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The Impact of Preoperative Anxiety/Depression on the Surgical Outcomes of Patients with Pilon Fractures: A Retrospective Study

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Abstract: ***Objective:*** ***This study investigates the psychological status of patients with pilon fractures and analyzes the impact of preoperative psychological state on surgical outcomes.*** ***Methods:*** ***We included 121 patients with pilon fractures from April 2018 to July 2024. All completed the Chinese version of the 9-item Central Sensitization Inventory (CSI-9), Hospital Anxiety and Depression Scale (HADS), Visual Analogue Scale (VAS), and American Orthopaedic Foot and Ankle Society Hindfoot Scale (AOFAS) preoperatively and postoperatively. Patients were divided into two groups: Group A (with preoperative anxiety or depression) and Group B (without). We assessed baseline data, central sensitization, pain, functional activity, and psychological status.*** ***Results:*** ***Of the 121 patients, 100 completed follow-up, with 41 (41%) showing preoperative anxiety or depression. Group A had significantly higher preoperative and final follow-up scores in central sensitization, pain, and anxiety/depression ($p<0.05$) compared to Group B. Group A also had worse overall prognosis. Significant differences were observed in improvements in central sensitization, pain, and anxiety/depression ($p<0.05$). Patients with depressive symptoms had poorer functional and pain recovery postoperatively. A significant correlation was found between postoperative pain improvement and functional activity in patients with preoperative depression ($p<0.05$).*** ***Conclusion:*** ***Both cohorts showed substantial improvements in pain management, psychological well-being, and central sensitization postoperatively. However, patients with preoperative anxiety or depression had inferior outcomes in postoperative pain, psychological status, and central sensitization. Preoperative depressive symptoms may impede postoperative pain improvement and functional recovery. Surgeons should prioritize mental and psychological care for patients with depression before surgery to optimize outcomes.***

Keywords: Pilon fracture, Open reduction and internal fixation (ORIF), Prognosis, Anxiety, Depression.

1. Introduction

Pilon fractures, which result from high-energy axial compressive forces, affect the distal tibial weight-bearing articular surface and are relatively infrequent in clinical settings [1]. The unique anatomical features of the distal tibia, including its thin soft tissue coverage, relatively poor vascularity, and large medullary cavity, collectively contribute to the complexity of treating Pilon fractures, making it one of the most challenging issues in orthopedics [2]. Currently, the surgical treatment of Pilon fractures primarily involves open reduction and internal fixation (ORIF), a method that effectively restores the normal anatomy of the articular surface and is widely used in clinical practice [3, 4].

However, the success of surgery relies not only on precise clinical techniques but also on the patient's individual condition and postoperative rehabilitation. To more intuitively present the recovery status of patients after surgery, an increasing number of clinicians have started to use patient-reported outcome measures (PROMs) to assess treatment efficacy. PROMs have become a vital tool for measuring postoperative pain, functional activity, quality of life, as well as the psychological state and satisfaction of patients [5]. Research has shown that a good psychological state has significant predictive value for postoperative recovery [6]. In a prospective study conducted by Li, preoperative anxiety or depression had a significant negative impact on surgical outcomes in patients undergoing total cervical discectomy [7]. Moreover, poor preoperative psychological status can also negatively affect the outcomes of total hip and knee arthroplasty [8]. Studies have indicated that poor psychological status not only interferes with surgical prognosis [9-12] but may also affect postoperative functional recovery [13, 14]. Therefore, preoperative psychological assessment of patients with orthopedic diseases plays a significant role in optimizing surgical outcomes and promoting overall patient recovery.

Although numerous studies have explored the prognostic factors associated with Pilon fractures, research on the impact of preoperative anxiety and depression on surgical outcomes remains relatively limited. This study aims to investigate the incidence of preoperative anxiety and depression in patients with Pilon fractures and to analyze their effects on postoperative pain, function, psychological state, and central sensitization. By providing clinicians with evidence-based insights, this research seeks to enhance surgical efficacy and patient satisfaction.

2. Methods and Patients

This retrospective study has been approved by the Ethics Committee of Xi'an Jiaotong University Affiliated Honghui Hospital / Xi'an Honghui Hospital, with the approval number: No.: 2025-KY-070-01, All the subjects signed the informed consent form and followed the principles of the Helsinki Declaration. A retrospective analysis was conducted on the medical records of patients admitted to Honghui Hospital in Xi'an from April 2018 to July 2024 and diagnosed with Pilon fractures. Inclusion criteria: (1) Patients with Pilon fractures treated surgically; (2) Age ≥ 18 years; (3) Patients with the language and cognitive abilities to independently complete

questionnaires. Exclusion criteria: (1) Incomplete basic clinical data; (2) Presence of other foot fractures, such as talus fractures, calcaneus fractures, metatarsal fractures, etc. (3) Patients with a history of psychiatric disorders. (4) Patients with diseases such as tumors or rheumatoid arthritis.

