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Article

Effects of Pre-MRI Multimodal Psychosocial Nursing Intervention on Anxiety and Examination Compliance in Patients With Optic Neuritis

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Abstract

Aims/Background: Magnetic resonance imaging (MRI) is essential for diagnosing and monitoring optic neuritis. However, the procedure itself may induce significant anxiety in patients, potentially compromising examination compliance and image quality. This study retrospectively evaluated the effects of a structured, multimodal pre-MRI psychosocial nursing intervention on anxiety and compliance in patients with optic neuritis. **Methods:** A total of 106 patients diagnosed with optic neuritis who underwent MRI at Jiaozhou Central Hospital of Qingdao between June 2021 and June 2024 were included. Patients were allocated to two groups based on the type of nursing intervention received before the MRI: the control group received routine nursing intervention, while the observation group received a comprehensive intervention comprising four core components: structured health education, individualized psychological support, environmental and emotional support, and family guidance. The Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) were administered at baseline to assess the comparability of general psychological status between groups. The State-Trait Anxiety Inventory Form-1 (STAI-1) was used to evaluate periprocedural state anxiety before and after the intervention. Physiological indicators, including heart rate and blood pressure as anxiety-related stress indicators, and oxygen saturation as a safety parameter, as well as examination compliance, were compared between the two groups. Compliance was assessed by MRI technicians using a 5-point scale based on image clarity and motion artifacts, with higher scores indicating better cooperation. **Results:** Baseline SAS, SDS, and STAI-1 scores did not differ significantly between the two groups ($p > 0.05$), indicating comparability in general psychological status and pre-intervention anxiety levels. Following the intervention, the STAI-1 score (43.16 ± 2.85) in the observation group was significantly lower than in the control group ($p < 0.001$). Additionally, the observation group exhibited significantly lower post-intervention heart rate and blood pressure compared with the control group ($p < 0.05$). The compliance score in the controlgroup was 4.00 (2.00, 5.00), while that in the observation group was 5.00 (4.00, 5.00); compliance in the observation group was significantly higher than that in the control group ($p < 0.05$). Furthermore, the observation group demonstrated a higher first-attempt success rate and a shorter mean examination time compared with the control group, with statistically significant differences ($p < 0.05$). **Conclusion:** A multimodal psychosocial nursing intervention administered before MRI examination effectively reduces periprocedural state anxiety and physiological stress responses in patients with optic neuritis. This approach may have broader applicability for improving patient compliance and MRI examination efficiency in other conditions.

Keywords: magnetic resonance imaging; psychosocial intervention; optic neuritis; anxiety; compliance

1. Introduction

Optic neuritis (ON) is a common inflammatory demyelinating disorder of the optic nerve, which may present as a primary inflammatory condition of the central nervous system or as a manifestation of a systemic autoimmune disease [1,2]. Its pathogenesis involves immune-mediated demyelination of the optic nerve, axonal injury, and localized inflammatory responses, constituting a complex pathological process [3]. Clinically, optic neuritis typically presents as acute or subacute monocular visual loss, accompanied by characteristic features such as orbital pain during extraocular movements and relative afferent pupillary defect (RAPD). Some patients may also exhibit optic disc edema or optic atrophy [4,5,6,7]. These clinical manifestations not only impair visual function but also significantly impact patients' psychological status and quality of life, especially among young adults. Visual impairment frequently leads to diminished learning capacity, reduced work performance, and impaired social adaptability, thereby increasing the overall disease burden.

Epidemiological evidence indicates that the annual incidence of optic neuritis is approximately 0.94–2.10 cases per 100,000 individuals, with most cases classified as typical optic neuritis, including idiopathic and multiple sclerosis (MS)-associated forms [8]. In recent years, advances in immunology and imaging have led to improved characterization of atypical optic neuritis etiologies. These include aquaporin-4 (AQP4) antibody-positive cases associated with neuromyelitis optica spectrum disorders (NMOSD), and myelin oligodendrocyte glycoprotein

antibody-associated disease (MOGAD) linked to MOG antibodies [9,10]. These findings not only expand current understanding of the pathological subtypes of optic neuritis but also provide a foundation for more precise clinical diagnosis and individualized therapeutic strategies. A clinical study has shown that approximately 55% of patients experience varying degrees of visual recovery within three months of onset [11]. Although optic neuritis is generally self-limiting, early diagnosis and timely intervention are essential to reduce disease burden and enhance the accuracy of clinical assessment [12]. Magnetic resonance imaging (MRI) is a key imaging tool for assessing optic neuritis and plays a pivotal role in the diagnosis and longitudinal follow-up of both typical and atypical forms [13].

