1–3]. PF is caused by the slight damage to foot fascia due to overloading, which can result in aseptic inflammation of the fascia or tendon[4–6]. Women, obese people, and athletes participating in frequent running activities have a higher risk of developing plantar fasciitis. One or both feet can be affected. The etiology of plantar fasciitis is poorly understood and likely multifactorial. And this condition is thought to be caused by biomechanical overstress of the calcaneal tuberosity. Discussion of its biomechanical etiology usually involves the windlass mechanism and tension of the plantar fascia in both stance and gait. Plantar fasciitis is more likely to inflict people who frequently run or perform high-impact activities like jumping, dancing, or athletic running. Though PF is self-limited, it can develop into chronic pain and thus treatment is needed. The surgical method is applicable for intractable PF cases on which the effect of conservative treatment is not desirable[7–11].

Early and accurate prognostic assessment of patients with PF is critically important for selecting the optimal treatment pathway. The diagnosis of PF is based on the patient's history and results of physical examination. Patients usually present with plantar heel pain on initiation of weight bearing, particularly in the morning on rising from sleep and after periods of rest. The pain tends to decrease after a few minutes and returns as the day proceeds and the amount of time the patient spends on their feet increases. Another important characteristic is the location of the pain, usually occurring at the origin of the plantar fascia from the medial tubercle of the calcaneus. Mechanical overload, irrespective of whether it is the result of biomechanical faults, obesity, or work habits of prolonged standing and running, may contribute to the symptoms.

Diagnostic imaging is rarely needed for the initial diagnosis of PF because it may not be helpful; although, it should be considered to rule out other causes of heel pain when doubts arise. Plain radiographs often reveal a heel spur on the inferior surface of the calcaneus. The presence or absence of heel spurs is not useful in diagnosing plantar fasciitis. Heel spurs are common in asymptomatic individuals and may be an incidental finding. The formation of heel spur is a continuous biological process. The plantar fascia is a critical structure arising from the medial process of the calcaneal tuberosity and inserting into the digits of the foot. Heel spur consists of mature lamellar bone and demonstrates degeneration and fibro-cartilaginous proliferation, even ossification in the condition of PF. At present, the relationship between the plantar calcaneal spurs and the plantar fasciitis pain stills remains elusive. The results of several studies comparing patients with and without plantar fasciitis showed that patients with thicker heel aponeurosis are associated with plantar fasciitis identified by magnetic resonance imaging (MRI).

Conservative treatments help alleviate the disabling pain, including rest, shoe inserts, activity modification, oral analgesics, night splints, stretching, corticosteroid injections, and extracorporeal shockwave therapy. Extracorporeal shockwave therapy is an alternative to surgery and ineffective conservative treatment for recalcitrant heel pain syndrome, approved in 2000 by the Food and Drug Administration. The rationale of extracorporeal shockwave therapy is to stimulate soft tissue growth by local hyperemia, neovascularization, reduction of calcification, inhibition of pain receptors, and denervation to achieve pain relief and persistent healing of chronic processes. If conservative treatment is ineffective, surgery can be considered. Currently, considerable controversy has emerged regarding the clinical efficacy of treatment for PF. The relationship between individual patient's characteristics and its potential predictive value on outcomes has not been studied. In addition, there is no scoring system to determine the severity of PF and no prognostic model in choosing between conservative or surgical treatment. So, we are unable to predict which patients are better suited for conservative treatment or surgery. Therefore, it is important to determine how patient's individual demographic characteristics, physical examination signs, duration and severity of symptoms, or imaging findings influence the likelihood of meaningful response to treatment. Furthermore, an effective scoring system will help physicians considerably in evaluating the severity of PF to improve the selection of patients[12, 13].

In this study, we aimed to: (i) retrospectively analyzed the independent predictors of achievement in successful conservative treatment and combined these predictors that were useful in grading severity and predicting effects; (ii) to develop a new scoring system based on common clinical indices regarding the disease severity. Thus, the results of the analysis were validated using the internal validation cohort to accurately identify the severity of PF and predict the treatment outcomes; (iii) the novel scoring system can be used to guide treatment selection for PF patients and can also serve as a supplement to the international clinical scale to assess feet function.