After obtaining approval from the ethics committee, we retrieved the contact details of patients through the medical record system and invited them to participate in this study. Baseline data, including age, gender, BMI, and follow-up duration, were collected from the patients, who were also required to complete questionnaires assessing their subjective feelings and functional status. The Hospital Anxiety and Depression Scale (HADS) was employed to evaluate the anxiety and depression levels of patients before surgery and at the final follow-up. The HADS consists of two subscales, HADS-A (anxiety) and HADS-D (depression), each containing seven items scored on a four-point scale ranging from 0 to 3. A total score of 8 or higher indicates the presence of anxiety or depression [15]. Additionally, the Visual Analogue Scale (VAS) was used to assess pain intensity before surgery and at the final follow-up. The VAS is a 10-cm line where 0 represents no pain and 100 represents the worst possible pain, with patients marking their pain level according to their subjective experience [16]. The American Orthopaedic Foot and Ankle Society Hindfoot Score (AOFAS) was utilized to assess functional status at the final follow-up. The AOFAS scoring system quantifies foot health and tracks improvements throughout treatment. The Chinese version of the 9-item Central Sensitization Inventory (CSI-9) was used to assess central sensitization (CS) before and after surgery. The CSI-9 is a shortened version of the 25-item Central Sensitization Inventory (CSI-25) and serves as a patient-reported tool for identifying individuals at risk of central sensitization among chronic pain patients. The CSI-9 comprises two parts: Part A includes nine questions assessed using a five-point Likert scale (0: never; 1: rarely; 2: sometimes; 3: often; 4: always), with scores ranging from 0 to 36. Higher scores indicate a greater likelihood of central sensitization, with a score of ≥18 showing good sensitivity and specificity for identifying central sensitization. Part B, consistent with the CSI-25, includes ten central sensitization-related conditions, collecting patients' past diagnostic information to aid in determining the presence of central sensitization [17]. All raters underwent appropriate training to ensure the accuracy of their assessments. Questionnaires and clinical data were entered into an electronic database following a standardized procedure and anonymized to ensure data accuracy and patient privacy.

Based on preoperative HADS scores, patients were divided into two groups: Group A (patients with preoperative anxiety or depression, defined as a score of ≥8 on either the HADS-A or HADS-D subscale) and Group B (patients without preoperative anxiety or depression, defined as scores <8 on both subscales).

3. Statistical Analysis

Statistical analysis for this study was conducted using IBM SPSS Statistics 26 software (IBM Corporation, USA). Initially, all continuous variables were tested for normality to determine if the data followed a normal distribution. Normally distributed data were described using mean ± standard deviation (Mean±SD), with independent samples t-tests used for between-group comparisons and paired samples t-tests for within-group comparisons. For data that did not follow a normal distribution, they were described using the median (interquartile range) [M(P25, P75)] and compared using the Mann-Whitney U nonparametric test. Ordinal categorical variables were described using frequency and percentage (%), with between-group comparisons performed using the χ^2 test. Figures 1-2 show the preoperative Computed Tomography (CT) and X-ray imaging data; Figures 3-4 present the postoperative CT and X-ray imaging data.

4. Radiographic Data

4.1 Preoperative

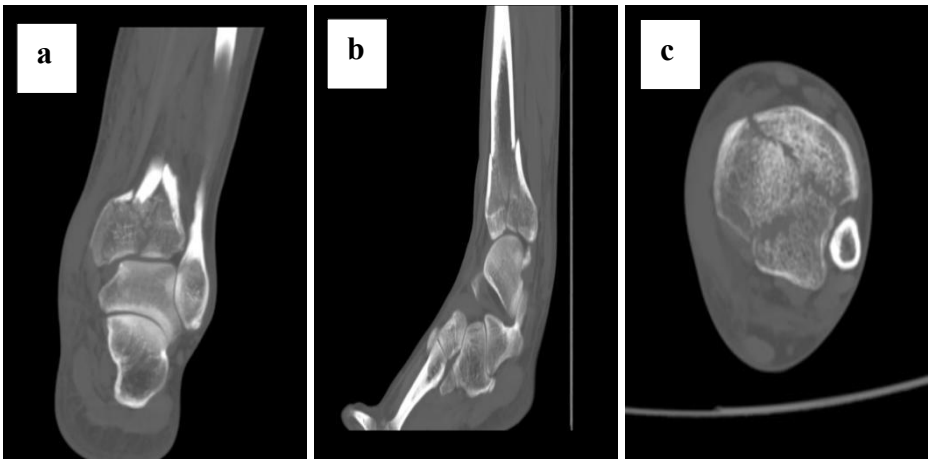

Figure 1: Preoperative CT imaging data. a The sagittal CT view reveals a distal tibial fracture involving the articular surface; b The coronal CT view shows a fracture of the distal tibial articular surface; c The axial CT section indicates a comminuted fracture of the distal tibial articular surface