Magnetic resonance imaging is a widely used non-invasive imaging technique characterized by the absence of ionizing radiation, high imaging resolution, and superior soft-tissue contrast [14,15]. Compared with conventional X-ray or computed tomography (CT), MRI offers significant advantages in tissue characterization and biocompatibility, and is therefore widely used in the diagnosis and evaluation of central nervous system disorders, especially optic neuritis [16]. However, despite its non-invasive nature, accumulating evidence indicates that a considerable proportion of patients experience varying degrees of anxiety and psychological distress before or during MRI examination [17]. Approximately one-third of patients exhibit clinically significant stress responses, which can be assessed using validated subjective scales and physiological indicators, including heart rate and blood pressure [18].

Patient anxiety not only affects psychological well-being but may also adversely influence examination performance and image quality. Heightened anxiety and fear can impair a patient's ability to remain still during examinations, thereby increasing the likelihood of motion artifacts; this, in turn, may result in reduced image quality, prolonged scan time, and, in some cases, the need for repeat examinations, ultimately compromising diagnostic accuracy and efficiency [19]. Factors that induce MRI-related anxiety are complex, including environmental stimuli associated with the examination itself, such as the confined space of the scanner, high noise levels, and prolonged scan duration, as well as individual psychological and cognitive factors, including concerns about examination results, anxiety about pain or the unknown, and fear of loss of control. Furthermore, misinformation or negative suggestions from family or peers may further exacerbate anxiety, thereby reducing patient compliance and cooperation [20].

In recent years, an increasing number of studies have demonstrated that psychological interventions and health education before MRI examinations can significantly improve patients' mental state [17,21]. By providing clear explanations of the examination procedure, supportive communication, and targeted psychological interventions before the examination, anxiety responses can be effectively alleviated; moreover, such approaches enhance patients' understanding and perceived control over the examination process, thereby improving cooperation and compliance, reducing motion artifacts, and ultimately improving image quality and diagnostic efficiency [22].

Therefore, implementing systematic psychological interventions and health education before MRI examinations may not only reduce patient anxiety and improve compliance but also indirectly enhance overall disease management. This retrospective study investigated the impact of a novel, multimodal psychosocial nursing intervention, encompassing health education, psychological support, and environmental optimization, before MRI examinations on anxiety and compliance in patients with optic neuritis, to provide evidence-based support for further improving the quality of diagnosis, treatment, and nursing care in optic neuritis.

2. Methods

2.1 Participants

This study included 106 patients with optic neuritis who received treatment and nursing care at Jiaozhou Central Hospital of Qingdao between June 2021 and June 2024. In this retrospective study, group allocation was determined by the pre-MRI nursing protocol the patient actually received in routine clinical practice. Both the control and observation groups comprised patients treated concurrently throughout the study period (June 2021–June 2024). The selection of nursing protocol was primarily based on the attending nurse's shift and the standardized nursing plan in effect at the time of the patient's appointment, rather than on patient-specific characteristics.

The inclusion criteria were as follows: (1) age ≥18 years; (2) confirmed diagnosis of optic neuritis based on clinical imaging and international consensus criteria [6]; (3) normal cognitive function with adequate reading and communication abilities; and (4) completion of MRI examination. The exclusion criteria were as follows: (1) incomplete clinical data; (2) cognitive impairment or severe psychiatric disorders that could interfere with cooperation during MRI examination; (3) presence of other ocular diseases; and (4) recurrent optic neuritis. The patient selection process is summarized in Fig. 1. Based on the type of nursing care received before MRI, eligible patients were divided into a control group and an observation group. Informed consent was obtained from all participants. This study was conducted following the principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Jiaozhou Central Hospital of Qingdao (approval number: 202501201-066).

2.2 Nursing Interventions

Routine nursing care was provided to patients before the MRI examination. Nursing staff carefully reviewed the patient's medical and allergy history, emphasizing any prior

