Journal of Orthopaedic Surgery and Research

RESEARCH

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The impact of preoperative anxiety and depression on the prognosis of patients with painful accessory navicular

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Abstract

Objective This study evaluated the clinical efficacy of modified Kidner procedures for painful accessory navicular(AN) syndrome. Furthermore, it investigated the differences between patients' pre- and post-operatively, analyzing the impact on post-operative pain and functional recovery.

Methods This study included 50 patients diagnosed with painful AN and treated with the modified Kidner procedure at the Department of Foot and Ankle Surgery, Honghui Hospital, Xi'an, between May 2014 and May 2023. All patients were assessed using the Hospital Anxiety and Depression Scale (HADS), Visual Analogue Scale(VAS), and American Orthopaedic Foot & Ankle Society Midfoot Scale (AOFAS) before and after surgery. Patients were divided into two groups based on the presence of preoperative anxiety/depression symptoms. Patients without preoperative anxiety/depression were assigned to Group A, while those with preoperative anxiety/depression were assigned to Group B. The baseline data, pain, functional activity, and psychological status scores of both groups were compared, and a correlation analysis was conducted to identify factors associated with anxiety/depression.

Results Out of 50 patients with painful AN syndrome who completed follow-up, 28 exhibited symptoms of anxiety/depression preoperatively, resulting in an incidence rate of 56%.Both Group A and Group B patients showed significant improvements in all postoperative evaluation metrics compared to preoperative levels ($p < 0.05$), yet the overall prognosis for Group B was poorer than that for Group A.There were significant differences in the degree of improvement in pain, functional activity, and anxiety/depression between the two groups($p < 0.05$).female patients had a significantly higher prevalence of anxiety than male patients ($p < 0.05$).

Conclusion Modified Kidner surgery can significantly improve the function, pain, and psychological status of patients with painful AN.However, patients with less favorable preoperative psychological status tend to have less satisfactory outcomes.Patients with preoperative anxiety or depression symptoms experience more significant pain relief after surgery, while those without such symptoms show better functional recovery.Moreover, female patients with painful AN have a higher incidence of preoperative anxiety.Future research should further explore the impact of preoperative psychological interventions on outcomes.

Keywords Painful accessory navicular, Modified Kidner procedure, Anxiety, Depression, Prognosis

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Introduction

The accessory navicular(AN) is the most common accessory bone in the foot [1], representing a congenital anomaly with an incidence in the population ranging from 4–21% [2, 3]. It is located on the medial side of the foot arch, behind and medial to the navicular tuberosity, and is connected to the navicular tuberosity through the posterior tibial tendon.Bauhin first described the AN in 1605 [4], and subsequent experts have further detailed its association with the posterior tibial muscle. For the treatment of painful AN, patients typically initiate with conservative management. However, when pain and functional limitations worsen and conservative treatments prove ineffective, surgical intervention becomes the primary therapeutic approach [5, 6].

Ankle surgeons currently have several treatment options for painful AN syndrome, including the modified Kidner procedure, simple excision, or arthrodesis with internal fixation.The modified Kidner procedure aims to remove the AN and reconstruct the posterior tibial tendon to alleviate foot pain and improve function.Studies have reported satisfactory outcomes with this procedure for the treatment of painful AN [7–9]. However, the success of surgery depends not only on technical skill but also on factors such as the patient's individual characteristics and postoperative care. Moreover, the psychological state of the patient is crucial for postoperative recovery [10].Research indicates that good mental health significantly predicts the degree of postoperative recovery [11].A study by Cao et al. [12] found that patients with osteochondral lesions who had symptoms of anxiety or depression before surgery had poorer postoperative pain and functional recovery. Additionally, research has indicated that lower preoperative mental health levels can negatively impact outcomes following total hip arthroplasty and total knee arthroplasty [13, 14]. Therefore, Poor mental health can significantly impact surgical outcomes and recovery [12, 15–16, 45–46] and a negative psychological state can also affect postoperative functional activities [17, 18].Thus, assessing and intervening on the psychological state of patients with painful AN before surgery is crucial for optimizing surgical outcomes and facilitating overall patient recovery.

While the modified Kidner procedure is well-established for the treatment of AN [19, 20], research on the impact of preoperative psychological status on surgical outcomes remains limited.This study aims to investigate the prevalence of preoperative anxiety/depression symptoms in patients with painful AN and to analyze their impact on postoperative pain and functional recovery in painful AN, with the hope of providing a reference for foot and ankle surgeons when formulating surgical plans, thereby further improving surgical efficacy and patient satisfaction.