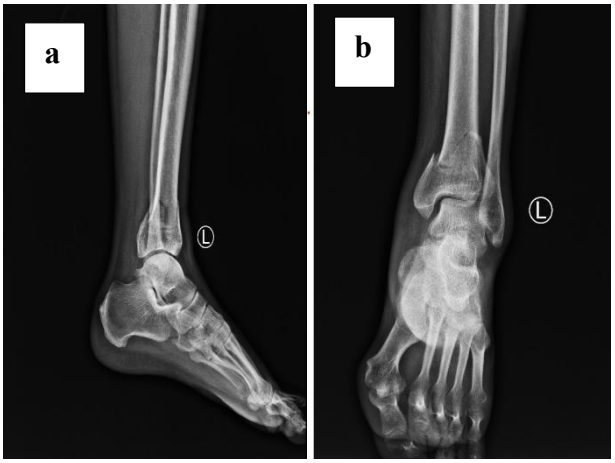

Figure 2: Preoperative X-ray imaging data. a The lateral view of the left ankle shows a clear fracture of the tibia involving the distal tibial articular surface; b The anteroposterior view of the left ankle reveals a distinct fracture line in the tibia

4.2 Postoperative

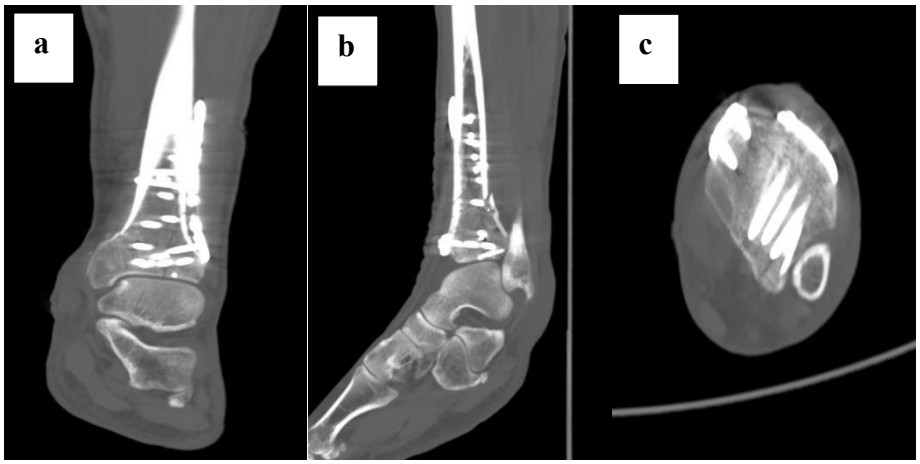

Figure 3: Postoperative CT imaging data. a The coronal CT view shows internal fixation of the tibial shaft; b The sagittal CT view reveals internal fixation of the distal tibia with good articular surface reduction; c The axial CT section indicates the distal tibial articular surface after internal fixation and reduction

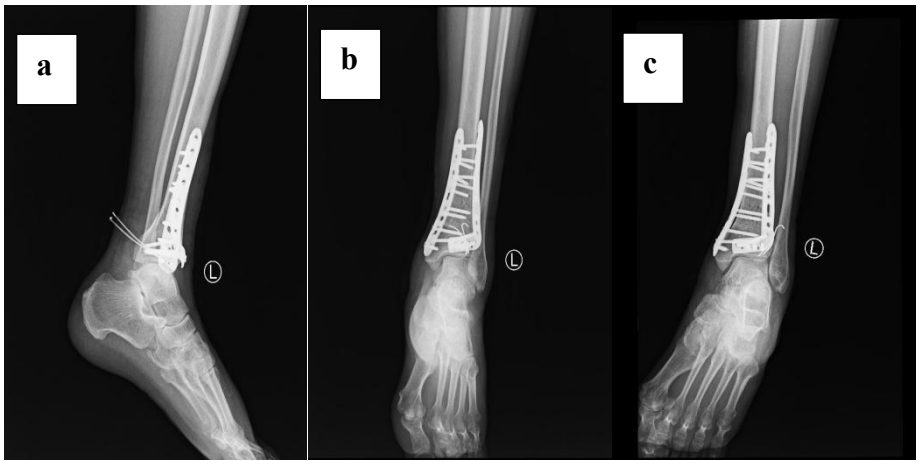

Figure 4: Postoperative X-ray imaging data. a Lateral view; b Anteroposterior view; c Ankle acupoint

5. Result

5.1 Preoperative Baseline Data

In this study, a total of 121 patients were followed up, with 100 patients completing the full follow-up. Among them, there were 77 males and 23 females, with a median age of 44.00 years ((Interquartile Range, IQR): 33.00, 52.00) and a median follow-up duration of 31.00 months (IQR: 11.00, 57.25).