Materials and Methods

Subjects

This study was conducted in accordance with the principles of the Declaration of Helsinki[14]. Data of consecutive patients

treated from 2014 to 2018 were retrospectively collected. Written informed consent was obtained from all patients.

Inclusion and Exclusion Criteria

Inclusion criteria was as follows: (i) age >18 years; having local pain in the area where the fascia attaches to the heel; having a symptomatic duration of >7 days; (ii) conservative treatment; (iii) age, sex, visual analog scale (VAS) score grade, duration of symptoms, edema, heel spur, MRI imaging, and other items; (iv) achieve minimal clinically important difference; (v) retrospective comparative study.

The exclusion criteria were: (i) having physical dysfunction in feet or ankles (walking difficulty caused by serious pain); (ii) having infection or tumor at the heel.

All eligible patients completed a demographic pertaining record. All conservative treatments were recorded. The least follow-up time was 6 months. A minimal reduction of 60% in the VAS score from baseline was considered as minimal clinically important difference (MCID)[15]. Failure to achieve the MCID was deemed as ineffective conservative treatment. Then, surgery would be considered.

Development of the Novel Scoring System

The factors significantly associated with MCID achievement in univariate analyses were subsequently analyzed in a multivariate manner with the Cox proportional hazards model. A group of academic professionals, consisting of 10 ankle specialists and rehabilitation physicians with more than 5 years of experience, were asked to participate in the development of the scoring system. An evidence-based process using the best available literature and expert opinion consensus was used to develop the novel scoring system.

Reliability, Reproducibility, and Validation Evaluation of the Novel Scoring System

Inter-observer reliability was determined by comparing the initial responses of five evaluators. Intra-observer reproducibility was evaluated by comparing one evaluator's responses to the same case, with an 8-week interval to limit the recall bias to a minimum. To evaluate the validation of the novel scoring system, patients in study cohort were also randomly allocated: 75% were selected as the total training sample and 25% were selected as the validation sample. The Hosmer–Lemeshow test was used to test the goodness of fit. The appropriate cut-off points for the novel score system were obtained using receiver operating characteristic (ROC) curves corresponding to the point on the curve nearest to the upper left corner of the ROC graph.

Statistical Analysis

SPSS 20.0 was used for statistical analysis. Mean, standard deviation, median, quartiles and inter quartiles for continuous variables, and frequency for categorical variables were calculated for the patients' demographic and clinical characteristics. Univariate analysis and multivariate Cox regression analysis with stepwise selection were performed to detect independent predictors. The regression coefficients of the multivariate Cox regression model were divided by the median of the included factors and rounded to the nearest unit to obtain simple point numbers to facilitate bedside calculation of the novel scoring system[16]. Statistical significance was set at $P < 0.05$. The intraclass correlation coefficient (*ICC*) and kappa coefficient (κ) were used to assess the agreement (two-way mixed-effect model, in which people effects are random, and measures effects are fixed). The values were expressed with a 95% *CI*[15–18]. Levels of agreement were graded according to the recommendations of Landis and Koch[19].

Results

Patient Characteristics and Clinical Findings

Among the 192 patients diagnosed with PF from January 2014 to December 2018 at Longhua Hospital, 180 were eligible to form the training cohort. The remaining 12 were excluded due to incomplete data or history of other treatments. The recruited patients (98 men and 82 women) had a mean age of 52.4 ± 11.3 years. The mean duration of symptoms was 5.4 ± 1.3 months. Of these patients, 58 (32.5%) had a body mass index <26 kg/m^2, 96 (53.3%) had a body mass index range between 26 and 30 kg/m^2, and 26 (14.4%) had a body mass index >30 kg/m^2. The baseline scores at presentation were a mean of 6.5 ± 1.1 points for the VAS and a mean of 2.5 ± 0.3 points for the Roles and Maudsley (RM) score. There were 69 (38.3%) patients who had a history of alcohol and tobacco use, 32 (17.7%) who had history of diabetes, 55 (30.6%) who had bilateral PF, and 62 (34.4%) who were unable to walk for >1h without pain. In imaging, there were 113 (62.7%) patients with heel spur as shown in X-ray and 48 (26.7%) with high intensity zone (HIZ) as shown in MRI (all evaluators agreed as to the presence of a spur or high intensity zone on MRI). All patients received the shoe inserts and oral non-steroidal anti-inflammatory drugs (NSAIDs). The flow chart for these patients is shown in Fig. 1.