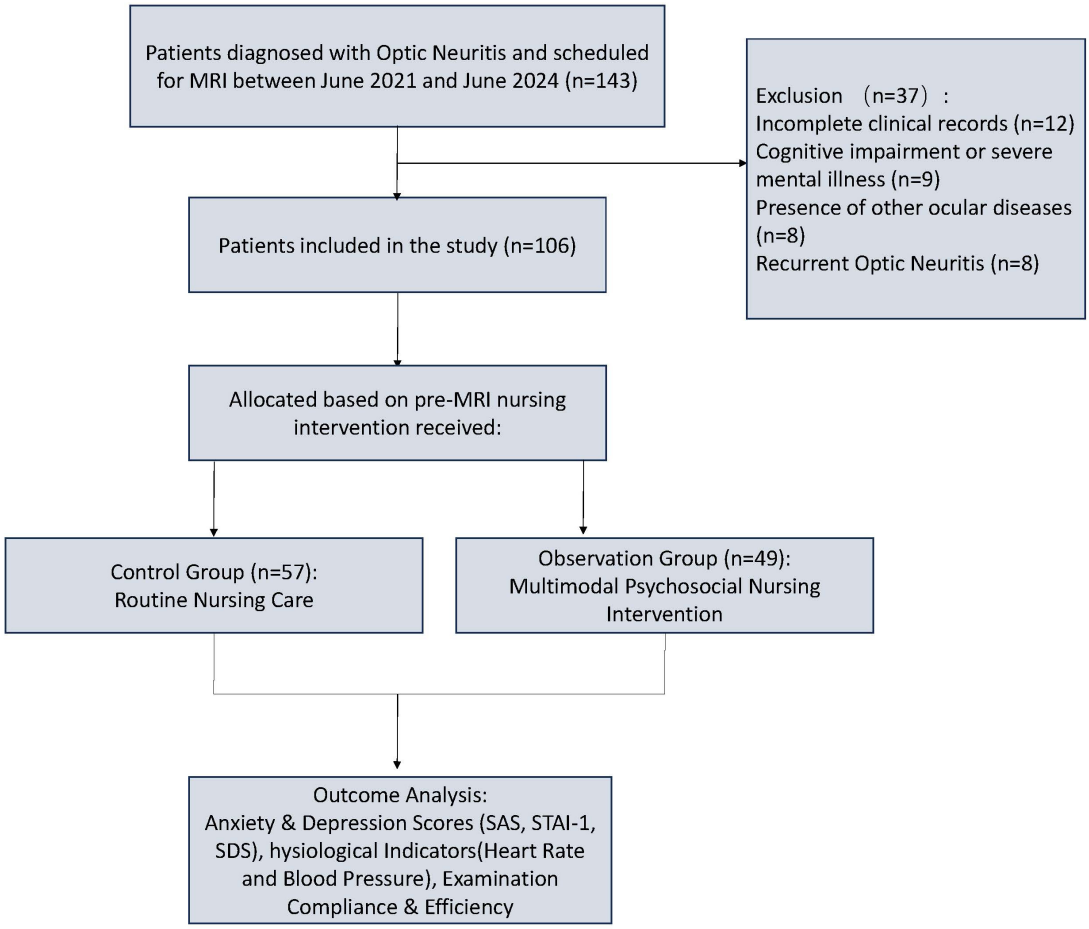

Fig. 1. Schematic illustration of the study design and intervention workflow. MRI, magnetic resonance imaging; SAS, Self-Rating Anxiety Scale; STAI-1, State-Trait Anxiety Inventory Form-1; SDS, Self-Rating Depression Scale.

hypersensitivity to contrast agents or other contraindications. Nurses provided education to patients and their families about the purpose, procedure, and precautions of the examination, including required positioning and cooperation during the examination, thereby facilitating an accurate understanding of the procedure. The nursing staff verified the contrast agent administration plan (including type, dosage, and rate) as prescribed by the radiologist or according to the departmental scanning protocol. Particular emphasis was placed on assessing the patient's clinical condition, especially screening for contraindications such as renal dysfunction or prior allergic reactions, to ensure safety during contrast administration.

Simultaneously, nursing staff assessed the patient's psychological status by evaluating their perception of and emotional responses to the MRI examination, including anxiety, tension, and fear. Appropriate psychological support and reassurance were provided, and potential environmental factors, such as noise and confined space, were explained to alleviate negative emotions. During the examination, nursing staff provided continuous guidance and support, closely monitoring patient responses to facilitate successful completion of the procedure.

Patients in the observation group received a specifically designed multimodal psychosocial nursing intervention prior to MRI examination. This intervention was conceptualized as an integrated approach aimed at addressing cognitive, emotional, and environmental sources of anxiety. It mainly included the following components: (1) Health education: Approximately 30 minutes before the examination, the responsible nurse introduced the purpose, procedure, and precautions of the MRI examination using graphic materials and video-based education. The nurse emphasized that MRI does not involve ionizing radiation, that the procedure is safe and reliable, and highlighted the importance of maintaining stillness during the examination. In addition, personalized education was provided in plain language tailored to the condition of each patient. The educational content also covered environmental aspects (e.g., equipment noise and confined spaces) and coping strategies, corrected misconceptions about MRI examinations, and facilitated an accurate understanding. After education,

questions were addressed to ensure comprehension and minimize concerns. (2) Psychological intervention: Based on health education, nurses conducted face-to-face communication to identify sources of anxiety and assess psychological status, and provided targeted support. A calm tone and positive guidance were used to encourage patients to express tension and fear, facilitate cognitive restructuring, and enhance their sense of control and trust. Before the examination, patients were guided to perform abdominal breathing and progressive muscle relaxation training to promote relaxation and stability during the examination. (3) Environmental and emotional support: Patients were provided with a quiet and comfortable waiting environment, with soft background music to reduce tension. During the examination, patients could wear headphones to listen to soothing music of their choice, thereby diverting attention and mitigating discomfort from noise and a confined space. Nursing staff accompanied patients throughout the process, monitored responses in real time, and provided verbal reassurance and support. (4) Family communication and guidance: Accompanying family members were instructed on how to provide appropriate support before and after the examination, including avoiding negative suggestions, using encouraging language, and assisting with preparation. They were also informed about the appropriate timing for involvement or withdrawal to optimize patient support.