Among the 100 patients who completed the full follow-up, 41 exhibited preoperative anxiety or depression symptoms, comprising 30 males and 11 females, with a median follow-up time of 31.00 months (IQR: 12.00, 56.50). The remaining 59 patients did not have preoperative anxiety or depression, comprising 47 males and 12 females, with a median follow-up time of 29.00 months (IQR: 11.00, 58.00).

There were no statistically significant differences between the two groups in terms of gender, age, BMI, and follow-up duration (P>0.05). However, significant differences were observed in preoperative VAS, HADS-A, HADS-D, and Pre-CSI-9 scores between the two groups (p<0.05). The general baseline data of the patients are presented in Table 1.

5.2 Comparison of AOFAS, VAS, HADS-A, and HADS-D Scores at Final Follow-Up Between Groups

Significant differences were observed in all scores at the final follow-up between the two groups (p<0.05, see Table 2). A detailed comparison of the AOFAS, VAS, HADS-A, and HADS-D scores at the final follow-up between the two groups is presented in Table 2.

5.3 Analysis of Differences in Evaluation Indicators Between Preoperative and Final Follow-Up

Both groups of patients exhibited significant improvements in functional activity, pain levels, and psychological status after surgery compared to preoperatively (P<0.05; see Table 3). Additionally, during the follow-up period, only one case of wound non-healing with infection was observed among the patients in both groups.

5.4 Comparison of Preoperative and Postoperative Differences in CSI-9, VAS, HADS-A, and HADS-D Scores Between Groups

Statistical analysis revealed significant differences in the preoperative and postoperative changes in CSI-9, VAS, HADS-A, and HADS-D scores between the two groups (p<0.05, see Table 4), indicating distinct improvements in pain levels, central sensitization, anxiety, and depression between the two groups.

Table 1: Baseline Data of Patients [Mean ± SD / M(Q1, Q3)]

Variables	Group A (n=41)		Group B (n=59)		*t*/*Z*/χ^2	*P*
	Male	Female	Male	Female		
Sex	30	11	47	12	0.575	0.448
Age (years)	46.54±12.32		41.75±12.47		1.899	0.061
BMI (kg/m^2)	24.79±4.09		24.97(23.15, 26.23)		-0.067	0.947
Follow-uptime (months)	31.00(12.00, 56.50)		29.00(11.00, 58.00)		-0.459	0.646
Pre-VAS	78.00(67.50, 87.00)		60.00(51.00, 69.00)		-4.975	0.000
Pre-HADS-A	10.00(9.00, 12.00)		4.00(2.00, 5.00)		-8.453	0.000
Pre-HADS-D	10.00(8.50, 12.00)		3.00(3.00, 5.00)		-8.510	0.000
Pre-CSI-9	23.00(20.50, 25.00)		10.36±5.00		-7.246	0.000

BMI: Body Mass Index; Pre: preoperative; SD: Standard Deviation; Q1: First quartile; Q3: third quartile; Group A: patients with preoperative anxiety or depression, defined as a score of ≥8 on either the HADS-A or HADS-D subscale; Group B: patients without preoperative anxiety or depression, defined as scores <8 on both subscales; t: The t-value is derived from an independent samples t-test, which is utilized to compare the means between groups. Z: The z-value is obtained from the Wilcoxon signed-rank test, which is employed for non-parametric comparisons. χ^2: The χ^2 value is derived from the chi-square test, which is used to determine if there are significant differences between different genders. P: P values < 0.05 were considered statistically significant.

Table 2: Comparison of Final Follow-up Evaluation Metrics Between the Two Groups [Mean ± SD / M(Q1, Q3)]

Variables	VAS	AOFAS	HADS-A	HADS-D	CSI-9
Group A (n=41)	21.22±8.32	75.15±10.60	6.71±3.20	7.07±3.40	9.00(6.00, 14.50)
Group B (n=59)	13.32±5.84	87.34±5.78	3.00(2.00, 4.00)	2.00(2.00, 3.00)	4.80±2.03
t/z value	5.243	-6.704	-6.391	-7.349	-6.103
p value	0.000	0.000	0.000	0.000	0.000

SD: Standard Deviation; Q1: First quartile; Q3: third quartile; Group A: patients with preoperative anxiety or depression, defined as a score of ≥8 on either the HADS-A or HADS-D subscale; Group B: patients without preoperative anxiety or depression, defined as scores <8 on both subscales; t: The t-value is derived from an independent samples t-test, which is utilized to compare the means between groups. Z: The z-value is obtained from the Wilcoxon signed-rank test, which is employed for non-parametric comparisons. P: P values < 0.05 were considered statistically significant.