Development of the Novel Scoring System

Among the 180 eligible patients, 118 (65.6%) achieved the minimal clinically important difference (MCID). According to the univariate analysis, significant inter-group differences correlated to the success rate of achieving MCID were found in terms of BMI, VAS score grade, duration of symptoms, ability or inability to walk for >1 h without pain, presence of edema, presence of heel spur, and HIZ on T2-weighted MRI imaging ($P < 0.05$). Table 1 demonstrates the demographic characteristics and the univariate analysis of all the factors. In the Cox analysis, the BMI and presence of edema was no longer significant for achieving MCID. The results of the entire Cox proportional hazards analysis including risk ratios, 95% confidence intervals, and *P* values are given in Table 2.

Five variables with significant predictive value in multivariate analyses (VAS score grade, duration of symptoms,

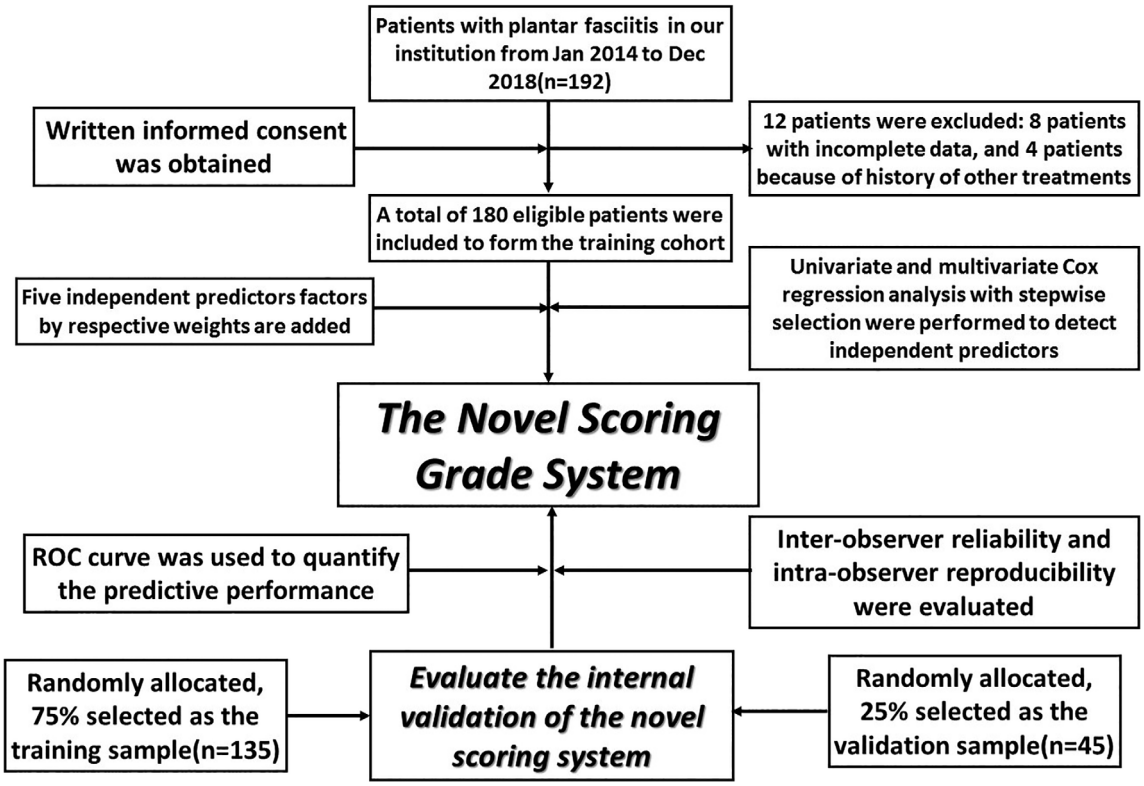

Fig. 1 The flow chart of the study.