This integrated approach aimed to alleviate anxiety through structured information delivery, cognitive and behavioral strategies, relaxation techniques, and the establishment of a supportive milieu.

2.3 Statistical Analysis of Baseline Data

This study collected baseline characteristics from two groups of patients, including age, gender, body mass index (BMI), disease duration, education level, marital status (married or unmarried), employment status, disease type (unilateral or bilateral), presence of other neurological symptoms, and history of MRI examinations. Baseline characteristics were compared between groups to assess comparability.

2.4 Assessment of Patient Anxiety and Depression Levels

2.4.1 Baseline Assessment of Anxiety and Depression Traits

To characterize the general psychological profile of enrolled patients at baseline, two widely used self-report instruments were employed: the Self-Rating Anxiety Scale (SAS) and the Self-Rating Depression Scale (SDS). Both scales are designed to assess symptom frequency over one week. The SAS, developed by Zung in 1971 [23], consists of 20 items (15 negatively worded and 5 positively worded). Each item is rated on a 4-point scale based on symptom frequency. The total raw score is converted to a standard score ranging from 25 to 100 by multiplying by 1.25. According to established criteria, a standard score <50 indicates no anxiety, 50–59 mild anxiety, 60–69 moderate anxiety, and ≥70 severe anxiety [23].

The SDS, developed by Zung in 1965 [24], also comprises 20 items (10 positively worded and 10 negatively worded) to assess depressive symptoms over the preceding week. Scoring follows the same procedure as the SAS, yielding a standard score ranging from 25 to 100, with higher scores indicating greater depressive tendency. A score <50 indicates no depression, 50–59 mild depression, 60–69 moderate depression, and ≥70 severe depression [24].

To assess anxiety at a specific time point, the State-Trait Anxiety Inventory Form-1 (STAI-1) [25] was also administered at baseline. This instrument includes 20 items, each rated on a 4-point scale (1–4), with total scores ranging from 20 to 80; higher scores indicate greater levels of state anxiety.

2.4.2 Assessment of Pre-Scan State Anxiety Changes

To dynamically evaluate changes in patients' immediate, situation-specific anxiety levels, the State-Trait Anxiety Inventory Form-1 (STAI-1) [25] was administered at two time points: at baseline (T1, upon arrival) and after the nursing intervention (T2, immediately before MRI examination).

2.5 Measurement of Patient Physiological Indicators

To objectively assess patients' physiological stress responses, heart rate and blood pressure were measured as sympathetic nervous system-related indicators of anxiety, while blood oxygen saturation was simultaneously monitored as a safety parameter to ensure patient well-being during the procedure. All measurements were performed by the same nursing staff in a quiet environment to minimize procedural variability. Measurements were obtained after the patient had remained seated and at rest for at least 5 minutes, and resting values of systolic blood pressure, diastolic blood pressure, heart rate, and blood oxygen saturation were recorded.

2.6 Indicators for Assessing Patient Compliance

In line with previous literature, this study employed a rating scale for MRI imaging quality to quantify patient compliance during MRI examinations [26]. Compliance was evaluated by qualified MRI technicians after examination, based on image clarity and motion artifacts. Technicians were blinded to group allocation. A 5-point Likert scale was used, with the following criteria: 5 points indicating complete compliance (clear images, no motion artifacts, no repetition required); 4 points indicating good compliance (minor artifacts present, requiring repetition of some sequences and minimal technician intervention); 3 points indicating fair compliance (moderate artifacts present, requiring moderate technician intervention but no re-examination); 2 points indicating poor compli-

ance (significant artifacts, rendering some images unusable and requiring re-examination); and 1 point indicating non-compliance (inability to obtain usable images, requiring re-examination).

The first-attempt examination success rate and mean examination time were recorded for both groups. In this study, "re-examination" specifically refers to the repetition of one or more imaging sequences during the same MRI session due to motion artifacts or insufficient cooperation that compromised image quality. It does not refer to scheduling a new MRI appointment on a different day. This definition aligns with the routine clinical MRI workflow, in which sequences are repeated as needed to ensure diagnostic image quality before the patient exits the scanner.

2.7 Timing of Measurements

All measurements were conducted at two predefined time points relative to the MRI examination and nursing intervention. The T1 (baseline) assessment was performed upon the patient's arrival in the MRI preparation area, before initiation of any study-specific nursing procedures. The T2 (post-intervention) assessment was conducted within 10 minutes of completing the nursing intervention and before the patient entered the scanner room, thereby ensuring that changes from T1 to T2 could be attributed to the intervention.