Table 3: Comparison of Preoperative and Final Follow-up Data Between the Two Groups [Mean ± SD / M(Q1, Q3)]

Variables		Preoperative	Final Follow-up	*t/z* value	p value
Group A (n=41)	VAS	78.00(67.50, 87.00)	21.22±8.32	-5.580	0.000
	HADS-A	10.00(9.00, 12.00)	6.71±3.20	-5.144	0.000
	HADS-D	10.00(8.50, 12.00)	7.07±3.40	-4.765	0.000
	CSI-9	23.00(20.50, 25.00)	9.00(6.00, 14.50)	-5.523	0.000
Group B (n=59)	VAS	60.00(51.00, 69.00)	13.32±5.84	-6.682	0.000
	HADS-A	4.00(2.00, 5.00)	3.00(2.00, 4.00)	-4.245	0.000
	HADS-D	3.00(3.00, 5.00)	2.00(2.00, 3.00)	-4.496	0.000
	CSI-9	10.36±5.00	4.80±2.03	10.190	0.000

SD: Standard Deviation; Q1: First quartile; Q3: third quartile; Group A: patients with preoperative anxiety or depression, defined as a score of ≥8 on either the HADS-A or HADS-D subscale; Group B: patients without preoperative anxiety or depression, defined as scores <8 on both subscales; t: The t-value is derived from an independent samples t-test, which is utilized to compare the means between groups. z: The z-value is obtained from the Wilcoxon signed-rank test, which is employed for non-parametric comparisons. P: P values < 0.05 were considered statistically significant.

Table 4: Change in Evaluation Metrics Between Preoperative and Final Follow-up in Both Groups [Mean ± SD]

Variables	VAS Difference	HADS-A Difference	HADS-D Difference	CSI-9 Difference
Group A (n=41)	55.07±14.94	3.85±2.82	3.39±3.41	11.59±5.88
Group B (n=59)	48.58±10.55	1.00(0.00, 2.00)	1.00(0.00, 2.00)	5.00(2.00, 9.00)
t/z value	2.400	-5.128	-3.592	-5.174
p value	0.019	0.000	0.000	0.000

SD: Standard Deviation; Group A: patients with preoperative anxiety or depression, defined as a score of ≥8 on either the HADS-A or HADS-D subscale; Group B: patients without preoperative anxiety or depression, defined as scores <8 on both subscales; t: The t-value is derived from an independent samples t-test, which is utilized to compare the means between groups. P: P values < 0.05 were considered statistically significant.

5.5 Correlation Analysis of Age, Gender, BMI, Central Sensitization Difference, Pain Difference, and Final Follow-Up AOFAS with Preoperative Psychological Status in Group A

The analysis revealed that the degree of pain recovery and functional activity at the final follow-up were significantly correlated with depression ($p<0.05$), but not with anxiety ($p>0.05$). Additionally, age, BMI, and the change in central sensitization were not significantly correlated with either anxiety or depression ($p>0.05$, see Table 5).

Table 5: Correlation Analysis of Age, Gender, BMI, CSI-9 Difference, and VAS Difference with Preoperative Psychological Status in Group A

Variables		Anxiety	Depression
Age	*r*	-0.125	-0.008
	p	0.437	0.961
Sex	*z*	-0.089	-1.086
	p	0.929	0.277
BMI	r	0.002	0.155
	p	0.989	0.333
CSI-9 Difference	r	0.060	0.245
	p	0.709	0.123
VAS Difference	r	-0.173	-0.567
	p	0.280	0.000
Postoperative AOFAS	r	-0.116	-0.345
	p	0.469	0.027

P: P values < 0.05 were considered statistically significant.

6. Discussion

Pilon fractures, resulting from high-energy trauma, are intra-articular fractures that often lead to poor surgical outcomes and a high incidence of complications [18, 19]. Even for experienced foot and ankle surgeons, managing this type of fracture remains a significant clinical challenge. Research has identified various surgical approaches, the use of internal fixation, and differences in surgical techniques as factors that influence the prognosis of pilon fractures [20-25]. Moreover, studies have shown that preoperative anxiety and depression are common among patients, and those with these conditions tend to have poorer postoperative recovery compared to those without [26, 27]. Additionally, there is a certain correlation between psychological status and foot pain and functional activity [28].

In this study, both groups of patients showed significant improvements in postoperative pain, function, psychological status, and central sensitization compared to preoperative levels. Hu et al. reported that patients with Pilon fractures who underwent ORIF had a median postoperative AOFAS score of 89.80 (84.00, 95.00) [29]. Victor Lu also reported similar results, with AOFAS scores improving from 57.14 at 3 months to 76.57 at 6 months and finally reaching 92.25 at 12 months postoperatively [19]. These findings are consistent with the improvements in functional activity observed in this study, further confirming the efficacy of ORIF.