Methods and participants

This retrospective study was approved by the Ethics Committee of Honghui Hospital in Shaanxi Province (Approval Number:2024-KY-300-01).A retrospective analysis was conducted on cases of patients diagnosed with painful AN syndrome admitted to Honghui Hospital in Xi'an from May 2014 to May 2024. All patients and their families had signed informed consent forms. Inclusion Criteria: ① Patients with significant clinical symptoms of AN who failed conservative treatment and underwent surgery; ② Patients aged 18 years or older; ③ Patients with the language and cognitive ability to independently complete questionnaires.Exclusion Criteria: ① Patients with incomplete clinical data; ② Patients with other foot diseases such as navicular necrosis, talonavicular arthritis, rheumatoid arthritis, bone tumors, and osteomyelitis; ③ Patients with a history of psychiatric disorders.

To ensure consistency in the study variables, all surgeries were performed by the same experienced foot and ankle surgeon to maintain uniformity in anesthesia and surgical techniques. Postoperative medication and treatment methods for patients were also standardized.

After obtaining approval from the ethics committee, we accessed patients' contact information through the medical record system and invited them to participate in this study. The study collected baseline data such as patients' age, gender, and BMI, and asked patients to complete a survey questionnaire that included subjective feelings and functional assessments.We utilized the Hospital Anxiety and Depression Scale (HADS) to assess patients' anxiety and depression levels before surgery and at the final follow-up. The HADS consists of two subscales, HADS-A (Anxiety) and HADS-D (Depression), each with seven items rated on a four-point scale from 0 to 3. A total score of 8 or above on either subscale is considered the threshold for the presence of anxiety or depression [21].Additionally, we used the Visual Analogue Scale (VAS) to assess the level of pain before surgery and at the final follow-up. The VAS consists of a 10 cm line, with one end representing no pain (0 points) and the other end representing the worst possible pain (100 points). Patients mark their level of pain on the line based on their subjective experience [22].We also employed the American Orthopaedic Foot & Ankle Society Midfoot Scale(AOFAS) to evaluate functional status before surgery and at the final follow-up. The AOFAS scoring system quantifies foot health and tracks improvements throughout the treatment process.All raters received appropriate training to ensure the accuracy of the scoring. All questionnaires and clinical data were entered into an electronic database through a standardized process and anonymized to ensure the accuracy of the data and the privacy and security of patient information.

Based on preoperative HADS scores, we categorized patients into two groups: Group A (no preoperative anxiety/depression symptoms, with scores on both subscales below 8) and Group B (preoperative anxiety/depression symptoms present, with a score above 8 on either subscale).

Statistical analysis

Statistical analysis for this study was conducted using SPSS 26.0 software.Initially, we performed normality tests on all continuous variables to determine if the data adhered to a normal distribution.For data conforming to a normal distribution, we describe them using the mean ± standard deviation (Mean ± SD) and perform independent samples t-tests for between-group comparisons and paired samples t-tests for within-group comparisons. For data not conforming to a normal distribution, we described them using the median (interquartile range) [M(P25, P75)] and compared them using the Mann-Whitney U non-parametric test.Categorical variables with an order were described using frequency and percentage (%), and group comparisons are made using the chi-squared test.Furthermore, for the study of correlations, Pearson's correlation analysis was used to assess the correlation between age, BMI, and anxiety/depression, while Mann-Whitney U non-parametric tests were used to analyze the correlation between gender and anxiety/depression.All tests were two-tailed, with the significance level set at $p < 0.05$.

Surgical method

A longitudinal incision approximately 5 cm in length was made on the medial side of the foot, and the skin, subcutaneous tissue, and fascia were sequentially incised. The posterior tibial tendon was bluntly separated, revealing a pseudarthrosis between the accessory navicular and the navicular bone at the tendon's insertion site. The pseudarthrosis was debrided, the accessory navicular was excised, and the posterior tibial tendon was repositioned anteriorly and inferiorly. An anchoring suture was placed at the navicular tuberosity, and after adjusting the tension to a satisfactory level, the wound was closed with tight sutures, ensuring secure fixation. Passive ankle joint movement on the operating table showed good mobility. The wound was then irrigated, sutured, and dressed with sterile compressive bandages (Figs. 1 and 2).