Due to the potential presence of visual impairment in patients with optic neuritis, all scales were administered in a standardized interview format. Two trained research nurses, blinded to group allocation, read each item aloud to the patient in a neutral tone and recorded the patient's verbal responses. At T1, patients completed the SAS, SDS, and STAI-1 to establish baseline psychological characteristics and state anxiety levels. At T2, only the STAI-1 was re-administered to evaluate changes in immediate state anxiety. To ensure consistency between the two assessors, inter-rater reliability was evaluated using 20 randomly selected questionnaires, yielding an intraclass correlation coefficient (ICC) of 0.77.

Physiological indicators were measured by the same nursing staff at T1 and T2 in a quiet environment, in accordance with the protocol in Section 2.5. Heart rate and blood pressure were analyzed as anxiety-related stress indicators, while blood oxygen saturation was analyzed as a safety parameter. Compliance-related indicators (compliance score, first-attempt success rate, and examination time) were evaluated by qualified MRI technicians after completion of the scan, based on the criteria in Section 2.6.

2.8 Statistical Analysis

All data were analyzed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using the Kolmogorov-Smirnov test to determine data distribution and evaluate assumptions for parametric testing, including normality and homogeneity of variances. For variables with a normal distribution, the Levene test was used to assess homogeneity of variance. When assumptions of normality and equal variances were satisfied, independent-samples *t*-tests were applied for between-group comparisons; when variances were unequal, Welch's *t*-test was used for corrective analysis. Normally distributed data were expressed as mean ± standard deviation ($\bar{x} \pm SD$), whereas non-normally distributed data were presented as median and interquartile ranges [M (Q_1, Q_3)]. The Mann-Whitney *U* test was used for comparisons of non-normally distributed variables between the two groups. Categorical variables were presented as frequencies (n) and percentages (%), and differences between groups were analyzed using the chi-square (χ^2) test, the Yates' corrected chi-square test, or Fisher's exact test, as appropriate, with corresponding χ^2 and *p*-values reported.

All statistical tests were two-tailed, with a significance level set at $p < 0.05$. Data analyzed using the above methods are presented in the Results section. In addition to between-group comparisons, within-group changes from baseline were also assessed. Specifically, paired-samples *t*-tests were used for normally distributed continuous variables, while the Wilcoxon signed-rank test was applied for non-normally distributed variables.

3. Results

3.1 Comparison of Patient Baseline Characteristics

A total of 106 patients were included in this study and divided into two groups according to the pre-MRI nursing intervention received: the control group (n = 57) received routine pre-MRI nursing care, while the observation group (n = 49) received the multimodal psychosocial nursing intervention. Analysis of baseline data demonstrated no statistically significant differences between the two groups in demographic and clinical characteristics ($p > 0.05$), indicating that the groups were comparable (Table 1).

3.2 Patient Anxiety Status

The state anxiety levels of the two groups, as measured by the STAI-1, are presented in Table 2. At baseline (T1), there was no statistically significant difference in STAI-1 scores between the control and observation groups ($p > 0.05$), indicating comparable initial levels of state anxiety.

Following the pre-MRI nursing intervention (T2), the observation group demonstrated a significantly greater reduction in state anxiety compared with the control group. The STAI-1 score in the observation group at T2 was significantly lower than that in the control group ($p < 0.001$). Furthermore, within-group analyses revealed a significant decrease in STAI-1 scores from T1 to T2 in both groups (both $p < 0.05$), with a more pronounced reduction in the observation group.

Baseline depressive characteristics, as assessed by the SDS at T1, are also presented in Table 2. There were no

Table 1. Baseline characteristics of participants.

Variables	Control group (n = 57)	Observation group (n = 49)	Statistic	*p*-value
Age (years)	41.65 ± 2.94	42.63 ± 2.50	$t = -1.841$	0.069
BMI (kg/m^2)	24.64 ± 1.96	24.34 ± 1.72	$t = 0.834$	0.406
Disease duration (days)	4.00 (2.00, 5.00)	3.00 (2.00, 4.00)	$Z = -1.501$	0.133
Gender, n (%)			$\chi^2 = 0.925$	0.336
Female	32 (56.14)	32 (65.31)		
Male	25 (43.86)	17 (34.69)		
Education level, n (%)			$\chi^2 = 1.848$	0.397
Junior high school and below	12 (21.05)	9 (18.37)		
High school	36 (63.16)	27 (55.10)		
University and above	9 (15.79)	13 (26.53)		
Marital status, n (%)			$\chi^2 = 0.141$	0.707
Unmarried	17 (29.82)	13 (26.53)		
Married	40 (70.18)	36 (73.47)		
Employment status, n (%)			$\chi^2 = 1.962$	0.375
Unemployed/Seeking work	7 (12.28)	11 (22.45)		
Stable employment	32 (56.14)	25 (51.02)		
Self-employed/Freelance	18 (31.58)	13 (26.53)		
Other neurological symptoms, n (%)			$\chi^2 = 0.514$	0.474
No	37 (64.91)	35 (71.43)		
Yes	20 (35.09)	14 (28.57)		
Disease type, n (%)			$\chi^2 = 0.002$	0.966
Unilateral	37 (64.91)	32 (65.31)		
Bilateral	20 (35.09)	17 (34.69)		
Previous MRI experience, n (%)			$\chi^2 = 1.286$	0.257
No	21 (36.84)	13 (26.53)		
Yes	36 (63.16)	36 (73.47)		

BMI, body mass index.