In this study, it was observed that patients with better preoperative psychological status had lower VAS scores, higher AOFAS scores, and lower CSI-9 scores at the final follow-up compared to those with poorer preoperative psychological status. These results suggest that a patient's psychological state may negatively impact postoperative pain, functional activity, and central sensitization. Previous studies have also indicated that patients with poor preoperative psychological status often have higher postoperative pain scores and less satisfactory functional recovery [30, 31]. Moreover, research has shown a positive correlation between higher levels of central sensitization and psychological issues such as anxiety and depression [32-34]. Therefore, foot and ankle surgeons should pay attention to the psychological assessment of patients before surgery and conduct necessary psychological interventions to improve the prognosis.

The results of this study indicate that patients with preoperative anxiety or depression symptoms experienced greater improvement in postoperative pain compared to those without such symptoms. This may be attributed to the fact that patients with higher levels of preoperative anxiety or depression had higher preoperative VAS pain scores, thus providing a greater potential for improvement postoperatively. Additionally, existing research has demonstrated a correlation between higher levels of anxiety or depression and increased pain intensity [35-37]. Furthermore, depressive mood has been shown to increase with the escalation pain [38]. Therefore, the success of surgery significantly alleviated the pain symptoms in these patients, which in turn further reduced their postoperative VAS scores.

This study conducted further correlation analysis on patients with preoperative anxiety or depression symptoms. The results showed a significant negative correlation between preoperative depressive symptoms and postoperative AOFAS scores. Studies have demonstrated that patients with preoperative anxiety or depression tend to have poorer postoperative functional activity, while those without such symptoms experience better outcomes [30, 31, 39, 40]. We found that patients with depressive symptoms are often reluctant to engage in physical activities [41] and do not actively participate in rehabilitation training postoperatively, leading to suboptimal functional recovery. Thus, the more severe the depressive symptoms, the worse the functional recovery. Additionally, we discovered a significant negative correlation between preoperative depressive symptoms and the degree of postoperative pain improvement. Research by Waguih William IsHak has shown a strong correlation between pain and depression, which may jointly exacerbate physical and psychological symptoms, resulting in functional impairment and prolonged symptom duration [42]. This further confirms the potential negative impact of depressive symptoms on pain treatment outcomes. Therefore, patients with depressive symptoms may have a smaller margin for improvement in pain management. We analyzed that patients with depression often have a poor preoperative psychological state, lower compliance with medical advice, and may not cooperate with treatment and rehabilitation exercises. This adverse psychological state and behavioral pattern can lead to poorer postoperative pain recovery, which is one of the main reasons for their inadequate pain improvement. Therefore, preoperative psychological assessment and intervention are of great significance for improving postoperative function and pain recovery.

This study has the following limitations: First, this study is a single-center retrospective study, and its results may only be applicable to the region and its surrounding areas, making it difficult to generalize to other regions. Second, this study used

the Chinese version of the CSI-9, but most patients did not complete Part B of the scale due to their complex personal circumstances, which may lead to biased results. In addition, the follow-up duration in this study varied due to individual differences among patients, which may also affect the consistency of the results. Therefore, future studies should be designed as large-sample, prospective, randomized controlled trials to overcome the above limitations and further validate the conclusions of this study.

7. Conclusion

ORIF surgery effectively improves functional activity, pain, psychological status, and central sensitization in patients with Pilon fractures. Patients with poorer preoperative psychological status tend to have worse outcomes. Patients with depression experience greater pain improvement but have poorer postoperative functional activity. Therefore, in future clinical practice, foot and ankle surgeons should prioritize the mental and psychological management of patients with depression before surgery to enhance surgical outcomes.

Figure legends: Figure 1. Preoperative CT imaging data. a The sagittal CT view reveals a distal tibial fracture involving the articular surface; b The coronal CT view shows a fracture of the distal tibial articular surface; c The axial CT section indicates a comminuted fracture of the distal tibial articular surface

Figure 2. Preoperative X-ray imaging data. a The lateral view of the left ankle shows a clear fracture of the tibia involving the distal tibial articular surface; b The anteroposterior view of the left ankle reveals a distinct fracture line in the tibia

Figure 3. Postoperative CT imaging data. a The coronal CT view shows internal fixation of the tibial shaft; b The sagittal CT view reveals internal fixation of the distal tibia with good articular surface reduction; c The axial CT section indicates the distal tibial articular surface after internal fixation and reduction

Figure 4. Postoperative X-ray imaging data. a Lateral view; b Anteroposterior view; c Ankle acupoint

References

[1] Mandi DM, Belin RP, Banks J, Barrett B. Pilon fractures. *Clin Podiatr Med Surg*. 2012;29(2):243-278.