ability of walking, presence of heel spur on plain radiographs, and HIZ on T2-weighted MRI imaging) were included in the scoring instrument. Each of these risk factors was graded from none (i.e. not present) to severe and given a score from 0 to 5 depending on the severity. The score for one patient was calculated using the following equation: **System score** = **VAS** (0–3 points = 1; 3.1–7 points = 3; 7.1–10 points = 5) + **duration of symptoms** (<6 months = 1; ≥1 6 months = 2) + **ability to walk without pain** (>1 h = 1; ≤1 h = 4) + **heel spur in X-ray** (No = 0; Yes = 2) + **HIZ in MRI** (No = 0; Yes = 2). Furthermore, the total score was divided into four categories of severity: mild (2–4 points), moderate (5–8 points), severe (9–12 points), and critical (13–15 points).

Evaluating Reliability and Reproducibility of the Novel Scoring System

We observed full inter-observer agreement when scoring the severity grade (mild, moderate, severe, or critical), with a κ value of 0.84 as perfect reliability. The κ values were 0.86 for mild, 0.78 for moderate, 0.82 for severe, and 0.91 for critical. These values for mild, severe, and critical grades implied perfect agreement, and the value for moderate grade indicated substantial agreement (Table 3). In the repeated evaluation 8 weeks after the first assessment, we observed perfect reproducibility, with a κ value of 0.92. The k values for each evaluator were 0.95, 0.91, 0.89, 0.90, and 0.94, respectively. These values all implied as perfect agreement (Table 4).

Accuracy of Predicting Conservative Treatment Outcomes in PF Patients

Of the 180 patients, 60 (33.3%) fell into the mild category, 56 (31.1%) into the moderate category, 55 (30.6%) into the severe category, and nine (5%) into the critical category. A histogram distribution of the score values is shown in Fig. 2. Remarkably, the patients in achieved MCID group showed a remarkably lower score (median points = 4.8) than patients in not-achieved MCID group (median points = 10.9). The optimum cut-off value was 10 points, indicating that patients with a score ≤10 had significantly better prognosis than those with a score >10.

The MCID-dependent-ROC curve area analysis was used to determine whether thesystem was good at predicting outcomes of conservative treatment. The area values for five characteristics were 0.75, 0.71, 0.72, 0.87, and 0.77, respectively, which demonstrated good discrimination. The diagnosis sensitivity of the five characteristics was 86.37%, 84.21%, 91.22%, 84.12%, and 89.32%, respectively, which demonstrated high accuracy. The diagnosis specificity of the five characteristics was 64.21%, 53.27%, 67.76%, 62.37%, and 79.58%, respectively, also demonstrating high accuracy (Table 5). The model had a good fitting with an overall accuracy of 90.6% (Fig. 3). Based on this cut-off value, the sensitivity and specificity for the accurate diagnosis of achieved MCID were 89.5% and

TABLE 1 Demographic characteristics and the univariate analysis

Variables	Achieved MCID (n = 118)	Not achieved MCID (n = 62)
Age (years)	53.1 ± 12.1	51.9 ± 10.5
Gender (male, cases)	66	32
BMI (kg/m^2, mean ± SD)*	25.5 ± 4.5	28.8 ± 4.3
<26	48	10
26–30	67	29
≥30	3	23
Alcohol and tobacco use (cases)	44	25
History of diabetes (cases)	20	12
Affected bilateral side (cases)	37	18
Duration of symptoms (months, mean ± SD)*	3.4 ± 1.3	8.5 ± 1.3
≥6 months (cases)	13	55
<6 months (cases)	105	7
Roles and Maudsley score (mean ± SD)	2.49 ± 0.27	2.52 ± 0.23
VAS (mean ± SD)*	4.2 ± 1.7	5.9 ± 1.7
0–3	41	3
4–7	66	54
8–10	11	5
Inability to walk for >1 h without pain (cases)*	16	46
Presence of oedema (cases)*	8	10
Presence of heel spur in X-ray (cases)*	61	52
Presence of HIZ in MRI (cases)*	10	38

* Variables compared with two groups (P < 0.05); MCID, minimal clinically important difference.

88.6%, respectively. Therefore, it could provide proper guidance in selecting the appropriate therapeutic strategy.