Table 2. Comparison of STAI-1 scores and baseline psychological characteristics between groups.

Variables	Control group (n = 57)	Observation group (n = 49)	Statistic	*p*-value
STAI-1 (pre-intervention)	47.82 ± 2.28	48.41 ± 2.51	$t = -1.256$	0.212
STAI-1 (post-intervention)	45.51 ± 2.20*	43.16 ± 2.85*	$t = 4.678$	<0.001
SAS (pre-intervention)	62.21 ± 2.37	61.56 ± 2.49	$t = 1.392$	0.167
SDS (pre-intervention)	63.63 ± 2.21	62.82 ± 2.70	$t = 1.710$	0.090
Anxiety level before intervention, n (%)			$\chi^2 = 2.782$	0.095
Mild	6 (10.53)	11 (22.45)		
Moderate	51 (89.47)	38 (77.55)		
Depression level before intervention, n (%)			$\chi^2 = 1.766$	0.184
Mild	2 (3.51)	6 (12.24)		
Moderate	55 (96.49)	43 (87.76)		

Note: * $p < 0.05$ compared with pre-intervention values within the same group. STAI-1, State-Trait Anxiety Inventory Form-1; SAS, Self-Rating Anxiety Scale; SDS, Self-Rating Depression Scale.

statistically significant differences between the two groups in SDS scores or in the distribution of depression severity levels ($p > 0.05$). These findings, together with baseline SAS data, indicate that the two groups had comparable general psychological profiles regarding anxiety and depression tendencies prior to the intervention.

3.3 Assessment of Patient Physiological Indicators

Physiological parameters were compared between the two groups. Heart rate and blood pressure were analyzed as objective indicators of anxiety-related stress responses, while blood oxygen saturation was assessed as a safety parameter. Before the nursing intervention, no statistically significant differences were observed between the two groups in blood pressure, heart rate, or blood oxygen saturation ($p > 0.05$). After the nursing intervention, the obser-

Table 3. Comparison of heart rate, blood pressure, and blood oxygen saturation between the two groups.

Variables	Control group (n = 57)	Observation group (n = 49)	Statistic	*p*-value
Heart rate (pre-intervention), (bpm)	98.00 (91.00, 105.00)	101.00 (91.00, 110.00)	$Z = -1.047$	0.295
Heart rate (post-intervention), (bpm)	87.00 (82.00, 92.00)*	84.00 (75.00, 90.00)*	$Z = -2.150$	0.032
Systolic blood pressure (pre-intervention), (mmHg)	128.00 (124.00, 132.00)	127.00 (123.00, 130.00)	$Z = -0.772$	0.440
Systolic blood pressure (post-intervention), (mmHg)	123.00 (118.00, 127.00)*	118.00 (116.00, 122.00)*	$Z = -3.818$	<0.001
Diastolic blood pressure (pre-intervention), (mmHg)	75.00 (70.00, 80.00)	75.00 (69.00, 79.00)	$Z = -0.470$	0.638
Diastolic blood pressure (post-intervention), (mmHg)	71.00 (70.00, 77.00)*	67.00 (63.00, 71.00)*	$Z = -4.761$	<0.001
Blood oxygen saturation (pre-intervention), (%)	97.00 (96.00, 98.00)	97.00 (96.00, 98.00)	$Z = -0.148$	0.882
Blood oxygen saturation (post-intervention), (%)	97.00 (95.00, 98.00)	96.00 (95.00, 97.00)	$Z = -0.896$	0.370

Note: * $p < 0.05$ compared with pre-intervention values within the same group.

Table 4. Comparison of examination compliance between the two groups.

Variables	Control group (n = 57)	Observation group (n = 49)	Statistic	*p*-value
Examination time (min)	30.16 ± 3.76	24.57 ± 2.90	$t = 8.458$	<0.001
Compliance score, M (Q_1, Q_3)	4.00 (2.00, 5.00)	5.00 (4.00, 5.00)	$Z = -2.849$	0.004
First-attempt success rate, n (%)			$\chi^2 = 10.755$	<0.001
Repeat sequences required	16 (28.07)	2 (4.08)		
Successful on first attempt	41 (71.93)	47 (95.92)		

vation group exhibited significantly lower blood pressure and heart rate compared with the control group ($p < 0.05$), while blood oxygen saturation did not change significantly, and the difference between groups was not statistically significant (Table 3).