[2] Schweigkofler U, Benner S, Hoffmann R. [Pilon Fractures]. *Z Orthop Unfall*. 2015;153(3):335-354, 355-356.

[3] Davidovitch RI, Elkhechen RJ, Romo S, Walsh M, Egol KA. Open reduction with internal fixation versus limited internal fixation and external fixation for high grade pilon fractures (OTA type 43C). *Foot Ankle Int*. 2011; 32(10): 955-961.

[4] McCann PA, Jackson M, Mitchell ST, Atkins RM. Complications of definitive open reduction and internal fixation of pilon fractures of the distal tibia. *Int Orthop*. 2011;35(3):413-418.

[5] Tang E, Yantsis A, Ho M, et al. Patient-Reported Outcome Measures for Patients With CKD: The Case for Patient-Reported Outcomes Measurement Information System (PROMIS) Tools. *Am J Kidney Dis*. 2024; 83(4): 508-518.

[6] Nicodemus CL, Epstein J, Huebner M, DeCicco B, Shaik M. The short- and long-term effect of osteopathic manipulative treatment on pain, and psychosocial factors in adults with chronic low back pain. *J Osteopath Med*. 2024;124(7):315-319.

[7] Li S, Qi M, Yuan W, Chen H. The impact of the depression and anxiety on prognosis of cervical total disc replacement. *Spine (Phila Pa 1976)*. 2015; 40(5): E266-E271.

[8] Vissers MM, Bussmann JB, Verhaar JA, Busschbach JJ, Bierma-Zeinstra SM, Reijman M. Psychological factors affecting the outcome of total hip and knee arthroplasty: a systematic review. *Semin Arthritis Rheum*. 2012; 41(4): 576-588.

[9] Chaudhry F, Morgan S, Kruse C, Wolfstadt J, Ekhtiari S. Effect of Depression Interventions in Patients Undergoing Total Joint Arthroplasty Without a Formal Diagnosis of Depression: A Systematic Review. *J Am Acad Orthop Surg*. 2024;32(14):647-655.

[10] Cao S, Zan Q, Lu J, et al. Analysis of preoperative and postoperative depression and anxiety in patients with osteochondral lesions of the talus. *Front Psychiatry*. 2024; 15:1356856.

[11] Maurer E, Walter N, Baumgartner H, Histing T, Alt V, Rupp M. Quality of life after fracture-related infection of the foot. *Foot Ankle Surg*. 2022;28(8):1421-1426.

[12] Althof JE, Beasley BD. Psychosocial management of the foot and ankle surgery patient. *Clin Podiatr Med Surg*. 2003;20(2):199-211.

[13] Goh GS, Khow YZ, Tay DK, Lo NN, Yeo SJ, Liow M. Preoperative Mental Health Influences Patient-Reported Outcome Measures and Satisfaction After Revision Total Knee Arthroplasty. *J Arthroplasty*. 2021; 36(8): 2878-2886.

[14] Wong SE, Colley AK, Pitcher AA, Zhang AL, Ma CB, Feeley BT. Mental health, preoperative disability, and postoperative outcomes in patients undergoing shoulder arthroplasty. *J Shoulder Elbow Surg*. 2018; 27(9): 1580-1587.

[15] Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983; 67(6): 361-370.

[16] He S, Renne A, Argandykov D, Convissar D, Lee J. Comparison of an Emoji-Based Visual Analog Scale With a Numeric Rating Scale for Pain Assessment. *JAMA*. 2022;328(2):208-209.

[17] Liang D, Yu X, Guo X, Zhang J, Jiang R. Cross-cultural adaptation and validation of the Chinese version of the short-form of the Central Sensitization Inventory (CSI-9) in patients with chronic pain: A single-center study. *Plos One*. 2023;18(3):e282419.

[18] Kottmeier SA, Madison RD, Divaris N. Pilon Fracture: Preventing Complications. *J Am Acad Orthop Surg*. 2018; 26(18):640-651.

[19] Lu V, Zhang J, Zhou A, Thahir A, Lim JA, Krkovic M. Open versus closed pilon fractures: Comparison of management, outcomes, and complications. *Injury*. 2022;53(6):2259-2267.