Result

Baseline data

In this study, a total of 61 patients were followed up, with complete follow-up data obtained for 50 patients. There were 18 males and 32 females, with a median patient age of 30.50 years (interquartile range: 24.00, 41.00) and a median follow-up duration of 36.00 months (interquartile range: 24.00, 57.50).Among the patients without preoperative symptoms of anxiety or depression, there were 22 cases, including 9 males and 13 females, with a median follow-up time of 26.50 months (interquartile range: 22.75 to 39.75).Of the 28 patients who had symptoms of anxiety or depression prior to surgery, 9 were male and 19 were female. The median follow-up time for this group was 35 months (interquartile range: 21.00 to 55.75).There were no statistically significant differences between the two groups in terms of gender, age, BMI index, follow-up duration, and preoperative AOFAS scores ($P > 0.05$). However, there were significant differences in preoperative VAS, HADS-A, and HADS-D scores between the two groups ($p < 0.05$).The general baseline data of the patients are presented in Table 1.

Analysis of the differences in evaluation indicators between preoperative and final follow-up

Following the modified Kidner procedure, both groups of patients showed significant improvements in functional activity, pain levels, and psychological status compared to preoperative conditions ($P < 0.05$, Table 2).Additionally, during the follow-up period, no patients in either group experienced complications such as skin necrosis, infection, or pain due to foreign body irritation.

Comparison of AOFAS, VAS, HADS-A, and HADS-D scores at the final follow-up between groups

There were significant differences in postoperative scores between the two groups ($p < 0.05$).The comparison of postoperative AOFAS, VAS, HADS-A, and HADS-D scores between the two groups is presented in Table 3.

The comparison of the preoperative and postoperative differences in AOFAS, VAS, HADS-A, and HADS-D scores between groups

Statistical analysis revealed significant differences ($p < 0.05$, Table 4) in the preoperative and postoperative AOFAS, VAS, HADS-A, and HADS-D scores between the two groups. These differences indicate distinct improvements in pain levels, ankle-foot functional activities, and the severity of anxiety and depression in both groups.

Analysis of the correlation between patient age, gender, Bmi, and preoperative psychological status

The analysis revealed a significant correlation between gender and anxiety ($p < 0.05$), but no significant correlation with depression ($p > 0.05$). Additionally, there was no significant correlation between age, BMI, and either anxiety or depression ($p > 0.05$, Table 5).