3.4 Comparison of Patient Compliance

Following the nursing intervention, cooperation during the MRI examination in the observation group was significantly higher than in the control group. Specifically, the MRI compliance score in the observation group was significantly greater than that in the control group. The first-attempt examination success rate in the observation group was also significantly higher than that in the control group (95.92% vs. 71.93%, $p < 0.001$). Additionally, the average examination time was significantly shorter in the observation group compared with the control group (24.57 ± 2.90 minutes vs. 30.16 ± 3.76 minutes, $p < 0.001$). These findings suggest that targeted nursing intervention significantly improved patient compliance during MRI examinations, enabling better cooperation during the scanning process, thereby improving image quality and examination efficiency (Table 4).

4. Discussion

This study aimed to retrospectively analyze the effects of a pre-examination multimodal psychosocial nursing intervention on anxiety and compliance in patients with optic neuritis. Patients' emotional status and anxiety levels were assessed using three validated scales (SAS, STAI-1, and SDS), together with physiological indicators, including heart rate and blood pressure. The results showed that, after the intervention, state anxiety (as measured by STAI-1) in the observation group was significantly lower than in the control group. Baseline assessments using the SAS and SDS instruments confirmed that the two groups had comparable general psychological characteristics prior to the intervention, thereby strengthening the validity of the between-group comparison.

Patient compliance was evaluated using a 5-point Likert scale for image clarity and stability, with average examination time and first-attempt success rate also included as indicators of compliance. The results showed that compliance and examination efficiency in the observation group were significantly higher than those in the control group. Overall, the implemented multimodal intervention significantly improved periprocedural state anxiety and physiological stress responses in patients with optic neuritis, and enhanced their cooperation during the examination, thereby shortening examination time and improving image quality.

These findings highlight the clinical value of a systematic, multi-component approach to pre-procedural care before MRI examinations, contributing positively to patient experience and the efficiency of imaging assessments in optic neuritis. MRI examinations are performed in a relatively enclosed environment, often accompanied by high noise levels and prolonged duration, which can readily induce anxiety, tension, and even fear in patients. Individuals with optic neuritis, due to impaired visual function, may experience an increased psychological burden related to concerns about vision loss and prognosis. Anxiety can activate the sympathetic nervous system, leading to physiological responses such as elevated blood pressure, increased heart rate, and muscle tension, which may further exacerbate discomfort and impair the ability to remain still during the examination, thus affecting image quality [19,27]. Within the

multimodal psychosocial nursing care model, coordinated psychological support, combined with health education, environmental optimization, and family guidance, may enhance patients' sense of control and security, thereby reducing uncertainty-related psychological stress [28]. In the present study, the observation group showed significantly lower STAI-1 scores compared with the control group, and both heart rate and blood pressure decreased significantly following the intervention, indicating that the integrated psychosocial nursing approach effectively alleviates anxiety and physiological stress responses. After gaining a clear understanding of the procedure, purpose, and safety of MRI examinations, patients may better tolerate environmental stimuli and maintain emotional stability, thereby reducing motion artifacts caused by psychological discomfort.

The findings of Tugwell et al. [29] showed that patients receiving pre-examination informational education had significantly lower STAI-1 scores than controls, which is consistent with the present results. In addition to psychological assessments, this study incorporated blood pressure, heart rate, and blood oxygen saturation to objectively evaluate anxiety reduction. The results showed that blood pressure and heart rate decreased significantly after the intervention in the observation group, while blood oxygen saturation did not change significantly. This observation further supports, from a physiological perspective, the effectiveness of psychological intervention in alleviating anxiety.

Anxiety is known to induce peripheral vasoconstriction and increase heart rate, while relaxation training and psychological support may help restore physiological homeostasis by activating the parasympathetic nervous system and reducing stress hormone levels [30]. Therefore, improvements in physiological indicators can be considered an objective reflection of the effectiveness of psychological interventions. In this study, no statistically significant difference in blood oxygen saturation was observed between the two groups. This finding is consistent with physiological expectations: in the absence of underlying cardiopulmonary disease, transient anxiety primarily influences heart rate and blood pressure through the sympathetic nervous system without significantly impairing pulmonary ventilation or oxygen exchange efficiency. This finding also indirectly suggests that the two groups were comparable in terms of their underlying health conditions affecting oxygenation function.