[20] Park J, Lee HB, Kim GL, Yang KH. Surgical Treatment Approach for Pilon and Talar Dome Fracture. *J Am Podiatr Med Assoc*. 2020;110(4).
[21] Zhao HY. [Delayed combined approach with three plates internal fixation for Pilon fracture with fibula fracture]. *Zhongguo Gu Shang*. 2020;33(3):257-260.
[22] Beaman DN, Gellman R. Fracture reduction and primary ankle arthrodesis: a reliable approach for severely comminuted tibial pilon fracture. *Clin Orthop Relat Res*. 2014;472(12):3823-3834.
[23] Minator SM, Ebrahimpour A, Okhovatpour MA, Karimi A, Zandi R, Sharifzadeh A. The Outcomes of Pilon Fracture Treatment: Primary Open Reduction and Internal Fixation Versus Two-stage Approach. *Arch Bone Jt Surg*. 2018;6(5):412-419.
[24] Taylor BC, So E, Karim A. Spanning External Fixation for Pilon Fractures: Steering Wheel and Kickstands. *Orthopedics*. 2020;43(3):e187-e190.
[25] Carter TH, Duckworth AD, Oliver WM, Molyneux SG, Amin AK, White TO. Open Reduction and Internal Fixation of Distal Tibial Pilon Fractures. *JBJS Essent Surg Tech*. 2019;9(3):e29.
[26] Nakagawa R, Yamaguchi S, Kimura S, et al. Association of Anxiety and Depression With Pain and Quality of Life in Patients With Chronic Foot and Ankle Diseases. *Foot Ankle Int*. 2017;38(11):1192-1198.
[27] Smolderen KG, Hoeks SE, Pedersen SS, van Domburg RT, de Liefde II, Poldermans D. Lower-leg symptoms in peripheral arterial disease are associated with anxiety, depression, and anhedonia. *Vasc Med*. 2009; 14(4): 297-304.
[28] Alburquerque-Sendin F, Rios-Leon M, Valera-Calero JA, et al. Clinical, Psychological, and Neurophysiological Outcomes Associated with Pain and Function in Individuals with Unilateral Plantar Heel Pain. *Pain Med*. 2022; 23(9): 1613-1620.
[29] Hu C, Zhu W, Chahal K, et al. Open reduction and internal fixation of Gustilo type-I and type-II open pilon fractures using a lateral approach. *J Orthop Surg (Hong Kong)*. 2019;27(3):615525010.
[30] Arshad Z, Haq II, Martins A, Bhatia M. The impact of pre-operative mental health on outcomes of foot and ankle surgery: A scoping review. *Foot Ankle Surg*. 2024; 30(3):165-173.
[31] Aspari AR, Lakshman K. Effects of Pre-operative Psychological Status on Post-operative Recovery: A Prospective Study. *World J Surg*. 2018;42(1):12-18.
[32] Mesci N, Mesci E, Kandemir EU, Kulcu DG, Celik T. Impact of central sensitization on clinical parameters in patients with rheumatoid arthritis. *North Clin Istanb*. 2024; 11(2):140-146.
[33] Ogon I, Teramoto A, Takashima H, et al. Associations between visceral fat chronic low back pain and central sensitization in patients with lumbar spinal stenosis. *J Back Musculoskelet Rehabil*. 2022;35(5):1035-1041.
[34] Kim JJ, Koh IJ, Kim MS, Choi KY, Kang KH, In Y. Central Sensitization Is Associated with Inferior Patient-Reported Outcomes and Increased Osteotomy Site Pain in Patients Undergoing Medial Opening - Wedge High Tibial Osteotomy. *Medicina (Kaunas)*. 2022; 58(12).
[35] Lerman SF, Rudich Z, Brill S, Shalev H, Shahar G. Longitudinal associations between depression, anxiety, pain, and pain-related disability in chronic pain patients. *Psychosom Med*. 2015;77(3):333-341.
[36] Fonseca-Rodrigues D, Rodrigues A, Martins T, et al. Correlation between pain severity and levels of anxiety and depression in osteoarthritis patients: a systematic review and meta-analysis. *Rheumatology (Oxford)*. 2021; 61(1):53-75.
[37] Oh J, Sohn JH, Shin CS, et al. Mutual relationship between anxiety and pain in the intensive care unit and its effect on medications. *J Crit Care*. 2015; 30(5): 1043-1048.
[38] Berna C, Leknes S, Holmes EA, Edwards RR, Goodwin GM, Tracey I. Induction of depressed mood disrupts emotion regulation neurocircuitry and enhances pain unpleasantness. *Biol Psychiatry*. 2010; 67(11): 1083-1090.
[39] Kennedy P, Joshi R, Dhawan A. The Effect of Psychosocial Factors on Outcomes in Patients With Rotator Cuff Tears: A Systematic Review. *Arthroscopy*. 2019;35(9):2698-2706.
[40] Paulsen MG, Dowsey MM, Castle D, Choong PF. Preoperative psychological distress and functional outcome after knee replacement. *Anz J Surg*. 2011; 81(10): 681-687.
[41] Liu Y, Zhao G, Guo J, Qu H, Kong L, Yue W. The efficacy of exercise interventions on depressive symptoms and cognitive function in adults with depression: An umbrella review. *J Affect Disord*. 2025; 368: 779-788.
[42] IsHak WW, Wen RY, Naghdechi L, et al. Pain and Depression: A Systematic Review. *Harv Rev Psychiatry*. 2018; 26(6):352-363.