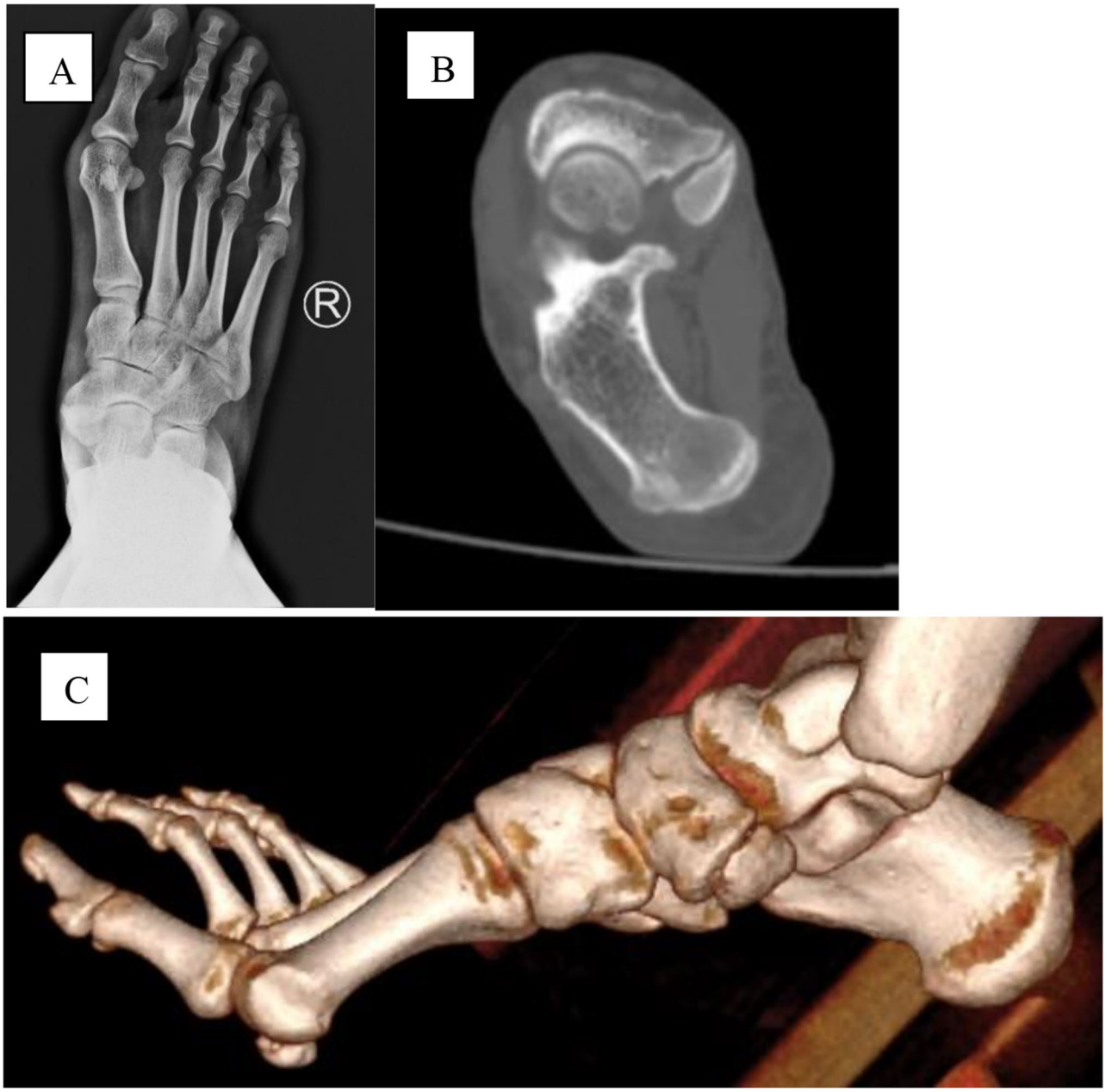

Fig. 1 Pre-operative Imaging Data. **A**: The radiograph of the right foot reveals a Type III accessory navicular bone; **B**: On the Computed Tomography(CT) cross-section, a fibrous connection between the accessory navicular and the navicular bone can be observed. **C**: Three-dimensional CT imaging reveals a larger accessory navicular bone at the navicular tuberosity

Discussion

Patients with painful AN syndrome typically exhibit tender bony prominences on the medial side of the foot, with pain intensifying during eversion or plantarflexion of the foot [23, 24]. This condition can adversely affect patients' quality of life, with limitations in activity, pain, and a sense of imbalance potentially contributing to psychological health issues. Studies have indicated that patients with foot disorders are more prone to symptoms of anxiety and depression compared to those without such conditions, and these symptoms are prevalent [25, 26]. Furthermore, research has established a correlation between mental health status and both foot pain and functional mobility [27].

This study found that between preoperative and final follow-up assessments, there was a significant improvement in postoperative pain, functionality, and psychological status in both patient groups.A study by Lee et al. demonstrated that patients who underwent the modified Kidner procedure experienced a significant reduction

Fig. 2 Postoperative Imaging Data. **A**: On the anteroposterior radiograph of the right foot, the Type III accessory navicular bone has been resected.;**B**: The CT cross-sectional image shows that the rivet is well-positioned. **C**: Three-dimensional CT imaging reveals the resection of the accessory navicular bone and a portion of the navicular tuberosity

in mean VAS scores from 7.1 ± 1.0 preoperatively to 1.8 ± 1.00 postoperatively, and an improvement in AOFAS scores from 40.8 ± 7.1 preoperatively to 88.4 ± 7.9 postoperatively [28].Yang et al. reported similar findings, with the mean VAS score decreasing from 6.33 ± 1.95 preoperatively to 0.2 ± 0.41 postoperatively, and the mean AOFAS score improving from 60.27 ± 21.51 preoperatively to 95.53 ± 5.79 postoperatively [29].This is consistent with our findings, further supporting the efficacy of the modified Kidner procedure.Additionally, during the follow-up period, neither group experienced related complications such as skin necrosis, infection, or pain

Table 1 Patient baseline data [Mean ± SD/Median(Q1,Q3)]