Within the multimodal intervention, the structured educational component played a crucial role in improving compliance and cooperation. The results showed that the MRI examination compliance score in the observation group was significantly higher than that in the control group, with a first-attempt success rate of 95.92% and a significantly shorter mean examination time. A previous study has indicated that patient resistance or non-cooperation during MRI examinations often arises from insufficient understanding and misconceptions about the procedure, such as the belief that MRI involves radiation or that prolonged examinations may cause harm to the body [31]. To address this concern, the present study implemented an individualized and visually supported health education approach, integrating text, images, and video materials to facilitate patients' understanding of the examination process before the examination, thereby alleviating psychological fear. Nursing staff tailored the content and delivery of education to patients' educational levels and comprehension abilities, making the information more targeted and accessible. The educational process represents not only the transmission of information but also a key component of psychological reassurance and trust building. Interaction between nurses and patients contributes to establishing a sense of security, promoting emotional stability and improving cooperation during the examination. This multimodal intervention, integrating health education, psychological support, environmental optimization, and family guidance, established a continuous, supportive pathway from cognition to emotion to behavior. It enables patients not only to "know what" but also to "know why", thereby enhancing understanding of the necessity of the examination at the cognitive level and fostering a sense of security and trust at the emotional level, ultimately improving compliance. Bolejko et al. [20] reported that psychological intervention combined with patient and family education before MRI examinations significantly improved patient compliance, findings consistent with those of the present study.

The intervention model proposed in this study demonstrates considerable potential for broader application in nursing practice. Through this nurse-led, multimodal psychosocial support model, a continuous nursing process can be established, encompassing pre-examination psychological preparation, emotional stabilization during the examination, and post-examination trust reinforcement. The model is characterized by its operational simplicity, high trainability, and scalability, making it suitable for implementation across imaging centers and neuro-ophthalmology departments.

However, several limitations should be acknowledged. First, as a single-center retrospective study, although no statistically significant differences in baseline characteristics were identified, unmeasured confounding factors, such as variations in nurse experience, MRI scanner availability, time-of-day scheduling, or temporal changes in nursing protocols, may have influenced the outcomes. The non-randomized, protocol-based allocation introduces the potential for selection bias. Furthermore, although core demographic and clinical data (e.g., disease type and duration) were collected, the retrospective dataset lacked detailed disease-specific severity indicators, such as baseline visual acuity and pain intensity. The absence of these variables limits a comprehensive assessment of group comparability in terms of disease severity and baseline symptom burden, which may influence both anxiety levels and

responsiveness to nursing intervention. Additionally, the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) were administered only at baseline to assess comparability of psychological traits; these instruments were not designed to capture short-term emotional changes and were therefore not repeated after the intervention. Second, the sample size was relatively limited, and individual variability and environmental factors may have influenced the results. Third, this study focused on short-term outcomes of the intervention and did not evaluate long-term changes in psychological status or follow-up compliance. Future studies employing prospective, multicenter, randomized designs with larger sample sizes are warranted to further validate the generalizability and stability of this intervention model. Such studies should incorporate standardized assessments of disease-specific clinical parameters (e.g., visual acuity and pain) to enable more comprehensive baseline comparisons and subgroup analyses. Additionally, sensitivity analysis stratified by enrollment period or incorporating key workflow-related covariates into regression models would further strengthen the robustness of the findings. However, such detailed operational data were not consistently available in the present retrospective dataset, underscoring the value of prospective data collection in future research.

5. Conclusion

In conclusion, this study demonstrates that a multimodal psychosocial nursing intervention administered before MRI can effectively reduce periprocedural state anxiety and physiological stress responses (including heart rate and blood pressure) in patients with optic neuritis, improve compliance and image quality, and thereby enhance examination efficiency and diagnostic accuracy. This intervention model is straightforward to implement, yields significant clinical benefits, and has strong potential for broader application. Integrating mental health education into the pre-imaging examination nursing process not only optimizes the patient experience but also provides novel nursing strategies and evidence-based support to improve the quality of neuroimaging diagnoses and overall healthcare efficiency.

Key Points

• A comprehensive, multimodal pre-MRI nursing intervention effectively alleviates periprocedural state anxiety and reduces physiological stress responses in patients with optic neuritis.

• Compared with routine care, the intervention group demonstrated significant improvements in post-intervention state anxiety (STAI-1 scores), blood pressure, and heart rate.

• The intervention directly improved patient compliance during MRI examinations, as reflected by higher compliance scores, a significantly increased first-attempt success rate, and a markedly shorter mean examination time.

• These findings suggest that a multimodal psychosocial approach may optimize patient cooperation and overall experience during medical examinations by enhancing cognitive control, increasing perceived security, and stabilizing physiological stress responses.

• Despite the inherent limitations of the retrospective design, the results provide valuable evidence supporting the systematic integration of psychological nursing intervention into imaging examinations to improve patient outcomes and healthcare efficiency.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

NM and BF designed the research study. NM performed the research. BF analyzed the data. NM drafted the article. Both authors contributed to the important editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee of Jiaozhou Central Hospital of Qingdao (approval number: 202501201-066). Informed consent was obtained from all participants, and all procedures followed the principles of the Declaration of Helsinki.

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Conflicts of Interest

The authors declare no conflicts of interest.

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