Discussion

Clinical Value of the Novel Scoring System

Predicting the severity and prognosis of PF is of vital importance because the patients might develop chronic, intractable, and refractory heel pain if the current therapeutic treatment produces poor outcomes and some patients may even need surgery.

TABLE 2 Multivariate analysis of the characteristic

Variables	Risk ratio	95% *CI*	*P* value
BMI	3.3	0.21–12.4	0.31
Duration of symptoms*	2.11	1.01–4.29	0.02
VAS*	8.12	4.14–16.23	<0.001
Inability to walk*	6.32	5.67–7.11	0.01
Presence of oedema	20.1	1.92–15.4	0.88
Presence of heel spur in X-ray*	1.92	0.98–3.54	0.03
Presence of HIZ in MRI*	2.18	5.24–9.11	<0.001

* variables, *P* value <0.05.

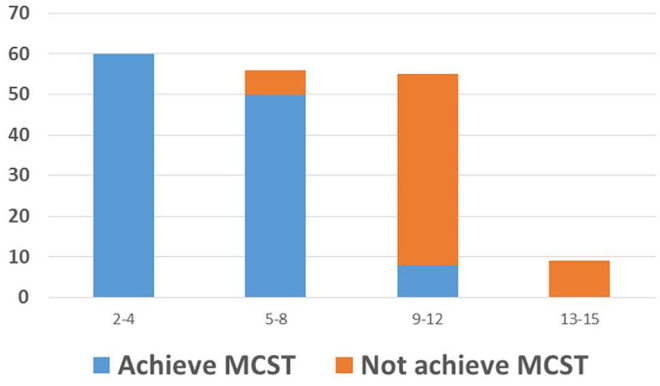

Fig. 2 A histogram distribution of the score value of patients. It showed that 60 (33.3%) patients were divided into the mild category, 56 (31.1%) patients were divided into the moderate category, 55 (30.6%) patients were divided into the severe category and 9 (5%) patients were divided into the critical category.

To the best of our knowledge, there is no such scoring system or prognostic model to evaluate the severity of PF and aid in clinical decision-making. In clinical studies, VAS, AOFAS, and RM score are widely used to evaluate pain in relation to daily activities for PF patients. Though well-accepted, VAS is only a pain assessment tool and cannot reflect the foot function of PF patients. The RM score, which can make up for the deficiency and shortcoming of VAS, includes three items: ability to walk, symptoms improved after treatment, and the patient being satisfied with the treatment outcome. However, the RM score range is too wide in severity evaluation and cannot evaluate the positive and negative predictive values separately. Both VAS and RM are subjective indexes and objective quantitative indexes are needed. AOFAS, one of the mostly used clinical rating systems in foot surgery, has a questionnaire including nine items that are divided into three subscales (pain, function, and alignment). The limitation of AOFAS is that the questions in it have a limited number of answers, and some answers can be interpreted differently. In addition, AOFAS is too complicated to be used in daily clinical practice[3, 20, 21].

Since the temporary loss of function caused by PF can decrease the patient's quality of life, questionnaires regarding functional outcomes are increasingly used in clinical practice and research to monitor the patients' recovery after

TABLE 3 Inter-observer reliability of the novel scoring system

Item	κ value	95% *CI*
Mild	0.86	0.37–0.64
Moderate	0.78	0.39–0.66
Severe	0.82	0.62–0.89
Critical	0.91	0.49–0.73
Overall	0.84	0.47–0.67

TABLE 4 Intra-observer reproducibility of the novel scoring system

Evaluator	κ value	95% *CI*
A	0.95	0.41–0.64
B	0.91	0.26–0.52
C	0.89	0.18–0.47
D	0.90	0.56–0.77
E	0.94	0.42–0.88
Overall	0.92	0.33–0.61

treatment. Currently, the choice of clinical treatment methods mostly depends on the doctors' subjective and empirical judgments. There lacks evidence for the classification and treatment scheme selection of PF. Besides, we found most of the indicators in RM and AOFAS scales were evaluated subjectively, without considering the disease course and imaging examination. These currently used scales serve to evaluate the therapeutic effect, rather than guide treatment programs. So, our novel rating system combines the subjective outcome reported by the patient and the objective outcome based on the image examination. We hope that this scoring system enables detailed evaluation of functional outcome and quality of life, which is not provided by other PROM (Patient-Reported Outcome Measure) questionnaires[22–24].