Variables	GroupA(*n* = 22)		GroupB(*n* = 28)		t/Z/χ^2	*P*
	Male	Female	Male	Female		
Sex	9(40.91%)	13(59.09%)	9(32.14)	19(67.86)	0.411	>0.05
Age(years)	26.50(22.75,39.75)		31.00(26.25,41.00)		-1.389	>0.05
BMI(kg/m^2)	21.94(19.05,24.18)		23.40(20.52,25.23)		-1.534	>0.05
Follow-uptime(months)	36.50(32.00,70.25)		35(21.00,55.75)		-0.870	>0.05
Pre-VAS	34.45 ± 6.95		46.14 ± 6.79		-5.980	<0.001
Pre-AOFAS	93.00(90.00,94.75)		66.18 ± 6.97		-1.952	>0.05
Pre-HADS-A	3.68 ± 1.73		12.04 ± 3.51		-10.212	<0.001
Pre-HADS-D	3.18 ± 1.50		10.21 ± 2.33		-12.279	<0.001

BMI: Body Mass Index; Pre: preoperative SD: Standard Deviation; Q1: First quartile Q3: third quartile GroupA: no preoperative anxiety/depression symptoms GroupB: preoperative anxiety/depression symptoms

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 preoperative and final Follow-up data for two groups [Mean ± SD/Median(Q1,Q3)]

Variables		Preoperative	Final Follow-up	t/z value	*p* value
GroupA(*n* = 22)	AOFAS	93.00(90.00,94.75)	92.23 ± 4.64	-4.114	<0.001
	VAS	34.45 ± 6.95	9.73 ± 6.21	17.500	<0.001
	HADS-A	3.68 ± 1.73	2.05 ± 1.17	4.739	<0.001
	HADS-D	3.18 ± 1.50	2.14 ± 1.52	2.596	<0.05
GroupB(*n* = 28)	AOFAS	66.18 ± 6.97	83.86 ± 5.53	-17.892	<0.001
	VAS	46.14 ± 6.79	14.25 ± 8.74	17.875	<0.001
	HADS-A	12.04 ± 3.51	3.00(2.00,5.00)	-4.550	<0.001
	HADS-D	10.21 ± 2.33	4.00(3.00,6.00)	-4.565	<0.001

SD: Standard Deviation; Q1: First quartile; Q3: third quartile GroupA: no preoperative anxiety/depression symptoms GroupB: preoperative anxiety/depression symptoms

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 evaluation indicators at final Follow-up for two groups [Mean ± SD/Median(Q1,Q3)]

Variables	AOFAS	VAS	HADS-A	HADS-D
GroupA(*n* = 22)	92.23 ± 4.64	9.73 ± 6.21	2.05 ± 1.17	2.14 ± 1.52
GroupB(*n* = 28)	83.86 ± 5.53	14.25 ± 8.74	3.00(2.00,5.00)	4.00(3.00,6.00)
t/z value	5.695	-2.052	-3.087	-3.495
p value	<0.001	<0.05	<0.05	<0.001

SD: Standard Deviation; Q1: First quartile; Q3: third quartile GroupA: no preoperative anxiety/depression symptoms GroupB: preoperative anxiety/depression symptoms

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

due to foreign body stimulation.Consequently, we deem the modified Kidner procedure to be a safe and effective surgical approach.

Our study also observed that patients with poor preoperative psychological status had lower AOFAS scores and higher VAS scores at the final follow-up compared to those with better preoperative psychological status, suggesting that preoperative psychological state may negatively impact postoperative pain and functional recovery.A study by Graham S Goh et al. has demonstrated that patients with hallux valgus who had poor preoperative mental health had worse postoperative VAS and AOFAS scores [30].Additionally, research suggests that patients with poor preoperative psychological status often have higher postoperative pain scores and poorer functional recovery [31, 32].Therefore, foot and ankle surgeons should pay attention to patients' psychological health when formulating treatment plans, conducting necessary psychological interventions to manage postoperative pain, functional recovery, and

Table 4 Differences in evaluation indicators between preoperative and final follow-up for two groups [Mean ± SD]

Variables	AOFAS Difference	VAS Difference	HADS-A Difference	HADS-D Difference
GroupA($n=22$)	21.91 ± 5.81	24.73 ± 6.63	1.00(0.75,3.00)	1.05 ± 1.89
GroupB($n=28$)	17.68 ± 5.23	31.89 ± 9.44	7.86 ± 4.15	5.61 ± 2.86
t/z value	2.704	-3.020	-4.944	-6.452
p value	<0.05	<0.05	<0.001	<0.001

SD: Standard Deviation; Q1: First quartile; Q3: third quartile GroupA: no preoperative anxiety/depression symptoms GroupB: preoperative anxiety/depression symptoms

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 5 Correlation between age, gender, BMI, and preoperative psychosocial status

Variables		Anxiety	Depression
Age	r	0.165	0.157
	p	0.251	0.277
Sex	z	-2.241	-0.416
	p	0.025	0.677
BMI	r	0.008	0.099
	p	0.956	0.495

BMI: Body Mass Index;

r: The r value is obtained from Pearson's correlation, which is used to assess the correlation between two variables

z: The z-value is derived from the Wilcoxon signed-rank test, which is used for non-parametric comparisons to analyze the correlation between genders

P: P values < 0.05 were considered statistically significant

psychological status comprehensively, thereby improving clinical outcomes.

Our study findings indicate that patients with preoperative symptoms of anxiety/depression experienced greater improvements in postoperative pain and psychological health compared to those without such symptoms preoperatively.Research indicates that higher levels of anxiety and depression are associated with increased pain severity [33–35].Moreover, depressive symptoms tend to occur concurrently with increased pain severity [36], a correlation that is reflected in the consistency between VAS and HADS scores.Our study suggests that patients with preoperative anxiety/depression symptoms had higher VAS and HADS scores, indicating a greater potential for improvement in pain and psychological health postoperatively. The successful surgery effectively alleviated the patients' anxiety and depression symptoms, thereby further reducing postoperative VAS scores. Furthermore, patients without preoperative symptoms of anxiety/depression have lower preoperative VAS and HADS scores, indicating a limited scope for improvement. Consequently, patients with preoperative anxiety/depression exhibit greater improvements in pain and psychological health compared to those without such symptoms.

Research indicates that the recovery of patients' functional activities is associated with various factors, including preoperative prehabilitation, postoperative rehabilitation exercises, and dietary habits [37–39].Additionally, studies have indicated that anxiety and sleep disorders are significantly associated with physical functional recovery after lumbar decompression surgery [40], and patients with depression tend to engage in unhealthy lifestyle choices, such as smoking and excessive alcohol consumption, which can also impact functional recovery [41].This study found that patients with anxiety and depression did not adhere well to prescribed rehabilitation exercises after discharge, nor were they able to maintain a healthy lifestyle, which may be the primary reason why patients without anxiety and depression symptoms showed greater improvement in functional activities compared to those with such symptoms.

In our correlation analysis of the two groups, we found no significant association between age, BMI, and preoperative anxiety/depression. However, there was a significant association between gender and preoperative anxiety symptoms, with female patients exhibiting more severe anxiety symptoms.Research has consistently shown that women are more prone to anxiety and depression than men, with the incidence rate in women being twice that of men [42, 43].Furthermore, Andreas Hinz and colleagues have reported that female patients exhibit higher levels of anxiety than their male counterparts [44].Consequently, it is essential to actively manage the psychological state of female patients in clinical practice to enhance surgical outcomes.

However, this study has several limitations: (1) The sample size is small($n=50$), and the data is derived from a single-center study, which may limit the generalizability of the findings and introduce bias. (2) The study is retrospective, which is subject to potential biases and confounding factors. (3) the follow-up duration varied among patients, which may affect the consistency of the results. Future studies should be designed as prospective, large-sample, multicenter, long-term follow-up randomized controlled trials to address these limitations.

Conclusion

The modified Kidner procedure significantly enhances the function, pain relief, and psychological well-being of patients with painful AN.However, patients with less favorable preoperative psychological status tend to have less satisfactory outcomes.Patients with preoperative anxiety or depression experience more pronounced benefits in pain relief, whereas those without such symptoms demonstrate superior functional recovery.Additionally, female patients with painful AN have a higher prevalence

of preoperative anxiety.Future studies should further investigate the impact of preoperative psychological interventions on patient outcomes.

Author contributions
Jia-chen Liang：Writing – original draft; Writing – review & editing Qiang Zan：Writing – review & editing Shi-Hang Cao：Writing – review & editing Xiao-cong Liu：Writing – review & editing Jing Huang：Writing – review & editing Yi Li：Writing – review & editing Jun-kui Xu：Methodology，Supervision，Writing – review & editing.

Funding
Role of the Funding Source: None.

Data availability
This retrospective study was approved by the Ethics Committee of Honghui Hospital in Shaanxi Province (Approval Number:2024-KY-300-01).

Declarations

Informed consent
Written informed consent was obtained from the patients.

Competing interests
The authors declare no competing interests.

Received: 11 March 2025 / Accepted: 16 April 2025
Published online: 29 April 2025

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