Unfortunately, most previous studies fail to establish a system that can evaluate the severities and analyze prognostic factors in PF patients before decision-making of the therapeutic approaches[25, 26]. Therefore, the aim of this study is to establish a novel scoring system called Longhua Scoring System that can comprehensively evaluate clinical features and prognostic risk factors. Individualized treatment approaches are often based on the feet's function as estimated by significant prognostic factors and scoring systems. To the best of our knowledge, this is the first study based on a large database to establish a scoring standard combining objective examination, imaging examination and functional limitations for objective evaluation, treatment, and prognosis of PF.

Comparison Between Other Scales and Novel Scoring System

An ideal and effective classification system must be comprehensive, simple, reliable, reproducible, and applicable in clinical treatment and prognosis, and communicable for peer review and spreading. Some studies also evaluated the validity, reliability, and responsiveness of the AOFAS: in terms of test–retest reliability, the Cronbach's α ranged from 0.439 to 0.753; in terms of internal reliability, the Cronbach's α ranged 0.511 to 0.693[27–32]. Compared with the previous scale, the Longhua scoring system demonstrates higher acceptance and reproducibility among PF patients, and therefore could be applied widely. Unlike other scales, our scoring system is specifically designed for PF patients.

Previous studies have shown that the PF has complicated pathogenic mechanism and the etiology is also complex and multifactorial[33, 34]. Pain status was a robust predictor of treatment outcome in PF patients according to our previous and other relevant studies[21, 35–37]. In our study, patients with higher VAS had a poorer prognosis than we thought. In particular, duration of symptom which is seldom used as a variable in other scales is also included in our scoring system. In the present study, we determined that a symptomatic duration of <6 months (score = 1) was significantly and independently associated with a good prognosis.

The clinical diagnosis of PF is challenging owing to the complex regional anatomy of the lesion. Whether the imaging findings (plain radiography and MRI) have a real association with PF has been debated for a lot time. Imaging features that are seldom included as variables in other systems are also considered in our scoring system. Osborne *et al.* believed the key radiologic features that differentiated heel pain included changes in the soft tissues, but not spurs[38]. Chimutengwende-Gordon *et al.* reported that a significant relationship was observed between the occurrence of night pain and calcaneal marrow edema on MRI[39]. Our study confirmed that a lateral radiograph should still be the first choice to evaluate heel pain. Several findings suggested PF could be detected on conventional radiographs. Despite this, plain radiography should not be used to diagnose PF without knowledge of clinical history or physical examination. Mahowald *et al.* demonstrated a high correlation between plantar fascia thickness and symptoms of PF[40]. Plantar calcaneal spurs and calcifications are uncommon occurrences in patients with PF in some studies. The percentage of asymptomatic individuals in whom heel spurs are present on routine radiographs is about 20%. So, currently their importance in terms of the diagnosis and prognosis of PF is still controversial[41, 42]. The result of our study showed that the presence of calcaneal spurs is common on lateral plain radiographs of individuals and represents a reliable sign of PF. Zhou *et al.* identified two types of calcaneal spurs on the preoperative radiographs and that the grade of PF is dependent on the classification of the calcaneal spurs[43]. Thus, the significance of plain radiography should receive more considerable attention. Maybe, the combination of thickened PF and presence of calcaneal spurs on lateral plain radiography can provide a higher sensitivity and specificity for evaluating heel pain. Is there a role for MRI in plantar heel pain? MRI is sensitive and helpful in excluding other

TABLE 5 Diagnosis capability of five characteristics

Characteristics	Sensitivity (%)	Specificity (%)	Area under ROC curve (95% *CI*)
VAS score	86.37	64.21	0.75 (0.63–0.84)
Duration of symptoms	84.21	53.27	0.71 (0.49–0.75)
Ability of walking	91.22	67.76	0.72 (0.65–0.84)
Presence of heel spur	84.12	62.37	0.86 (0.75–0.81)
Presence of HIZ	89.32	79.58	0.77 (0.69–0.89)

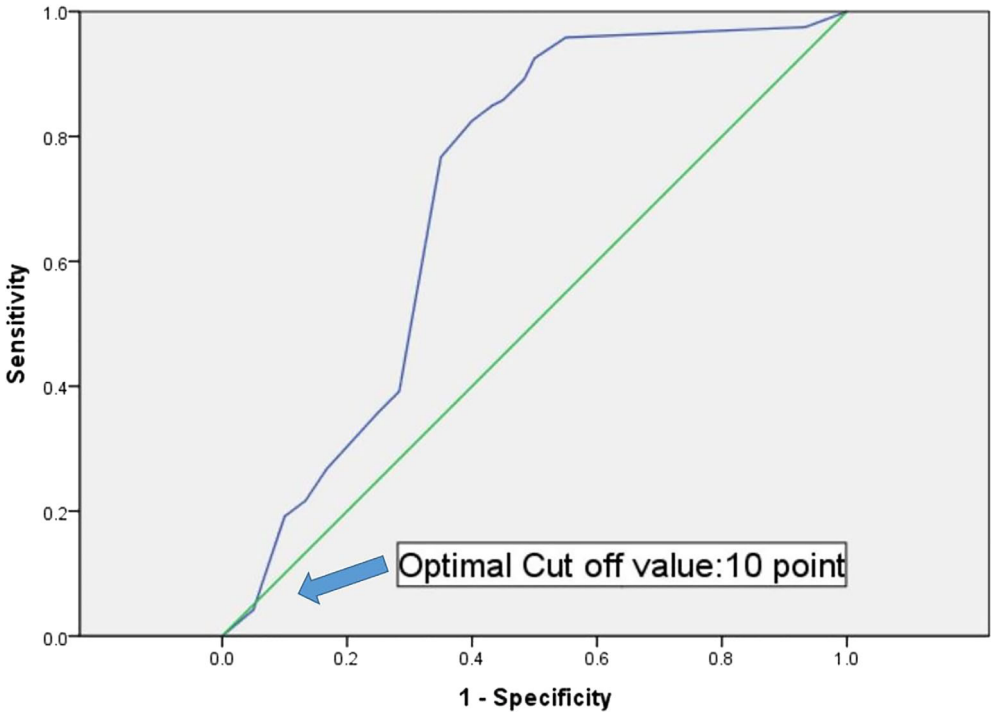

Fig. 3 The optimum cut-off value was 10 points, indicating that patients with a score ≤10 had significantly better prognosis than those with a score >10 and the model had a good fitting with a ROC value of the accuracy of 90.6%.

causes of heel pain. MRI is very sensitive and most helpful in excluding other causes of heel pain[44]. Our study demonstrated that presence of signal intensity within the plantar fascia has a significant relationship with the symptoms. Image characteristics were mainly shown in terms of the plain radiography and MRI image indices described in our novel scoring system. Thus, the plain radiography and MRI image indices are useful characteristics and significant prognostic factors not only for diagnosis but for evaluation of PF.

Strengths and Limitations

Our study should be considered in the context of several notable strengths. First, this study is the first, to our knowledge, to provide a grade score system analyzing the severity of PF, and also provide a predictive model analyzing the factors associated with achievement of meaningful improvement in pain and disability of patients with PF. Thereby, physicians can promoting value-based care and increase the effectiveness of treatment in selected patients. Second, an evidence-based process using the best available literature and expert-opinion consensus was used to develop the novel scoring system.

Limitations exist in this study. First, this was a retrospective study with uncontrolled clinical observation and selection for treatment procedures. Second, the sample size of patients is small and may be insufficient as a basis for proposing a scoring system. Third, using our scoring system, it remained unclear whether surgical intervention or conservative therapy should be selected, and the lack of wide evaluation for the grading score system in clinical practice can be also considered as a flaw of this study.

Conclusion

The novel score system shows a high comprehensibility. Use of the novel score in clinical settings may significantly improve decision-making processes. It means that it is crucial for clinicians to select the individual treatment for patients with PF to avoid inappropriate treatments. If patients have a score of ≤10, surgery may be avoided, conservative treatment would be an alternative option and have a good prognosis. Surgical treatment is recommended for patients with a score >10.

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